



Drought and Rural Livelihoods in the Semi-Arid Zones of Katsina State, Nigeria

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Abstract

This study examined the implications of drought on rural livelihoods in the drought-prone areas of Katsina State. The research employs both quantitative and qualitative methods. Baure, Sandamu, Zango, and Mai'adua Local Government Areas (LGAs) were purposively selected, and questionnaires were administered to 215 respondents in the study LGAs' selected communities. Data were analyzed using descriptive statistics, including tables, bar charts, and pie charts. Findings revealed that males (87.4%) constituted the majority of drought victims, and the economically active population aged 30 to 44 (51.2%) was most exposed to drought risks. The periods (years) 2013, 2002, and 2006 were identified as the most severe drought years, which correspond with severe food insecurity and livelihood stress, particularly in Baure, Sandamu, Zango, and Mai'adua LGAs. The period (years) 2005 and 2012 were reported as the wettest during the study period, which reflects a general increase in the areas covered for crop production and a relative increase in crop output, particularly between 2005 and 2015. Agricultural data showed that millet and sorghum occupy the largest cultivated areas due to their drought tolerance. Most respondents observed a short, increasingly unpredictable rainy season, and drought adversely affected all livelihood activities, with farming (53.9%) the most affected, followed by trade (18.1%) and animal rearing (13.0%), resulting in weight loss and increased mortality among livestock. Findings suggest that drought significantly disrupts agricultural production, food security, and household income, underscoring the need for adaptive interventions such as multiple income-generating activities, irrigation, fodder banks, insurance schemes, and climate-smart agricultural practices to strengthen community resilience.

Keywords: Drought, Livelihoods, Rainfall variability, Agricultural Production, Katsina, Nigeria

INTRODUCTION

Drought is a well-known and costly climate-related natural hazard that affects more people than any other natural disaster worldwide (Loukas & Vasiliades, 2004; Bacanli et al., 2008). Unlike other climate-related natural hazards, droughts are typically prolonged in duration and may encompass a large region. The physical boundaries of areas affected by drought are sometimes arbitrary, and the impacts can be difficult to identify (Bergman, 2009). Although drought is characteristic of arid and semi-arid areas worldwide, it is considered a temporary climatic event that occurs not only in dry lands but also in humid areas (Maliva & Missimer, 2012; Wilhite et al., 2014). Drought is therefore a temporary aberration characterized by changes in rainfall dynamics, and any dramatic increase in rainfall may reduce the spatial coverage of the affected area. In contrast, aridity is a long-term climatic feature characterized by low average precipitation and typically found in regions with low rainfall (Türkeş, 1999; Maliva & Missimer, 2012). Following Oladipo's (1993) definition, drought is a climatic event characterized by a shortage of rainfall sufficient to adversely affect water supplies and crop and livestock production, resulting in significant disruptions to economic activities and temporary ecological changes in the affected areas.

Drought is a dynamic, ambiguous, and complex phenomenon that many researchers find challenging to understand, both in its nature and in its spatial and temporal occurrence. The region that has received the least rainfall may not be the one experiencing drought. Consequently, most scholars agree that areas of drought occurrence are directly associated with a prolonged shortage of surface and subsurface water, which can cause a severe hydrological imbalance that affects the normal functioning of the natural ecosystem (Abaje et al., 2013; Yaduvanshi et al., 2015; Hassan et al., 2019). The occurrence of drought in northern Nigeria can impair the rural economy and impose severe socioeconomic constraints, resulting from starvation, disease, famine, and rural migration (Oladipo, 1993; Nasiru, 2007). Drought is frequent in northern Nigeria, particularly in the north of latitude 120N, specifically in the dryland areas of the Sudano-Sahelian Ecological Zone (SSEZ),

which occupies almost one-third of Nigeria's total land area (FRN, 2003; Odekunle et al., 2018).

Even though grain production in northern Nigeria plays an important role in providing the main staple diet of the people of Nigeria and enhancing food security at the local and national levels, shreds of evidence have shown that frequent occurrence of drought in the area poses one of the most significant environmental challenges to the sustainability of the livelihood system of the people (Alhassan et al., 2003; Abubakar & Yamusa, 2013; Olagunju, 2015). Among the States of Northern Nigeria, Katsina has a historical record of droughts, which has made it a drought-prone State, exposing its economy to water-related hazards and leaving it vulnerable to loss (Oladipo, 1993; Bashir, 2008). The frequency of drought in the area was due to high interannual variability in rainfall (Nasiru, 2007). While Abaje et al. (2012) identified trends and fluctuations in annual rainfall in northern Nigeria, showing a decrease of 220.20mm at a rate of 3.67 per annum in Katsina and its immediate environs, Yahaya (2021) identified moderate vulnerability to desertification among farm households of the State. This reflects an apparent increase in water-deficit problems and a significant challenge for farming and livelihoods.

While studies have been conducted on the spatial characteristic of drought; frequency of occurrence; the severity of drought and its impact on crop yields, water resources development, and food security; as well as the problems and management of drought in northern Nigeria in general (Oladipo, 1993; Abaje et al., 2013; Oladipo & Adedeji, 2016; Oladipo & Ologunorisa, 2018; Hassan et al., 2019), the micro-level impacts of drought on livelihood at the household and community scale have not been adequately explored in Katsina State. Therefore, the present study bridges this gap by conducting an empirical, community-based study to assess drought frequency and severity, evaluate its impacts on livelihoods, and recommend adaptive strategies to mitigate worsening impacts.

METHODOLOGY

The methodology comprises Research design, Study area, Population and sampling, Data collection, Instrument Reliability/validity, Data analysis, and Ethical consideration.

Research Design

The study adopted a mixed-method approach, combining quantitative (questionnaire survey) and qualitative (key informant interviews) methods to assess drought impacts on livelihoods.

Study Area

Katsina State is located between latitudes 11° 07' N and 13° 22' N and longitudes 6° 52' E and 9° 20' E, sharing boundaries with Kano to the northwest, Jigawa State to the northeast, Kaduna State to the south, Zamfara State to the west, and the Niger Republic to the north. Katsina State has a total land area of 24,192 square kilometres and an estimated population of 5,801,584 as of 2006 (NPC & ICF, 2019). The northern part of Katsina State, which constitutes the semi-arid zone of the State, has a latitudinal extent of 12°27' to 13°20'N and a longitudinal extent of 6°58' to 9°07'E, representing the study area (Figure 1). This zone is part of the Sudan Savannah zone of Nigeria and is characterized by a semi-arid climate with low, erratic rainfall, high temperatures, and high evapotranspiration. The semi-arid areas of Katsina State experience an average annual rainfall of 600-700mm, occurring mainly between June and September. It enjoys a long dry season of 7 months. The temperature in the area is high, especially during the peak of the dry season, between March and May, with an average annual temperature of approximately 280 °C to 320 °C (Adedeji & Adedeji, 2014).

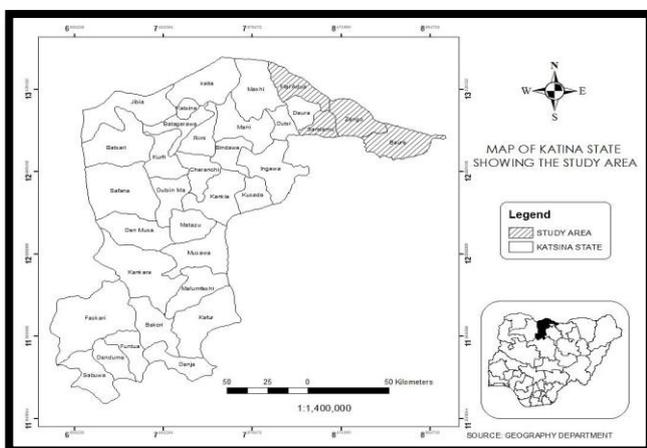


Figure 1: Katsina Showing the Selected LGAs
Source: Adapted and Modified from Yahaya (2021)

The climate of the zone supports mostly Sahel savanna vegetation, particularly found in the northeastern and some northern parts of the State,

characterized by shrubs, grasses, and sparse trees. Northern Katsina is prone to drought and desertification, which constitutes the main perennial ecological problem of the area due to climate change and human activities (Adamu, 2000). Katsina State is predominantly rural, with a great majority of the population being Hausa-Fulani Muslims, and is also home to several ethnic groups, including the Kanuri, Tiv, and Yoruba. An estimated 70 per cent of its population resides in rural areas, with agriculture being the primary economic activity. The soil of the area is marginal for efficient arable crop production. Livestock production is also widespread in the area, as it is known for its large production of cattle, goats, and sheep (Katsina State Ministry of Environment [2002] as cited in Yahaya & Adeniyi, 2019).

Population and Sampling

Four Local Governments (Baure, Sandamu, Zango, and Mai'adua) were purposively selected due to their frontline exposure to drought and vulnerability to desertification, as supported by Yahaya (2021). The target population comprised household heads aged 18 years and above who could provide relevant information. The Krejcie and Morgan (1970) sample size determination table was used, resulting in a sample size of 215 respondents. The sample was proportionally distributed among the selected LGAs based on population size: Baure (52), Sandamu (45), Zango (61), and Mai'adua (57).

Data Collection

Primary data were collected through the administration of a structured questionnaire. Key informant interviews were conducted to obtain qualitative insights. Secondary data were sourced from the Katsina State Agricultural and Rural Development Agency (KATARDA) on crop area coverage (hectares) and estimated production (metric tons).

Instrument Reliability and Validity

A pilot study (pre-test) was conducted in Dutsi Local Government Area, which has similar ecological and socioeconomic characteristics but was excluded from the main study. The questionnaire responses were tested using Cronbach's Alpha, yielding a coefficient of 0.81, indicating high internal consistency and instrument Reliability as noted by Gliem and Gliem (2003).

Data Analysis

A total of 215 questionnaires were successfully administered and analyzed. Quantitative data were analyzed using frequency counts, percentages, charts, tables, and figures. Qualitative data from key informant interviews were analyzed thematically and used to complement quantitative findings.

Ethical Considerations

Informed consent was obtained from all participants to ensure they fully understood the purpose of the study and voluntarily agreed to share information about their livelihoods and experiences with drought. Participants' identities and the sensitive socioeconomic information shared were kept confidential and anonymous throughout the research.

RESULTS AND DISCUSSION

Table 1 presents the socio-demographic characteristics of drought victims. From the results, the respondents were skewed more towards males (87.4%) as they were more accessible to the researcher. This suggests that men are more actively engaged in drought-prone livelihood activities such as farming, livestock rearing, and trade. This aligns with the assertion of [Yahaya &](#)

[Malik \(2021\)](#) that males dominate the farming population in northern Katsina and are most affected by desertification.

The age distribution of the respondents indicates that the 30–44-year age group accounts for the highest proportion (51.2%), followed by the 45-60-year age group (30.2%), and a smaller proportion (10.2%) below 30 years. This indicates that middle-aged adults are the most active group in agricultural and livelihood practices, consistent with [Eni and Abua \(2014\)](#), who found that individuals within the economically active age bracket are more exposed to the socioeconomic impacts of environmental stress.

The respondents' educational attainment shows that Islamic Education (51.2%) constitutes the majority in the area. This suggests that the people are known for their predominantly informal education, which is not surprising for rural communities, especially in northern Nigeria, where Muslims are the dominant group. Their cultural system places a high value on Quranic education. Marital status data reveal that 86.1% of individuals were married, indicating a strong sense of family responsibility, which may intensify the burden of drought impacts on household welfare and livelihood decisions.

Table 1: Socio-Demographic Characteristics of Drought Victims

Socio-economic characteristics	Variables	Frequency	Percentage (%)
Gender	Male	188	87.44
	Female	27	12.56
	Total	215	100
Age	< 30	22	10.23
	30 – 44	110	51.16
	45 – 60	65	30.23
	Above 60	11	5.17
	No Response	7	3.31
	Total	215	100
Educational Qualification	No formal education	15	6.98
	Primary education	33	15.35
	Secondary education	37	17.21
	Tertiary education	20	9.30
	Islamic education	110	51.16
	Total	215	100
Marital Status	Married	185	86.05
	Divorced	30	13.95
	Total	215	100

Source: Author’s Field Survey Output, 2022

Perceived Occurrence of Severe Drought and Wet Years

Table 2 shows the years respondents identified as the worst drought years and the wettest years. The years 2013 (27.9%), 2002 (13.7%), and 2006 (12.6%) were perceived as the most severe drought years, while 2005 (31.6%) and 2012 (25.6%) were recalled as the wettest. The clustering of drought years in the early 2000s and 2010s corresponds to meteorological records indicating significant variability in rainfall across northern Nigeria (Oladipo, 2010). This pattern reflects the cyclical nature of rainfall deficits in semi-arid regions of Nigeria, where alternating wet and dry years affect both crop yields and water availability (Ifeyanyi-Obi et al., 2017). This implies that the community has experiential knowledge of climatic changes that align with scientific evidence of increasing drought frequency due to climate variability in northern Nigeria.

Table 2: Wet and Dry Years According to Respondents

Worst Drought Years	Percentage	Wettest Years	Percentage
1994	9.63	1993	3.31
1996	4.65	1995	4.19
2002	13.70	2001	8.38
2006	12.56	2005	31.63
2013	27.90	2012	25.58
2016	11.63	2015	1.86
1988	1.39	1990	5.17
No response	18.54	No response	19.88
Total	100		100

Source: Author’s Field Survey Output, 2022

Land Area and Production of Major Crops in the Study Area

Figures 2 and 3 illustrate the total land area cultivated and production estimates for key crops grown in Katsina State, including millet, sorghum, maize, rice, beans, soyabeans, cotton, and groundnuts.

Figures 2 and 3 show that 2013 is among the years with appreciable hectares of land being cultivated (1,400 hectares) and relatively high output yields of 1,800 metric tons, despite being the year of the worst drought. The year 2012, often cited as the wettest, actually produced the second-highest yield among 2003-2015, despite having a lower cultivated land area. Production levels are influenced not only by the area cultivated but also

by the availability of rainfall and the use of inputs such as fertilizers and seeds. This result indicates a general increase in both the areas covered for crop production and crop output between 2012 and 2015. Therefore, the drought of the study period cannot be considered severe, as appreciable output yields were recorded.

According to the respondents, based on interviews conducted, millet, sorghum, and maize cover the most significant areas, reflecting their drought tolerance and importance as staple crops in the region. In contrast, rice and cotton occupy the smallest areas, likely due to rice's higher water requirements and the decline in cotton cultivation, driven by local demand and prices. This distribution demonstrates adaptation to semi-arid climatic conditions, in which farmers prioritize crops that can survive with minimal rainfall. The pattern aligns with the findings of Abaje et al. (2014), who reported that cereal crops, particularly millet and sorghum, dominate agricultural land use in northern Nigeria due to their resilience to drought.

Furthermore, millet and sorghum have the largest cultivated areas; their prices are relatively lower than those of maize and beans, which serve a dual role as income-generating crops for rural households and have high demand for both human consumption and livestock feed, as reported by farmers. The findings imply that the cropping pattern in Katsina State is shaped by the need to balance food security and income generation amid climatic uncertainty.

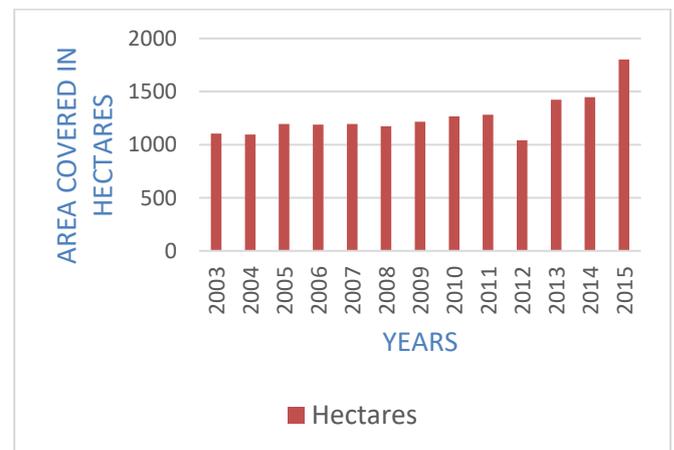


Figure 2: Area Covered for the Production of Major Crops in Katsina State (in hectares)

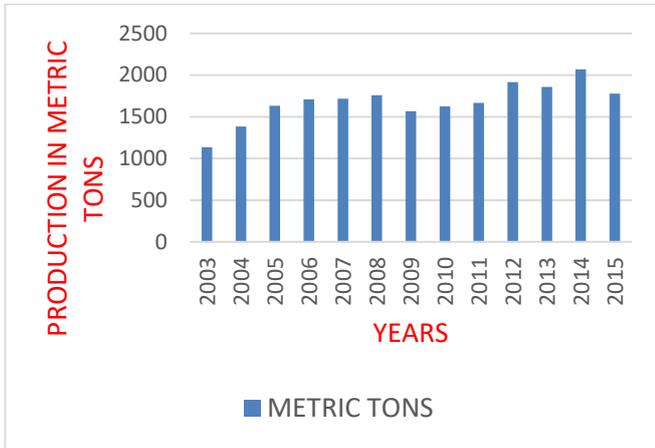


Figure 3: Estimated Production of Major Crops in Katsina State (Metric Tons)

Temporal Distribution of Rain Onset and Cessation Dates

Perceptions of drought vary widely across regions and groups of people. The problem of drought perception is closely linked to the temporal rain onset and cessation. Aside from the various types of droughts, regional differences further complicate the definition of drought (Redmond, 2002). For example, a person living in a region characterized by a generally wet climate is likely to have a different experience with drought than a person living in a region with an arid climate, because climate expectations are drastically different between the two regions.

Figures 4 and 5 summarize the temporal onset and cessation of rainfall, facilitating understanding of drought perception in the study area. Indices such as rain onset, cessation, and dry spells were used to gather responses from farmers and villagers.

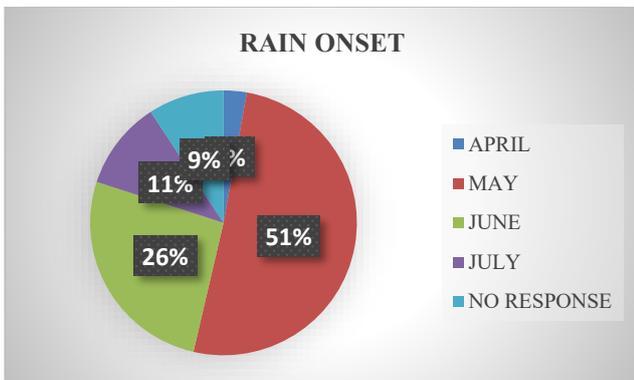


Figure 4: Respondents' views on Rain Commencing Months

Figure 4 reveals respondents' perceptions of rainfall onset. Most respondents indicated that May

(51%) and June (26%) were the onset of the rainy season, while a smaller proportion (3%) mentioned April. The onset of the rainy season in the northern part of Katsina is unsurprisingly between May and June, which aligns with the NIMET (2018) prediction that most States of north-western Nigeria will have an onset from June 1st. This perception corresponds with the regional climatic pattern of the Sudano-Sahelian zone, where rainfall typically begins between May and June (Adefolalu, 2007). Although June marks the onset of the rainy season, farmers do not rush to plant because of the dry spells that often follow, lasting 10-18 days after the onset of the rain. These findings align with the assertion by Enete and Amusa (2010) that delays in the onset of rainfall have been increasingly reported, thereby affecting planting decisions and shortening the growing season. According to Figure 5, most respondents identified November to May as the driest months, which coincides with the Harmattan season, characterized by low humidity, strong winds, and reduced soil moisture. Respondents reported severe dryness in March and April, with April considered the driest month. These conditions exacerbate water scarcity and negatively impact both crops and livestock (Audu & Aremu, 2012). The identification of these months reflects local awareness of seasonal drought patterns.

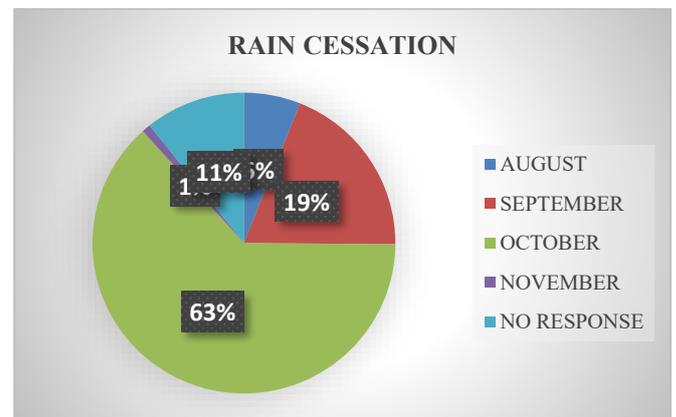


Figure 5: Respondents' views on Rain-Ending Months

Furthermore, respondents' perception of the cessation of rain, as shown in Figure 5, reveals that October is widely accepted as the month marking the end of rainfall, as reported by 63% of respondents. This indicates that farmers enjoy only 4–5 months of the growing season, and consequently, people are likely to experience long

periods of drought, especially from November to May. This is consistent with climatological data for northern Nigeria. A shorter rainy season and early cessation of rainfall limit crop maturation and harvest, compounding food insecurity risks (Ifeanyi-Obi et al., 2017).

Impact of Drought on Rural Livelihoods

Table 3 highlights the effects of drought on livelihood activities. Table 3 shows that farming (53.9%) is the most affected livelihood, followed by trade (18.1%), handicrafts (13.9%), and animal rearing (13.0%). This may be because farming is the predominant livelihood system, supporting over 80% of people in the study area. This aligns with earlier findings that agriculture-dependent households are most vulnerable to climatic shocks (Nnaji et al., 2018).

Table 3: Drought Effects on Livelihood

Livelihood Options	Frequency	Percentage
Handicraft	30	13.95
Trade	39	18.14
Farming	116	53.95
Animal rearing	28	13.02
Others	2	0.93
Total	215	100

Source: Author’s Field Survey Output, 2022

Other notable impacts of drought were on trade, handicrafts, and animal rearing. When farming is affected, other activities that depend on it will also suffer. For instance, the trading activities of people in the area depend significantly on consumer goods derived from farm produce, and a decrease in agricultural output is also expected to reduce trading activity. During drought periods, handicrafts such as rope, mat, and basket making, local cloth weaving, pottery, as well as calabash and wood carving also suffer because they depend on natural resource-based raw materials. Other activities that are little affected by drought, constituting 0.93%, include artisanal practices such as tailoring, barbing, and blacksmithing.

The occurrence of droughts in this zone has significant implications for the animals, especially the cattle sector. Animals could not obtain sufficient fodder, resulting in cattle losing weight during mild droughts, whereas severe droughts

increased livestock mortality rates. Subsistence farmers who derive other benefits from cattle, such as milking, transport, and ploughing, also suffer losses because the quality and quantity of the milk are reduced, and the weight and strength of cattle used as draught animals are drastically reduced.

Due to the dry nature of the area and the insufficient surface water to support irrigation, a significant amount of productive land was reportedly converted to marginal land that has become unusable for crop production. Similarly, many indigenous tree species of high economic and medicinal value to rural people are going extinct because of the precarious variable climate, which has disrupted complete ecological recovery even when rains return.

Drought reduces soil fertility, limits irrigation water, causes pasture loss, and constrains household income diversification. Consequently, many respondents reported the loss of livestock, reduced food availability, and increased poverty. These findings correspond with the assertions of Oladipo (2010) and Ifeanyi-Obi et al. (2017) that drought remains a major driver of livelihood insecurity in northern Nigeria.

CONCLUSION AND RECOMMENDATIONS

This study demonstrates how drought has shaped the socioeconomic and environmental realities of communities in Katsina State. The predominance of male and middle-aged respondents suggests that their profile is that of those most affected by drought impacts. The reported years of extreme drought coincide with observed regional rainfall variability, and the predominance of drought-tolerant crops such as millet and sorghum reflects the adaptive responses of local farmers.

The study concludes that drought remains a persistent environmental hazard with severe socioeconomic implications for rural communities in Katsina State. It disrupts agricultural productivity, undermines household income, and worsens food insecurity.

Enhancing adaptive capacity through education, technology, and institutional support is essential for building long-term resilience. The study therefore recommends that livelihood diversification into multiple income-generating activities is essential.

Promoting efficient irrigation will support year-round crop production. Establishing fodder banks and livestock insurance schemes can help address feed shortages and health challenges, thereby mitigating the impact of drought on animal production. Given the drought's widespread effects, proactive preparedness remains the most effective strategy for coping with the situation.

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