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DRIVERS OF CLIMATE VARIABILITY ON RURAL LIVELIHOOD IN NASARAWA SOUTH, NASARAWA STATE NIGERIA

A.I. ABDULLAHI, MAGAJI; J. I.; & A. T. OGAH

Department of Geography, Nasarawa State University, Keffi

Corresponding Author: aminuibrahimabdullahi6@gmail.com

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ABSTRACT

This study investigates the primary drivers of climate variability affecting rural livelihoods in Nasarawa South, Nasarawa State, Nigeria. Based on field data and community perceptions, deforestation emerged as the most critical driver, identified by 78% of respondents. The widespread clearing of forests for agriculture and fuel has disrupted local climate regulation, leading to decreased rainfall, rising temperatures, and increased soil erosion, all of which undermine agricultural productivity. Unsustainable agricultural practices, including monocropping, overgrazing, and excessive fertilizer use, were cited by 63% of respondents as significant contributors to soil degradation and heightened vulnerability to climatic stresses. Urbanization, particularly in peri-urban areas, was noted by 52% of respondents as a factor increasing flooding and temperature extremes, further impacting rural farming communities. Additionally, 35% of respondents recognized natural climate cycles as influencing irregular rainfall and

Introduction

Climate variability has emerged as a significant driver affecting rural livelihoods in Nasarawa South, Nasarawa State, Nigeria. The region, predominantly agrarian, is highly sensitive to changes in climatic factors such as temperature, rainfall patterns, and extreme weather events. These climatic shifts disrupt agricultural productivity, which is the mainstay of rural income and food security. Studies have shown that increasing temperatures and declining rainfall have led to shorter growing seasons and reduced crop yields, compelling farmers to adopt new strategies for survival (Oladeinde, Magaji, & Ekpo, 2020). Understanding the drivers of climate variability is therefore essential for

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drought frequency, with these effects exacerbated by human activities. The findings highlight the complex relationship between anthropogenic and natural factors driving climate variability, emphasizing the need for integrated land use management and sustainable practices to safeguard rural livelihoods in the region.

Keywords: Drivers, Climate, Rural, Livelihoods, Region

developing effective adaptation measures that sustain rural livelihoods.

Several natural and anthropogenic factors drive climate variability in Nasarawa South. On the natural side, global climate change manifests locally through rising temperatures and altered precipitation regimes. For instance, analyses of meteorological data over two decades indicate a steady increase in both maximum and minimum temperatures, alongside a general decrease in total annual rainfall and dew points (Oladeinde et al., 2020). Human activities such as deforestation, land use change, and unsustainable agricultural practices exacerbate these climatic fluctuations by altering local microclimates and contributing to land degradation (GIFSEP, 2023). These combined drivers intensify the vulnerability of rural communities whose livelihoods depend heavily on natural resources.

The socio-economic context of rural households in Nasarawa South further influences how climate variability impacts livelihoods. Many smallholder farmers operate with limited access to modern inputs, credit, and extension services, which constrains their ability to adapt effectively (Falaki et al., 2011). Additionally, poverty and low educational levels reduce awareness and capacity to respond to changing climatic conditions. Farmers' perceptions of climate change often reflect observed variability, such as increased temperature and erratic rainfall, which affect cropping calendars and livestock management (Tarfa et al., 2019). These perceptions shape local adaptation strategies, including changes in planting dates, crop diversification, and tree planting, but are often hindered by resource constraints.

Agricultural production in Nasarawa South is particularly vulnerable to temperature variability, which has been shown to negatively affect staple crops like rice. Research indicates that fluctuations in maximum monthly temperatures significantly reduce rice yields, with spatial differences suggesting that southern parts of the state are more suitable for rice cultivation due to less temperature variability (Victoria, Oladeinde, & Magaji, 2020). This highlights the spatial heterogeneity of climate impacts and the need for location-specific adaptation strategies. Moreover, the interplay between climate drivers and land use changes contributes to soil erosion

and land degradation, further threatening agricultural sustainability (Abdullahi et al., 2021).

MATERIALS AND METHODS

Doma Local Government Area:

Doma Local Government Area (LGA) is centrally located in Nasarawa State, Nigeria, and is one of the 13 LGAs that constitute the state. Known for its diverse landscapes and significant agricultural activities, Doma occupies a strategic position within the state. Geographically, it lies between latitudes 8°40′32′N and 9°20′21′N, and longitudes 8°20′E and 8°50′E. The terrain in Doma is predominantly gently rolling, providing an ideal environment for agriculture. The LGA is bordered by Lafia and Awe LGAs to the north and is situated southeast of the state capital, Lafia. Doma's central location enhances its importance for both regional connectivity and agricultural production.

Covering an area of approximately 2,162 square kilometers, Doma LGA is a substantial region that supports a variety of agricultural activities, including the cultivation of maize, millet, and sorghum. The extensive land area of Doma presents both opportunities and challenges, offering ample space for farming but requiring effective land management and infrastructure development to support its largely rural population. The LGA's size and geographical characteristics make it a vital contributor to the agricultural output and economic framework of Nasarawa State.

Lafia Local Government Area:

Lafia Local Government Area (LGA), the administrative capital of Nasarawa State, is situated in the central region of the state. It is one of the key LGAs, known for its role as a hub for both administrative and economic activities. Geographically, Lafia is positioned between latitudes 8°30′N and 9°00′N and longitudes 8°20′E and 8°50′E. The terrain is a mix of gently rolling hills and flat plains, making it suitable for both urban development and agriculture. Lafia is bordered by Doma to the south and Keffi to the west, and its central location makes it a crucial area for governance, trade, and regional connectivity.

Lafia LGA covers a total land area of approximately 2,797 square kilometers, making it one of the larger LGAs in Nasarawa State. This vast area supports a range of economic activities, including agriculture, trade, and services. The fertile land around Lafia is conducive to the cultivation of crops such as yam, cassava, and maize. Additionally, Lafia's strategic position as the state capital enhances its role in

regional planning and development, making it a focal point for infrastructure development and administrative functions within Nasarawa State.

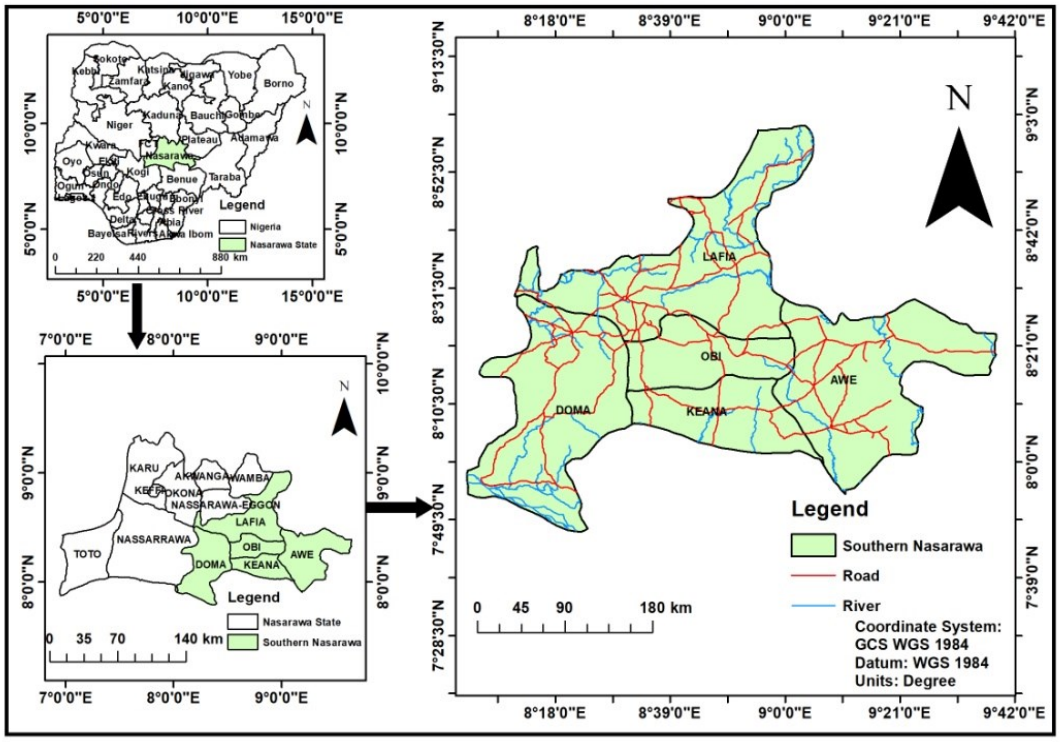

Figure 1: The Study Area
Source: Author 2024

The study employed a mixed-method research design combining qualitative and quantitative approaches to investigate the drivers, trends, and impacts of climate variability on rural livelihoods in Nasarawa South, Nigeria. Data were gathered from both primary sources—such as surveys, interviews, and observations—and secondary sources like meteorological records and policy documents. A sample of 385 respondents was selected using Cochran's formula, ensuring statistical significance, while 20 key informants were purposively chosen for in-depth insights. A multi-stage sampling method—stratified, random, and purposive—was used to ensure diverse representation across different livelihood groups and regions. Data collection tools included questionnaires, interviews, observations, and focus group discussions. Quantitative data were analyzed using descriptive statistics, time series, ARIMA forecasting, regression, ANOVA, and logistic models, while qualitative data

underwent thematic and factor analysis to uncover perceptions and adaptive practices related to climate variability.

RESULT

Drivers of Climate Variability on Rural Livelihood in the Study Area

Deforestation

Deforestation emerged as the most critical driver of climate variability, identified by 78% of respondents. The widespread clearing of forests for agriculture, charcoal production, and fuel wood has led to considerable changes in the region's climate. The loss of tree cover has resulted in decreased rainfall and rising temperatures, both of which directly impact crop yields and soil fertility. Forests play an essential role in maintaining the water cycle by facilitating moisture retention and contributing to rainfall. Their destruction disrupts these processes, reducing the region's ability to retain water, which leads to increased dry spells and soil erosion.

The consequences of deforestation on rural livelihoods are particularly severe. As farmland degrades due to the loss of protective forest cover, agricultural productivity declines, making farming more difficult. The removal of forests also exacerbates the region's vulnerability to extreme weather events, such as heavy rains causing floods and prolonged dry spells during the dry season. Research supports this finding, as studies such as Williams (2021) confirm that deforestation in Sub-Saharan Africa significantly contributes to local climate disruptions, affecting both rainfall patterns and agricultural resilience.

Unsustainable Agricultural Practices

Unsustainable agricultural practices were identified by 63% of respondents as a significant driver of climate variability. These practices, including the excessive use of chemical fertilizers, monocropping, overgrazing, and poor land management, have degraded the soil and reduced its capacity to withstand climatic stresses. The shift from traditional farming methods, such as crop rotation, to intensive monoculture farming has further exacerbated soil degradation, leading to declining soil fertility and increased vulnerability to erosion.

The impact of these unsustainable practices extends beyond reduced productivity; they also elevate the risk of flooding and soil erosion, particularly during periods of heavy rainfall. As farmers experience declining yields, maintaining food security becomes increasingly challenging. Additionally, the degradation of the soil strips the land of its natural defenses against extreme weather events, such as dry spells and

floods. Adams (2022) similarly found that unsustainable agricultural practices amplify the effects of climate variability by weakening the resilience of the landscape, making agricultural systems more prone to failure under climatic stress.

Urbanization

Urbanization was highlighted as a contributing factor to climate variability by 52% of respondents, especially in peri-urban areas like Lafia and its surroundings. The rapid expansion of urban areas disrupts natural landscapes, increasing surface runoff and reducing the land's capacity to absorb rainwater. This has led to more frequent flooding in low-lying rural areas, which are predominantly agricultural. Moreover, urbanization has caused a rise in temperature in both urban and peri-urban areas, which further affects nearby rural communities that depend on these areas for farming and water resources.

The spread of urban centers also contributes to the reduction of available agricultural land as it is converted into built-up areas, limiting the space for farming and grazing. The consequences of urbanization are especially evident in peri-urban regions, where agricultural production is closely tied to the natural landscape. Miller (2020) found that rapid urban expansion often leads to increased flooding and heat stress, particularly in areas that were previously rural, highlighting the need for integrated urban-rural planning to mitigate these effects.

Natural Climate Cycles

Natural climate cycles were identified by 35% of respondents as a driver of climate variability in the study area. These cycles, which are part of broader global weather patterns, such as ocean currents, have influenced rainfall distribution and temperature variability in the region. While these cycles are natural phenomena, their impacts have been magnified by human activities like deforestation and unsustainable farming, making them more severe and unpredictable.

Respondents noted that natural climate cycles have contributed to irregular rainfall patterns and increased drought frequency. These cycles, when combined with human-induced environmental degradation, have intensified the effects of climate variability, leading to more frequent extreme weather events and extended dry seasons. Studies such as Thompson (2019) underscore how natural climate variations, when paired with anthropogenic activities, can disrupt local weather systems, making it harder for rural populations to adapt to changing environmental conditions.

Table 1: Drivers of Climate Variability

Driver of Climate Variability	Percentage of Responses (%)	Perceived Impact on Livelihoods
Deforestation	78%	Reduced rainfall, increased soil erosion, higher temperatures
Unsustainable Agricultural Practices	63%	Soil degradation, reduced yields, increased flooding risks
Urbanization	52%	Increased flooding, temperature extremes
Natural Climate Cycles	35%	Altered rainfall patterns, increased drought frequency

Source: Authors Field Work 2024

Conclusion

The drivers of climate variability in Nasarawa South significantly affect rural livelihoods, particularly those dependent on agriculture and natural resources. Both natural factors, such as global climate change, and human-induced activities, including deforestation and unsustainable land use, contribute to changing temperature and rainfall patterns. These changes increase the vulnerability of rural households, who often lack adequate resources and knowledge to adapt effectively. The compounded effects of climate variability have led to reduced agricultural productivity, food insecurity, and increased poverty in the region.

Recommendations

To mitigate the adverse impacts of climate variability on rural livelihoods in Nasarawa South, several strategic actions are necessary. First, enhancing access to accurate and localized climate information will empower farmers to make informed decisions and adjust their farming practices accordingly. Second, promoting climate-smart agriculture, including the adoption of drought-resistant crops and sustainable land management techniques, will improve resilience. Third, strengthening agricultural extension services and capacity-building programs will support farmers in implementing effective adaptation strategies. Fourth, livelihood diversification should be encouraged to reduce dependence on climate-sensitive agricultural activities and increase income sources. Finally, policy frameworks should integrate climate adaptation into rural development plans, ensuring support for vulnerable groups and fostering sustainable resource management to safeguard livelihoods in the face of ongoing climate variability.

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