



Understanding Socio-Economic Drivers of Forest Degradation and Fragmentation in a Climate Change Context: Evidence from Malumfashi, Katsina State, Nigeria

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Abstract

This study examines the socio-economic drivers and determinants of deforestation, forest degradation, and fragmentation within the context of the ongoing climate crisis in Malumfashi Local Government Area of Katsina State, Nigeria. A sample of 400 respondents was determined using the Taro Yamane (1967) formula, and respondents were selected through a systematic sampling technique. Primary data were collected using structured questionnaires and analyzed using descriptive statistical methods. The findings indicate that firewood collection is the predominant driver of forest degradation, as reported by 48.2% of respondents. Other significant contributing factors include rapid population growth (45.2%), agricultural expansion (25.3%), unsustainable extraction of forest resources for biomass and timber (13.5%), and livestock grazing (11.5%). In addition, 44% of respondents identified negative impacts on environmental stability and socio-economic development, while 46% highlighted the broader ecological and livelihood consequences associated with forest decline. The study concludes that livelihood-related socio-economic activities are central to the processes of deforestation, forest degradation, and fragmentation in the study area. It therefore recommends the implementation of forest landscape restoration strategies based on nature-based solutions, including reforestation, agroforestry, watershed management, and assisted natural regeneration, to enhance ecological resilience and support sustainable development.

Keywords: Deforestation, Forest Fragmentation, Socio-economic Drivers, Climate Change Crisis, Agroforestry, Environmental Sustainability.

Introduction

Vegetation plays a vital role in sustaining life on Earth by providing both tangible and intangible ecosystem services. It supports food production, regulates climate, reduces surface albedo, increases atmospheric humidity, and maintains the balance of essential gases such as carbon dioxide (CO₂) and oxygen (O₂), which are crucial for human survival (Adamu, 2022; Sule et al., 2024). However, global environmental change, particularly climate change has been significantly influenced by deforestation and forest degradation. These activities are estimated to contribute about 18–20% of global greenhouse gas (GHG) emissions, especially in developing countries, thereby accelerating global warming and related climate crises. Forests serve as major carbon sinks, and their destruction disrupts the carbon cycle, intensifying atmospheric carbon concentrations (Gorte & Sheikh, 2010 in Adamu, 2021; Yang, 2023). Efforts such as Reduced Emissions from Deforestation and Forest Degradation (REDD) have therefore become important strategies for mitigating climate change impacts (Atedhor & Atedhor, 2024).

Forests are complex ecological systems dominated by trees whose canopies often form continuous cover. They support a

wide range of biodiversity, including shrubs, herbs, climbers, wildlife, and soil microorganisms that enhance soil fertility, particularly in tropical environments Chombaet, al. (2020). In Nigeria, forests have historically been central to livelihoods, providing economic resources, environmental protection, and social benefits. Despite this importance, deforestation has continued at an alarming rate due to limited and ineffective control measures. Socio-economic activities such as fuelwood extraction, agricultural expansion, urbanization, and infrastructure development have significantly contributed to forest loss and degradation.

Nigeria is reported to have one of the highest rates of primary forest loss globally, with over 50% of its forests lost in recent decades due to unsustainable practices (FAO, 2004). The country's total land area is approximately 91 million hectares, of which only about 12.18% remains under forest cover (Ahmed & Aliyu, 2019; Alapata & Abolaji, 2024). This rapid decline underscores the urgent need for sustainable forest management. According to FAO (2007), deforestation involves the permanent conversion of forest land to other uses or a long-term reduction in tree canopy cover below 10%, while forest degradation refers to a decline in forest quality, structure, and productivity due to disturbances. Forest fragmentation, on the other hand, results in the breaking up of

continuous forest into smaller, isolated patches, often driven by human activities and land-use pressures.

The combined effects of deforestation, degradation, and fragmentation pose serious environmental and socio-economic challenges. These include biodiversity loss, disruption of ecosystem services, increased flooding, rising temperatures, soil nutrient depletion, and reduced carbon sequestration capacity (Alageet, al 2025). Additionally, these processes threaten the livelihoods of forest-dependent communities and contribute to broader climate instability. Climate change, largely driven by human activities since the 19th century, has already resulted in a global temperature increase of approximately 1.2°C, leading to extreme weather events, food and water insecurity, and ecological disruptions (UNDP, 2023; Sule et al., 2024; Jellason, 2019).

Despite Nigeria's rich forest resources and their importance to sustainable development goals (SDGs), ongoing pressures from population growth, migration, and economic activities continue to drive forest decline. In regions such as Katsina State, forest reserves and natural vegetation are increasingly threatened by subsistence farming, logging, fuelwood collection, and urban expansion. These activities not only degrade forest ecosystems but also contribute to rising atmospheric carbon levels and climate-related risks.

Although various efforts have been made to reduce deforestation and its drivers, these measures have not been sufficiently effective. Understanding local perceptions of the socio-economic drivers of deforestation, forest degradation, and fragmentation is therefore essential for developing sustainable and context-specific solutions. Consequently, this study seeks to examine the socio-economic determinants of forest loss in Malumfashi Local Government Area of Katsina State, with the aim of providing informed recommendations for improved forest management and environmental sustainability.

2.0 Materials and Methods

2.1 The study area

Malumfashi Local Government Area (Figure 1) is located in the south eastern part of Katsina State. Found on a plateau of about 2200 feet above sea level with a total land area of 674km². Its absolute location lies at Latitude 11°48'N and 12°06'N and Longitude 7°06'E and 7°07'E. Relatively, absolutely, it is bordered by Musawa L.G.A to the north, to the northwest by Kankara L.G.A to the west, Bakori L.G.A, to the south by Kafur L.G.A and to the east by Gwarzo L.G.A in Kano State (Yakubu, 2014 and Adamu, 2022).



Figure 1: Map of Katsina State showing Malumfashi Local Government Area.

Source: Ministry of Land and Survey, Katsina State (2021).

Malumfashi Local Government Area is characterized by a tropical wet and dry climate (Aw) according to the Köppen–Geiger classification system. The area experiences distinct wet and dry seasons, with significant rainfall occurring during the summer months and minimal precipitation in the winter period. The mean annual temperature is approximately 25.2°C, while the average annual rainfall is about 921 mm. Rainfall is largely concentrated between May and September, with peak precipitation occurring in August, averaging about 271 mm (Yakubu, 2014).

Vegetation in the study area falls within the Northern Guinea Savannah zone, which is typically characterized by woodland vegetation interspersed with grasses. Dominant plant species include *Isoberliniatomentosa* and *Uapacatogoensis*, alongside a well-developed grass layer mainly composed of species from the *Andropogoneae* group (Yakubu, 2014). Some savanna plants persist in a suffrutex form, although many develop into full trees under favorable environmental conditions (Aigbe & Oluku, 2012 in Adamu, 2022). Common tree species found in the area include *Tamarindusindica*, shea butter (*Vitellariaparadoxa*), mango (*Mangiferaindica*), cashew (*Anacardiumoccidentale*), baobab (*Adansoniadigitata*), locust bean (*Parkiabiglobosa*), neem (*Azadirachtaindica*), and eucalyptus (Yakubu, 2014).

The soils of Malumfashi are predominantly reddish ferruginous tropical soils, derived in situ from weathered basement complex rocks such as gneiss, and containing minerals like quartz and mica. The upper soil layers consist of a mixture of these materials and transported particles, likely deposited by wind action. In addition, fadama soils occur along river valleys, particularly near the Hinachi and Asha-da-Lafiya rivers. These soils are generally dark grey clay, with textures that vary and are often characterized by poor drainage conditions (Yakubu, 2014).

According to the 2006 population census, Malumfashi has a population of 182,920, with a notably large proportion (47.4%) within the 0–14 age group, indicating strong potential for future population growth (Yakubu, 2014). The area is predominantly inhabited by the Hausa and Fulani ethnic groups, collectively referred to as *Katsinawa*. The major

languages spoken are Hausa and Fulfulde, which are widely used across northern Nigeria and parts of sub-Saharan Africa. Minority groups such as the Yoruba and Igbo are also present, mainly as migrants from other regions of the country. In terms of religion, Islam is the dominant faith, followed by Christianity and traditional religious practices (Adamu, 2022).

The economy of Malumfashi is largely agrarian, with agriculture serving as the primary source of livelihood for the majority of the population. The area functions as a key center for the production, processing, and marketing of agricultural products. Major crops cultivated include cereals such as maize, millet, and guinea corn; root and tuber crops like sweet potatoes and cocoyam; legumes including beans, groundnuts, and soybeans; as well as sugarcane and a variety of vegetables. Livestock rearing, particularly by the Fulani, is also an important economic activity. In addition to agriculture, the local economy is supported by commercial activities such as banking, trading (wholesale and retail), transportation, hospitality, and communication services. Other sources of employment include the civil service and private sector institutions, alongside small-scale enterprises such as tailoring, catering, and barbing.

2.2 Sources of data

The data utilized in this study were obtained from both primary sources, employing a combination of qualitative and quantitative methods of data collection. Primary data were gathered through the administration of structured questionnaires and field observations. The questionnaire was specifically designed to elicit information from the target respondents regarding the socio-economic drivers of deforestation, forest degradation, and fragmentation, as well as the strategies adopted to mitigate these challenges within the study area.

2.3 Sampling and sampling procedure

In order to determine the sample size of the population, Yamane (1967) formula was adopted during the research.

Yamane sample size determination is expressed as:

$$n = \frac{N}{1 + N(e)^2}$$

Where:

n = sample size,

N= the study population,

e = level of significance (error limit),

1= unity (constant).

Therefore:

$$n = \frac{362,700}{1 + 362,700(0.05)^2}$$

$$n = \frac{362,700}{1 + 906.75}$$

$$= \frac{362,700}{907.75}$$

$$n = 399.6 \cong 400$$

400 is the sample size

Table 1: Table of Sample Size.

S/N	Selected Ward	Sample Size	Number of Respondents.
1.	BarinDawa	400/12	34
2.	Dan Sarai	400/12	34
3.	Dayi	400/12	34
4.	Gorar Dan Saka	400/12	34
5.	Karfi	400/12	33
6.	Makaurachi	400/12	33
7.	Malumfashi A	400/12	33
8.	Malumfashi B	400/12	33
9.	Na Alma	400/12	33
10	RuwanSanyi	400/12	33
11.	Yaba	400/12	33
12.	Yar Mama	400/12	33
Total		400	400

The sample size (SS), representing the total number of questionnaires administered, is presented in Table 1. A non-proportionate sampling technique was adopted for the distribution of questionnaires due to the absence of up-to-date population data for the existing wards within Malumfashi Local Government Area of Katsina State.

For the selection of respondents, communities with a documented history of forest resource utilization were identified and targeted across the wards of the study area. A *systematic sampling method* was then employed in administering the questionnaires. In this approach, the first respondent was selected randomly, after which subsequent respondents were chosen at a fixed interval, specifically, every third household was selected until the desired sample size was achieved.

2.4 Data analysis

The quantitative data generated from the field was analysed using descriptive statistics based on responses obtained from the administered questionnaires. These data was computed, processed and analyzed using Micro Soft Excel 2007 and SPSS 26 (Statistical Package for Social Science). The result was presented using tables and was discussed according to the goal of the study.

3.0 Result and Discussion

3.1 Socio-Economic Causes of Deforestation, Forest Degradation and Fragmentation.

The Food and Agriculture Organization (FAO, 2007) emphasizes the importance of distinguishing between the agents of deforestation, forest degradation, and fragmentation and their underlying causes. Agents refer to the individuals, institutions, or development projects directly responsible for

forest clearing, whereas causes represent the broader socio-economic and political forces that drive such actions. Failure to make this distinction may lead to the misattribution of responsibility, often blaming actors who are responding rationally to prevailing economic and institutional conditions. In this context, Table 2 presents the perceptions of local communities regarding the major socio-economic drivers of deforestation, degradation, and fragmentation in the study area.

The results in Table 2 indicate that 48.2% of respondents identified agricultural activities, including subsistence farming, commercial agriculture, and livestock production as the primary driver of deforestation, degradation, and fragmentation. Firewood collection was reported by 25% of respondents as a significant contributing factor. Additionally, 12.4% and 9.6% of respondents attributed these processes to logging activities and poverty/unemployment, respectively. Settlement expansion and infrastructure development were perceived as the least influential drivers, accounting for only 4.8% of responses.

These findings suggest that activities such as agricultural expansion, fuelwood extraction, livestock grazing, and commercial timber harvesting constitute the principal agents of forest loss in the study area. The results are consistent with findings by Yang (2023), who reported that agriculture is the leading direct driver of deforestation globally. According to the United Nations Framework Convention on Climate Change (UNFCCC), approximately 48% of deforestation is attributed to subsistence agriculture, 32% to commercial agriculture, 14% to logging, and 5% to fuelwood extraction.

Given these findings, there is a clear need for community-based interventions that promote sustainable forest management practices. Strategies such as agroforestry, the taungya farming system, and climate-smart agricultural practices should be encouraged to reduce pressure on forest resources and address the socio-economic drivers of deforestation, degradation, and fragmentation.

Table 2: Socio-Economic Causes of Deforestation, Forest Degradation and Fragmentation

Causes (Drivers)	%
Firewood collection	25
Agriculture	48.2
Logging	12.4
Poverty and unemployment	9.6
Settlement/infrastructure development	4.8
Total	100

Source: Field Survey, 2022.

3.2 Socio-Economic Determinants of Deforestation, Forest Degradation and Fragmentation

This study attributed to socio-demographic factors, such as population growth and the political economy of class structure, and specific exploitation activities like commercial logging, forest farming, fuel wood gathering, and pasture clearance for cattle production to be the determinant of deforestation, degradation and fragmentation in the study area. Table 3 provides an overview of both direct and underlying socio-economic determinants of deforestation, degradation and fragmentation. From the result, high population growth (45.2%) coupled with rapidly conversion/expanding of agricultural land (25.3%), and over-exploitation of forest resources for collection of solid biomass and timber (13.5%) as well as livestock herding/cattle ranching (11.5%) are believed to be responsible for accelerated rate of deforestation, degradation and fragmentation in the study area. Similarly Kumar et al., (2022) pointed out that population explosion, land-use change for agriculture, industry, urbanization, and improper forest management are considered as the major reasons responsible for the acceleration of forest degradation. The study further maintained that deforestation and forest degradation set off a series of environmental changes that significantly reduce the valuable provisioning services and also affect local and global biodiversity. This shows the need for forest landscape restoration to restore the integrity of deforested or degraded landscapes through the adoption of nature-based solutions such as plantation, agro-forestry, watershed management and erosion control, as well as natural forest regeneration.

Table 3: Socio-Economic Causes of Deforestation, Degradation and Fragmentation

Causes	%
Rapid population growth	45.2
Conversion/ expanding of forest to agricultural land	25.3
Collection firewood /timber	13.5
Livestock herding/cattle ranching	11.5
Weakness of regulatory and corruption fighting mechanisms	4.5
Total	100

Source: Field Survey, 2022.

3.3 Severity of the Consequences of Deforestation, Degradation and Fragmentation

Table 4 shows the perceived consequences of deforestation, forest degradation and fragmentation arising from economic activities in the study, the result reveals that about 44% of the respondents indicated that deforestation, degradation and fragmentation have disreputably affected the environmental stability and socioeconomic development of Malumfashi Local Government Area negatively while 46% of the respondents agreed that deforestation, degradation and fragmentation have damaging affect ecological balance and

socioeconomic development of Malumfashi Local Government Area. Finally only insignificant percentage (10%) of the respondents view that deforestation, degradation and fragmentation have damaging affect ecological balance and socioeconomic development of the study area. This implies that majority of the respondents are fully aware and convinced of the fact that their environment is exposed to danger through their actions in particular through their means of livelihood and socio-economic pursuits. This called for urgent action to mitigate the impact by embarking on sustainable forest management practices, sustainable land use management, sustainable and climate smart agriculture, agro-forestry, afforestation, reforestation, development of shelter belt and adoption of sustainable, climate smart and modern energy in the study area. Bello et, al. (2019) and Yang (2023) argued that deforestation and forest degradation results in the significant environmental consequences, such as harmful soil erosion and transformation of productive into wasteland.

Although Yang (2023) argued that there has been debate over how population increase affects deforestation, but further added that population growth accounted for just 8% of occurrences of tropical deforestation. According to him the United Nations Food and Agriculture Organization found in 2000, that deforestation can be caused by a combination of population pressure and stagnant economic, social, and technological conditions and the role of population growth in a local setting may vary from decisive to negligible.

As the population pressure may continue to affect the existing patches of forest reserve and irrespective of the nature of the consequences there is for more concerted effort of individual and community in sustainable agricultural practices as well as restoration of the degraded forest reserve plus establishment of new plantations, woodlots, shelter belt and grazing reserves in order to mitigate the significant environmental consequences, such as harmful soil erosion and wasteland arising from deforestation, degradation and fragmentation.

Table 4: Perceived Consequences of Deforestation, Degradation and Fragmentation

Response	%
Disruptive	44
Damaging	46
Nuisance	10
Total	100

Source: Field Survey, 2022.

3.4 Conclusion and recommendation

The study concluded that socio-economic and means of livelihood of the people to some extent were the major drivers/causes and determinates of deforestation, forest degradation and fragmentation in the study area. It was discovered that agriculture (crop production of subsistence and commercial farming and livestock) was the major driver of deforestation, forest degradation and fragmentation while rapid population growth that is associated with demand for

more expansion of agricultural land, space for housing and productive activities and urbanization were determinants for deforestation, forest degradation and fragmentation in the study area. Based on the findings of the research it was recommended that;

- i. There should be community engagement aimed at sustainable forest management and sustainable practices such agro-forestry, taungya farming system and climate smart agricultural productions that may discourage deforestation, degradation and fragmentation from the complex socio-economic and livelihood processes.
- ii. There is need for forest landscape restoration to bring back the integrity of deforested or degraded landscapes through the adoption of nature-based solutions such as plantation, agro-forestry, watershed management, erosion control, and natural forest regeneration.
- iii. There is need for more concerted effort of individual and community in sustainable agricultural practices and restoration of the degraded forest reserve plus establishment of new plantations, woodlots, shelter belt and grazing reserves

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