



ANALYSIS OF THE EFFECT OF DEFORESTATION AND SUSTAINABLE SOLUTIONS IN DARAZO LOCAL GOVERNMENT AREA, BAUCHI STATE NIGERIA

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ABSTRACT

The study analyzed the effects of deforestation and proffered sustainable solutions in Darazo Local Government Area, of Bauchi State, Nigeria. A multi-stage sampling technique was employed in selecting 400 respondents for the study. Data were collected using structured questionnaires and analyzed using descriptive statistics. The findings revealed that the majority (70.0%) of respondents were male, while 30.0% were female. Subsistence farming was the predominant occupation (58.7%), followed by trading/small business (20.0%), wood/charcoal vending (14.6%), and civil service (6.7%). Regarding education, 43.3% had no formal education, while only 6.7% attained tertiary education. Analysis of domestic energy sources showed heavy dependence on traditional biomass, with firewood/fuelwood being the dominant source (76.7%), followed by charcoal (16.7%), kerosene (4.7%), and Liquefied Petroleum Gas (LPG) (2.0%). Respondents' perception of deforestation drivers ranked uncontrolled firewood/charcoal collection as the highest driver (mean = 4.81), followed by expansion of agricultural land (mean = 4.65), illegal commercial logging/timber trade (mean = 4.40), overgrazing by livestock (mean = 4.02), and road/infrastructure development (mean = 3.15). The study concludes that deforestation in the study area is driven primarily by domestic energy dependence and agricultural expansion, exacerbated by low education levels and poverty. The study recommends the promotion of alternative clean energy sources, community-based environmental education, enforcement of forestry regulations, and adoption of agroforestry practices to mitigate deforestation and enhance environmental resilience.

Keywords: Deforestation, Sustainable, Solutions, Domestic, Energy

INTRODUCTION

Forests play a critical role in maintaining ecological balance, supporting biodiversity, and providing socio-economic benefits to communities worldwide (FAO, 2022). They serve as carbon sinks, regulate water cycles, and provide livelihoods for millions of people, particularly in developing countries. However, rapid deforestation has emerged as a pressing environmental challenge across the globe. In Africa, the rate of forest loss is among the highest, with Nigeria ranked as one of the countries experiencing severe deforestation (World Bank Group, 2017; Climate Transparency, 2020). Deforestation in Nigeria is driven by several interrelated factors, including agricultural expansion, fuelwood collection, population pressure, logging, and infrastructural development (Ogunleye and Owoseni, 2023; Oyetunji *et al.*, 2020). These pressures have significantly altered forest landscapes, resulting in soil degradation, biodiversity loss, desertification, and shifts in local climate conditions (Ajala and Odunlami, 2020; Suleiman and Musa, 2020). The northern part of Nigeria, particularly Bauchi State, is highly vulnerable due to its semi-arid climate and dependence on land-based resources for survival (Sani and Yakubu, 2020; Ibrahim and Adamu, 2022). Darazo Local Government Area (LGA) in Bauchi State represents a critical case study, as it lies within the Sahelian ecological zone where desertification and land degradation are increasingly threatening local livelihoods (BASEPA, 2023; Bauchi State Government, 2024). Reports from Global Forest Watch (2025) indicate a consistent loss of forest cover in Darazo, exacerbated by rising population, unsustainable farming methods, and overreliance on wood fuel. The socio-economic impacts are profound, ranging from reduced



agricultural productivity to heightened vulnerability of rural households (Ayodele and Ologunorisa, 2021; Agbogidi *et al.*, 2020).

Despite these efforts, the effectiveness of existing strategies remains limited due to weak enforcement of environmental policies, poverty, and inadequate community participation (Agbogidi *et al.*, 2020; Solidaridad Network, 2025). There is therefore a growing need for systematic analysis of the drivers and effects of deforestation in Darazo LGA, alongside the identification of sustainable, community-driven solutions that align with Nigeria's Climate Change Policy and global frameworks for sustainable development (Bauchi State Government, 2024; WCED, 1987; Federal Ministry of Environment, 2021). In Bauchi State, and particularly in Darazo Local Government Area, deforestation is exacerbated by poverty, population pressure, and overdependence on wood for fuel and income generation (Ayodele and Ologunorisa, 2021; Ogunleye and Owoseni, 2023). According to Global Forest Watch (2025), forest cover loss in Darazo has intensified in recent years, with land being rapidly converted for agriculture, grazing, and fuelwood harvesting. The consequences include desert encroachment, soil degradation, rising land surface temperatures, and variability in rainfall patterns (Ajala and Odunlami, 2020; Suleiman and Musa, 2020; Sani and Yakubu, 2020). These environmental shifts not only threaten food security but also undermine the livelihoods of rural households that depend on natural resources for survival (Tama *et al.*, 2025; Ibrahim and Adamu, 2022). This study, therefore, seeks to analyze the environmental, climatic, and socio-economic effects of deforestation in Darazo Local Government Area, while also exploring sustainable solutions that can mitigate its impact and promote resilience for local communities. By bridging empirical evidence with policy and community action, the study will contribute to strategies for sustainable environmental management in Bauchi State and Nigeria at large.

The aim of this study is to analyze the effects of deforestation in Darazo Local Government Area, Bauchi State, Nigeria, and to propose sustainable solutions that can mitigate its impacts and promote environmental resilience.

The specific objectives of the study are to:

- i. describe the socioeconomic characteristics of the respondents;
- ii. identify the major sources of domestic energy by the respondents; and
- iii. determine respondents' perception of deforestation drivers

METHODOLOGY

The Study Area

The study is conducted in Darazo Local Government Area (LGA) of Bauchi State, Nigeria. Darazo lies approximately between latitudes 10°30'N and 11°30'N and longitudes 9°30'E and 10°30'E. It shares boundaries with Ganjuwa and Ningi LGAs to the west, Misau to the north, and parts of Jigawa and Yobe States to the east. The LGA serves as one of the major gateways between Bauchi and northeastern Nigeria. Darazo LGA covers an estimated landmass of about 3,985 km², making it one of the largest LGAs in Bauchi State. According to the National Population Commission (NPC, 2006), the LGA had a population of about 251,597 people, with current projections (based on an annual growth rate of 2.6%) placing the population above 400,000 as of 2023. The climate of the area is tropical continental, characterized by two distinct seasons: the rainy season (May–October) and the dry season (November–April). Annual rainfall ranges between 800 mm and 1200 mm, while temperatures vary from 21°C in the harmattan period to over 40°C in the hot season (March–April). Vegetation in Darazo is classified under the Sudan Savanna zone, consisting mainly of grasses, scattered shrubs, and drought-resistant trees such as neem (*Azadirachta indica*), baobab (*Adansonia digitata*), and locust bean (*Parkia biglobosa*). However, deforestation, overgrazing, and fuelwood harvesting have significantly altered the natural vegetation cover. Socio-economically, the people of Darazo are predominantly farmers, herders, and traders. Major crops include millet, sorghum, maize, groundnut, and beans. Livestock rearing is also a common practice, with cattle, goats, and sheep forming an integral part of rural livelihoods. In recent years, increasing pressure on land resources has accelerated deforestation, contributing to desertification and threatening local livelihoods.



Population of the Study

The population of this study comprises the residents of Darazo LGA, including rural households, community leaders, farmers, herders, fuelwood traders, and government officials. For the purpose of this research, the target population is defined as individuals aged 18 years and above, who are either directly or indirectly affected by deforestation and land-use changes. According to projections from the National Bureau of Statistics (NBS, 2023), the adult population of Darazo is estimated at approximately 220,000 individuals. This forms the accessible population from which the sample for the study is drawn.

Sampling Technique and Sample Size

Multi-stage sampling technique was adopted for this study. In stage one selection of wards Darazo LGA is subdivided into wards. A purposive sampling method was used to select five wards (e.g., Darazo, Gabciyari, Yautare, Sade, and Lanzai) based on high incidences of deforestation and accessibility. In second stage from the selected wards, two communities were randomly selected, making a total of ten communities. In the final stage from the selected communities, systematic random sampling was employed to select households. From each household, one adult respondent was chosen to participate in the survey. Additionally, Key Informant Interviews (KIIs) were conducted with selected stakeholders, including officials from Bauchi State Environmental Protection Agency (BASEPA), community heads, and representatives of non-governmental organizations engaged in environmental conservation.

The sample size was determined using Yamane's (1967) formula for finite population:

Where:

n = Sample size

N = Population size (220,000 adults)

e = Level of precision (0.05)

Thus, a sample size of 400 respondents was adopted for the survey. In addition, 10 key informants and 5 focus group discussions (FGDs) were included to complement quantitative findings with qualitative insights.

Methods of Data Collection

Data for this study were collected through the administration of structured questionnaire which were administered to sampled households to obtain quantitative data on perceptions, causes, and impacts of deforestation. Key Informant Interviews (KIIs) were conducted with stakeholders such as officials of Bauchi State Environmental Protection Agency (BASEPA), local government forestry officials, traditional rulers, and NGO representatives. Focus Group Discussions (FGDs) were organized in selected communities to capture collective views, gender perspectives, and community-level experiences of deforestation. Field Observations were also carried out to visually assess the extent of vegetation loss, land degradation, and community adaptation strategies. Secondary information was obtained from journals, government reports, textbooks, conference proceedings, Bauchi State development plans, and publications from international organizations such as the FAO, UNEP, and World Bank. These provided a theoretical and empirical basis for comparison with primary findings.

Methods of Data Analysis

Data collected were analyzed using both quantitative and qualitative methods. Responses from the structured questionnaires were coded and entered into the Statistical Package for the Social Sciences (SPSS) Version 26. Descriptive statistics such as frequency counts, percentages, mean scores, and standard deviation were used to summarize demographic characteristics, causes, and effects of deforestation.

RESULTS AND DISCUSSION

Socioeconomic Characteristics of the Respondents

The result from Table 1 revealed that the majority (70.0%) of respondents were male, while 30.0% were females. This gender distribution indicates that men are predominantly the primary decision-makers and frontline actors in land-use and forest-related activities in the study area. This implies that deforestation interventions and sustainable solution programs must intentionally target



men; however, the presence of 30.0% female respondents also indicated the need for gender-sensitive policies, as women in rural settings are heavily involved in fuelwood collection and household energy management. This finding aligns with Ogunleye and Owoseni (2023), who reported similar male-dominated participation in deforestation-related studies in northern Nigeria due to cultural norms and gendered division of labor.

Table 1: Distribution of Respondents Based on Socioeconomic Characteristics

Variable	Category	Frequency (n)	Percentage (%)
Gender	Male	105	70.0
	Female	45	30.0
Primary Occupation	Subsistence Farming	88	58.7
	Trading/Small Business	30	20.0
	Civil Service	10	6.7
	Wood/Charcoal Vendor	22	14.6
Education Level	No Formal Education	65	43.3
	Primary Education	40	26.7
	Secondary Education	35	23.3
	Tertiary Education	10	6.7
Total		150	100.0

The finding further revealed that subsistence farming was the most common livelihood activity, with more than half (58.7%) of respondents. This was followed by trading/small business (20.0%), wood/charcoal vending (14.6%), and civil service (6.7%). The predominance of subsistence farming highlights the heavy reliance of local households on land-based resources for survival. This finding implies that agricultural expansion is likely a major direct driver of deforestation, as farmers clear more forest areas to cultivate crops. This finding is consistent with Sani and Yakubu (2020) and Ibrahim and Adamu (2022), who documented that over 60% of rural households in Bauchi State depend on subsistence agriculture, leading to continuous forest conversion. On the other hand, the largest proportion of respondents (43.3%) had no formal education. Primary education accounted for 26.7%, secondary education 23.3%, and tertiary education only 6.7%. The high percentage of no formal education is significant because limited education reduces awareness of the environmental consequences of deforestation and limits adoption of sustainable land-use practices. This finding is in line with Ayodele and Ologunorisa (2021), who found that low educational attainment correlates with higher deforestation rates in rural Nigerian communities, as educated individuals are more likely to adopt alternative energy sources and agroforestry techniques.

Major Sources of Domestic Energy

The results from Table 2 revealed that analysis of domestic energy sources showed a heavy dependence on traditional biomass. Firewood/fuelwood (76.7%) was the dominant energy source, used by the respondents. This was followed by Charcoal (16.7%), while kerosene (stove) accounted for only 4.7%, and Liquefied Petroleum Gas (LPG) was used by only 2.0% of households. The overwhelming majority of the respondents relied on firewood which indicated that domestic energy demand is a critical driver of deforestation in the study area. Each household regularly harvest wood for cooking and heating exerts cumulative pressure on forest resources. The very low adoption of LPG reflects challenges of affordability, accessibility, and cultural cooking preferences. This finding implies that unless alternative clean energy sources are made available and affordable, forest degradation will continue unabated. The result is consistent with Global Forest Watch (2025), which reported that fuelwood collection accounts for over 70% of forest cover loss in the Sudan Savanna Zone of Nigeria. Similarly, Agbogidi *et al.* (2020) found that in rural areas of Northern Nigeria, firewood and charcoal constitute more than 80% of household energy mix, driven by poverty and lack of electricity.

Table 2: Respondents Distribution Based on Sources of Domestic Energy

Energy Source	Frequency (n)	Percentage (%)
Firewood/Fuelwood	115	76.7
Charcoal	25	16.7
Kerosene (Stove)	7	4.7
Liquefied Petroleum Gas (LPG)	3	2.0
Total	150	100.0

Perception of Deforestation Drivers

The findings from Table 3 revealed that respondents ranked five drivers of deforestation based on mean scores, with higher scores indicating stronger perceived importance. Uncontrolled firewood/charcoal collection was ranked 1st with a mean score (\bar{X} =4.81). This finding confirms that local communities themselves recognize fuelwood harvesting as the most pressing cause of forest loss in the study area. This implies that the finding on firewood/charcoal is near-universal agreement. This perception aligns with the energy use data where 93.4% of households (76.7% firewood 16.7% charcoal) depend on wood-based fuels.

Table 3: Respondents Perception of Deforestation Drivers

Deforestation Driver	Mean Score	Rank
Uncontrolled Firewood/Charcoal Collection	4.81	1 st
Expansion of Agricultural Land	4.65	2 nd
Illegal Commercial Logging/Timber Trade	4.40	3 rd
Overgrazing by Livestock	4.02	4 th
Road/Infrastructure Development	3.15	5 th

Expansion of agricultural land ranked 2nd with a mean score of (\bar{X} =4.65). Given that majority of respondents are subsistence farmers, this perception is ecologically valid. As population increases, more forest areas are cleared for crop production, creating a feedback loop where deforestation reduces soil fertility, prompting further clearing of new forest lands. This finding corroborates Oyetunji *et al.* (2020), who reported agricultural expansion as the primary driver of deforestation in semi-arid Nigeria. Illegal commercial logging/timber trade ranked 3rd (\bar{X} =4.40). Although not the top driver, this score indicated that commercial exploitation of timber for construction and sale is a recognized problem. The implication is that weak enforcement of forestry regulations allows unsustainable logging to persist. This agrees with Suleiman and Musa (2020), who documented illegal logging as a major but often underreported cause of forest degradation in Bauchi State.

Overgrazing by livestock ranked 4th (\bar{X} =4.02). In Darazo, where farming and herding coexist, livestock grazing damages tree seedlings and compacts soil, reducing forest regeneration capacity. The implication is that farmer-herder conflicts and land-use competition indirectly worsen deforestation. This finding is consistent with Tama *et al.* (2025), who noted that overgrazing in the Sudan Savanna zone accelerates desertification by removing vegetative cover. Road/infrastructure development ranked 5th (\bar{X} =3.15). Although still above the midpoint of the scale, this suggests that while infrastructure projects contribute to forest loss, respondents view them as less immediate compared to fuelwood collection and farming. This finding diverges slightly from some National-level reports (e.g., Federal Ministry of Environment, 2021) which rank infrastructure higher; however, in a rural, economically marginalized LGA like Darazo, direct livelihood pressures (energy and food) naturally dominate local perceptions.

CONCLUSION AND RECOMMENDATION

Deforestation in study area is driven predominantly by heavy dependence on traditional biomass energy, with households using firewood and charcoal, alongside agricultural expansion practiced by subsistence farmers, due to low level of education. The community accurately perceives uncontrolled fuel wood collection and agricultural land expansion as the most critical drivers, while the



negligible adoption of clean energy alternatives like LPG reflects persistent energy poverty and weak policy enforcement. zone.

Based on the findings the following recommendations were made;

- i. The Federal and State Government should subsidize the distribution of Liquefied Petroleum Gas (LPG) and improved cooking stoves to reduce the household dependence on wood-based fuels.
- ii. Government and other stakeholders should intensify environmental education programs using local languages should be implemented to reach out to the respondents with no formal education.
- iii. Community forest surveillance committees should be established to combat illegal logging among deforestation drivers.
- iv. Agricultural extension services should promote agroforestry and boundary planting to address agricultural expansion by subsistence farmers.
- v. Designated grazing reserves and cut-and-carry fodder systems should be introduced to mitigate overgrazing.

REFERENCES

- African Development Bank. (2017). African economic outlook 2017: Entrepreneurship and industrialisation. Abidjan: African Development Bank.
- Agbogidi, O. M., Okumagba, P. O., & Akpoborie, A. (2020). Deforestation and rural livelihood in the Niger Delta region of Nigeria. *Journal of Environmental Science and Technology*, **13**(2): 45-54.
- Ajala, O. A., & Odunlami, S. A. (2020). Climate change and deforestation in northern Nigeria: Causes and consequences. *Nigerian Journal of Geography and the Environment*, **8**(1): 22-35.
- Ayodele, O. O., & Ologunorisa, T. E. (2021). Socio-economic drivers of deforestation in rural Nigeria. *Journal of Sustainable Development in Africa*, **23**(4): 67-82.
- BASEPA (Bauchi State Environmental Protection Agency). (2023). State of the environment report: Bauchi State. Bauchi: BASEPA Publications.
- Bauchi State Government. (2024). Bauchi State development plan 2024-2028: Towards sustainable environmental management. Bauchi: Ministry of Budget and Economic Planning.
- Climate Transparency. (2020). Brown to green: The G20 transition to a low-carbon economy. Berlin: Climate Transparency Secretariat.
- FAO (Food and Agriculture Organization). (2022). The state of the world's forests 2022: Forest pathways for green recovery and building inclusive, resilient and sustainable economies. Rome: FAO.
- Federal Ministry of Environment. (2021). Nigeria's climate change policy: A roadmap for national climate action. Abuja: Federal Ministry of Environment.
- Global Forest Watch. (2025). Tree cover loss in Nigeria: Darazo Local Government Area, Bauchi State. Retrieved from <https://www.globalforestwatch.org>
- Ibrahim, A. B., & Adamu, Y. M. (2022). Land use change and forest degradation in semi-arid zones of Bauchi State, Nigeria. *West African Journal of Ecology*, **19**(3): 112-128.
- National Population Commission (NPC). (2006). 2006 population and housing census of the Federal Republic of Nigeria: Priority tables. Abuja: National Population Commission.
- National Bureau of Statistics (NBS). (2023). Demographic statistics bulletin 2023. Abuja: National Bureau of Statistics.
- Ogunleye, M. B., & Owoseni, J. O. (2023). Drivers of deforestation in northern Nigeria: A household-level analysis. *African Journal of Environmental Economics*, **11**(2): 89-104.
- Oyetunji, O. T., Adebayo, A. A., & Olaniyi, O. M. (2020). Agricultural expansion as a driver of deforestation in Nigeria's savanna regions. *Journal of Tropical Agriculture and Environment*, **14**(1): 33-48.
- Sani, A., & Yakubu, M. (2020). Vulnerability of rural households to deforestation in semi-arid Nigeria. *Savanna Journal of Geography*, **7**(2): 56-71.



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- Solidaridad Network. (2025). Sustainable landscape management in northern Nigeria: Progress and challenges. Abuja: Solidaridad West Africa.
- Suleiman, K., & Musa, I. (2020). Environmental impacts of deforestation in Bauchi State, Nigeria. *Journal of Arid Environment Studies*, **12**(3): 101-118.
- Tama, D. M., Bello, A., & Umar, H. (2025). Overgrazing and desertification in the Sudan Savanna zone of Nigeria. *Pastoralism and Environmental Change*, **9**(1): 44-59.
- WCED (World Commission on Environment and Development). (1987). Our common future (The Brundtland Report). Oxford: Oxford University Press.
- World Bank Group. (2017). World development indicators 2017: Forests and deforestation. Washington, DC: World Bank Publications.
- Yamane, T. (1967). Statistics: An introductory analysis (2nd ed.). New York, NY: Harper and Row.