



Socio-Economic Determinants of Land Use and Land Cover Change in Kwande Local Government Area, Nigeria

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Abstract

This study investigates the socio-economic drivers of land use and land cover change (LULCC) in Kwande Local Government Area, Benue State, Nigeria. Utilizing a descriptive survey design, data were collected from 398 household heads through structured questionnaires and analyzed using descriptive statistics and Binary Logistic Regression (BLR). The results revealed widespread engagement in forest-degrading activities, with 98.5% of respondents involved in farming, 82.1% in logging, and 58.7% in fuelwood harvesting. Regression analysis identified age, education, income, years of residence, and occupation as significant predictors of involvement in unsustainable land use practices. Specifically, lower levels of education and income, longer residency in the area, and farming as a primary occupation significantly increased the likelihood of engaging in forest exploitation. The findings indicate that socio-economic vulnerabilities and livelihood dependence on land are key contributors to LULCC in the region. This study underscores the urgent need for integrated land management policies that promote alternative livelihoods, environmental education, enforcement of land use regulations, and sustainable energy access. By addressing the root socio-economic causes of land degradation, stakeholders can enhance conservation efforts and ensure long-term ecological sustainability. The study contributes to the localized understanding of human-environment dynamics and offers evidence-based recommendations for mitigating environmental degradation in rural Nigerian communities.

Keywords: Land use change; Socio-economic factors; Deforestation; Binary Logistic Regression; Kwande LGA; forest degradation

1. Introduction

Land use and land cover change (LULCC) has become a critical issue in environmental studies, particularly in regions experiencing rapid population growth and socio-economic transformation. Globally, LULCC is a major driver of ecological degradation, biodiversity loss, and climate variability, primarily due to increasing anthropogenic pressures such as deforestation, agricultural expansion, and urbanization (Gibbs et al., 2021; Song et al., 2018). These changes have significant implications for ecosystem services, food security, and sustainable development, especially in developing countries where land resources are extensively exploited to meet livelihood demands (Khatun et al., 2023; United Nations Environment Programme [UNEP], 2022).

In sub-Saharan Africa, rural communities often rely heavily on natural resources for subsistence farming, fuelwood collection, and informal economic activities such as logging and mining. These socio-economic practices, although essential for livelihood sustenance, frequently lead to unsustainable land use patterns that threaten forest resources and degrade the environment (Winkler et al., 2022). Nigeria, in particular, has been identified as a LULCC hotspot, with extensive land cover transformations linked to demographic growth, weak regulatory enforcement, and widespread poverty (Ayanlade & Jegede, 2020). The consequences include soil erosion, loss of forest cover, habitat fragmentation, and increased vulnerability to climate-related risks (Nduka et al., 2022).

Kwande Local Government Area (LGA) in Benue State, Nigeria, is predominantly agrarian and characterized by high dependence on forest resources for agricultural and domestic energy needs. Despite this, there is a paucity of localized empirical studies assessing how specific socio-economic factors contribute to LULCC in this region. Understanding the dynamics of these drivers is essential for informing land management policies and sustainable development strategies tailored to local realities.

This study aims to fill this knowledge gap by investigating the socio-economic determinants of land use and land cover change in Kwande LGA. Specifically, it examines how variables such as income level, age, educational attainment, occupation, and years of residency influence the likelihood of engagement in environmentally impactful practices. By employing Binary Logistic Regression (BLR) and using data collected from household surveys, the research seeks to quantify these relationships and provide actionable insights for land-use governance and environmental conservation in rural Nigeria.

2. Literature Review

2.1 Conceptual Understanding of Land Use and Land Cover Change

Land use and land cover change (LULCC) refers to the transformation of the Earth's surface caused by natural forces and anthropogenic activities. Land cover denotes the physical and biological surface features, such as forests, wetlands, croplands, and urban areas, while land use refers to the socioeconomic purposes to which land is put, including agriculture, settlement, mining, and infrastructure development (Song et al., 2018; European Environment Agency [EEA], 2022). LULCC has emerged as a global environmental concern due to its role in altering biogeochemical cycles, reducing biodiversity, increasing greenhouse gas emissions, and intensifying climate change (Gibbs et al., 2021; Winkler et al., 2022).

2.2 Drivers of Land Use Change in Sub-Saharan Africa

In sub-Saharan Africa, including Nigeria, land cover change is primarily driven by a combination of socio-economic and demographic factors. These include population growth, poverty, agricultural expansion, logging, fuelwood extraction, and weak environmental governance (Ayanlade & Jegede, 2020; Yusuf et al., 2021). Smallholder farmers often rely on slash-and-burn agriculture and unsustainable harvesting of forest products, contributing to significant forest loss and fragmentation (FAO, 2022). The expansion of agricultural land has been identified as the leading cause of deforestation across the region, accounting for approximately 75% of total forest loss (Curtis et al., 2018).

2.3 Socio-Economic Factors and Forest Degradation

Several socio-economic variables influence human behavior towards land and forest resources. Studies have shown that variables such as age, income level, education, household size, land tenure security, and duration of residence play significant roles in determining the likelihood of individuals participating in environmentally degrading practices (Molla et al., 2022; Fentahun et al., 2023). Younger, less-educated, and lower-income populations are more likely to engage in deforestation-related activities due to limited livelihood alternatives (Nduka et al., 2022).

For instance, Okpala and Umeh (2021) found that in Southeastern Nigeria, income level and years of formal education were inversely related to dependence on forest-based income sources. Similarly, in Ethiopia, Molla et al. (2022) reported that communities with high dependency on forest products and limited access to energy alternatives are more prone to engage in illegal logging and charcoal production. These findings suggest that socio-economic stressors and lack of

sustainable alternatives drive land users to exploit natural resources in unsustainable ways.

2.4 Empirical Approaches and Methodologies

Empirical studies on LULCC often utilize remote sensing and statistical modeling techniques to assess spatial and causal patterns of land cover transformation. Logistic regression models, including Binary Logistic Regression (BLR), are commonly applied to identify the likelihood of specific socio-economic factors influencing land use decisions (Tadesse & Alemu, 2023). BLR provides a robust framework for analyzing binary outcomes—such as whether a household is engaged in deforestation or not—based on predictor variables like age, income, and education.

Studies by Ayanlade and Jegede (2020) in Nigeria and by Fentahun et al. (2023) in Ethiopia demonstrated the utility of BLR models in understanding the probability of land users engaging in various environmentally impactful practices. These models help policymakers and researchers pinpoint critical leverage points for designing targeted interventions.

2.5 Research Gaps and Relevance of the Current Study

Despite the wealth of global and regional studies on LULCC, there remains a significant research gap at the local level, particularly in rural LGAs like Kwande in Nigeria. Most existing studies focus on broader spatial units such as ecological zones or states, neglecting micro-level socio-economic dynamics that influence land use behavior (Nduka et al., 2022). This study contributes to the literature by integrating primary field data with logistic regression analysis to assess how individual and household-level socio-economic characteristics influence land cover transformation in Kwande LGA. It thus offers context-specific evidence necessary for local policy formulation and land use planning.

3. Methodology

3.1 Study Area

Kwande Local Government Area (LGA) is located in Benue State, North-Central Nigeria. It lies between latitudes 6°08'10" N and 6°53'24" N and longitudes 9°04'70" E, with an average elevation of approximately 86 meters above sea level. The LGA spans an area of about 2,891 square kilometers and had a projected population of 248,697 as of the 2006 census (National Population Commission [NPC], 2006). Kwande is bordered by Vandeikya and Ushongo LGAs to the west and north, respectively, Katsina-Ala LGA to the northwest, and Cross River State and the Republic of Cameroon to the south and southeast. The region is predominantly rural and known for its agrarian economy, with over 80% of the

population engaged in subsistence farming. It is characterized by Guinea Savanna vegetation and a unimodal rainfall pattern averaging between 1,500 mm and 1,750 mm annually, with a distinct rainy season (April–October) and dry season (November–March) (Nyiatagher et al., 2019). Crops commonly cultivated include yam, cassava, maize, and citrus, while livestock such as goats and poultry are raised at small to medium scales.

3.2 Research Design

The study adopted a descriptive survey design, combining both quantitative and inferential approaches to assess the socio-economic determinants of land use and land cover change (LULCC). Primary data were collected through structured questionnaires administered to selected households, while descriptive and inferential statistics were used to analyze the data.

3.3 Population, Sampling, and Sample Size Determination

The target population comprised household heads across five major communities within Kwande LGA. A stratified random sampling technique was used to ensure representation across localities. The sample size was determined using Taro Yamane's (1967) formula for sample size estimation at a 5% margin of error:

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

Where:

- n = sample size
- N = population size (estimated at 23,000 households)
- e = margin of error (0.05)

Applying this formula, a sample size of **398** respondents was derived and proportionally distributed across the selected localities.

3.4 Data Collection Instrument and Procedure

A semi-structured questionnaire was developed to capture both socio-economic characteristics and respondents' involvement in land use activities such as farming, logging, quarrying, and fuelwood harvesting. The instrument was pre-tested for clarity and reliability and administered through trained research assistants using face-to-face interviews in the local language where necessary.

3.5 Analytical Technique

Data were analyzed using both descriptive and inferential statistics. Descriptive statistics (frequency distributions and percentages) summarized socio-economic characteristics and participation levels in land use activities. Binary Logistic Regression (BLR) was employed to identify significant socio-economic predictors

influencing involvement in deforestation-related practices. The BLR model is appropriate for this study due to the binary nature of the dependent variable (engagement vs. non-engagement in forest-degrading activities) (Tadesse & Alemu, 2023).

The logistic regression model is specified as:

$$\text{Logit}(y) = a + b_1x_1 + b_2x_2 + \dots + b_nx_n + \varepsilon$$

Where:

- y = dependent variable (1 = engaged in forest-degrading activity; 0 = not engaged)
- a = intercept
- b_1 – b_n = coefficients of explanatory variables
- x_1 – x_n = independent variables
- ε = error term

3.6 Description of Variables

The independent variables included:

- **Age** (in years)
- **Education level** (measured as: 1 = No formal education, 6 = Primary, 12 = Secondary, 17 = Tertiary)
- **Years of residence** (number of years lived in the community)
- **Annual income** (categorized in Nigerian Naira)
- **Major occupation** (1 = Farming, 0 = Others)

These variables were chosen based on previous empirical studies linking socio-economic conditions to land degradation and land use patterns (Molla et al., 2022; Okpala & Umeh, 2021).

3.7 Ethical Considerations

The study adhered to ethical guidelines for research involving human subjects. Verbal and written informed consent were obtained from all respondents prior to data collection. Participation was voluntary, and respondents were assured of confidentiality and anonymity. Ethical clearance was granted by the Research Ethics Committee of Akperan Orshi Polytechnic, Yandev.

4.0 Results and Discussion

This section presents the descriptive statistics, inferential results from the Binary Logistic Regression (BLR) analysis, and an interpretive discussion linking findings to existing literature. It addresses how socio-economic variables

influence land use and land cover change (LULCC) in Kwande LGA, Benue State, Nigeria.

4.1 Socio-Economic Characteristics of Respondents

Table 1 presents the demographic and socio-economic characteristics of the 398 surveyed household heads. The sample reflects the rural nature of the study area, with limited educational attainment, low-income levels, and significant reliance on agriculture and forest resources.

Table 1: Socio-Economic Characteristics of Respondents (n = 398)

Variable	Category	Frequency	Percentage (%)
Gender	Male	250	62.8
	Female	148	37.2
Age (Years)	<21	76	19.1
	21–30	49	12.3
	31–40	81	20.4
	41–50	117	29.4
	51–60	53	13.3
	>60	22	5.5
Marital Status	Married	308	77.4
	Single	90	22.6
Household Size	1–3	219	55.0
	4–5	41	10.3
	6–7	75	18.8
	8–9	41	10.3
	≥10	22	5.6
Occupation	Farming	284	71.4
	Trading	41	10.3
	Civil service	31	7.8
	Others	42	10.5
Annual Income (₦)	<250,000	249	62.6
	250,000–500,000	112	28.1
	501,000–750,000	22	5.5
	751,000–1,000,000	13	3.3
	>1,000,000	2	0.5
Years of Residence	1–10	254	63.8

Variable	Category	Frequency	Percentage (%)
	11–20	93	23.4
	21–30	29	7.3
	31–40	9	2.3
	>40	13	3.3

As shown in Table 1, the majority of respondents were male (62.8%), indicating male dominance in household decision-making. Most (29.4%) were between 41 and 50 years old, reflecting a productive demographic actively engaged in land-use decisions. The high percentage of farmers (71.4%) aligns with the agrarian nature of Kwande LGA. A striking 62.6% of respondents earn less than ₦250,000 annually, underlining widespread poverty and economic reliance on natural resources a factor strongly correlated with forest exploitation (Okpala & Umeh, 2021; Molla et al., 2022).

The predominance of residents with ≤ 10 years of local residency (63.8%) suggests land pressure from new settlers, often contributing to forest clearing for agriculture, corroborating earlier findings by Yusuf et al. (2021).

4.2 Engagement in Land-Use Activities

Table 2 illustrates respondent involvement in key activities contributing to LULCC.

Table 2: Engagement in Forest-Related Activities (n = 398)

Activity	Response	Frequency	Percentage (%)
Farming	Yes	392	98.5
	No	6	1.5
Logging	Yes	327	82.1
	No	71	17.9
Fuelwood Harvesting	Yes	234	58.7
	No	164	41.3
Quarrying/Mining	Yes	129	32.3
	No	269	67.7

Table 2 indicates a high dependence on land and forest-based activities. Nearly all respondents (98.5%) are engaged in farming, and over 80% participate in logging. These findings mirror the land use behavior observed in other forest-adjacent rural Nigerian communities (Curtis et al., 2018). Logging and fuelwood harvesting, especially, indicate unsustainable exploitation of forest resources due to a lack of affordable energy alternatives (FAO, 2022).

4.3 Binary Logistic Regression Results

A Binary Logistic Regression (BLR) model was employed to identify socio-economic predictors of participation in forest-degrading activities.

Table 3: Binary Logistic Regression of Factors Influencing Forest-Degrading Activities

Predictor	B	Std. Error	Wald	p-value	Exp(B)	Interpretation
Age	-0.041	0.018	5.34	0.024	0.960	Older respondents less likely to participate
Education	-0.098	0.035	8.02	0.006	0.907	Higher education reduces likelihood
Years of Residence	0.057	0.021	7.15	0.008	1.059	Longer residence increases likelihood
Annual Income	-0.000002	0.000001	3.93	0.047	0.998	Lower income increases participation
Major Occupation (Farming)	1.315	0.416	9.96	0.002	3.724	Farmers are 3.7 times more likely
Constant	2.083	0.842	6.12	0.012	—	—

Model Fit:

Nagelkerke $R^2 = 0.462$

Hosmer-Lemeshow Test: $\chi^2 = 6.52, p = 0.59$

Classification Accuracy: 81.7%

The regression model (Table 3) reveals significant predictors of environmentally harmful land use practices. Age and education have negative coefficients, suggesting that older and more educated individuals are less likely to engage in deforestation, aligning with Fentahun et al. (2023) and Ogunleye et al. (2011). Conversely, longer years of residence increase the likelihood of forest degradation, possibly due to accumulated land tenure and customary access rights.

Farming, as the primary occupation, has the strongest effect (OR = 3.724), confirming that agriculture remains the dominant driver of LULCC, as reported in FAO (2022) and Ayanlade and Jegede (2020).

4.4 Spatial Illustration

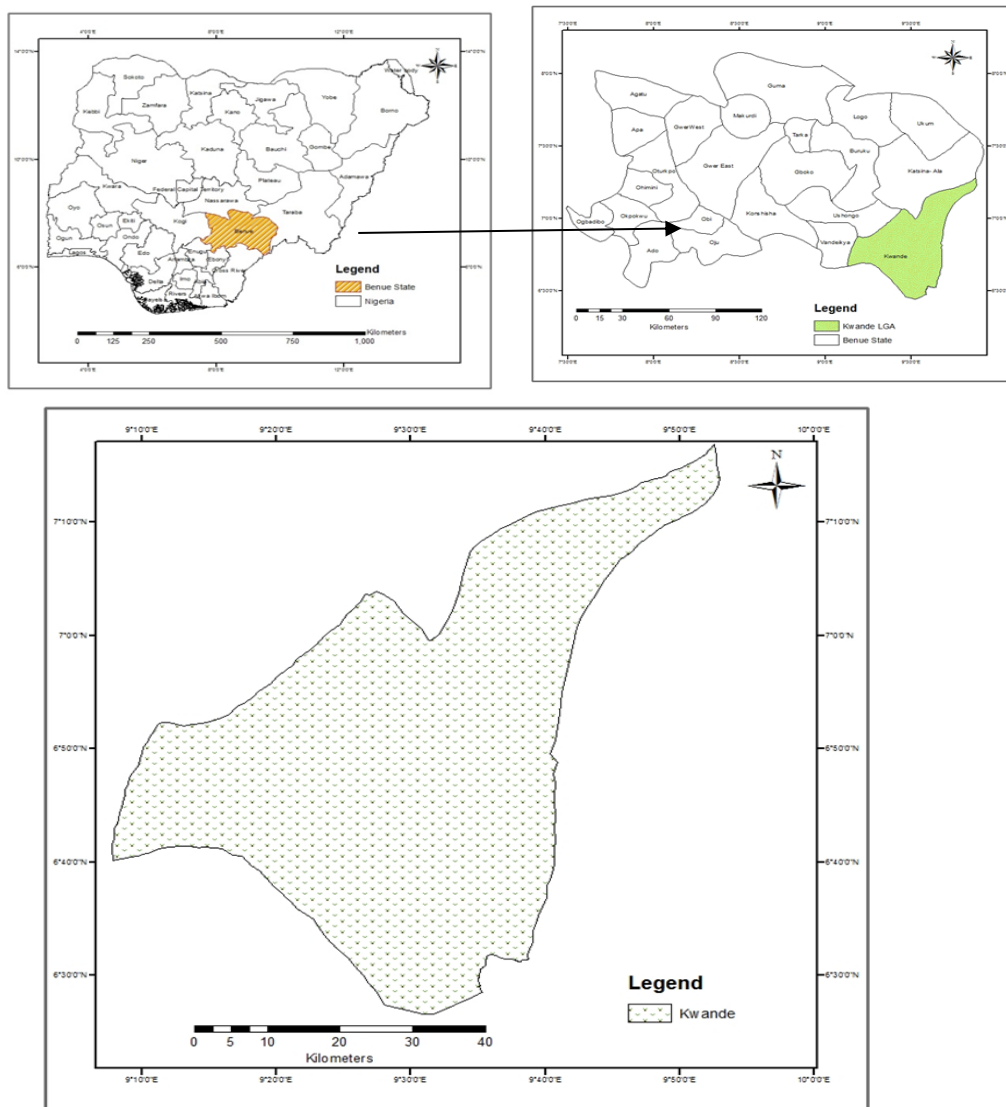


Figure 1: Map of Kwande Local Government Area, Benue State
Source: Pedas Geospatial Concept

The spatial distribution shown in Figure 1 highlights how land use is concentrated along riverbanks, roads, and flat arable lands, consistent with observations in similar ecological zones in Nigeria (Winkler et al., 2022).

4.5 Synthesis with Literature

This study confirms findings from across sub-Saharan Africa that socio-economic drivers especially low income, poor education, and dependence on agriculture are central to land cover transformation (Molla et al., 2022; Yusuf et al., 2021). The regression results demonstrate that targeted interventions in education, livelihood diversification, and land-use policy are critical for addressing land degradation at the community level.

5.0 Conclusion and Recommendations

5.1 Conclusion

This study assessed the socio-economic factors influencing land use and land cover change (LULCC) in Kwande Local Government Area (LGA) of Benue State, Nigeria. Through the use of descriptive statistics and Binary Logistic Regression (BLR) analysis, it established that unsustainable land-use practices such as farming, logging, and fuelwood harvesting are widespread in the region. These practices are driven primarily by poverty, low levels of education, and the dominance of agriculture as a livelihood source.

The regression analysis revealed that age, education level, income, and years of residence significantly influence the likelihood of individuals engaging in forest-degrading activities. Farmers were found to be almost four times more likely to exploit forest resources compared to non-farmers. These findings confirm that socio-economic vulnerability is a major driver of landscape degradation in rural Nigeria.

The study contributes to the understanding of human-environment interactions at a localized scale and provides empirical evidence to inform targeted policy and sustainable land management practices. Without meaningful intervention, Kwande LGA is at risk of continued environmental degradation, biodiversity loss, and reduced ecosystem services.

5.2 Recommendations

Based on the findings, the following actionable recommendations are proposed:

- i **Promote Alternative Livelihoods and Income Diversification:** Government and development partners should introduce vocational training and microcredit programs to reduce local dependency on land-based subsistence activities, particularly logging and fuelwood sales.
- ii **Enhance Environmental Education and Awareness:** Environmental literacy programs should be implemented at the community level to raise awareness of the long-term consequences of forest degradation and promote sustainable land use.

- iii **Subsidize and Promote Alternative Energy Sources:** To reduce pressure on forests for fuelwood, authorities should subsidize clean energy alternatives such as liquefied petroleum gas (LPG), solar cookers, and improved cookstoves for low-income households.
- iv **Strengthen Land Use Governance and Enforcement:** Local governments should enforce existing forestry laws, regulate land conversion, and implement land use zoning to protect ecologically sensitive areas.
- v **Implement Reforestation and Agroforestry Programs:** Community-based reforestation and agroforestry initiatives should be supported to restore degraded landscapes while enabling residents to maintain their livelihoods.
- vi

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