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EFFECTS OF LIVELIHOOD ACTIVITIES ON ENVIRONMENTAL DEGRADATION AMONG FARMING HOUSEHOLDS IN THE KWAMI LOCAL GOVERNMENT AREA GOMBE STATE, NIGERIA

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Abstract

This study analyzed the environmental effects of livelihood diversification activities among farming households in Kwami Local Government Area, Gombe State, Nigeria. A multi-stage sampling procedure was employed to select 360 respondents, and a structured questionnaire was used to collect data. Descriptive statistics and OLR were used for data analysis. The top three non-farm livelihood activities among respondents were charcoal production (33.3%), logging and timber processing (13.9%), and mining (9.2%). Environmental degradation was measured using a 5-point Likert scale and categorized into three levels: low (1–2), medium (3), and high (4–5). The OLR analysis showed that charcoal production, logging, and mining had statistically significant and positive effects on environmental degradation levels, with charcoal production having the strongest impact. The study concludes that unsustainable livelihood diversification strategies significantly contribute to environmental degradation. Therefore, adopting sustainable alternatives that minimize ecological damage is essential to ensure long-term environmental and livelihood security.

Introduction

Most rural households in Kwami LGA rely heavily on rain-fed farming, resulting in low economic returns, food insecurity, poverty, and increasing levels of destitution (Babatunde, 2013). This is due to their vulnerability to unpredictable rainfall patterns, prompting them to engage in other livelihood activities to supplement their

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income, such as mining, charcoal production, and lumbering. Farming households invest in alternative income-generating ventures, which is crucial to achieving economic stability. Rural households construct a diverse portfolio of activities and social support capabilities in their struggle for survival and improvement in their standards of living (Gebru *et al., 2018*). However, these livelihood activities, while offering potential economic benefits, also pose significant environmental risks. Increased reliance on resource-intensive activities, such as mining and deforestation, may lead to the exploitation of natural resources, contribute to environmental degradation, and undermine agricultural productivity and land sustainability. Livelihood activities' effect on the environment can vary greatly, and the net impact can depend on the balance between the positive and negative effects (Albore, 2018).

Environmental degradation refers to the deterioration of the environment through the depletion of resources (such as air, water, and soil quality), resulting in the destruction of ecosystems, habitat destruction, and negative impacts on human health and well-being (Yeganeh, 2020). The United Nation International Strategy for Disaster Reduction (UNISDR) refers to environmental degradation as "The reduction of the capacity of the environment to meet social and ecological objectives, and needs". The relationship between livelihood activities and environmental degradation among farmers is complex and can vary depending on various factors, such as location, socioeconomic conditions, and the specific activities being pursued.

Environmental degradation has become a major global issue in this century. It constitutes deforestation, soil erosion, biodiversity loss, water and air pollution, and the destruction of natural habitat. The effect of livelihood activities on the environment can vary greatly, and the net impact depends on the balance between the positive and negative effects (Vijay *et al*., 2022).

Studies have shown that farmers' livelihoods are supplemented by various activities, including firewood selling, quarrying, petty trading, and handycraft, owing to inadequate land resources and variability in rainfall patterns (Etuk, Udoe and Okon, 2018). Similarly, a greater part of the north diversified their income livelihoods as a response to unsustainable agriculture (Ahmed, 2012). Adi (2002) and Mohammed *et al*. (2020) identified four livelihood activities among residents in Nguru, namely: farming, trading, skilled non-farm and low skilled non-farm that are less directly dependent on ecosystem resources and environmental condition are prevalent.

Despite the importance of livelihood activities in Gombe state, empirically documented studies on its effect on environmental degradation in Kwami LGA of Gombe state are scarce. These livelihood activities in the area open the door for more negative factors on the environment. Hence, this study is necessary. Specifically, it sought to:

i. Identify the livelihood activities of the farming households in the study area;
ii. Examine the relationship between livelihood activities and levels of environmental degradation,
iii. To assess the impact of various livelihood activities on the likelihood of environmental degradation.

Methodology

The study was carried out in Kwami LGA of Gombe State, Nigeria, located on latitude 10.4931, 10°30'35 North, longitude 11.2099° 11°12'36°East, and covers a land area of about 1,787 square kilometers, It has a population of 195,298 people (2006 census) projected to 391,611 people at 3.5% growth rate in 2024. Annual rainfall of up to 1091.4 mm. Its temperature ranges from 32º to 40°C. It shares borders with Dukku LGA to the west, Gombe with the south, Bajoga to the north, and Yamaltu deba to the east. The indigenous people of kwame are the Kwamanci, Bolawa, Fulani, kanuri, Tera, and Hausa. Agriculture is the mainstay of the people, with arable land for sheep, goats, and cattle rearing. Over 80% of the population is directly engaged in small-scale farming of virtually all major arable crops. Other occupations include charcoal production, lumbering, blacksmithing, trading, crafting, hunting, and carving.

A multistage sampling technique was used to select the study respondents. The first stage involved the purposive selection of three districts (Bojude, Malam-sidi, and Gadam) from the four districts of Kwami LGA. This was done based on the observed prevalence of livelihood activities known to contribute to environmental degradation, such as cutting down trees for charcoal production in the districts. The second stage involved the purposive selection of two (2) communities from each of the selected districts, giving a total of six communities for the study: Doho, Taffi, Kurugu, Dinawa, Jarkwami, and Girgam. This was done based on accessibility and feasibility for data collection considering factors such as the willingness of the community to participate in the study. Finally, a sample size of three hundred and sixty (360) respondents was selected for the study, representing 10% of the total population of 3600 obtained from the Gombe State Agricultural Development Program (GSADP). This sample size was chosen because it provides a manageable and representative subset of a population, allowing for in-depth analysis and data collection.

Primary data were collected through a structured questionnaire administered to respondents to gather information on their livelihood activities and perception of the level of environmental degradation. Deforestation, soil erosion, and biodiversity loss were used as proxy indicators to measure environmental degradation. Environmental degradation levels were assessed using a Likert scale (1 = Low, 2 = Medium, 3 = High), where respondents rated the extent of soil erosion, deforestation, and other indicators of environmental degradation in the area. Responses were then classified into three categories based on predefined criteria: low, medium, and high. Respondents who reported minimal environmental degradation (e.g., low levels of soil erosion and minimal deforestation) were classified as "low," those who reported moderate levels were classified as "medium," and those who reported severe environmental degradation were classified as "high." The classification system was based on a scale of 1-5, where 1 = minimal environmental degradation and 5 = severe environmental degradation. Responses were categorized as follows: low (1-2), medium (3), and high (4-5).

This classification system allowed for the analysis of the relationships between the levels of environmental degradation and livelihood activities.

Data analysis was conducted using descriptive (frequency, percentage, rank) and inferential statistics (Ordinal Logistic Regression model, (OLR) The relationship between livelihood activities and environmental degradation levels was analyzed using OLR. Environmental degradation was categorized into three ordered levels: low, medium, and high. The independent variables included various livelihood activities, such as charcoal production and lumbering. The OR model estimated the odds ratios for each livelihood activity, indicating the change in odds of being in a higher environmental degradation category."

Model formula:

$Y\ (ED)=\beta_0 + \beta_1X_1 + \beta2X_2 + \beta3X_3 + \beta_4 X_4 +\ldots\ldots\ldots+ \beta n(Xn) + U_i\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots$ (i)

Where:

Y (ED): Environmental degradation (dependent variable)

X_1 , X_2 , X_3 ..... X_n: Livelihood activities (independent variables)

β_0: intercept

$\beta_1, \beta_2, \beta_3$..... βn: coefficients of each independent variable

X_1 = mining (number of times engaged per month)

X_2 = Charcoal production (number of bags produced per month)

X_3 = Logging and timber processing (number of woods harvested per month)

X_4 = Artisanal fishing (hours spent per month/year)

X_5 = brick-making (number of bricks laid per year);

X_6 = Construction (number of projects completed per year)

X_7 = Craftsmanship (number of items crafted per year)
X_8 = Transportation services (number of trips per year)
X_9 = Tourism-related activities (number of days per year engaged in tourism activities)
X_{10} = Small-scale manufacturing (hours spent manufacturing per year)
ε= Error term

Model

ED $=\beta_0+\beta_1$(mining)$+\beta 2$(Charcoal production) $+\beta 3$(Logging and timber processing) $+\beta_4$ (Artisanal fishing) $+\ldots\ldots+\beta_{10}$ (Small-scale manufacturing) + ε …… (ii)

Environmental degradation levels were assessed using a 5-point Likert scale, with 1 representing minimal degradation and 5 indicating severe degradation. The responses were classified into three categories:

i. Low degradation (1–2)
ii. Degradation (3)
iii. High degradation (4–5)

This classification enabled the use of OLR to evaluate the relationship between livelihood activities and environmental degradation levels. The dependent variable was environmental degradation (ED), while the independent variables included the frequency or intensity of livelihood activities such as charcoal production, mining, logging and timber processing, artisanal fishing, and other livelihood activities.

The model specification was:

ED=β0+β1X1+β2X2+β3X3+…+β10X10+εED = β_0 + β_1X_1 + β_2X_2 + β_3X_3 + \ldots + β_ {10}X_ {10} + \varepsilon

Where:

i. ED = environmental degradation (low, medium, and high)
ii. $X_1 – X_{10}$ = Livelihood activities
iii. $\beta_0 – \beta_{10}$ = Coefficients
iv. ε = Error term

Ordinal logistic regression (OLR) was used to estimate the odds of falling into a higher environmental degradation category with respect to each livelihood activity intensity. Model validity was assessed using pseudo-R-squared values and chi-square tests of likelihood ratio.

RESULTS AND DISCUSSION

Livelihood activities of the farming households

Table 1: Livelihood activities of the farming households in the study area. The predominant livelihood activities engaged by the farming households are charcoal production (33.3%), logging and timber processing (13.9%), and mining (9.2%). Charcoal production is an important source of income and may indicate a strong charcoal market demand. These activities have severe implications for environmental degradation. The high prevalence of charcoal production and logging significantly contribute to deforestation and soil erosion as trees are cut down and burned, while mining activities lead to soil contamination and water pollution. The cumulative effect of these livelihood activities is likely to have devastating consequences for the environment, ultimately threatening the ecosystem's sustainability, reducing agricultural productivity, and increasing vulnerability to climate change. Rukwe *et al.* (2019) also found that off-farm income-generating activities in the study area were skewed toward trading, blacksmithing, firewood selling, and other livelihood diversification activities in their study on rural farmers' households' livelihood security options amidst conflicts in Taraba State.

Table 1–Respondent distribution based on livelihood activities

Livelihood activities	Frequency	Percentage	Ranks
Artisanal fishing	30	8.3	4th
Charcoal production	120	33.3	1st
Brick-making	22	6.1	5th
Logging and processing of timber	50	13.9	2nd
Transportation services	16	4.4	11th
Craftsmanship	18	5.0	10th
Tourism-related activities	20	5.6	7th
Construction	19	5.3	9th
Small-scale manufacturing	20	5.6	7th
Mining	35	9.2	3rd
Others (specify)	10	2.8	12th

Source: Field Survey of 2024

Relationship between Livelihood Activities and Environmental Degradation Levels in the United States

Table 2 presents the results of the ordinal logistic regression analysis. The model was statistically significant at the 1% level (chi-square = 89.72, $p < 0.001$), indicating that the set of livelihood activities significantly predicted the level of environmental degradation.

The pseudo-R-squared (Nagelkerke) value of 0.428 that the model has moderate explanatory power. The results show that charcoal production, logging and timber processing, and mining had statistically significant and positive coefficients, indicating that increased involvement in these activities significantly increased the odds of experiencing higher environmental degradation.

Table 2: Ordinal Logistic Regression Results for Livelihood Activities and Levels of Environmental Degradation

Livelihood Activity	Coefficient (β)	Std. Error	Wald χ^2	p-value	Odds Ratio (Exp β)
Mining (X_1)	0.524	0.184	8.11	0.004**	1.689
Charcoal Production (X_2)	0.831	0.156	28.40	0.000***	2.296
Logging and Timber Processing (X_3)	0.712	0.172	17.17	0.000***	2.038
Artisanal Fishing (X_4)	0.122	0.148	0.68	0.409	1.130
Brick-making (X_5)	0.217	0.196	1.23	0.267	1.242
Construction (X_6)	-0.089	0.178	0.25	0.619	0.915
Craftsmanship (X_7)	-0.042	0.151	0.08	0.776	0.959
Transportation (X_8)	-0.108	0.185	0.34	0.561	0.898
Tourism Activities (X_9)	-0.019	0.167	0.01	0.910	0.981
Small-scale Manufacturing (X_{10})	0.064	0.144	0.20	0.653	1.066
Intercept (Thresholds)					
Low to Medium	-1.872	0.488			
Medium to high	0.729	0.377			

Note:
***p < 0.01; **p < 0.05**

The results suggest:

i. Charcoal production had the highest odds ratio (OR = 2.296), indicating that it is the most significant contributor to high environmental degradation.

ii. Logging and timber processing (odds ratio [OR] = 2.038) and mining (OR = 1.689) were also significant contributors.

iii. Other livelihood activities, such as artisanal fishing, tourism, transport, and small-scale manufacturing, had no statistically significant impact on environmental degradation.

These findings reinforce the environmental threats posed by unsustainable livelihood strategies. Intense pressure from tree cutting and mining on forest resources and land disrupts ecosystems and accelerates land degradation. This aligns with the findings of Etuk *et al.* (2018) and Vijay *et al.* (2022), who noted that non-farm livelihood strategies in rural Nigeria, particularly in resource-scarce settings, often carry environmental trade-offs.

Conclusions and recommendations

The findings of this study underscore the critical link between livelihood diversification strategies and environmental degradation in the LGA of Kwami. The use of ordinary logistic regression provided empirical evidence that certain livelihood activities—especially charcoal production, logging and timber processing, and mining—significantly increase the likelihood of higher environmental degradation levels. These activities exert the most pressure on natural resources, contributing to deforestation, soil erosion, and biodiversity loss. In particular, coal production had the strongest association with environmental degradation, followed closely by logging and mining. This highlights the urgent need for local and state authorities, environmental agencies, and development partners to promote environmentally sustainable livelihood alternatives. Such alternatives should reduce the dependence on ecologically destructive practices while providing viable economic returns to farming households.

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