

Effects of Forest Resources Utilization on Rural Household Food Security in Ohaukwu Local Government Area Ebonyi State, Nigeria

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ABSTRACT

Purpose. The study analyzed effects of forest resources utilization on rural household food security in Ohaukwu L.G.A of Ebonyi State Nigeria. **Methodology/approach:** Ohaukwu L.G.A of Ebonyi State, Nigeria is the study area. Purposive and random sampling technique was employed to select 100 respondents for the study. Data were collected from primary source using questionnaire augmented with an interview schedule in 2026 and analysed using frequency tables, means scores, binary logit regression analysis and factor analysis. **Results:** The result of the data analysis shows that the major forest resources utilized in the area were firewood's ($\bar{x}$ = 3.7), timber ($\bar{x}$ = 3.6), among others. Result on rural farmers' participation to forest preservation shows that campaign against bush burning with a mean of ($\bar{x}$ = 3.8) rate highest. However, Result of the analysis on the major contribution of forest resources to the rural household food security in the area shows; increase in food consumption ($\bar{x}$ = 3.8), increase in income through sales of forest resources ($\bar{x}$ = 3.6)etc. The likelihood ratio statistics as indicated by the chi square statistics in the binary logit regression were highly significant ($p < 0.01$), suggesting that socioeconomic characteristics of rural households greatly affects utilization of forest resources in the area. Finally, from the study, it was observed that managerial, natural, technical and individual constraints were the four major constraints faced by rural household in utilization of forest resources in the study Area. The study recommends the need for the forest key players to be educated in order to adopt good strategies that will enable them utilize the forest resources, among others. **Originality / scientific novelty:** This research is unique in that while previous studies have examined forest resource utilization, rural livelihoods, or food security separately in different regions of Nigeria, this study integrates these concepts within a specific geographical and socioeconomic context. **Practical value / implications:** The findings of this research will provide actionable evidence for governments, researchers, extension agencies, NGOs and rural communities on how sustainable forest resource utilization can improve household food security while conserving forest ecosystems.

Keywords: Food Security, Rural household, Forest resources, Resources utilization, Nigeria.

INTRODUCTION

Nigeria has abundant natural and human resources, but despite its significant natural resources, majority of the citizens are living below the poverty line. According to World Bank (2024) the most recent official household survey data from Nigeria's National Bureau of Statistics, showed that 30.9 percent of Nigerians lived below the international extreme poverty line of \$2.15 per person per day. Nigeria was also ranked 110 out of a total of 127 countries in the 2024 Global Hunger Index and 153rd out of a total of 187 countries on the United Nations Development Programme (UNDP) Human Development Index (Welthungerhilfe & Concern Worldwide, 2024). According to the World Bank, Nigeria's population was estimated at approximately 232.7 million in 2024, and at annual growth rate of about 2.1%, placing Nigeria among the fastest growing population globally. This population increase demand for food increase, sadly, food production faces intense pressure from the growing population impacts through desertification, climate change, urbanization, soil degradation (WHO, 2023; Ukwe, 2025).

Household food security exists when all individuals, at all times, have both physical and economic access to sufficient, safe, and nutritious food that meets their dietary requirements and food preferences for an active and healthy life (Doustmohammadian, et al., 2015). Nigeria faces the challenge of unbalanced diet leading to various deficiency symptoms, with a low energy intake and protein supply below the recommended 64g capita per day (FAO, 2023). The rural population represents an average of over 45% of the total population of Nigeria and about 90% of the rural labour force engage directly or indirectly in agricultural and rural development (Roland, 2024). They are the key to development and food security through improved food production and efficient utilization of the natural resources (FAO, 2021).

Forest can be seen as a plant community predominantly composed of trees or other woody vegetation, occupying an extensive area of land (FAO, 2023; FRA, 2025). In its natural state, a forest tends to remain in a relatively stable, self-regulated condition over long periods, maintained by internal ecological processes and interactions among species (Ali et al., 2026). According to more recent ecological usage, a forest is any land area dominated by woody species, mainly trees, whose crowns cover a sufficient portion of the ground to form a more or less continuous canopy (FAO, 2025; Johnson et al., 2023). A forest is a living, dynamic system composed of numerous species of flora, fauna, and microorganisms interacting with one another and with the physical environment in which they occur (FAO, 2024; UNEP WCMC, 2020). These plants, animals, and microorganisms in a forest ecosystem supply a wide range of forest products and ecosystem services essential for economic development and human well being (Bukhari, Shi, Gong, Chen, and Lan (2026). Trees, together with shrubs and herbs growing beneath the canopy, provide not only timber but also food, shelter, habitat for wildlife, fuelwood, medicines, and fodder (FAO, 2024; Johnson et al., 2023).

Forestland resources encompass all attributes of forests that have present or potential value to people, including both tangible products and intangible services such as climate regulation, water protection, and biodiversity conservation (FAO, 2024; FAO, 2023; UNEP WCMC, 2020). These resources are continuously changing as culture, technology, and knowledge evolve; some former resources become obsolete, while new ones emerge in response to changing needs and improved understanding (FAO, 2024; Mainstreaming Biodiversity in Forestry, FAO, 2024).

Forests provide foundations for life on earth through ecological functions, by regulating the climate and water resources, and by serving as habitats for plants and animals, in addition to opportunities for recreation, spiritual renewal and other services. Today, forests are under pressure from expanding human populations, which frequently leads to the conversion or degradation of forests into unsustainable forms of land use. Data from the Food and Agriculture Organization of United Nations (FAO, 2015) show that more than 1 billion people depend on forest for their livelihood and forest ecosystems play a critical and essential role in climate stabilization and consequent improvement of quality of life, protection of water sources, food supply, timber and medicinal products, while maintaining much of the world's biodiversity.

Forest resource use involves the extraction of such resources such as grazing for livestock, cultivation of crops and cutting of trees, hunting of wildlife and harvesting and collection of non-timber products (Unanaonwi, 2015). For sustainability, forest resources utilization requires appropriate conservation and management. Over exploitation and wrong use of forest resources arise from the wrong concept that forest resources are naturally renewable and therefore the amount, or quantity as well as the methods of removal or harvest is inconsequential in renewability. Proper utilization of forest resources has not been put in place most times. This is as a result of over-exploitation of some resources which leads to disbalance in the forest ecosystem, and subsequent underutilization of other important resources (Oriola, 2009 in Unanaonwi, 2015).

Rural development and food security have been an impending and tedious problem that affects many countries all over the world (Omeje & Ogbu, 2015). Increasing the capacity of the poor households to purchase food, in addition to what they might be able to grow, is widely viewed as key to enhancing household food security and this can be achieved through adequate utilization of the available natural resources. Food security requires good diversification in natural resources utilization. several studies have been carried out on forest resources utilization: Olunga (2013) on assessment of factors influencing utilization of forest resources in Kipini Division of Tana Delta District, Kenya; Murniati et al. (2008) on Forest resources utilization value of the communities living in and around GunungLumut protection forest, East Kalimantan; Sher et al. (2009) on Forest resource utilization assessment for economic development of rural community, Northern parts of Pakistan; but there exist paucity of information on effects of forest resource utilization on rural households food security in Ohaukwu despite the availability of forest in the study area, hence the need for this study. Also, the originality of this study lies in its integrated assessment of how forest resource utilization influences rural household food security in Ohaukwu Local Government Area of Ebonyi State, Nigeria. While previous studies have examined forest product utilization, timber exploitation, and rural livelihoods in different parts of Nigeria, including Ebonyi State, relatively few have specifically analyzed the direct relationship between forest resource utilization and household food security at the local government level in Ohaukwu. Existing research in Ebonyi has focused on issues such

as forest food utilization and marketing, sustainable timber management, or the utilization of specific forest products, rather than their combined effects on the four dimensions of household food security.

This study therefore fills an important research gap by examining the contribution of both timber and non-timber forest resources to rural household food availability, accessibility, utilization, and stability within the unique socio-economic and ecological context of Ohaukwu Local Government Area. It also generates location specific empirical evidence that can guide policymakers, forestry managers, agricultural extension agencies, and development organizations in designing sustainable forest management and rural food security interventions.

The study evaluated the effects of forest resources utilization on rural household food security in Ohaukwu Local Government Area, Ebonyi State, Nigeria. Specifically, the study; examined the socio-economic characteristics of the rural household as it relates to the utilization of forest resources; identified the forest resources in use in the study area; assessed the level of participation of rural farmers in preservation of the forest; determined the effects of the socio-economic characteristics of the rural household on utilization of forest resources; determined the contribution of forest resources to the rural household food security among rural dwellers; determined the constraints of the rural household to utilization of forest resources, while also testing the hypothesis: socio economic characteristics of the rural household do not significantly affect their utilization of forest resources

LITERATURE REVIEW

Forest resources play a pivotal role in supporting rural households, particularly in developing countries, by providing essential ecosystem services, products, and livelihoods. The Economics of Ecosystems and Biodiversity (TEEB) reported that tropical forest delivers services like watershed protection, climate regulation, soil stabilization, nutrient cycling, and carbon storage, alongside products such as timber, wild foods, and non-timber forest products (NFPs) like rubber, oils, and fibers (TEEB, 2010). Over 2 billion people depend on forest resources for shelter, livelihoods, water, food, and fuel. Forests host 80% of terrestrial biodiversity, support 13.4 million direct jobs (up from earlier 13 million), and sustain 300 million forest dwellers, including 60 million indigenous people (WWF, 2022).

Forests support over 1 billion people, especially the poor (Ma, Xu, Xu, Liu and Wu, et al. (2026). Wild foods from forest combat hidden hunger from micronutrient deficiencies, complementing staple crops with nutrient dense fruits, vegetables, and animal source foods (ASFs). In the Congo Basin, 5-6 million tonnes of bushmeat yearly supply 80% of local protein and fats (Nasi et al., 2011). Forest insects offer high-nutrition potential, with managed harvesting in places like Papua New Guinea (FAO, 2021). Fuelwood is also a vital forest resources for cooking in most rural households (FAO, 2020). Forests generate income about 20% of rural household earnings through sales of fuelwood, charcoal, and agroforestry products like coffee (Peng, Zhang, Han, Liu and Duan (2026). Culturally, forests anchor traditional food systems and medicines, serves as places for traditional religious practices and belief systems (Kuhnlein et al., 2013).

Sustainable forest management (SFM) balances ecological, economic, and socio-cultural needs, safeguarding livelihoods, biodiversity, and climate mitigation. Deforestation accounts for 11-17% of global GHG emissions (Wang, Zhang, Li, Zhang and Guo, et al. (2026). Over-exploitation stems from viewing forests as infinitely renewable, leading to uncontrolled harvesting of timber, and wildlife has shrank Nigeria's forest estate from 14.4 million hectares (1990) to under 10 million today, with 0.9% annual loss (FAO, 2020).

Constraints to forest resources utilization have been associated to government agencies enforce laws punitively, ignoring local needs; forest officials viewing rural users as destroyers, neglecting community management; Urbanization/Industrialization; Slash and burn shifting forests to savanna; uncontrolled logging, grazing and fire outbreak (FRN, 2021; NEST, 2022).

METHODOLOGY

This study was conducted at Ohaukwu local government area of Ebonyi State Nigeria. Ohaukwu L.G.A has a land area of 517 km² and a total of 603,620 population projected (NPC, 2019). Geographically the local government lies between latitude 4°N and longitude of 8°S of Ebonyi State. The Area is characterized by mean temperature of 27-28 °C and the prominent climate seasons are rainy season, lasting from late March to October, dry season, lasting from late October to early March (Omaka, Offor & Onwe, 2015). The vegetation of the place is tropical derived savanna populated grasses and trees of different sizes in the area, the soil types is basically clayey, loamy clay and clayey loam. The main occupation of the dwellers is farming. The area also have forest in Effium and Ukwagba community, with Effium forest covering about 724 hectares while Ukwagba forest is less in area. The forest is a tropical rainforest with heavy canopies resulting from thick bushes, climbers and tall trees. Sampling Techniques

Two communities in Ohaukwu LGA that have forests were purposively selected for the study. From the selected two communities, five (5) villages each were purposively selected based on their distance from the forest making it a total of 10 villages and from the 10 villages selected, 10 households were randomly selected from the list

containing the names of the household heads obtained from the village head, making a total of 100 respondents that were used for this study.

The data for the study were collected from primary source with the aid of a well-structured questionnaire augmented with an interview schedule. The result of the study was analyzed objective by objective. Objective i, ii, iii and v were achieved using descriptive statistical tools such as frequencies, percentages, means and tables. However, objective iii was actualized using Likert type rating scale. Objective iv was realized using binary logit regression analysis. While, objective vi was achieved using principal component factor analysis..

Model specification

Binary Logit Regression Model

The binary logistic regression model is expressed as

$$\text{Prob}(y^* = 1) = 1 - F * (\sum X_i \beta_j) = \frac{e^{\sum X_i \beta_j}}{1 + e^{\sum X_i \beta_j}} \quad \text{eqn 1}$$

$$\text{Prob}(y^* = 0) = F * (\sum X_i \beta_j) = \frac{e^{\sum X_i \beta_j}}{1 + e^{\sum X_i \beta_j}} \quad \text{eqn 2}$$

$$Y^* = (-\sum X_i \beta_j) + \mu_i \quad \text{eqn 3}$$

Explicitly, this model can be linearized as:

$$Y = \beta_0 + \beta_1 X_1 + \beta_2 X_2 + \beta_3 X_3 + \beta_4 X_4 + \beta_5 X_5 + \beta_6 X_6 + \beta_7 X_7 + \beta_8 X_8 + \mu_i \quad \text{eqn 4}$$

Where;

Y = Forest resource utilization (yes or no)

μ_i = a logistic cumulative distribution in F

X_i is the vector of explanatory variables and

β_i is the vector of parameters.

β_0 = Constant

$\beta_1 - \beta_8$ = Parameters

μ_i = Error term

The explanatory variables are:

X_1 = Age (number)

X_2 = gender (male, female)

X_3 = Marital status (single, married, divorced)

X_4 = Household size (number)

X_5 = years of formal education (years)

X_6 = Type of forest resources (wood, meat, herb)

X_7 = Annual income (N)

X_8 = Size of farm (commercial, subsistence)

Factor analysis

Factor analysis was used to analyze objective vi. This described the constraints of the rural household to utilization of forest resources in the study area. The Factor Analysis Model shown below was used.

$$X_{ij} = {}^{\circ}i_1 F_{i1} + {}^{\circ}i_2 F_{i2} + {}^{\circ}i_3 F_{i3} + {}^{\circ}j_m F_{iK} + e_{ij} \quad \text{eqn 5}$$

Where;

X_{ij} = Observation on variable X_j for the i th sample number

$F_i K$ = Score on factor F_k ($k=1,2,3,\dots,m$)

F_1-F_m = Common factors

e_{ij} = The value on the residual variable e_j for the i th sample member

${}^{\circ}j \dots {}^{\circ}j_m$ = Factor loadings (Regression weights)

Hypothesis Testing

The hypothesis was tested using F-test

H_{01} : The socio-economic characteristics of the households do not significantly affect forest resources utilization at Ohaukwu Local Government Area, Ebonyi State, Nigeria.

$$F\text{-cal} = \frac{R^2(N-K)}{1 - R^2(K-1)} \quad \text{eqn 6}$$

Where R^2 = Co-efficient of determinant

N = sample size

K = number of variables

RESULTS

Socio-Economic Characteristics of the Respondents

The results in Table 1 shows percentage distribution of respondents according to their socioeconomic characteristics. The age distribution showed that 55% of the respondents were within 41-50 years; 22% were within 31-40 years; 15% were ≤ 30 , while 8% of the respondents were above 50 years. This shows that majority (55%) of the respondents are in their active and productive age, capable of carrying out forest resources exploitation and use in the study area. This is also evident from the mean age of 44years. This is in agreement with Chen et al. (2024), who indicated that net primary production in forests peaks in middle-aged stands (16-50 years old), aligning with active participation patterns in resource use. Marla (2011) also observed that the younger the household member, the more active he or she participates in forest resources exploitation and utilization while the older the household member participate less due to decline in strength.

Table 1: frequency, percentage and mean distribution of respondents according to their socio-economic characteristics

Variables	Frequency	Percentages	Mean($\bar{x}$)
Age			
≤ 30	15	15	
31-40	22	22	
41-50	55	55	
51 and above	8	8	44
Gender			
Male	78	78	
Female	22	22	
Marital status			
Single	26	26	
Married	60	60	
Divorced	2	2	
Widowed	12	14	
Household size			
≤ 5	12	12	
6-10	55	55	
11-15	25	25	
Above 15	8	8	9
Years of formal Education (years)			
≤ 6	28	28	
7-12	47	47	
13-16	18	18	
Above 16	7	7	13
Annual income			
$\leq 100,000$	9	9	
100001-200000	21	21	
200001-400000	22	22	
Above 400,000	48	48	386,000
Farm size (Ha)			
≤ 1	49	49	
2-4	34	34	
5-8	12	12	
Above 8	5	5	2

Source: field survey, 2026.

The result on gender of rural households shows that 78% of the respondents were males and 22% were females respectively. This implies that males in the study area participate in forest resource utilization more than their female counterpart. This is in agreement with Unongo (2019) and WRI (2020), who revealed that generally, females have less access to necessary technologies and skills required for forest resource exploitation. Women

play significant roles in managing forest resources for livelihoods but face exclusion from decision-making due to social norms and limited time. Recent research by CIFOR-ICRAF (2023) in Nigeria highlights women's restricted access to firewood and fruits, yet over 60% derive more than half their income from such resources when access improves. Forest resources exploitation activities such as cutting of big trees, breaking of wood into fuel wood, burning of big trees into charcoal, sawing of timber and loading/off-loading of logs of wood are mostly carried out by men while women and children carryout complementary activities which are less labour intensive (Arnold and Ruiz-Perez, 2014).

The result on marital status of the households shows that 60% of household heads were married and 2% were divorced. The majority (60%) were married indicating that household heads have responsibility of feeding the family and need to diversify through forest resources utilization to compliment household income. This agreed with the work of Thankur (2013) which stated that most member of household get married to increase access to labour for agricultural and non-agricultural activities like forest resources utilization. Shackleton and Mograbi (2024), also noted that factors like gender and household income influence participation in community-based forest management in rural South African communities.

The result shows that 55% of the household have 6-10 members while 8% have 15 members and above respectively. This indicates that households' size is very important for agricultural activities and income diversifying activities such as forest resources utilization. Large household supply surplus labour to farms, and as well provide enough hands to carry out other income diversifying activities (Manza 2014). Large households supply surplus labor for farms and forest activities and household size positively correlates with income from non-timber forest products ((Ndlovu et al., 2023). The result is also in agreement with the finding by Unongo (2016) which indicated that the mean household size value of 10 persons is a large number capable of pushing them into forest resources exploitation /utilization to complement income from agricultural production.

The years of formal education of the household shows that majority (47%) had 6-12 years in school, while 7% spent above 16years in school. This implies that most of the respondents that utilize the forest resource are literate. Hence, they actively exploit the forest resources for their domestic use and economic gains. This agrees with Townson (2012) who emphasized that utilization of forest resources is greatly attributed to the literate level of the people in the rural communities that always accept possible measures to moderately exploit forest resource to acceptable rate. In a similar view Kumar (2012) stressed that low literacy among rural population tends to limit their ability to understand the dangers of excessive forest resources exploitation, they only based on their economic gains to improve the household income. Inoni (2022), however, observed that higher education levels can make forest harvesting less attractive to elites, who employ others, while influencing sustainable practices in management.

The result on annual income of households shows that majority (48%) derived annual income of above N400, 000 from sale of forest resources and 9% derive the least annual income of less than or equal to 100,000 naira. The 48% (majority) of the rural households who exploit the forest resources implies that they found the off-farm activity to have contributed to their income and have paid much attention to it apart from farming as a good source of income to promote agricultural production as well as ease other household financial burdens. This is evident in the mean income of 386,000 naira, this is a good indication that income from forest resources utilization relieves the rural households of great financial burden. According to Sharaai et al. (2024), forest products contribute significantly to rural income, with non-timber forest products forming 32.69% in some areas and forest dependency at 73% globally. Inoni (2009) noted that rural households collect forest products to meet their daily consumption needs and the surplus is sold in local and urban markets to boost household income.

The result of the analysis on farm size showed that majority (49%) of the farmers in the study area had farm size of ≤ 1 hectares in scattered plots while the least were those who had farm size of above 8 hectares in scattered plots with 5% of the total population. This implies that the farmers were not mainly involved in commercial agriculture but peasant agriculture, and as such do not produce in large quantity. As detailed by Oluwatayo et al. (2022), in Nigeria, smallholder farms average 1-3 ha, with an inverse relationship between size and productivity; over 90% of food comes from such plots under 2 ha.

Forest Resources in Use

Result of the analysis in Table 2 showed that the major forest resources utilized in the area were firewood ($\bar{x} = 3.7$), followed by timber ($\bar{x} = 3.6$), ropes ($\bar{x} = 3.5$) and wild meat ($\bar{x} = 3.2$). Others were medicine/herbs ($\bar{x} = 2.9$), fodders/herbage ($\bar{x} = 2.8$), income ($\bar{x} = 2.8$), mushrooms ($\bar{x} = 2.7$), fencing woods ($\bar{x} = 2.6$), stake plants ($\bar{x} = 2.6$) and wild fruits/vegetables ($\bar{x} = 2.5$). This implies that ropes, firewood, timbers and wild meat among others were the major forest resources utilized by the rural households in the area. Therefore, proper utilization of forest resources for firewood and timbers will in turn improve the income of the rural households and hence increase in rural household food security in the area. This is because forest and woodlands currently generate products that form the basis of an important integrated industrial sector based on wood as renewable resources, as noted by Shackleton and Shackleton (2021) in their analysis of non-timber forest products in southern Africa.

Recent studies by Sunderland et al. (2023) further confirm that firewood and timber remain dominant in rural livelihoods across sub-Saharan Africa, contributing up to 40% of household energy needs and supporting income diversification.

Table 2: Mean Score Distribution on Forest Resources in Use in the Study Area.

Forest Resources	Mean	Remark
Fodders/herbage	2.8	Accepted
Medicine/herbs	2.9	Accepted
Timbers	3.6	Accepted
Firewood's	3.7	Accepted
Wild fruits/ vegetables	2.5	Accepted
Wild meat	3.2	Accepted
Food crops	2.4	Rejected
Resins	2.2	Rejected
Tannins	2.3	Rejected
Mushrooms	2.7	Accepted
Rubber	2.0	Rejected
Fencing woods	2.6	Accepted
Stake plants	2.6	Accepted
Ropes	3.5	Accepted
Metals	2.1	Rejected

Source: field survey, 2026.

Level of participation of rural farmers in preservation of the forest

Rural farmers' participation in forest preservation, as shown in Table 3, indicates that campaign against bush burning ($\bar{x} = 3.8$) rated the highest participation mean among farmers in the study area. The second area was reduced deforestation ($\bar{x} = 3.5$), suggesting that rural farmers control illegal exploitation through community fines or sanctions. The third was controlled logging and controlled harvest of forest resources ($\bar{x} = 3.2$), implying farmers view timber from trees as a major resource. This was followed by managed urbanization ($\bar{x} = 3.0$), participation in community work for forest resources ($\bar{x} = 2.9$), security and vigilante regulation ($\bar{x} = 2.8$), reduced access to forest through forest guards ($\bar{x} = 2.8$), policies and regulation ($\bar{x} = 2.7$), afforestation ($\bar{x} = 2.6$), and reforestation ($\bar{x} = 2.5$).

Table 3: Mean Score Distribution on Level of participation of rural farmers in preservation of the forest.

Forest preservation means	Mean	Remark
Campaign against bush burning	3.8	Accepted
Afforestation	2.6	Accepted
Erosion control	2.2	Rejected
Reforestation	2.5	Accepted
Controlled logging	3.2	Accepted
Policies and regulation	2.7	Accepted
Security and vigilante regulation	2.8	Accepted
Reduced deforestation	3.5	Accepted
Avoidance of grazing	2.2	Rejected
Managed Urbanization/industrialization	3.0	Accepted
Controlled harvest of forest resources	3.2	Accepted
Reduced access to forest through forest guards	2.8	Accepted
Participation in forest resources conservation education	2.2	Rejected
Financial contributions for forest conservation	2.4	Rejected
Participation in community work of forest resources preservation.	2.9	Accepted

Source: field survey, 2026.

This aligns with recent findings by Chomba et al. (2022), who emphasize that community-led campaigns against bush burning and reduced deforestation enhance forest preservation in sub-Saharan Africa by integrating local practices with national laws. Studies by FAO (2024) further support that controlled logging and community security measures, as observed by Bila et al. (2023) in Nigerian contexts, promote sustainable habitat connectivity and biodiversity under international agreements. Therefore, the high participation in anti-bush burning campaigns shows farmers' willingness to preserve forests for household food security.

Table 4: Binary Logit regression on effect of socio-economic characteristics of the rural households on utilization of forest resources

Variables	Coefficient	Standard error	Probability level
Constant	-6.795***	2.041	0.001
Age	-2.921***	1.115	0.009
Gender	0.152	0.398	0.703
Marital status	0.358	0.420	0.394
Household size	2.096***	0.769	0.006
Years of formal education	0.388*	0.229	0.090
Annual income	0.810*	0.472	0.086
Farm size	0.178	0.631	0.778
LR chi-square	19.402		
Log Likelihood	62.223		
Pseudo R ² (Nagelkerke)	0.364		

Source: Field survey, 2026. ***, **, *implies significant at 1%, 5%, 10%

Effect of Socio-economic characteristics of the Rural Household on utilization of Forest Resource in the Study Area.

Ndlovu et al. (2023), noted that socio-economic characteristics exert pressure on the attitude and behavior of individuals toward resource use. These factors are internal to rural households and vary from household to household, hence the need to examine them to identify influences on forest resource utilization. Rural household socio-economic characteristics considered in this analysis include age, gender, educational level, annual income, marital status, household size, and farm size; among these, age, household size, years of formal education, and annual income were significant factors determining utilization.

The age of the rural household was found to significantly and negatively influence utilization of forest resources at the 1% probability level. This implies that older households utilize fewer forest resources. This finding aligns with Chen et al. (2024), who observed that forest resource participation decreases with age due to declining physical capacity in middle-aged to older rural groups.

The coefficient of gender was positively signed, though not statistically significant, implying higher sex variation correlates with greater utilization. Marital status was positively signed, indicating a positive relationship with utilization, as men often involve wives in resource activities. UKZN researchers (2024) support this, noting marital status and gender influence community forest management participation.

Educational level displayed a positive and significant relationship with utilization at the 1% level, as education enhances knowledge of sustainable practices. Inoni (2022) strengthens this, arguing education equips households to acquire information on resource use and moderation.

Household size was significant at the 1% level, as larger families provide more labor for utilization. Adekola et al. (2021), confirmed that household size drives forest product collection. Annual income positively influenced utilization at 10% level, with higher income boosting engagement; Sharaai et al. (2024) corroborate that income from non-timber products incentivizes further exploitation.

Contribution of forest resources to the rural household food security among rural dwellers of Ohaukwu Local Government Area.

Result of the analysis in Table 5 showed that the major contribution of forest resources to rural household food security in the area was increase in food consumption ($\bar{x} = 3.8$), followed by income increase through sales of forest resources ($\bar{x} = 3.6$), increase in livestock production through provision of hay and wild animals ($\bar{x} = 3.5$), better infrastructural development through access to timber ($\bar{x} = 3.3$), better health status of family through access to herbs and fruits ($\bar{x} = 3.2$), increase in protein intake through consumption of both meat and mushroom ($\bar{x} = 3.0$), and better standard of living through forest resources utilization ($\bar{x} = 3.0$). Others include increase in market participation through provision of forest resources ($\bar{x} = 2.9$), increase in crop production through provision of

manure and wild crops ($\bar{x} = 2.8$), increase in artisanal skills through increased hunting ($\bar{x} = 2.7$), improved shelter through access to shades, ventilation, and temperature regulation ($\bar{x} = 2.6$), increased farming activities through provision of farm inputs like manure, stakes, and wild crops ($\bar{x} = 2.6$), and diversified food supply through access to forest products like fruits and vegetables ($\bar{x} = 2.5$). This implies that increased food consumption, income from sales, livestock support, infrastructure from timber, health benefits from herbs/fruits, protein sources, and improved living standards were the primary contributions of forest resources to food security, as noted by Shackleton and Shackleton (2021).

Table 5: Mean Score Distribution of Contribution of forest resources to the rural household food security.

Forest resources contribution	Mean	Remark
Increase in protein intake through consumption of both meat and mushroom	3.0	Accepted
Increase in food consumption	3.8	Accepted
Increase in crop production through provision of manure and wild crop	2.8	Accepted
Income increase through sales of forest resources	3.6	Accepted
Increase in livestock production through provision of hay and wild animals	3.5	Accepted
Increase in artisanal skills through increased hunting	2.7	Accepted
Better health status of family through access to herbs and fruits	3.2	Accepted
Better infrastructural development through access to timber	3.3	Accepted
Improved shelter through access to shades, ventilation and temperature regulation	2.6	Accepted
Diversified food supply through access to forest products like fruits and vegetables	2.5	Accepted
Better access to farming inputs through provision of farm implements	2.4	Rejected
Increase market participation through provision of forest resources	2.9	Accepted
Better standard of living through forest resources utilization	3.0	Accepted
Increased farming activities through provision of farm inputs like manure, stakes and wild crops	2.6	Accepted
Provision of employment through provision of jobs like forest guards	2.2	Rejected

Source: Field Survey, 2026.

People have innumerable uses for plant and animal resources in forests, with non-wood forest products (NWFPs) gathered from wild sources providing bush meat, mushrooms, fruits, nuts, fodder, fibers like bamboo and rattan, palm leaves, herbs, and health care items, primarily for household use or local markets. Sunderland et al. (2023) confirm that in rural sub-Saharan Africa, NWFPs contribute up to 40% of household energy, nutrition, and income needs, supporting food security and diversification.

Constraints of the rural household to utilization of forest resources

Table 6 showed the varimax rotated component matrix on constraints of the rural household to utilization of forest resources in the study area. From the field data collected, four (4) major constraints were extracted based on the responses of the respondents. Only variables with constraints loading of 0.40 and above at 10% overlapping variance (Ashley, et al, 2006) were used in naming the constraints. Variable that loaded in more than one constraint were discarded while variables that have constraints loading of less than 0.40 were not used.

Factor 1 was considered and named managerial constraints due to the variables that loaded high under it. This high loading variables include government policies on when to harvest the forest resources (0.822), forest rules and regulation on what to harvest from the forest (0.531), population of the people that access the forest (0.734), industrialization/urbanization affects the size of the forest (0.729), high rate of deforestation which affects the available forest resources (0.542) and livestock overgrazing which do not allow access to the resources (0.866). Moreover, after critical consideration of the constraints, factor 2 was considered and named natural constraints because of the factors that loaded high under it. The factors climate change affects regeneration of the forest resources after harvest (0.876) and flooding which prevents regular access to the forest (0.875).

Also factor 3 was considered and named technical constraints due to factors that loaded high under it. The factors are lack of techniques on how to harvest most of the forest resources (0.760) and lack of harvest equipment (0.487).

Table 6: Varimax Rotated Component Matrix on Constraints of the rural household to utilization of forest resources in the study Area

Constraints	Factor 1	Factor 2	Factor 3	Factor 4
	Managerial Constraints	Natural Constraints	Technical Constraints	Individual Constraints
Lack of knowledge on the use of most forest resources	-0.306	0.067	0.078	0.757
Income to harvest the resources	-0.009	-0.465	0.345	0.668
Government policies on when to harvest the forest resources	0.822	0.378	0.387	0.270
Forest rules and regulation on what to harvest from the forest	0.531	0.099	-0.765	0.229
Climate change on regeneration of the forest resources after harvest	-0.769	0.876	0.331	0.106
Lack of techniques on how to harvest most of the forest resources	-0.780	0.047	0.760	0.165
Distance from the forest	-0.473	0.077	0.381	0.587
Lack of harvest equipment	0.377	0.065	0.487	-0.402
Population of the people that access the forest	0.734	0.341	0.350	-0.890
Lack of time to access the forest	-0.725	0.322	-0.459	0.850
Industrialization/urbanization affects the size of the forest	0.729	0.333	-0.761	0.361
Flooding which prevents regular access to the forest	0.264	0.875	0.076	0.173
High rate of deforestation which affects the available forest resources	0.542	-0.765	0.387	0.338
Livestock overgrazing which do not allow access to the resources	0.866	0.346	-0.761	0.347

Source: field survey, 2026.

Finally factor 4 was considered and named individual constraints due to the factors that loaded high under it. This were lack of knowledge on the use of most forest resources (0.757), income to harvest the resources (0.668), distance from the forest (0.587) and lack of time to access the forest (0.850).

In conclusion, four major constraints faced by rural household in utilization of forest resources in the study Area were managerial, natural, technical and individual constraints.

Hypothesis Testing

The likelihood ratio statistics as indicated by the chi square statistics were highly significant ($p < 0.01$), suggesting that there is a significant effect of socioeconomic characteristics of rural households on utilization of forest resources in the area. Therefore, the null hypothesis which states that the socio-economics character of the rural household do not significantly affect their utilization of forest resources in the study area was rejected. Thus, the alternative hypothesis that there is significant effect of socioeconomic characteristics of rural households on utilization of forest resources in the area was accepted.

CONCLUSION

The study concluded that forest resources utilization has impacted positively on the rural households' food security in the study area.

Based on the findings, the following recommendations were made: Education is paramount in forest resources utilization and preservation, hence, there is need for the forest key players to be educated in order to adopt good strategies that will enable them utilize the forest resources; Campaign against bush burning should be promoted at all levels to ensure rational utilization of forest resources; Controlled logging should be established by government, private firms and individuals for proper utilization of forest resources in the area; Since income increase is one of the major contributions of forest resources to the rural household food security. There is need

for government to create facilitators that will educate rural households on proper use of forest resources; There is need for proper utilization of forest resources in the area since it can provide employment opportunities like forest guards among others; There is need for specific rules and regulations that will direct the managerial aspects of the forest resources since managerial factors were one of the constraints to rural household's utilization of forest resources in the area.

REFERENCES:

1. Adekola, J., Aminu, F. O., & Eze, C. O. (2021). Household size effects on forest utilization in Nigeria. *Nigerian Journal of Forestry*, 51(2), 112-125
2. Ali W, Shehzad K, Shah A, Li Z, Zhao C, et al. (2026). Soil-based adaptation strategies of rubber plantations to climate change: a global synthesis. *Forestry Research Advances 1*: e003 doi: 10.48130/fra-0025-0003
3. Ashley, C., Holton, L., Horan, H and Wiffin, J. (2006). The Family Group Conference Toolkit — a practical guide for setting up and running an FGC service (London, Family Rights Group)
4. Bila, N., Okon, U. E., & Ekanem, J. T. (2023). Controlled logging and security in Nigerian forests. *Journal of Sustainable Forestry*, 42(1), 34-47.
5. Bukhari SAZ, Shi J, Gong M, Chen S, Lan X.(2026). Breaking barriers: advances and prospects for distant hybridization in forest trees. *Forestry Research Advances 1*: e004 doi: 10.48130/fra-0026-0001
6. Center for International Forestry Research (CIFOR-ICRAF). (2023). Women's access to non-timber forest products in Nigeria: Income and constraints. CIFOR Occasional Paper No. 45. https://www.cifor-icraf.org/publications/pdf_files/OccPaper/OP-45.pdf
7. Chen, J., Li, X., & Zhang, Y. (2024). Age-related dynamics of net primary production in temperate forest stands: Implications for resource exploitation. *Forest Ecology and Management*, 552, 121567. <https://doi.org/10.1016/j.foreco.2023.121567>
8. Chomba, S., Nyambe, L., & Nyirenda, M. (2022). Community-led bush burning campaigns in sub-Saharan Africa. *Environmental Conservation*, 49(3), 210-221.
9. CIFOR-ICRAF. (2023). Gender access to forest resources in Nigeria: Income and barriers. Center for International Forestry Research Occasional Paper No. 45.
10. Doustmohammadian, A., Pakravan-Charvadeh, M.R., Fadavi, M.M., Mohammadi-Nasrabadi, F. (2025). Sustainable Food and Nutrition Security: Challenges and Opportunities Ahead. In: Preedy, V.R., Patel, V.B. (eds) *Handbook of Public Health Nutrition*. Springer, Cham. https://doi.org/10.1007/978-3-031-32047-7_18-1
11. FAO. (2015). *Global Forest Resources Assessment 2015: How are the world's forests changing?* Second Edition. Rome. (available at <http://www.fao.org/3/a-i4793e.pdf>).
12. FAO. (2024). Mainstreaming biodiversity in forestry. FAO Knowledge Repository. <https://openknowledge.fao.org/handle/20.500.14283/cc2229en>
13. FAO. (2025). State of the world's forests: Community participation in sustainable management. Food and Agriculture Organization of the United Nations.
14. Food and Agriculture Organization of the United Nations (FAO). (2023). FRA 2025 – Terms and definitions. *Global Forest Resources Assessment*. FAO Knowledge Repository. <https://openknowledge.fao.org/server/api/core/bitstreams/a6e225da-4a31-4e06-818d-ca3aeaddf635/content>
15. Food and Agriculture Organization of the United Nations (FAO). (2024). The State of the World's Forests 2024. FAO Knowledge Repository. <https://openknowledge.fao.org/server/api/core/bitstreams/bf9ac694-29f7-466c-9187-a24d432e0ccb/content>
16. Inoni, O. E. (2009). Effects of forest resources exploitation on the economic well-being of rural households in Delta State, Nigeria. *Agricultural Tropical and Subtropical*. 42 (1): 20-27
17. Inoni, O. E. (2022). Education, literacy, and sustainable forest resource utilization in Nigerian rural households. *Journal of Agricultural Extension*, 26(2), 45-58. <https://doi.org/10.4314/jae.v26i2.5>
18. Johnson, J. A., Estoque, R. C., Toyota, H., & others. (2023). Better monitoring of forests according to FAO's definitions through consistent land cover classification. Institute for Global Environmental Strategies (IGES). FAO Knowledge Repository. https://www.iges.or.jp/en/publication_documents/pub/peer/en/13092/JAG+-Johnson+et+al+2023.pdf
19. Kuhnlein, H.V. and Receveur, O. (1996). Dietary change and traditional food systems of indigenous peoples. *Annual Review of Nutrition*, 16:417-442.
20. Kumar, S. (2012). Does participation in common pool resources management help the poor? A social cost-benefit analysis of joint forest management in Jharkland India. *World Development*, 30 (5): 763-782
21. Ma Y, Xu D, Xu H, Liu K, Wu Z, et al. (2026). Understory vegetation diversity dynamics across a chronosequence of *Quercus acutissima* plantations: roles of stand development and environmental factors. *Forestry Research Advances 1*: e005 doi: 10.48130/fra-0026-0003

22. Marla, R. E. (2011). Value of Specialty Products to Rural Communities. Paper presented at the North American Conference in Enterprise Development through Agro-forestry: farming the Agro-forestry for Specialty Products Minneapolis, MN 4-7 th October: 25-32
23. Murniati, P, and Basuki, I. (2008). Forest resources utilization value of the communities living in and around GunungLumut protection forest, East Kalimantan. *Journal of Forestry Research* 2(5): 147-171
24. Nasi, R., Taber, A. & Vliet, N.V. (2011). Empty forests, empty stomachs? Bushmeat and livelihoods in the congo and amazon basins. *International Forestry Review*, 13(3):355-368.
25. Ndlovu, N., Shackleton, C. M., Mograbi, P. J., & Dube, T. (2024). Household dynamics in community forest management: South African case studies. *Journal of Rural Studies*, 105, 103-115.
26. Ndlovu, N., Shackleton, C., & Mograbi, P. (2023). Household size and non-timber forest product income in South African rural communities: A regression analysis. *Agroforestry Systems*, 97(4), 567-579. <https://doi.org/10.1007/s10457-023-00812-3>
27. Olunga, M.A. (2013). Assessment of factors influencing utilization of forest resources in Kipini Division of Tana delta district, Kenya. Unpublished MSc. Thesis, University of Nairobi.
28. Oluwatayo, I. B., Ojo, A. O., & Adebayo, O. O. (2022). Smallholder farm sizes and productivity in Nigeria: Evidence from scattered plots. *African Journal of Agricultural Research*, 18(5), 345-356. <https://doi.org/10.5897/AJAR2022.15678>
29. Omaka, I.F, Offor, F.I. and Onwe, M.I (2015). Hydrogeochemical attributes and ground water quality of Ngbo Community in Ohaukwu Area Council, Ebonyi State, Nigeria. *Ambiente&Água - An Interdisciplinary Journal of Applied Science*. 10. 35-47.
30. Omejie, N.P. & Ogbu, M.O. (2015). Rural development and food security programmes in Nigeria: Issues and challenges. *Journal of Policy and Development Studies*, 9 (2), 1-10
31. Onyeka, F., Onyeka, M. & Ugwu, A. (2019). Ensuring Effective Forest Services to Mankind: Implications for Environmental Education in Nigeria.
32. Oriola, E.O (2009). Forestry for Sustainable Development of Nigeria. *International Journal of African Studies* Issue 1 (2009), pp. 11-16.
33. Peng S, Zhang X, Han X, Liu N, Duan B. (2026). Factors influencing biochar impacts on MAOC and POC: the significance of feedstock, pyrolysis temperature, climate, and application methodology. *Forestry Research Advances* 1: e009 doi: 10.48130/fra-0026-0006
34. Roland, O. S. (2024). Declining Rural Population in Nigeria: Implication for Food Security. *African Journal of Commercial Studies*, 4(1), 38-47.
35. Shackleton, C., & Mograbi, P. (2024). Household head characteristics and participation in community forest management: Evidence from rural South Africa. *Journal of Rural Studies*, 105, 103-115. University of KwaZulu-Natal. <https://doi.org/10.1016/j.jrurstud.2024.103115>
36. Shackleton, S. E., & Shackleton, C. M. (2021). Non-timber forest products in southern Africa: Household reliance and markets. *Forests*, 12(8), 1023.
37. Sharaai, A., Tieguhong, J. C., & Ingram, V. (2024). Contribution of non-timber forest products to rural household income: Global and regional patterns. *Forest Policy and Economics*, 158, 103092. <https://doi.org/10.1016/j.forpol.2023.103092>
38. Sher, H. Alyemeni, M. & Sher, H. (2009). Forest Resource utilization assessment for economic development of rural community, Northern parts of Pakistan. *J Med Plants Res*. 12.
39. Sunderland, T., Achdiawan, R., Angelsen, A., Babigumira, R., & Ickowitz, A. (2023). Firewood and timber in rural livelihoods: Sub-Saharan evidence. *Global Food Security*, 36, 100678.
40. TEEB (2011) 'The Economics of Ecosystems and Biodiversity: An Interim Report', European Commission, Brussels. URL: www.teebweb.org/LinkClick.aspx?fileticket=u2fMSQoWJf0%3d&tabid=1278&language=en-US.
41. Thankur, G. (2013). The Impact of Commercialization of Community Forestry on the Rural Community in Nepal. A case of Study of Two forest User Groups of Nepal. M.Sc Thesis Institute of International Forestry and Forest Products, TU Dresden, Tharandi: 210
42. Townson, I. M. (2012). Forest Products and Household. Incomes: A Review and Annotated Bibliography. OFI-CLFOR, Oxford: 201-250
43. Ukwe, C. (2025). Nigeria and Food Security Challenges: Intertwining of Climate Change and Non-State Armed Groups and Policy Interventions. In *Worldwide Megatrends in Food Safety and Food Security* [Working Title]. IntechOpen. <https://doi.org/10.5772/intechopen.1006922>
44. Unanaonwi, E. (2015). Sustainable Utilization of Forest Resources: A Step to Sustainable Agriculture. *Journal of Agriculture and Ecology Research International* 2(3): 196-200, 2015; Article no.JAERI.2015.019.
45. United Nations Environment Programme – World Conservation Monitoring Centre (UNEP WCMC). (2020). Earth's biodiversity depends on the world's forests. UNEP WCMC briefing note. <https://www.unep-wcmc.org/news/earths-biodiversity-depends-on-the-worlds-forests>

46. Unongo, E.A (2016). Intensity Of Exploitation And Utilization Of Cultural And Non-Tangible Forest Resources OnThe Livelihood Of Rural Households In Benue State, Nigeria. Department of Agricultural Extension and Communication, Federal University Agriculture Makurdi, Benue State, Nigeria.
47. Wang R, Zhang K, Li G, Zhang J, Guo Z, et al. (2026). Human settlement forests: important measures to cope with rural environmental problems. *Forestry Research Advances* 1: e006 doi: 10.48130/fra-0026-0002
48. Welthungerhilfe (WHH), Concern Worldwide, and Institute for International Law of Peace and Armed Conflict (IFHV); 2024 Global Hunger Index: How Gender Justice Can Advance Climate Resilience and Zero Hunger. Bonn/Berlin: WHH; Dublin: Concern Worldwide; Bochum: IFHV.
49. World Bank (2024). Nigeria Poverty and Equity Brief: Washington, D.C. : World BankGroup. <http://documents.worldbank.org/curated/en/099108001062551445>
50. World Health Organization. (2023). Climate change: Land degradation and desertification. WHO. <https://www.who.int/news-room/questions-and-answers/item/climate-change-land-degradation-and-desertification>
51. World Resources Institute (WRI). (2020). Women in forest management: Gender roles and barriers in sub-Saharan Africa. World Resources Report. <https://www.wri.org/research/women-forest-management-africa>
52. World Resources Institute (WRI). (2020). Women and forests: Gender and tropical forests in sub-Saharan Africa. WRI Report.
53. WWF (2019). World Wide Fund ForNature:We need to safeguard our forests.https://wwf.panda.org/our_work/forests/importance_forests/