



## **Socio-economic Factors Influencing Utilization of Forest Resources at Odoaba Forest Reserve, Benue State, Nigeria**

**S. A. Shomkegh<sup>1\*</sup>, P. U. Ancha<sup>1</sup> and P. Onuche<sup>1</sup>**

<sup>1</sup>*Department of Social and Environmental Forestry, Federal University of Agriculture, Makurdi, Benue State, Nigeria.*

### **Authors' contributions**

*This work was carried out in collaboration among all authors. The authors collectively designed the study. Author PO collected field data, wrote the protocol and the first draft of the manuscript. Author PUA performed the statistical analysis and managed the analyses of the study. All authors read and approved the final manuscript.*

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### **ABSTRACT**

Forest resource utilization poses a challenge to the balance between fragile ecosystems and impoverished populations. As population increases, the demand for forest resources and the resultant degradation are expected to increase. This study investigated the factors influencing utilization of forest resources in Odoaba forest reserve. Probit regression model was used to assess the factors influencing utilization of forest resources in the reserve. Data was collected from 376 households using semi-structured questionnaire. The result of analysis shows that Age ( $\beta=0.006$ ,  $p<0.01$ ), marital status ( $\beta = 0.157$ ,  $p>0.05$ ), household size ( $\beta=0.044$ ,  $p<0.05$ ) and years of residence ( $\beta=0.009$ ,  $p<0.01$ ) had positive significant influence on utilization of forest resources. However, education ( $\beta= -0.002$ ,  $p<0.01$ ) and income level ( $\beta= -7.69$ ,  $p<0.01$ ) had negative significant influence on utilization of forest resources from the reserve. There is need to invest in sensitization and training of households on commodity value chains which can boost income and reduce dependence on forests. Secondly, there is need for provision of low interest credit facilities to households for crop intensification. This will ensure that households have increased food supply

\*Corresponding author: E-mail: [sshomkegh@gmail.com](mailto:sshomkegh@gmail.com);

and also increased crop residue to use as fuel wood instead of relying on the forests all-year-round as well as reducing expansion of agricultural land into forest demarcated areas. Youth and women development enterprise fund should be created by the government and made accessible as a positive approach towards development. Diversification of activities that can help generate income should be encouraged to avoid reliance on forest resources.

*Keywords: Socio-economic factors; forests resources; utilization; odoba forest reserve.*

## 1. INTRODUCTION

Natural resources form the bulk of resources that are important to many economies of the world in meeting economic and development needs [1]. Majority of people who are poor in the world economies, mostly dwell in rural areas and depend mainly on agriculture or natural resources and ecosystem services for livelihood [2]. According to [3] the utilization of natural resources as a livelihood strategy is important especially to the communities residing adjacent to these resources. Such communities collect, process and/or market various kinds of natural resources either as a predominant activity or as part of a diversified portfolio of livelihood strategies designed to spread and minimize specific risks [4]. Forest resource utilization poses a major challenge to the delicate balance between complex-fragile ecosystems in many developing countries. Forests in such economies are major sources of livelihood for the rural communities who depend on the resources for fuel wood, construction material and livestock grazing, among others. The extraction of biomass in the form of forest products like timber, fuelwood and fodder alters wildlife habitat and constitutes one of the most important threats to forests and wildlife [5]. Increase in the population of communities surrounding forests is directly proportional to increase in demand for the forest resources, leading to increase in forest degradation. Factors associated with the increase in forest degradation broadly include demographic, economic, institutional and technological factors ([6,5,7]). FAO, [8] estimated the rate of forest destruction at 13 million hectares per year (for the period 1995-2005) with about 1.6 billion people relying to some extent on the forests for their livelihood. However, different forms of extraction may have different levels of impact ([5,9]). Forests play many important roles in the ecosystem. They provide direct benefits to communities around them such as fuelwood, fruit, water, animals, shade and green environment among others and also act as habitat for various plant and animal species. Forests are important for attracting rainfall which

is important in supporting agriculture. Forests, among the natural resources, have potentials and limitations for improving human welfare [10]. Forests improve human welfare by providing a range of resources including timber, non-timber forest resources, and recreation. Forests also supplement household income thus providing safety nets ([11,12,13]). However, people tend to destroy the environment by cutting down forest trees; overgrazing and cultivating marginal lands [14]. These activities affect soil nutrient content which in turn affects tree growth, forest cover, birds and invertebrates ([15;9]). Further, grazing, removal of dead tree branches and dry leaves from the ground alter the nutrient dynamics while constant movement of cattle and humans erode the top soil layer [16] and browsing by goats and sheep affect re-growth, reduce perennial cover and increase exotic annual cover [17].

Studies on factors influencing utilization of forest resources by communities have been conducted around the world. For example Lepetu and Oladele [18] assessed socio-economic determinants of forest conservation in Botswana. Garekae et al. [19] documented socio-economic factors influencing household forest dependency in Chobe enclave, Botswana and [1] assessed factors influencing utilization and conservation of forest resources in Kipini Division of Tana Delta District, Kenya. Lepetu and Garekae [20] documented attitudes of local communities towards forest management practices in Botswana.

In Nigeria, Jimoh et al. [21] studied the prevalence, utilization and conservation strategies for Non-Timber Forest Products in South Western Zone of Nigeria. Also, Ancha et al. [22] assessed the contribution of Odoba forest reserve to the livelihoods of the surrounding communities. However, the socio economic factors influencing utilization of the forest resources by the people have not been investigated. Thus, this study was conducted with the aim of investigating the socio economic factors influencing utilization of the forest resources at Odoba forest reserve for effective decision making and policy.

**2. METHODOLOGY**

**2.1 Study Area**

The study area was conducted at Odoba Forest Reserve in Otukpa district of Ogbadibo Local Government Area (LGA) of Benue State. It is located between latitude 7° 08' 34" – 7° 10' 45" N and longitude 7° 49' 16" -7° 51' 29" E. [23] reported that the reserve has an area of 2.77 km<sup>2</sup> and was established for pole production with Teak (*Tectona grandis*) as the dominant tree species. Other species planted were *Gmelina arborea*, *Eucalyptus deglupta*, *E. torrelliana* and *E. citriodora*. The forest reserve is adjoined by four communities; Ogonukwu, Epaeigbo, Eloga, and Odoba (Fig. 1). According to [24], the land uses of Ogbadibo were Agriculture (farm land, 70%), commercial (markets, 10%), and institutions (Schools and religious buildings, 20%). The vegetation is made up of broad leafed species and herbaceous graminoids. The reserve is overseen by a Divisional Forest officer (DFO) who reports to the Director of Forestry in the State Ministry of Water Resources and Environment. The DFO is assisted in the reserve by field workers.

**2.2 Population, Sampling Procedure and Sampling Size**

The 2006 population Figures of the adjoining communities were projected to 2016 using 2.8% growth rate as expressed by [25].

$$P_t = P_o (1 + r)^t$$

Where:

- P<sub>t</sub> = Population Projection Figure for 2016 for any community
- P<sub>o</sub> = Existing population as at 2006
- 1 = Constant
- r = Population Growth Rate (2.8%)

t = Number of years population was projected (10 Years)

Taro-Yamene formula [26] was then used for determination of the projected population sample size as shown in (Table 1). Taro-Yamene formula is expressed as:

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

Where:

- n = Projected population sample size
- N = Total size of projected population
- 1 = Constant
- e = Error degree of tolerance 0.05

The sample size of each community was determined using the formula:

$$nh = \frac{n \times Nh}{N}$$

Where

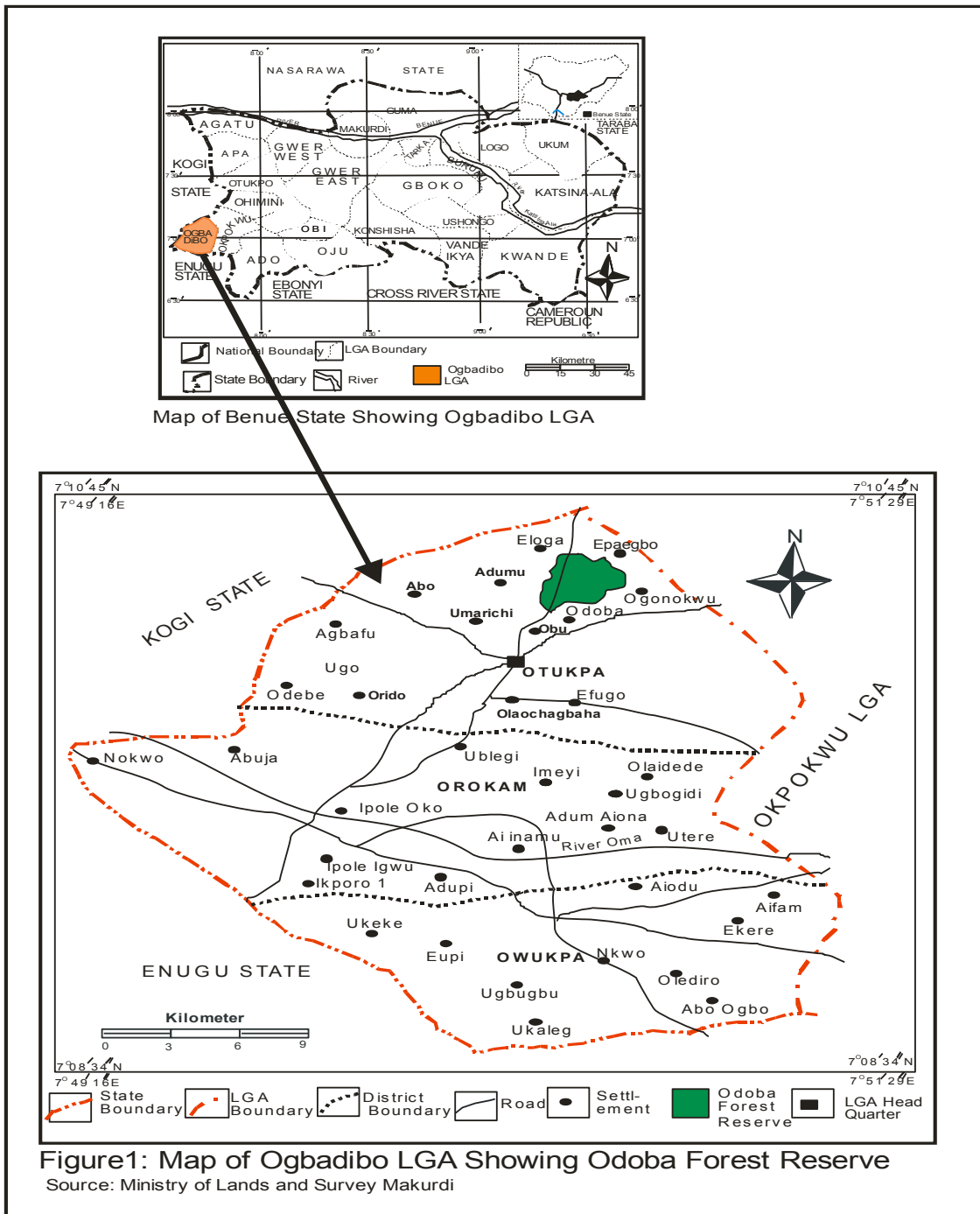
- nh = Community sample size
- n = Projected population sample size
- Nh = Community Population (Projected)
- N = Total size of projected population

The communities were purposely selected due to their proximity to the forest reserve. Systematic random technique was used to select households in each of the communities. The first household in each community was randomly selected for interview and thereafter every fourth household was selected. Two matured persons in each household were purposively selected for interview as they could provide useful information for the study. This procedure was maintained until the sample size for the community was obtained. Therefore, 376 respondents were sampled in 188 households.

**Table 1. Determination of sample size for the study**

S/No	Communities	2006 population figures	2016 projected figures	Community sample size	Number of households selected
1	Odoba	1734	2285	136	68
2	Ogonukwu	954	1257	75	38
3	Epaeigbo	1409	1857	111	56
4	Eloga	689	908	54	27
Total	-	4786	6307	376	188

Source: National Population Commission, 2006 projected to 2016 using 2.8 % growth rate  
Sample size (n) = 376



### 2.3 Data Collection

Pre-tested semi-structured questionnaire was used to obtain primary data from the respondents. Data collected included socio-economic characteristics of respondents in the study area, and responses on utilization of forest

resources collected from the forest reserve. Direct administration of the questionnaire at the respondents' homes was done with the support of research assistants.

The socio economic variables collected and their coding format were as follows:

Variables	Description / code
Age (Yrs)	Actual age of Respondents
Years of Schooling (Yrs)	Non formal = 0, Primary = 6, Secondary = 12 and Tertiary =17
Marital Status	Married = 1, Single = 0,
Household Size	Actual number of persons in a household
Annual Income	Actual income earned by respondents
Years of Residence in Locality	Actual number years respondents resided in the locality
Do you utilize forest resources from the reserve	Yes = 1 and No = 0

## 2.4 Data Analysis

Descriptive statistics was used to analyze the socio-economic characteristics of the people as reported in [22]. Probit regression model as used by [18] was as adopted to determine the socio-economic factors that influenced utilization of forest resources from Odoba forest reserve. The relationship between the probability of utilization of forest resource ( $P_i$ ) and its determinants ( $q$ ) is given as:  $P_i = \beta q_i + \mu_i$ , where  $P_i = 1$  for  $X_i \geq Z$ ;  $i=1, 2, \dots, n$ ;  $q_i$  is a vector of explanatory variables and  $\beta$  is the vector of parameters. The Probit model computes the maximum likelihood estimator of  $\beta$  given the non-linear probability distribution of the random error  $\mu_i$ . The dependent variable  $P_i$  is a dichotomous variable which is 1 when a respondent utilizes forest resources and 0 if otherwise.

## 3. RESULTS

### 3.1 Socioeconomic Factors Influencing Utilization of Forest Resources in the Odoba Forest Reserve

The socioeconomic factors influencing utilization of forest resources by communities around Odoba forest reserve are presented in Table 2. Age of the people significantly influenced utilization of forest resources from the reserve ( $p < 0.01$ ). The positive coefficient of  $\beta = 0.006$  indicates that a unit increase in age of the people increases utilization of forest resources by the factor 0.006. Education has a significant negative influence on forest resources utilization having a coefficient of ( $\beta = -0.002$ ,  $p < 0.01$ ). The negative coefficient indicates an inverse relation showing that a unit increase in education level of the people decreases their utilization of forest resources from the reserve. On the basis of marital status, the single (unmarried) people had a non significant positive influence on forest resources utilization ( $\beta = 0.157$ ,  $p > 0.05$ ). However, the married people had a significant positive influence ( $\beta = 0.078$ ,  $p < 0.10$ ). This result indicated that a unit increase in both the

unmarried and married people increases their utilization of forest resources by the factors of 0.157 and 0.078 respectively. Household size had a positive significant influence on forest resources utilization ( $\beta = 0.044$ ,  $p < 0.05$ ) indicating that a unit increase in household size leads to increase in the utilization by the factor 0.044. The annual income of the people had a negative significant influence ( $\beta = -7.69$ ,  $p < 0.01$ ) on utilization of forest resources. This indicates an inverse relationship whereby a unit increase in the income of the people decreases the utilization of forest resources from the reserve by the factor of 7.69. The number of years of residence of the people in the area has a positive significant influence ( $\beta = 0.009$ ,  $p < 0.01$ ) on utilization of forest resources. This result indicates that a unit increase in the years of residence of the people in the locality increases the likelihood of utilization of forest resources by the factor of 0.009.

## 4. DISCUSSION

The study found age having significant positive influence on utilization of forest resources from Odoba forest reserve. The mean age of the people was 42 years [22]. This finding agrees with [18] that age significantly influence forest conservation in Botswana. Also, the finding is in line with the work of [27] that age significantly influenced household dependence on forests in forest-based rural communities in Vhembe District of South Africa. However, the finding disagrees with [19] that age had a negative significant influence on household forest dependency in Chobe enclave, Botswana. Also, the result is not in line with [28] that age does not have negative significant influence on dry Afromontane forest of Desa'a in Tigray region, Northern Ethiopia. [29] and [30] also had age negatively influencing forest resources in their study. Age is one of the demographic factors that affect the knowledge, attitude and practice of individuals towards environmental management [30].

**Table 2. Probit regression estimate of socio economic factors influencing utilization of resources from Odoba forest reserve**

Variables	Coefficient	Robust standard error
Age	0.006***	0.008
Years of Schooling	-0.002***	0.014
<b>*Marital status</b>		
Single	0.157	0.274
Married	0.078*	0.270
Household Size	0.044**	0.024
Mean Annual Income	-7.69***	-0.7
Years of Residence in Locality	0.009***	0.007
Constant	-0.525	0.459
Observations	304	

\*\*\* $p < 0.01$ , \*\* $p < 0.05$ , \* $p < 0.1$

The level of education of the people had an inverse relationship with utilization of forest resources from the reserve. Education is an important issue in development of livelihood strategies as it determines which livelihood activities a household is involved. This finding is line with [19] that education had a negative significant influence on household forest dependency in Chobe enclave, Botswana. Similarly [31] found that a unit increase in the year of education reduces the probability of cutting trees by 4%. However, the finding is not in line with [1] that education significantly and positively influenced conservation of forest resources in Kipini division of Tana Delta district, Kenya. Also, the finding is not in line with ([18], [28] and [27]) as they found education to have significantly influenced utilization of forest resources. The implication of this finding is that, encouraging the community members to get education reduces the possible pressure on forest resources collection from the reserve. Similar arguments were put forward by [32] in the Coastal region of Tanzania. He emphasized that the level of education has a remarkable bearing on sustainable management of natural resources. This might be due to possibility of educated members who have better alternatives than those who are not educated. Education enables people to go away from subsistence agricultural activities. [33] showed that high educated people will have greater off- farm employment opportunities than less educated ones. [34] and [35] found in their study that less educated people are more likely to rely on forest income, as they have less access to alternative incomes such as wages or business. According to [36], education is normally considered as the key to improved opportunities for development and accessibility to information and services.

Household size of the people was found to have positively and significantly influenced utilization of forest resources from the reserve. A unit increase in the household size of the people brought about a significant positive increase in the utilization of forest resources in the reserve. This finding agrees with [1] that a unit increase in household size of the people brought about significant positive influence on conservation of forest resources in Kipini division of Tana Delta district. Also, the finding is in line with [20] that household size significantly influenced the people's willingness to participate in the management of Kasane Forest Reserve, Botswana. The study by [18] and [28] also confirms this finding. However, [19] disagree with the finding that a unit increase in household size decreases forest dependency in Chobe enclave, Botswana. The reason put forward by the unexpected relationship between household size and forest dependency was small household number of the people. The mean household size had smaller standard deviation, demonstrating less spreading of the values away from the mean and each other. Therefore, the values for the variable household size were very close to the mean, hence less variability on the level of forest dependency. Household size determines per capita collection and utilization of forest products and therefore influences human disturbance of forest reserves. This implies that an increase in the household size increases frequent forest product collection from the reserve. [22] documented significant contribution of forest resources to the livelihood of the adjoining villages to Odoba forest reserve. Given that most household members in the study area are farmers, the larger the household size, the higher the chances that the members will be involved in various livelihood strategies than depend on

reserve's resources. A larger household size implies an over-exploitation of the reserve's resources to satisfy livelihood needs. Such implications have been confirmed by [37], [38] and [39]) who reported a strong relationship between household size and environmental degradation. Youth generally take greater risks relative to older people in the community. Furthermore, with limited off farm opportunities, younger people relied more on forest resources to meet their basic needs. Thus, [40] noted that younger households are being trapped in poverty due to limited alternative economic opportunities in Rwanda.

An increase in the income of the households significantly decreases utilization of forest resources in the reserve. This finding is line with previous studies by ([18,20] and [1]). Low incomes of people have been reported to exacerbate pressure on common pool resources resulting in consequent degradation of natural resources [41].

The years of residence in a locality has a positive significant influence on utilization of forest resources from the reserve. This finding agrees with [18] that a unit increase in period of residency of the people significantly influenced forest conservation in Botswana by the factor 0.027. The result also agrees with [19] and [27]). The more people stay in a given place, the more their families grow in size. Thus, more forest products are demanded from the reserve to meet the demands of the growing population. The length of stay in the communities implies that they have enough knowledge of trends of forest resources available in the reserve and associated problems in their respective villages. People who live in a certain area for a longer period of time accumulate experience of the reserve. Similar observations were reported by [38] and [42] which show that people who have stayed longer in an area are likely to provide relatively reliable historical data concerning resources in such areas.

## 5. CONCLUSION

The study has established the socioeconomic factors that influenced utilization of forest resources in Odoaba forest reserve. Issues for decision making and policy with regards to these factors are creating opportunities for improved education since increasing the number of educated people in the communities' decreased the utilization of the forest resources. This can be achieved by establishing more schools by

government and private individuals or upgrading the facilities in the schools, engaging competent teachers for improved conservation education. Also, there is need to invest in sensitization and training on commodity value chains which could boost income to minimize dependence on forests. Again, there is need for provision of accessible credit to households for crop intensification. This will ensure that households have increased food supply and also increased crop residue to use as fuel wood instead of relying on the forests all-year-round as well as reducing expansion of agricultural land into forest demarcated areas. Youth and women development enterprise fund should be created by the government and funds made accessible as a positive approach towards development. Diversification of activities that can help generate income should be encouraged to avoid reliance on forest resources.

## COMPETING INTERESTS

Authors have declared that no competing interests exist.

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