

## **Analysis of forest dependence and its determinants in forest communities of Southwest Nigeria**

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**Citation:** Fatoki, O., Thompson, O., Ojo, S., Oyerinde, O., & Olarewaju T. (2021). Analysis of forest dependence and its determinants in forest communities of Southwest Nigeria. *Bulgarian Journal of Soil Science, Agrochemistry and Ecology, 55*(3-4), 11-21.

### **Abstract**

This study assessed forest dependence and its determinants among forest households in Southwest, Nigeria. Primary data was used for the study and multi-stage sampling technique was used to select 294 forest households in the study area. Data were collected using questionnaire while descriptive statistics and Tobit regression model were used for analysing data collected. Majority of the households' sampled were males, married, with mean age of 47.8 and had an average household size of seven. The result shows that large proportion of the households give high priority to the provisioning and physical benefits of the forest such as supply of firewood, medicinal plants and farming activities more than the regulating, cultural and supporting benefits. The Tobit regression model shows that the factors that positively influence forest dependence were length of stay, dependency ratio, farm size and gender (male) while age, non-forest income, distance to nearest forest and credit facilities exerted negative influence. Therefore, the study recommends that medium and long term credit should be made available to forest households and empowerment programs should also be designed for male households in forest communities to create employment aside forestry related ones to ensure successful forest rehabilitation scheme in Nigeria.

**Key words:** forest dependence, forest benefits, livelihoods, forest communities, southwest region

## Introduction

Forests are highly valued for the provision of timber and non-timber forest products and they are regarded as habitat for rich genetic pools as well as being central to regional and local climate influence. They help in alleviating poverty in natural resource-rich environment (Vedeld et al., 2007; Kabubo-Mariara & Gachoki, 2008; Kamanga et al., 2009; Lopez-Feldman et al., 2011; Rayamajhi et al., 2012; World Bank 2013). Forests play significant roles by contributing to the diets of forest households and that of those living far beyond the woods. For instance, forest fruits, berries and nuts are popular among rural and urban consumers. These forest foods and many more add variety and flavour to diets and also providing essential nutrients like vitamins, fats, minerals and proteins. During times of emergencies and seasonal food shortages as a result of floods, droughts or war, forest foods also serve as vital insurance for malnutrition or famine (Alonge, 2014). Furthermore, forests provide important environmental and ecological functions and serve as an important resource base, if sustainably managed. Forests also help in supporting other economic activities like agriculture and fisheries, by means of ecological functions and services like soil and watershed protection; regulating services such as climate, water disease regulation as well as aesthetic, educational, cultural heritage values, tourism and recreation (Cavatassi, 2004, Adekunle & Agbaje, 2008).

Despite the numerous benefits that are provided by the forest, increasing rate of deforestation has been witnessed in many countries and it is complemented by the depletion of forest resources and the services they provide especially in developing countries. However, there is concern about the continued loss of forest in developing countries due to the carbon emissions potentials and biodiversity losses (Baccini et al., 2012). Conserving tropical forests is a serious challenge because local communities located around the forest depend on its resources as a source of income. As reported by Food and Agricultural Organization (FAO), 2018; forest resources help in providing employment

for more than 2 million people by supplying fuel wood and poles. Between 1990 and 2005, Nigeria lost about 36% of its primary forest and this made Nigeria to be one of the 10 countries with the highest deforestation rate in the world. More worrisome is that by 2046, forest land in Nigeria will be reduced to grasslands if necessary action is not taken and forest dependent households will be stripped of their livelihood (Nigeria Conservation Foundation (NCF), 2019).

To remedy the situation, the Nigeria Conservation Foundation in partnership with the Nigerian government is planning the Green recovery program. The aim of the program is to establish a forest rehabilitation scheme in 25% of the total land mass of Nigeria by 2047 while simultaneously promoting actions to combat forest degradation (NCF, 2019). To achieve the forest rehabilitation program, it is important to know the rate of dependence on forest resources and its determinants in forest communities as this will help in developing strategies to achieve sustainable forest conservation in Nigeria. Several studies have been carried out on the utilisation, conservation and management of forest resources in southwestern Nigeria (Orimoogunje & Adesina, 2009; Babalola, 2015; Amusa, 2017; Ariyo et al., 2018) but little or no study has been done to examine forest dependence and its determinants in communities around forest reserves in southwest, Nigeria. This study will also provide information on the benefits and associated livelihood outcomes from the forests among local communities in order to incorporate them within the development plans and formulation of policies for sustainable forestry development. Meanwhile, the study objectives are to highlight the benefits from the forest and their importance as well as determine forest dependence and its determinants in the southwest region of Nigeria.

## Methodology

### *Study Area*

This study will be carried out in the Southwest region of Nigeria which is known to accommodate a good number of forest reserves available in the country. Southwest of Nigeria is one of the

6 geo-political zones in the country and it has 6 states which are Ekiti, Lagos, Ogun, Ondo, Osun and Oyo. The climate of Southwestern Nigeria is tropical in nature and it is characterized by wet season (March – October) and dry season (November – February). The area lies between longitude 2° 31' E and 6° 00' E and Latitude 6° 21' S and 8° 37' N. The population of Nigeria is estimated to be over 195 million while that of the Southwest is estimated at 32.5 million people (National Bureau of Statistics, 2018). The southwest region is dominated majorly by Christians who are members of the Yoruba ethnic and they make up about 21% of the population in Nigeria.

### **Source of Data Collection and Sampling Method**

Primary data was used for the study and it was obtained with the aid of questionnaire from forest households in the study area. The data collected consist of information on socioeconomic as well as demographic characteristics of the respondents. Other information such as number of years the respondents has been living, working or visiting the forest reserves among others were obtained. Information was also obtained on livelihood activities and income derivable from activities in the forest.

Multi-stage sampling method was employed for the study to select fringe community households' of forest reserves that were used for the study. The primary data were obtained from forest community dwellers through the administration of well-structured questionnaire. The study area has 6 states which are Ekiti, Lagos, Ogun, Ondo, Osun and Oyo States. In the first stage, purposive sampling technique was used to select 3 states which are Ogun, Oyo and Ondo States because from the 6 states in the southwest region of Nigeria, the selected states have a good number of forest reserves available in the State. The second stage employed the sampling technique -  $n = N/1 + N(e)$  developed by Yamane (1967) to select the number of forest reserves to be sampled from each of the 3 states selected to ensure that the sample was proportionate to the population size. This gives a total of 10 forest reserves that was randomly

selected and in the final stage, 30 households were selected from the fringe communities around the selected forest reserves using random sampling to get a sample size of 300 households that was used for the study. Out of the 300 questionnaire administered, only 294 was found analysable for this study.

### **Analytical Techniques**

Descriptive statistics in the form of tables, frequency and percentages were used to describe the socioeconomic characteristics of the forest households and the benefits derived from the forest. Quantitative technique (tobit regression model) were employed to determine the factors influencing households' dependence on forest. Forest dependence (Y) was calculated as the percentage of forest income in total household income. The tobit model can be described in terms of a latent variable  $y_i^*$ . Suppose, however that  $y_i^* > 0$  is observed if  $y_i^* > 0$  and is not observed if  $y_i^* \leq 0$ , then the observed  $y_i$  will be defined as

$$y_i = \begin{cases} y_i^* = x_i \beta + e_i & \text{if } y_i^* > 0 \\ 0 & \text{if } y_i^* \leq 0 \end{cases}$$

$$\mu_i \sim \text{IID } N(0, \sigma^2)$$

Tobit model also assumes independent and normal distribution of error term in a maximum likelihood procedure. The procedure has probit and linear parts which are for censored observations and uncensored observations respectively. They are given as:

$$\Pr(y_i = 0) = \Pr(y_i \leq 0) = \Pr(\varepsilon_i \leq -x_i' \beta) = \Pr((\varepsilon_i / \sigma) \leq -(x_i' \beta / \sigma)) = \Phi(-x_i' \beta / \sigma) = 1 - \Phi(x_i' \beta / \sigma)$$

for the probit censored part and

$$\lim_{\mu \rightarrow 0} \Pr(y_i < Y_i \leq y_i + \mu | y_i > 0, \mu > 0) = \lim_{\mu \rightarrow 0} \left\{ \Phi\left(\frac{y_i - x_i' \beta - \mu}{\sigma}\right) - \Phi\left(\frac{y_i - x_i' \beta}{\sigma}\right) \right\}$$

$$= f(\varepsilon_i) = \frac{1}{\sigma} \Phi \left( \frac{y_i - x_i \beta}{\sigma} \right)$$

for the linear uncensored part (Woolridge, 2009).

Model specification depict that livelihoods are both sustainable and lead to sustainable resource use, or the livelihoods are unsustainable and results in resource degradation (Shiferaw & Bantilan, 2004). The adapted model was specified as:

$$y_i = \alpha + x_i \beta_i + e_i$$

$y_i$  was forest dependence, the dependent variable  $\alpha$  is the regression constant,  $\beta_i$  was parameters of interest associated with the  $x_i$ ,  $x_i$  are the explanatory variables while  $e_i$  were error terms.

$x_1$  Age (years)

$x_2$  Years spent in the community

$x_3$  Dependency ratio (ratio of the number of dependent household members younger than 15 years or older than 60 years old divided by the number between 15 and 60 years)

$x_4$  Income

$x_5$  Farm size (hectares)

$x_6$  Gender dummy (Male-1, Female - 0)

$x_7$  Nativity dummy (Natives -1, Non Natives - 0)

$x_8$  Residency dummy (Resident-1, Non residents - 0)

$x_9$  Distance to the nearest forest from home (km)

$x_{10}$  Access to credit (Access -1, no access - 0)

$x_{11}$  Household size (number)

$x_{12}$  Membership of Association (Member -1, otherwise -2)

$x_{13}$  Years of formal education

$x_{14}$  Marital status (Married = 1, otherwise = 0)

## Results and Discussion

### *Socioeconomic Characteristics of Forest Communities Households*

Table 1 revealed that majority (74.5%) of the respondents and by extension forest communities' residents are household heads who are the major decision makers in the households. This helped

in ensuring that responses provided are those of household decision makers (UNICEF, 2007). Also, majority (76.9%) of the respondents are mostly males as expected because this is the required norm about headship and decision making of households in Nigeria. This finding is in line with Kalaba et al., (2013) in which the 72.5% of the households were males in the work carried out on the contribution of forest provisioning ecosystem services to rural livelihoods in Zambia. The mean age of the respondents is 47.88 which show that they are economically active and this is in line with the age distribution of the country where the aged are very minimal. The result below further shows that most (41.5%) of the respondents had secondary education followed by 28.6% that had primary education and just few (18.0%) had no formal education in the forest communities. Majority (93.9%) of the respondents in the study area were married thereby further strengthening the needed household level decision making process. Table 1 reported that average household size in the forest communities sampled is 7.05 which imply that the respondents have large household size which may affect their purchasing power.

### *Importance of Forest Benefits to the Community*

Forests are of tremendous importance due to ecological and economic roles they play. These roles are often seen as benefits to the immediate community (UNDP et al., 2009). In this light, this study sought the availability and importance of such benefits in the study area. Forests benefits were broadly categorized into four: provisioning, regulating, cultural and supporting (Morris & Camino, 2011). These four categories of forest benefits were presented to forest-dwelling households to confirm the extent to which the forest available in their community provide them, their importance as well as the priority they place on them. The results were presented on Table 2.

Provisioning and regulating benefits were perceived as the most abundant according to Table 2. Majority of all the forest community dwellers agree that the forests provide these benefits. Supply of firewood was the most perceived (85.6%). This

**Table 1.** Distribution of respondents by socioeconomic characteristics

Variables	Frequency	Percentage
<b>Household Member Type</b>		
Head	219	74.5
Spouse	56	19.0
Others	19	6.5
Total	294	100
<b>Age</b>		
Less or equal to 30	8	2.8
31 – 40	82	28
41 – 50	111	36.8
51 – 60	52	17.9
Greater than 60	41	14.0
Mean (Std error)	47.88 (0.69)	
<b>Gender</b>		
Male	226	76.9
Female	68	23.1
<b>Education</b>		
None	53	18.0
Primary	84	28.6
Secondary	122	41.5
OND	8	2.7
BSc/HND	25	8.5
Adult education	2	0.7
<b>Household Size</b>		
1 – 4	40	13.7
5 – 8	191	65.0
9 – 12	41	13.9
Greater than 12	22	7.5
Mean (Std error)	7.05 (0.17)	
<b>Marital Status</b>		
Single	10	3.4
Married	276	93.9
Widow	8	2.7
Total	294	100

Source: Field Survey, 2020

**Table 2.** Importance of forest benefits to the community

Forest benefits	Availability of Benefits		Importance of Benefits		Rank of Benefit
	Limited	Abundant	Not important	Important	
<b>Provisioning</b>					
Supply of Firewood	16.5	83.5	14.5	85.6	1
Supply of irrigation water	32.7	67.4	36.2	63.8	11
Supply of construction materials	21.4	78.6	24.2	75.8	5
Supply of bush meat	30.3	69.7	38.7	61.3	14
Supply of medicinal materials	18.7	81.7	20.2	79.7	2
Support for farming	20.7	79.3	25.8	74.2	4
<b>Regulating</b>					
Flood control	48.0	52.0	35.0	65.0	10
Provision of cool breeze	19.3	80.7	20.8	79.2	3
Serve as wind breaks	19.6	80.4	26.0	74.0	6
Purify the air	34.3	65.7	33.5	66.5	8
Microclimate stabilization	25.1	74.8	39.8	60.2	15
<b>Cultural</b>					
Provide attractive landscape	34.4	65.6	50.2	49.8	18
Support recreation	44.2	55.7	45.8	54.2	17
Support ecotourism	59.2	40.8	57.2	42.8	19
Shade for animals and humans	28.8	71.2	29.2	70.8	7
<b>Supporting</b>					
Support biodiversity	34.5	65.5	37.0	63.0	12
Maintenance of wildlife habitat	34.8	65.2	37.6	62.4	13
Protection of endangered species	22.6	77.4	39.9	60.1	16
Protection against wind erosion	38.5	61.5	33.8	66.2	9

Source: Field Survey, 2020

is not surprising as rural households are known to rely heavily on fuel wood as a source of energy for cooking. This benefit was further ranked as the most important of all other nineteen as it readily comes in the first position among others. Provisioning benefits in the supply of medicinal plants (79.7%) was also perceived next followed by regulating function of providing cool breeze (79.2%) and the fourth highly ranked benefit is the support for farming (74.2%). Also, provision-

ing benefits of supplying construction materials was ranked in the fifth position. Meanwhile, priority placed on the importance of all benefits showed that provisioning and physical benefits particularly as seen here the support of forests for livelihood are more important than regulating, cultural or supporting benefits to the forest community dwellers. This finding is in consonance with that of Kalaba et al., (2013) that reported that forest provisioning ecosystem services are very

important in providing food, medicine, fodder and construction materials in Zambia.

The regulating function of forests in serving as wind breakers is perceived as the sixth most important benefits of all the nineteen benefits present to the respondents. This is the second regulating function that is ahead of provisioning benefit. Furthermore, the cultural benefit of shade for animals and humans (70.8%) was highly ranked among the category of variables in the cultural function of forests presented to the respondents. However, availability of tourism potential of the forest is low (40.8%). This may be due to the huge degradation rate of the forests in Nigeria that has affected tourism activities. Recreational benefits (55.7%) and attractive landscapes (65.6%) were abundant. Table 2 also reveals that the forests abundantly (65.5%) supports biodiversity therefore conservation activities can be promoted in this aspect. In essence, it is observed that forests were not well appreciated except for the limited consumptive benefits like the provisioning functions of some of the forest resources.

### ***Livelihood Activities in Forest Communities***

The livelihood pattern and associated income were profiled in this study. This is of particular interest as it suggests the economic uses which the forest resources were being explored for. The results were presented in Table 3. Farming was the most prevalent primary occupation in the forest communities in which a substantial proportion (46.3%) of the farming activities is non forest dependent while 37.1% is forest dependent. This may be closely hinged to the restrictions in most forest reserves to be used for farming activities to avoid degradation. Total income realized from forest-based activities is N523396.47 by a forest household. Furthermore, other forest dependent livelihood activities that the forest community dwellers are involved are hunting (45.9%), lumbering (13.6%) and other non-timber forest products collections (37.1%). These activities are providing employment for majority of the forest community dwellers who ordinarily would have been jobless. Therefore, forests like other natural resources provide safety nets for rural households

(USAID, 2016).

### ***Factors Influencing Households Dependence on Forests***

Households often depend heavily on forests for income (OECD, 2008). Therefore, this study examined factors influencing households' dependence on forests for income generation. The result is presented on Table 4. A look at the model at hand showed that the Log likelihood value of -89.451 was statistically significant at 1% indicating that all the coefficients of the independent variables in the model were not simultaneously zero. Likelihood ratio chi-Square (LR chi<sup>2</sup>) test indicated that at least one of the independent regression coefficient is not equal to zero i.e., it contributed something to the model. The number in the parentheses indicated the degrees of freedom of the Chi-Square distribution used to test the LR Chi-Square statistic and is defined by the number of independent variables in the model which was fourteen in this case. The p-value was compared to a specified alpha level at which a type I error was willing to be accepted. On the overall the LR test indicated a significance at 1% ( $p < 0.01$ ) which indicates that at least one of the coefficients of the regression model was not equal to zero.

Socio economic characteristics significantly explained the reason households explore forests for income. Both positive and negative influences were established between socio economic characteristics and forest dependence. Socioeconomic factors that positively influence dependence on forests were years spent in community, dependency ratio, farm size and gender (being a male) while those that exert negative influence were age, non-forest income, distance to nearest forest and access to credit. The males were more likely to depend on the forest for livelihood as the coefficient of gender (male) dummy was significant ( $P < 0.01$ ). This was in line with the findings in India where males were found to be more dependent on natural resources for income (Das et al., 2015). Also, an increase in the number of non-working member of households implies that those that are working and earning income will depend on the forest for additional income. The coefficient of farm size was significant ( $P < 0.01$ ) which implies that the

**Table 3.** Livelihood activities in forest-dwelling communities

Income from all sources	Frequency	%	Returns	Average Returns	Standard error of returns
<b>Forest dependent</b>					
Farming	123	41.8	28,130,000	228,699.19	8419.25
Hunting	135	45.9	12,550,890	92,969	44,384.52
Lumbering	40	13.6	5,420,331.20	135,508.28	23,607.71
Firewood	109	37.1	7,218,000	66,220	5518.33
Average			53,319,221.2	523,396.47	
<b>Non Forest dependent</b>					
Farming	136	46.3	32,540,000.00	239,264.71	9478.65
Agro process- ing, Trading and Hospitality	167	56.8	10205000.00	61,107.78	3078.35
Artisanship and Craft	63	21.4	3656000.00	58031.33	2010.68
Wage employ- ment	82	27.9	20,178,000.00	246,073.00	8608.89
Others	12	4.08	882,760.00	73563.33	2987.82
Average			67,461,760.00	678040.15	

Source: Field Survey, 2020

larger the farm size, the more the dependence on forest resources like forest watershed or other water bodies in the forest. This is possible because farmers may rely on water from the forest for irrigation purposes during period of water shortage and dry season. An increase in the number of years spent in the forest community supports the exploration of the forest for livelihood activities as the coefficient is positive and significant ( $P < 0.05$ ). This result is similar to the findings of Ofoegbu et al., 2017 that longer year of residence in forest communities significantly influence use of forest resources.

Age of the forest households has a negative influence on forest dependence which implies that an increase in age of the forest households will reduce the rate at which they make a living from the forest. This result supports the finding of Maua et al., 2018 that age is a socioeconomic factor influencing households' dependence on forests in South Nandi forest, Kenya. Furthermore, distance to the nearest forest is significant ( $P < 0.05$ ) and negatively influence dependence on forest. This

means that longer distance to the forest will limit the rate at which the households explore the forest. This supports the finding of Giliba et al., 2017 that distance between homestead and forest is a significant factor influencing deforestation in the Bereku forest reserve in Tanzania. The coefficient of non-forest income is significant ( $P < 0.01$ ) and exert negative influence on forest dependence. This implies that an increase in non-forest income will reduce the level of forest dependence for income. Also, households that do not have access to credit are more likely to depend on the forest for livelihood.

There are several marginal effects based on the result of the tobit model and the marginal effects are same as the coefficients in Stata (Bius, 2014; Williams, 2014; Olarewaju, 2018). In the light of the above, a unit increase in age will reduce forest dependence by 0.02. Also, a unit increase in income will also reduce dependency on forest by about two times (1.71). Furthermore, forest households that do not have access to credit will depend more on the forest by 0.4 unit while a unit



**Table 4.** Tobit regression of forest dependency

Forestry Dependency	Coefficient	Std error	t-value
Age	-0.024135**	0.009234	-2.61
Years in community	0.0021589**	0.001058	2.04
Dependency ratio	0.1119285*	0.0679772	1.65
Income	-1.71e-06***	3.92e-07	-4.37
Farm size	0.0055165***	0.001909	2.89
Gender	0.0869286**	0.0343466	2.53
Nativity	-0.0276119	0.029679	-0.93
Residency	0.0178725	0.042868	0.42
Distance to nearest forest	-0.0964562**	0.0461733	-2.09
Access to credit	-0.4562121*	0.1258212	-3.62
Household size	0.0085974	0.0058421	1.47
Membership of association	0.0485254	0.0425723	1.14
Education	-0.0009581	0.0030115	-0.32
Marital status	0.0177693	0.0537029	0.33
Constant	0.408167	0.1533909	2.66
Log likelihood	-89.451027		
LR chi <sup>2</sup> (14)	44.76		
Probability chi <sup>2</sup>	0.0000		
Pseudo R <sup>2</sup>	0.6077		

**Source:** Computed from 2020 Field Survey

\*\*\*, \*\*, \* represent statistical significance at 1%, 5% & 10%.

increase in the number of non-working members of households will increase forest dependence by 0.11 unit. In a nutshell, forest households who do not have access to credit and with a large number of non-working members depended more on the forest for livelihood.

## Conclusion

Priority placed on the importance of forest benefits showed that supply of firewood, medicinal materials, cool breeze and farming activities were the first, second, third and fourth most important. It is therefore evident that provisioning/physical benefits as well as support for livelihoods are more important than regulating, cultural or supporting benefits to forest households. Majority of the forest households practice farming and a

substantial proportion of these farming practices are dependent on forest in which the farmers get an average income of N228,700 per year. Other income generating activities from the forest are hunting, lumbering and firewood collection. Males, households that have no access to credit, spent longer years in the forest communities and have large number of non-working members depended more on the forest. Increase in non-forest income reduced the dependency level on the forest in the forest communities meaning if forest households are exposed to activities that can generate income aside the forest, the pressure on forest reserves will significantly reduce and forest conservation efforts will be promoted.

## Recommendation

The study recommends that Empowerment programmes and skill acquisition centres should be designed and established for forest households particularly the males to engage them in other employment aside forest related ones. Since access to credit significantly reduced dependency level on forests, provision of institutional support as well as conducive policy environment should be put in place to expedite medium and long term credit facilities to forest households in order to ensure successful forest rehabilitation scheme in Nigeria.

## References

- Adekunle, M. F., Momoh, S., & Agbaje, B. M.** (2008). Valuing urban forests: the application of contingent valuation methods. *Ethiopian Journal of Environmental Studies and Management*, 1(2), 61-67.
- Alonge, T.** (2014). *Evaluation of the contribution of forest resources to households' food security in Ogun state, Nigeria*. Unpublished MSc thesis, Department of Agricultural Economics and Farm Management, Federal University of Agriculture Abeokuta, Nigeria.
- Amusa, T. O., Jimoh, S. O., & Azeez, I. O.** (2017). Socio-economic factors influencing marketing of non-timber forest products in tropical lowland rainforests of south-western Nigeria. *Southern Forests: a Journal of Forest Science*, 79(2), 161-168.
- Ariyo, O. C., Okojie, L. O., & Ariyo, M. O.** (2018). Villagers' willingness to pay for forest conservation in Ibadan, Oyo State, Nigeria. *Asian Journal of Agricultural Extension, Economics & Sociology*, 1-14.
- Babalola, F.** (2015). Production and marketing of non-timber forest products as a driver of agroforestry practices in southwest, Nigeria. *XIV World Forestry Congress, Durban, South Africa. 7-11, September*.
- Baccini, A. G. S. J., Goetz, S. J., Walker, W. S., Laporte, N. T., Sun, M., Sulla-Menashe, D., ... & Houghton, R.** (2012). Estimated carbon dioxide emissions from tropical deforestation improved by carbon-density maps. *Nature climate change*, 2(3), 182-185.
- Bius, M.** (2014). *Marginal Effect Failing with Tobit*. Available online at [www.stata.com/statalist/archive/2014-03/msg/01052.html](http://www.stata.com/statalist/archive/2014-03/msg/01052.html) (last accessed 19.11.2020).
- Cavatassi, R.** (2004). *Valuation methods for environmental benefits in forestry and watershed investment projects*. ESA working paper, No 04-01, 2-25. [www.fao.org/es/esa](http://www.fao.org/es/esa)
- Das, S., Behera, B. & Mishra, A.** (2015). Determinants of household use of wetland resources in West Bengal, India. *Wetlands Ecology and Management*, 23(5), 803-816.
- Food and Agricultural Organization.** (2018). *The state of the world's forests: forests pathways to sustainable development. Publication of the Food and Agricultural Organization of the United Nations*, 1-27. <http://www.fao.org/policy-support/tools-and-publications/resources-details/en/c/1144279/>
- Giliba, R. A., Boon, E. K., John, C., Chirenje, L. I. & Musamba, E. B.** (2017). The influence of socio-economic factors on deforestation: a case study of the Bereku Forest Reserve in Tanzania. *Journal of Biodiversity*, 2(1), 31-39.
- Kabubo-Mariara, J. & Gachoki, C.** (2008). *Forest dependence and household welfare: empirical evidence from Kenya, CEEPA Discussion Paper No. 41* Pretoria, University of Pretoria, South Africa.
- Kalaba, F. K., Quinn, C. K., & Dougil, A. J.** (2013). The role of forest provisioning ecosystem services in coping with household stresses and shocks in Miombo woodlands, Zambia. *Ecosystem Services*, 5, 143-148.
- Kamanga, P., Vedeld, P. & Sjaastad, E.** (2009). Forest incomes and rural livelihoods in Chiradzulu District, Malawi. *Ecological Economics*, 68(3), 613-624.
- Lopez-Feldman, A., Taylor, J.E. & Naude-Yu'nez, A.** (2011). Natural resource dependence in rural Mexico. *Investigacio'n Economica*, LXX(278), 23-44.
- Maua, J. O., Harrison, T. M., & Joshua, C.** (2018). Socioeconomic factors influencing dependence of households on non-timber forest products in South Nandi forest, Kenya. *Journal of Economics and Sustainable Development*, 9(14), 105-113.
- Morris, J. & Camino, M.** (2011). *Economic assessment of freshwater, wetland and floodplain (FWF) ecosystem services. UK National Ecosystem Assessment Working Paper, UK NEA Economics Analysis Report*. From <http://uknea.unep-wcmc.org/LinkClick.aspx?fileticket=IVLEq%2BxAI%2BQ%3D&tabid=82> (last accessed 06.07.2019).
- National Bureau of Statistics.** (2018). *Statistical Report on Women and Men*. Available online at [www.nigerianstat.gov.ng](http://www.nigerianstat.gov.ng). (last accessed 19.12.2020).
- Nigeria Conservation Foundation.** (2019). *Green recovery Nigeria: towards a prosperous nation*. Available online at [www.ncfnigeria.org](http://www.ncfnigeria.org) (last accessed 05.08.2020)
- OECD.** (2008). *Natural resources and pro-poor growth: the economics and politics. DAC Guidelines and Reference Series*. ISBN 978-92-64-04182-0 from <http://www.oecd.org/environment/environment-development/42440224.pdf> (last accessed 25.07.2019).
- Ofoegbu, C., Chirwa, P. W., Francis, J., & Babalola, F. D.** (2017). Socioeconomic factors influencing household dependence on forests and its implication for forest-based climate change interventions, Southern forests. *Journal of Forest Science*, 79(2), 109-116.
- Olarewaju, T. O.** (2018). *Wetlands attributes, associated livelihood outcomes and willingness to pay for wetland development among households in communities around Ogun river basin, Nigeria*. Unpublished PhD thesis, Department of Agricultural Economics, Federal University of Agriculture, Abeokuta, Nigeria.

**Rayamajhi, S., Smith-Hall, C., & Finn, H.** (2012). Empirical evidence of the economic importance of central Himalayan forests to rural households, *Forest Policy and Economics*, 20, 25-35.

**Shiferaw, B. & Bantilan, C.** (2004). Rural poverty and natural resource management in less-favoured areas: revisiting challenges and conceptual issues. *Journal of Food, Agriculture and Environment*, 2(1), 328-339.

**Kaggwa, R., Hogan, R., and Hall, B.** (2009). *Enhancing Forests Contribution to Growth, Employment and Prosperity*. Kampala, UNDP/NEMA/UNEP Poverty Environment Initiative

**UNICEF.** (2007). *The state of the world's children. Women and children: the double dividend of gender equality*. New York, NY: UNICEF House. ISBN 978-92-806-3998-8. <https://www.unicef.org/media/84811/file/SOWC-2007.pdf>

**USAID.** (2016). (LIFT) Project FHI 360 1825 Connecticut Avenue NW Washington, DC 20009. From <http://theliftproject.org/wp-content/uploads/2013/03/Livelihood-and-Food-Security-Conceptual-Framework.pdf> (last accessed 17.04.2020).

**Vedeld, P., Angelsen, A., Bojo, J., Sjaastad, E. & Kobugabe, G.** (2007). Forest environmental incomes and the rural poor. *Forest Policy and Economics*, 9, 869-879.

**Williams, R.A.** (2014). Using the margins command to estimate and interpret adjusted predictions and marginal effects. *The Stata journal*, 12(2), 308-331.

**Wooldridge, J. M.** (2009). *Introductory Econometrics: A Modern Approach, 4e*. Mason, OH: South-Western CENGAGE Learning ISBN-10: 1111531048

**World Bank.** (2013). *Managing forest resources for sustainable development: an evaluation of World Bank Group experience*. Washington, DC: IEG World Bank.

**Yamane, T.** (1967). *Statistics: An Introductory Analysis, 2nd Edition*, New York: Harper and Row.