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SOCIO-ECONOMIC IMPORTANCE OF FUELWOOD PRODUCTION IN GAMBARI FOREST RESERVE AREA, OYO STATE, NIGERIA

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ABSTRACT
Fuelwood apart from meeting domestic energy need of the people around forest areas provide a means of livelihood as a source of income. The socio-economic analysis of fuelwood collectors in Oyo State, Nigeria, was investigated with a view to determine its potentials and impact on the income of the rural communities in Gambari forest reserve area. Data for the study were obtained from a total sample of 119 randomly selected respondents through interviews schedules, application of structured questionnaires and personal observations. Descriptive statistical tools such as frequencies, percentages and tables were used to analyze variables of interest such as age, gender, family size, education, income and type of enterprise. Cash analyses were made to determine the profitability of the enterprise. Multiple regressions were also employed to find out the relationship between income generated from fuelwood and some selected socioeconomic factors (independent variables).Result showed that the industry is profitable with an average Gross margin of ₦82, 130.00 and Net return of ₦81, 055.00. There was a positive and strong relationship between income generated from fuelwood sales and the gender, family size, level of education and amount paid to labour; with coefficient of determination (R^2=0.67556). A negative relationship was noted between income generated from fuelwood sales and amount paid to government. The study indicated that income generated from fuelwood sales within the period of study increased with increasing number of households, level of education and amount paid to labourers with little revenue generation into the State treasury. Uncontrolled collection of fuelwood leads to the destruction of forest resources. It therefore recommended that the state forestry department should educate the collectors on the importance of rational exploitation, tree planting, and the value of maintaining the existing trees on their farm plots. Fuelwood will continue to be indispensible for a variety of local industries and craft: restaurants, bakeries, curing tobacco, brick burning and barbecue, to name few.

Key Words: Non-timber forest products, fuelwood, economic assessment, livelihood.

INTRODUCTION
Non-timber forest products (NTFPs) are a vital source of livelihood for a large proportion of the poor living in or close to the forest in most tropical countries. Fuelwood is a non-timber forest product commonly used for domestic and industrial energy generation. Wood harvesting for fuelwood is the third most important economic activity for the inhabitants of forest dependent area, after farming and animal husbandry (FAO, 1990). Moreover, local processing of NTFPs increases off-farm rural employment opportunities. Small-scale forest-based enterprises, many of them based on NTFPs, provide up to 50 percent of income for 20 to 30 percent of the rural labour force in India (Campbell, 1988). In addition to subsistence and income-generating potential, NTFPs also provide food security to large low-income populations, their cattle and other domestic animals, particularly during droughts or famines (FAO, 1989). There are diverse technical, environmental, social, cultural and economic reasons for choosing fuelwood as a source of energy (Horgan, 2000). These factors make fuelwood use a site- and situation-specific energy option. There are diverse reasons for

choosing wood as a source of energy. For many users the choice depends on the availability and affordability of other energy options (Horgan, 2000).In the past, wood harvesting in developing countries was mainly for domestic consumption, and it was mostly women who gathered the dry branches and trunks of trees and shrubs for fuelwood (Awah 1995). Today the situation has changed, as increased commercialization of the sector has led to the widespread harvest of both dead and live branches and trunks by men and women (Awah 1995). Fuelwood is harvested, processed, marketed and consumed exclusively by forest dependent communities, moving from collectors through wholesalers and retailers to consumers. Fuelwood is forest product with little sophistication in length of processing and marketing, the products reach the final consumers more or less directly. The fuelwood sector employs many men, women, and children in both rural and urban areas, offering both temporary and permanent employment opportunities. It is important economically because it offers an immediate source of income to the exploiters (Larinde and Kehinde, 2004). Fuelwood is obtained by splitting logs and big branches into halves and smaller pieces. Most of the wood harvested in the villages for household use are harvested by women and younger children and transported on head, animal, truck and bicycle. Apart from its increasing commercial value, factors encouraging the use of fuelwood include cooking habits, purpose of cooking, family size, social rank and food type (Montalembert and Clement 1983; Munslow *et al.* 1989; Robin and Leach 1989; Musa unpublished). For centuries fuelwood has remained an affordable and reliable source of domestic energy for the rural populations of the developing countries (FAO. 1990). Rural population in oil rich developing countries will continue to depend on wood because bringing oil, gas and electricity within their reach would require very high capital expenditure on roads and on electric transmission lines. A large number of rural households are becoming more involved in producing of fuelwood for the market; hence it is necessary to shift the focus of study from subsistence to income generation. However, insufficient attention is often given to the process and methods of identifying income-generating NTFPs enterprises. In many instances it is important not only to consider what is currently produced and how it is marketed, but also to look critically at current and potential markets and to appraise whether a potential product *is* sustainably managed. For many fuelwood users in developing countries, energy options are limited. A consumer contemplating switching fuels may need to factor in the possible impacts on existing equipment and may have to assign economic values to known or perceived externalities which may differ with the energy or fuel source. In the commercial and industrial sector, a large number of prepared-food vendors such as restaurants, vendors of barbecue, bakeries, makers of agidi (maize steamed in leaves) and palm oil producers depend on woodfuel. Institutions such as hospitals, schools and prisons and industries such as blacksmiths are among the highest consumers of scrap wood, coconut wood and charcoal.

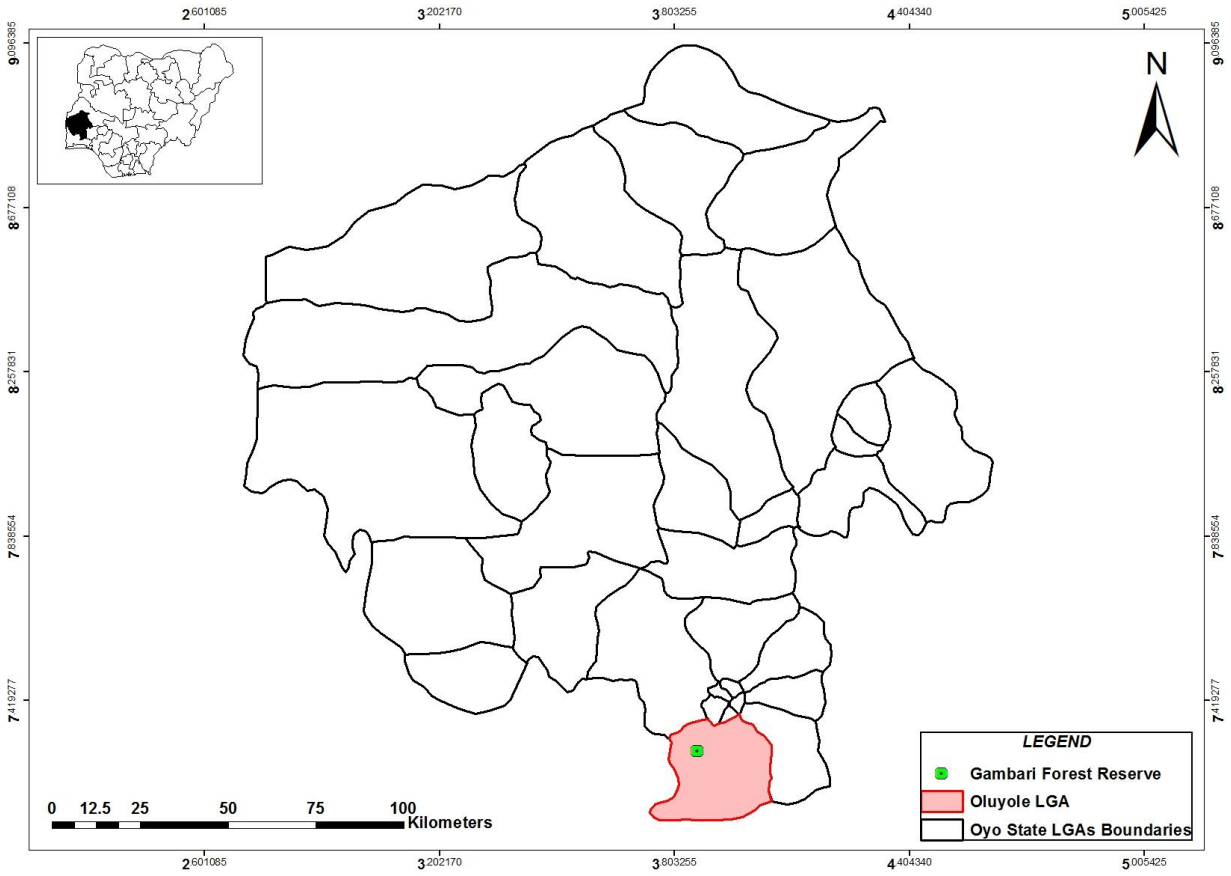
Livelihoods connote the means, activities, entitlements, assets by which people do make a living through natural or biological means (i.e. land, water, common property resources, flora, fauna), social (i.e. community, family, social methods, participation, empowerment) and human (i.e. knowledge, creation of skills) and are therefore paramount to the debate on sustainable development. Fuelwood no doubt provides a means of livelihood as a cheap source of domestic energy and income to supplement farming for the forest dwellers throughout the year. Social impact assessment is an integral part of environmental impact assessment which aims to widen the focus and integration of the social and economic implications of a development programme on the life, economy, culture and existence of the host or beneficiary communities. The renewable nature of the forest also offers potential for sustained output of wood for fuel, provided appropriate harvesting and management can be instituted before destruction reaches an irreversible point. This study therefore is a socio-

economic assessment of forest communities involved in fuelwood collection and trade from the Gambari forest reserve as a means of livelihood.

MATERIALS AND METHODS

Study Area:

The study was conducted in Gambari Forest Reserve located in Oluyole Local Government Area (LGA) of Oyo state. It is one of the early forest reserves in the state and it is divided into 5 series namely Onogambari, Busogboro, Onipe, Olonde and Mamu. Gambari forest reserve is a lowland forest. The reserve is located between latitude 7^0 25`N and longtitude $3^0$ 50`E. It is situated at the southern part of Ibadan bounded on the west by River Ona and on the east by the main road of Ibadan to Ijebu-ode. The reserve is bounded by Abanla and Odo-ona settlements in Oluyole local government area of Oyo State in the north and in the south by Mamu and Abatan settlements in Ijebu-ode local government area of Ogun State. Both dry and wet season are experienced in the reserve. Dry season lasts for 3months (December-February). The average annual rainfall is about 1140mm and average annual temperature is about 26.4^0C (80^0F). The reserve has been reduced to secondary high forest dominated by trees like *Mansonia altissima, Triplochiton scleroxylon, Terminalia superba, Celtis zenkeri, Sterculia spp, Terminalia ivorensis* and *Cola spp,* the planted area is dominated by *Tectona grandis, Gmelina arborea*. The reserve provides 5major NTFPs namely fuelwood, sponge, snails, leave and ropes.



Sampling technique and data collected

The study utilized a random sampling technique to obtain cross sectional data from one out of the 5 series in the reserve, Busogboro was purposively selected because fuelwood producers are more organized and kept good records. Primary data were exclusively used for the study.

Data collected include; socio economic characteristics of households and their fuelwood production data. A total of 120 structured questionnaires were administered for fuelwood collectors while 119 were retrieved. To overcome language problem, and for appropriate understanding of the questions and responses, the questionnaire was read and interpreted to the illiterate respondents.

Data analysis

Descriptive statistical tools such as frequencies, means, modes and percentages were used to analyze the variables of interest such as age, gender, family size, education, income, type of enterprise and amount paid to labourers. Cash flow analysis such as gross margin and net return were also employed.

Gross margin = Total value of production (Revenue) – Variable cost of production
Net Return = Gross Margin – Fixed Cost

Also inferential statistical tools especially the multiple regression was also employed to find out the relationship between income generated from fuelwood and some selected socioeconomic factors (independent variables).The linear regression model is as follows:

$$Y = \delta_{0+} \delta_1 X_{i1} + \delta_2 X_{it2} + \delta_3 X_{i3} + \delta_4 X_{i4} + \delta_5 X_{i5} + \delta_6 X_{i6} + e \ldots\ldots\ldots\ldots\ldots\ldots (1)$$

Where Y = Income generated from fuelwood by the respondent
X_1 = age of collectors in (years)
X_2 = Gender of collector (male = 1, female = 0)
X_3 = family size (Numerical value)
$X_{4=}$ level of education of collectors (years)
X_5 = Fees pay to government (yes = 1, 0 = otherwise)
X_6 = Amount paid to labour (Naira ₦)
$X_{7=}$ Type of enterprise engage in (other than firewood collection)
E = Error term

RESULTS AND DISCUSSION

Demographic characteristics of respondents

Demographic analysis of respondents shows that age groups of 36-55 years had the highest number of respondents (36.1%). This was followed by the age group of 26-35 years (30.3%). This shows that majority of the respondents are in their active periods and are bread winners for their respective family within their communities. The majority of the respondents (58.8%) were males while 41.2% were females, which means that fuelwood collection is not the exclusive preserve of the males even thou males are more involved in harvesting of fuelwood in Gambari forest reserve. This might also be due to the fact that women are involved in domestic cooking and supplementing farm income in off season periods. More men are involved supply of fuelwood when more rural labour has to be diverted to other activities in those seasons of the year when agricultural labour is not in demand (Larinde and Kehinde, 2004). Most of the respondents (37.0%) completed primary school education, 24.3% had no formal education, and 21.0% had secondary education, while post secondary school certificate holders recorded the least value of 17.6% (Table 1). This depicts that educational level of the people is inversely proportional to the number in the business, implying that those that are well educated are not many in the business. This is not surprising since a great percentage of rural dwellers have little education and tertiary education institutions qualifications are not prerequisites. Most of the respondents interviewed were married, which shows that family labour is a strong in generating more output. The distribution of household

size revealed that the largest household have between 1 –5 people and 55.7% of these are tenants, that is, live in rented apartments while 44.3% own their apartments.

Table 1 Distribution of fuelwood producers' socio economic characteristics

Characteristics		Frequency	Percentage (%)
Age	1 5– 25	12	10.1
	26 – 35	36	30.3
	36 – 55	43	36.1
	56above	28	23.5
Gender	Male	70	58.1
	Female	49	41.2
Marital status	Married	106	89.1
	Single	24	8.4
	Widow	2	1.7
	Divorced	1	0.8
Level of education	No formal education	29	24.3
	Primary school	44	37.0
	Secondary school	25	21.0
	Tertiary education	21	17.6
Household size	1 – 5 people	52	43.7
	6 – 10 people	55	46.2
	11 – 15 people	12	10.0
Residential status	Villagers	64	53.8
	Non-villagers	55	46.2

Source: Fieldwork (2010)

Production and management

Apart from the natural forests fuelwood in the study area is derived from several sources, such as bush fallow, tree plantation sites, reforestation sites, agroforestry systems and farmland. Trees are cut and carried or transported to level areas where they can be split, bundled according to size of fuelwood. The various types that are common are logging wastes, moderate medium braches and small branches. Most of the producers practice coppicing and coppice trees are normally harvested in rotational patches every two to five years. When production takes place in government plantation it is usually after logging and it is controlled by forest officer, with time duration after payment of specified fee. It was found that villages adjoining the forest (5 km distance) meet their total fuelwood requirements from the forest. Seventy-five percent of the fuelwood comes from the forest; while the remaining 25 percent comes from farmland, bush fallows and Agroforestry lands.

Table 2. Percentage distribution of fuelwood sources.

Fuelwood source	Percentage (%)
Natural forest	10.3
Plantation	68.2
Farmland	10.4
Bush fallow	5.6
Others	5.5
Total	100

Source: Field work 2008

Structure of fuelwood industry

The fuelwood industry can be classified into small, medium and large scales based on the number of people engaged and capital investment in production as follows: small scale: less than 5 employees; medium scale: more than 5 but less than 10 employees; large scale: 10 employees and above. Table 2 indicates that majority of the establishment were operating as small scale enterprise with family members as part of the labour force, this group account for 85 percent in the study area. The medium scale enterprise ranked second with 15 percent while large scale enterprise was zero percent.

Table 3. Percentage distribution of fuelwood enterprise showing scale of production.

Size	Employees	Number of Establishments	Percentage (%)
Small	1-5	101	85
Medium	6-10	18	15
Large	>10	0	0
Total		119	100

Source: Fieldwork 2008

Wood species utilized by fuelwood producers

Most of the fuelwood production in Onigambari forest reserve area originates from a handful of species: *Leucaena leucocephala*, *Leucaena glauca, Gliricidia sepium*, *Tectona grandis, Gmelina arborea, Swietenia macrophylla. Acacia spp, Albizzia spp, Cassia siamea*, and *Pithecellobium saman.* Findings from the study show that supplies from preferred species are inadequate and selectivity in terms of species has declined significantly. Producers noted that species which in the past were not utilized, owing to less than optimal characteristics, are now being burnt for fuel.

Estimation of Revenue from fuelwood sales

Revenue from sales was obtained from the average of revenue for all the respondent, the fixed cost items were depreciated and variable cost were estimated, therefore total cost of production is the total annual depreciation value plus the total variable costs. The gross margin is the difference between the total value of production and the variable costs of production. Net return is taken as gross margin less fixed cost.

Table 4: Average cost value of variable cost items

Item	Average Cost (₦)	Percentages
Wood	44,200.00	84.4
Labour	1,200.00	2.3
Permit/lincecsce	1,200.00	2.3
Rope	800.00	1.5
Transportation	5,000.00	9.5
Total variable cost	52,400.00	100

Table 5: Average depreciation values of fixed cost items

Item	Acquisition Cost (₦)	Expected life span (years)	Annual depreciation (₦)
Matchet/Cutlass	1,000	2	500
Axe	500	4	125
Tape rule	150	1	150
File	500	2	250
Wooden harmer	100	2	50
Total variable cost	2,250		1,075

Average total revenue of respondent = ₦134, 530.00
Total cost of production = total variable cost + total annual depreciation value
= ₦52, 400.00 + ₦ 1,075.00 = ₦53, 475.00
Gross margin = Total revenue – Variable cost of production
= ₦134, 530.00 – ₦52, 400
= ₦82, 130.00
Net returns = Gross margin – fixed cost
Therefore, Net Return = ₦82, 130.00 – ₦ 1,075.00
= ₦81, 055.00
From the above it clear that fuelwood trade is very profitable, the average fuelwood producer is able to recoup his or her investment and makes a net return of ₦81, 055.00 which translates to 151.57%, return on investment.

Table 6. Regression Analysis of Income on Fuelwood

	Functional forms			
Parameters	Double-log	Semi-log	Exponential	**Linear**
Constant Terms	7.804661	8.432810*	906.318495	4698.46265
	(0.171329)	**	(1553.141698)	(1717.796262)
		(0.247800)		
Gender (X_2)	0.012886*	0.091374*	5783.712157*	1068.400527*
	**	**	**	**
	(0.65786)	(2010403)	(596.363971)	(12.254472)
Family size (X_3)	0.012886	0.016967	655.659698	7.526758
	(0.170236)	(0.068889)	(1543.233599)	(477.553866)
Amount paid to Govt.	-0.322533**	-0.237048**	-2079.90009	-
(X_4)	(0.152436)	(0.109643)	(1381.872195)	1687.631107**
				(760.065588)
Level of education	0.085202	-0.038050	1545.234536	**141.201691**
(X_5)	(0.096416)	(0.046676)	(874.032192)	**(323.563837)**
Type of Enterprise	0.72689	0.00391	-162.108021	**- 152.038042**
(X_6)	(0.089596)	(0.020618)	(812.210735)	**(142.926246)**
Amount paid to	-0.122754	0.023370	-2198.385451	**71.038543**
Labourers (X_7)	(0.183446)	(0.84744)	(1662.981092)	**(587.462278)**
R^2	0.4859	0.4527	0.4788	**0.67556**

Note: ** t-value significant at 5% level
*t-value significant at 1% level
Values in parenthesis are estimated standard errors

The regression analysis of the effects of some of the variable on income generated from fuelwood is shown below. Four functional forms double-log; semi-log, exponential and linear were fitted to the data collected for the analysis, and the linear function was chosen as being best suited to capture the effect of these variables on the income from fuelwood and this because of the magnitude of R^2 and the significance of other relevant diagonistics statistics.

The estimated linear function for income is

$$\mathbf{Y = 4698.46257 + 1088.400527X_2 + 7.526758X_3 - 1687.631107X_4 + 141.201691X_5 - 152.038042X_6 + 71.038543X_7}$$

$$\mathbf{R^2 = 0.67556 \quad F = 38.86779}$$

The coefficient of multiple regression or determination is 0.67556 and it is highly significant at 1 percent including high relevance of the independent variables in explaining the model implies that 67.5% of the variation in the gross value of the income is accounted for by the independent variable included in the model which are gender, family size, amount paid to government, level of education, type of enterprise and amount paid to labour. From the regression results obtained, it is observed that only the coefficient of the value of gender is significant at 1 percent. Also all the regression coefficients have positive indicators except those of the value of the amount paid to government and type of enterprise which implies that as the amount paid to government increases, the income will decrease and for the type of enterprise, if the people are involved in more than one business, the less the income realized from fuelwood because they will not be able to devote more time for fuelwood as they will be involved in other businesses. The regression coefficient for gender is positive and significant at 1%, which suggests that gender has a significant impact on the value of income which may be true in the sense that men are believed to be physically stronger than women and this gives them an advantage in harvesting which makes them to harvest more fuelwood than women, this increase their income it implied that the higher the harvest, the higher the income realized. Also, the regression coefficient of family size, level of education and amount paid to labour are all positively related to the income and this implies that the higher values of these variables, the higher the value of income.

Marketing of products

Marketing of fuelwood in the study area is simple, basically from producers to consumers in most cases except in some cases urban fuelwood sellers that come to buy in bulk. Large number of prepared-food vendors such as restaurants, vendors of barbecue (Suya) and party event outfit that served at celebrations, and bakeries are regular customers of fuelwood sellers. Institutions such as hospitals, schools and prisons and industries such as blacksmiths are among the highest consumers of fuelwood.

Fuelwood as sources of livelihood

Result from the study indicate that out of the 119 respondent, 84.9% which is 101 respondent are full time fuelwood collector, 7.6% use it to supplement their income, 3.4% take it as business, 2.5% are involved because of unemployment, while1.7% are involved in it as hobby. 53.8% are resident within the forest community while 46.2% are from adjoining communities. This indicates that fuelwood contribute positively to the livelihood of the community, there is strong evidence that the poor in the community engage in fuelwood extraction because it is less capital intensive. Farm implement such as cutlass can easily be adapted as a working tool.

Figure 1: Firewood displayed at roadside

CONCLUSION

Fuelwood production in Gambari forest reserve is a profitable business. Aside from its potential role for domestic cooking and agricultural processing, it also has significant

potential of providing reliable income for rural households and other forest dependent people in the area. The market price of fuelwood do not reflect their full economic costs, profit on fuelwood has a negative relationship with what fuelwood collectors pay to the government, the market is dominated by supplies originating from open access to forest. The bulk of the fuelwood supplied to the market has zero stumpage value, this does not reflect the social cost or true value of the wood, this create a disincentive for farmers and private entrepreneur who want to grow trees for fuelwood because production cost will reduce profit margin.

More men harvesting may lead to over-exploitation of forest resources and degradation of the land. Sustainable harvesting of existing fuelwood stands, education, and the creation of fuelwood plantations are the surest way to combat the growing trend of deforestation and pressure on available trees. Thus, there should be regular inventory of fuelwood stands for the resource to be managed on sustainable basis. Efforts should also be geared towards the protection and conservation of rich biodiversity associated with natural forests and fuelwood growth areas, sustainable development, and utilization of forest resources through scientific management, promotion of coppice management. The renewable nature of the forest also offers potential for sustained output of wood for fuel, provided appropriate harvesting and management can be instituted before destruction reaches an irreversible point. Fuelwood collection definitely exert some pressure on forest resources through deforestation which has effect on the environment and the people, hence there is a clear need for the development of integrated management approaches to this forest resource such as establishment of fuelwood plantations or village woodlots; Otherwise, with increasing population pressure fuelwood will inevitably go the way of other non-timber resources.

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