Journal of Environment Protection and Sustainable Development
Vol. 1, No. 2, 2015, pp. 54-58
http://www.publicscienceframework.org/journal/jepsd

Determinants of Fuelwood Consumption among Farming Households in Imo State, Nigeria

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Abstract

The environment and protective role of forest in any nation or community cannot be over emphasized as forests have been identified with enhancement of rural comfort, air purification, noise abatement, regulating microclimate and a host of other ecological services. Fuelwood collection from forests in Imo State is leading to deforestation and decimating forest resources. We sought to bring clarity to this discourse by analyzing determinants of fuelwood consumption, and coping measures to increasing fuelwood scarcity in the area. The study adopted the multistage random sampling technique in selecting sixty household heads from the area. The instrument for data collection was questionnaire. Data collected were analyzed using descriptive statistics and regression analysis. The result showed that the average fuelwood consumed by households in the area was 21.5kg per week. Furthermore, the major determinants of the fuelwood consumption in the area were age, gender, farm size, marital status, main occupation, and educational level of household heads. The main coping measures for increasing fuelwood scarcity in the area were shifting to saw dust (45.00%) and extinguishing firewood after cooking (45.00%). The study recommends that low-cost strategies for reducing fuel consumption should be developed and promoted.

Keywords

Deforestation, Fuelwood Consumption, Determinants, Fuelwood Scarcity, Imo State

Received: March 23, 2015 / Accepted: April 5, 2015 / Published online: April 10, 2015

1. Introduction

Deforestation is a very serious threat to environmental sustainability. Human activities are globally recognized as the principal cause of deforestation (Becek and Odihi, 2008) which is one of the leading causes of global warming – the culprit for climate change (Ramanathan and Carmichael, 2008; Sagar and Kartha, 2007).

A major reason for deforestation is greater dependence of the bulk of the world population on forests for their energy needs. In Nigeria, about 72 percent of the population depend on fuelwood for cooking (Eleri *et al.,* 2012). Fuelwood consumption is estimated at about 80 million cubic meters (about 25 million tonnes) and this traditional energy source accounts for about 55 percent of Nigeria's primary energy requirements (Friends of the Environment, 2005).

In Imo State of Nigeria deforestation is very severe. Imo State has 72.8 per cent of households dependent on fuelwood for cooking (NBS/CBN/NCC, 2011). Fuel-wood is therefore of great economic significance especially poor rural households in Imo State where majority of the inhabitants live in rural areas and are directly or indirectly dependent on fuel-wood to meet their energy needs (NBS/CBN/NCC, 2010; Eleri *et al.,* 2012).The above situation makes Imo State to be a perfect case study for deforestation issue.

Significant progress has been made (Ikurekong*et* al., 2009; Tee *et al.*, 2009; Ishaya *et al.*, 2009; Babanyara and Saleh, 2010; Gbadegesin and Olorunfemi, 2011; Onyekuru and Eboh, 2011; Nura *et al.,* 2011; Onoja and Idoko, 2012; Onoja and Emodi, 2012; Nnaji *et al.,* 2012a; 2012b; Bolaji, 2012;

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Olatinwo and Adewumi, 2012; Ojo *et al*., 2012; Oyekale *et al*., 2012) in understanding the demand and supply of fuel-wood in Nigeria. But, none of these studies attempted to explore themeasures farming households adopt in coping with scarcity of fuel-wood in farming communities in Imo State, Nigeria. Also, empirical evidence is scanty on the determinants of fuelwood consumption in terms of their signs and sizes in farming communities in Nigeria.

2. Methodology

The study was carried out in Imo State, Nigeria. The State is located in the rainforest agro-ecological region of Nigeria and shares common boundaries with Abia State on the east and northeast, Rivers State on the south, and Anambra State on the west and northwest. The State lies between latitudes 5°45'N and 6°35'N of the equator and longitudes 6°35' E and 7°28' E of the Greenwich Meridian (Microsoft Corporation, 2009). It has a total land area of about 5,067.20 km^2 (Imo State Ministry of Lands Owerri, 1992). The State has an average annual temperature of 28°C, an average annual relative humidity of 80%, average annual rainfall of 1800-2500mm and an altitude of about 100m above sea level (Imo ADP, 1990). The State has three agricultural zones namely Orlu, Owerri, and Okigwe agricultural zones. These divisions are for administrative and extension convenience and not for any agro-ecological difference (Nwajiuba *et al.,* 2008). The State is also delineated into 27 local government areas. This ensures effective coverage by Imo State Agricultural Development Programme (ADP). The State is generally situated in the rainforest of Nigeria; characterized by intermittent period of heavy, moderate and light rainfall intersperse with dry period. The population of the state is 3,934,899 persons with many subsisting in farming (NBS, 2006). A multi-stage random sampling technique was used to select the respondents for the study. Two Local Government Areas (LGAs) were randomly selected from each agricultural zone in Imo State. In each LGA, two communities were randomly selected. One village was selected from each of the selected communities. Out of the twelve villages selected, five household heads were randomly selected from each making up sixty household heads for the study. Questionnaire was used for data collection. Data collected were analyzed using descriptive statistics and regression analysis. The implicit model of the regression is as follows:

$Y = f(X_1, X_2, X_3, X_4, X_5, X_6, X_7, X_8, X_9, e)$. Where;

Y = Collection/Consumption of fuelwood (Kg)

X_1 = Age (years)

X_2 = Gender (Male =1; female = 0)

X_3 = Farming experience (years) otherwise =0)

X_4 = Farm size (Ha)

X_5 = Marital status (married = 1; single = 0)

X_6 = Main occupation (farming = 1; others = 0)

X_7 = Education (years spent in school)

X_8 = Household size (number of persons)

X_9 = Location (rural = 1; peri-urban = 0)

e = error term

3. Results and Discussion

3.1. Collection/Consumption of Fuelwood

Average fuelwood consumed by households in the area is 21.5 kg/week. Majority (50.00%) of the households consumed 20-30kg of fuelwood per week, 35.00% consumed over 30kg of fuelwood per week while the remaining 15.00% consumed less than 20 kg of fuelwood per week (Table 1). This results shows that fuelwood consumption in the area is very high showing greater dependence of fuelwood as source of energy for cooking and other related chores at the households. This dependence also implies that the forest in the area is being depleted at a very fast rate.

Table 1. Frequency distribution of respondents according to weekly consumption of fuelwood

Consumption (Kg)	Frequency	Percentage
<20	9	15.00
20-30	30	50.00
>30	21	35.00
Total	60	100.00

Mean farm size = 21.5kg/week
Source: Field Survey, 2013

3.2. Determinants of Fuelwood Collection/Consumption

In order to analyse the determinants of fuelwood collection/consumption in the area, a multiple regression was done and subjected to four functional forms (linear, semi log, double log and exponential forms). The linear form was chosen as the lead function because it has the R^2 value of 0.624, the highest F-value of 9.220, and the highest number of significant variables (six variables).

The empirical result is consistent with the theoretical postulations of the model. The coefficient of multiple determination of 0.624 indicates that about 62.4% of the variation in fuelwood consumption in the study area has been captured by the model. This clearly shows that the model is very strong, reliable and has high predictive ability. The implication of this outcome is that 62.4% of fuelwood consumption is induced/caused by the explanatory variables.

Age is positively and significantly related to fuelwood consumption. This implies that the older collectors collect/consume more fuelwood than the younger collectors. This could be that the older collectors have more responsibility in their households that could require the use of fuelwood more than the younger collectors. The relationship is significant at the 10% level of probability.

Gender is negatively and significantly related to fuelwood consumption. This implies that women consume more fuelwood than men. The relationship is significant at the 10% level of probability. Explanation of this issue must take the gender component of labour reallocation decisions into account. Women play an important role in fuel-wood collection and therefore it is expected that their allocation of time to fuel-wood collection is more sensitive to scarcity of the good than that of males. Another reason could be that most women have the sole responsibility to cook and take care of other household chores; and the main source of energy in rural Nigeria is fuelwood.

Farm size is positively and significantly related to fuelwood consumption. This implies that collectors with larger farms collect/consume more fuelwood than their counterparts with smaller farms. The relationship is significant at the 1% level of probability. This is because larger farmers tend to have more woody biomass content than smaller farms.

Marital status is positively and significantly related to fuelwood consumption. This implies that married collectors consume more fuelwood than unmarried collectors. The relationship is significant at the 10% level of probability. This may be as a result of the labour requirement in fuelwood collection which married household heads will make use of members of their family as labour force.

Main occupation is positively and significantly related to fuelwood consumption. This implies that collectors who are fully involved in farming collect/consume more fuelwood than collectors who are not fully involved in farming. This explains the greater dependence of farmers on fuelwood as the main source of energy for cooking. The relationship is significant at the 1% level of probability.

Education is negatively and significantly related to fuelwood consumption. This implies that the less educated collect/consume more fuelwood than more educated. The relationship is significant at the 10% level of probability.

Table 2. Multiple regression estimates of the determinants of fuelwood consumption

Variables	Linear Form		Semi Log Form		Double log Form		Exponential Form	
	Coefficient	t	Coefficient	t	Coefficient	t	Coefficient	t
(Constant)	2.009	2.740	0.812	4.294	0.027	0.066	-276.286	-0.639
Age	0.018	1.919*	0.005	2.234**	0.257	2.431**	2.06E-035	0.053
Gender	-0.431	-1.838*	-0.114	-1.890*	-0.119	-1.995*	-98.585	-1.309
Experience	-0.006	-0.891	-0.002	-0.833	-0.030	-0.912	-3.42E-029	-0.335
Farm size	0.055	10.990***	0.017	1.275	0.043	0.965	0.000	0.014
Marital status	0.684	1.845*	0.202	2.117**	0.173	1.767*	106.304	0.928
Main occupation	0.183	8.693***	-0.084	-1.543	-0.074	-1.351	36.886	0.512
Education	-0.057	-1.946*	0.016	2.140**	0.143	1.708*	6.33E-006	1.156
Household size	-0.029	-0.586	-0.010	-0.754	-0.034	-0.395	-4.15E-005	-0.272
Location	0.041	0.160	-0.008	-0.121	-0.019	-0.285	57.853	0.695
R^2	0.624		0.324		0.328		0.078	
F	9.220***		2.663**		2.712**		0.470	

Source: Field Survey, 2013 and Computer printout of SPSS result;
*** Significant at the 1% level; **Significant at the 5% level; *Significant at the 10% level

3.3. Coping Strategies with Increasing Fuelwood Scarcity

This research also explored in detail how households react to fuelwood scarcity. Table 3 shows household coping strategies grouped as leading to either substitution to other energy forms, technological substitution or some kind of income adjustment.

Most of the respondents adopted conservation measures, and these include extinguishing fuelwood after cooking (45.00%) and soaking dry food and adding cooking lime before and during cooking (10.00%). About 17.00 % of the respondents indicated that they often use a lid when cooking as a means of speeding up cooking and thereby reducing the amount of fuelwood used. This implies that fuelwood scarcity might lead households to become more technologically innovative. Interestingly, about 33.33 % indicated they work to earn more money to buy fuelwood as a result of its scarcity. Also, increased scarcity seems to push more households to use alternative energy, approximately 35.00% indicated they that shifted from fuelwood to cheaper forms of fuel like palm fronds. Fifteen percent indicated that they shifted to charcoal while only 5.00% shifted to kerosene stoves. This finding suggests that fuelwood scarcity has some inducing effects on households' consumption of fuelwood such as inducing households to engage in energy conservation, technological substitution, shift to other forms of energy, and increase in income earning.

Table 3. Coping with increasing scarcity of fuelwood

Coping strategies	Frequency	Percentage	Effect
Shift to charcoal	9	15.00	Substitution effect
Shift to kerosene stove	3	5.00	Substitution effect
Shift to saw dust	27	45.00	Substitution effect
Shift to palm fronds	21	35.00	Substitution effect
Earn more money	20	33.33	Income effect
Use lid when cooking	10	16.67	Technological substitution
Extinguish firewood after cooking	27	45.00	Energy Conservation
Other reasons e.g. soaking food before cooking, adding lime	6	10.00	Energy Conservation
Not applicable	8	13.33	

Note: Multiple response recorded
Source: Field Survey, 2013

4. Conclusion

The results of this study show that fuel-wood collection and consumption is high in the area. This, therefore, supports the assertion that forests are highly being depleted. This means that deforestation is increasing in the area. Also, the decision to collect and consume fuel-wood in rural areas of Imo State are determined by several social, economic and farm factors. These factors include age, gender, marital status, main occupation, farm size, and educational level of the collectors. Sometimes in the year, dry fuelwood becomes scarce. This is mainly during the rainy season, and households react to fuelwood scarcity in several ways. These include extinguishing fire immediately after cooking, shifting to saw dust, shifting to palm fronds, and soaking dry food and adding cooking lime before and during cooking, shift to charcoal, and shift to kerosene stoves. The strengths of the results presented here provide an interesting ground for future research. Understanding the conditions under which rural individuals and households pursue different coping strategies for fuel-wood scarcity and the impact of these strategies on farming decisions would provide excellent avenues for future research.

Several policy insights can be obtained from this study. Low-cost technologies for reducing fuelwood consumption in the area should be developed and promoted. Developing fuel-efficient woodstoves may be the most obvious low-cost means of reducing fuel-wood consumption. For conservationists and policymakers concerned about how to make Nigerian agriculture more environmentally sustainable, policies aimed at promoting the growing of trees on own farms (agro-forestry) should be encouraged.

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