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Firewood consumption around Budongo Forest Reserve in western Uganda

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Abstract

Wood fuel is renewable, but its consumption can be sustained when the rate of harvesting does not exceed the growth rate. For a per capita firewood consumption of 0.7 m^3 in Masindi and 0.6 m^3 in Hoima District, age, sex, and family size, influenced the levels of fuelwood consumption. Willingness to participate in communal management of forest resources was influenced by gender and age. It is recommended that conservation of fuelwood resources should be encouraged by introducing efficient cooking stoves and other energy saving measures. In addition, communities should be encouraged and facilitated to plant woodlots so as to reduce their dependance on fuelwood resources from communal and government forest reserves.

Key words: Firewood, consumption, communal forest resources, socio-economic factors, willingness to participate.

Introduction

Uganda's forest resources are important for the country's economic growth and development. Over nine-tenths of Uganda's energy requirements is based on wood obtained from the forests (MFEP, 1994). Fuelwood is a major source of domestic and industrial energy. It is used in the processing of agricultural products such as tea, tobacco and sugarcanes; in the construction industry for baking bricks, tiles and lime; and in fish processing. However, the country's dependence on biomass energy resources is a source of great concern because gazetted and non-gazetted forest resources from which most of the firewood is harvested are disappearing rapidly due to population increase. It is estimated that deforestation in Uganda is occurring at the rate of 650 km^2 annually (FAO, 1993).

Lack of a mechanism to control harvesting of fuelwood in non-gazetted forest resources presents a further problem. There is a need for an organised management institution to oversee the utilisation of non-gazetted forest resources to avoid a situation that Hardin (1968) described as "the tragedy of the commons." A significant question to ask at this stage is: How can common pool natural resources be managed and exploited in a way that avoids both excessive consumption and high administrative costs? It has become clear that neither state control, nor privatization of institutions has been uniformly successful in empowering individuals and communities to manage natural resources sustainably (McKean, 1998).

Traditional institutions were used by communities in the past to establish rules and regulations governing access to forest resources and share rights and duties towards that resource. However, the role of local communities in regulating the use of these resources was discouraged by both colonial and post-independence governments. For instance the Forest Act of 1964 which was amended in 1967 centralised the administration of local forest reserves. Consequently, the colonial and post-colonial government policies influenced the attitudes of local communities to ownership of these resources. Thus local people perceived forest resources as government property and were not willing to participate in their management (Banana and Gombya-Ssembajjwe, 1998).

Socio-economic characteristics of local communities such as age, gender, wealth, education, heterogeneity of the population, household size, landholding and distance from the forest influence the level of dependence on the forest for firewood and other goods and services (Turiho-habwe, 1995). Similarly, socio-economic characteristics may be used to explain the differences between those who are willing to manage a resource used in common and those who do not. The priority expectation is that there is a significant relationship between the quantity of firewood harvested and willingness to participate in community

based management of forest resources from which the bulk of the firewood is obtained.

This article is based on a study carried out around Budongo Forest in Masindi and Hoima Districts to determine the per capita consumption of firewood. The specific objectives of the study were: (1) to determine the demographic and socio-economic factors that affect the quantity of firewood consumed by rural households and (2) to assess the relationship between the quantity of firewood harvested and willingness to participate in community based management of forest resources. Such information is necessary because it assists in formulating appropriate policies for sustainable utilization of firewood resources in Uganda.

Description of the study area

Two forest patches adjacent to Budongo Forest Reserve in Masindi and Hoima Districts, were selected for the study. The forest patch studied in Masindi District was the stretch along Nyamagita communal forest and Muzinduki private forest in Budongo sub-county. The area studied in Hoima District was the stretch along Sangwe communal forest and Kyamugongo government forest reserve in Kitoba sub-county.

Budongo forest reserve and the two forest patches are medium altitude moist semi-deciduous forests located along the edge of the western rift valley in western Uganda. The Budongo forest ecosystem is a mixture of tropical high forest, woodlands and savanna grasslands. The tropical high forest is dominated by Celtis, Khaya and Cynometra spp. The original tree cover was of exceptional quality, in terms of species richness and commercial value (Howard et al., 1996). Almost a century of continuous exploitation by saw millers has radically changed the floristic composition of the forest.

The forests are surrounded by heterogenous communities in terms of culture, language and nationality (Obua et al., 1998). In the last half century, the traditional inhabitants, the Banyoro, were joined by peoples from other parts of Uganda, Sudan and Congo who settled in the area. Agriculture is the major economic activity in the area. The main cash crops grown are coffee and tobacco and the major food crops are maize, beans, cassava, millet and potatoes.

Methodology

A household survey was conducted using a semi-structured questionnaire. Using a table of random numbers, four hundred and five respondents were selected from a list of households located within four kilometres from the forest patches. According to Obua (1996), local communities living within a range of five kilometres from the forest boundary directly affect or are affected by the presence of a forest. The questionnaire was developed to collect data on the demographic and socio-economic characteristics of the population such as size of land holdings, gender of household head, level of education of household head, ethnicity and size of household. Knowledge of this relationship is useful because socio-economic factors determine the extent to which local people depend on the forest resource for their livelihood (Obua et al., 1998).

In order to determine per capita firewood consumption, one headload of firewood of a known volume and weighing 25 kg was shown to each female respondent and asked how many headloads of that size her household uses in one week. Annual firewood consumption was then determined and per capita consumption computed.

Data analysis

Chi-square tests were used to show the relationship between firewood use by the households and their demographic and socio-economic characteristics. Logistic regression model (Koutsoyiannis, 1977) was used to show whether demographic and socio-economic characteristics of households can affect their willingness to participate in management of forest resources from which they obtain firewood and other forest resources. In using this model, it is assumed that the probability that an individual supports participatory forest management is independent of their demographic and socio-economic characteristics, i.e.

$$P_i(0,1) = a_0 + a_1 \text{sex}_i + a_2 \text{landholding}_i + a_3 \text{family size}_i + a_4 \text{cubic metre}_i + a_5 \text{distance}_i + a_6 \text{marital status}_i + a_7 \text{education}_i + a_8 \text{done communal work}_i + a_9 \text{time spend}_i + a_{10} \text{income}_i + a_{11} \text{age}_i + \mu_i$$

P_i = the probability of an individual saying "no" 0= unwilling or "yes" 1= willing to participatory forest management,

$a_0 \ldots a_{11}$ are coefficients,

μ= error term

Results and discussion

Demographic and socio-economic characteristics

The demographic characteristics of the respondents are presented in Table 1. The average age of the respondents was 39 and 41 years in Hoima and Masindi respectively. The majority of the households were headed by males who are middle aged, with little formal education and no formal employment. Most respondents (70.9% and 65.0% in Masindi and Hoima, respectively) owned less than two hectares of land. Customary land tenure was the most dominant form of land ownership. Agriculture was the major source of income supplemented by sale of forest products. Tobacco was a major cash crop grown. The average annual income was US $200 and is less than Uganda's per capita income of US$ 240. All the respondents lived within four kilometres from the forest boundary. They used firewood as a major source of energy for cooking, brick making, distilling local gin and tobacco curing. Seventy nine percent of the respondents said that the forest has been rapidly reduced in size and quality by pitsawyers, coming from outside the community.

Firewood utilization

The extent of household firewood use in Masindi and Hoima is presented in Table 2. On average, households used 4.5 m^3 of firewood per year. The per capita consumption was 0.7 m^3 in Masindi and 0.6 m^3 in Hoima.

Table 1. Socio-economic characteristics of respondents by district

Socio-economic characteristics	Frequency of response(%)	
	Masindi (n=195)	Hoima (n=210)
Age		
0-35	43.0	51.5
36-90	57.0	48.5
Sex		
Male	77.8	43.5
Female	22.2	56.5
Size of landholding (hectares)		
0.0- 2.0	70.9	65.0
2.1- 25	29.1	35.0
Land tenure		
Customary	91.6	93.5
Leased	8.4	3.7
Borrowed	0.0	3.7
Family size		
0-6	58.2	67.0
7-28	41.8	33.0
Household head education level		
None	19.6	17.0
Primary	61.5	59.5
Secondary	10.1	21.5
Post secondary	1.3	1.0
Formal employment		
No	69.6	67.5
Yes	30.4	32.5
Household income (Ug. sh.)		
0-100,000	55.7	15.5
100,001-551,000	44.3	84.5
Distance from forest (Km)		
0.- 0.5	61.4	68.5
0.51-4	38.6	31.5

Chi-square test showed that there was no significant difference in the use levels of firewood in the two communities ($P< 0.05$). The households involved in distilling of waragi (a local gin), brick-making and tobacco growing used more firewood. The number of meals prepared per household per day also significantly determined the quantity of firewood used.

Chi-square tests show that apart from family size, age and sex (significant at $P< 0.05$), all other demographic and socio-economic factors did not significantly influence the quantities of firewood consumed (Table 3). The obvious explanation is that the larger the household, the bigger the quantity of fuelwood used. Tobacco growing, brick-making and distilling of waragi were carried out by male household heads. Consequently, the consumption of firewood in male headed households was significantly more than in households headed by females. The young respondents had small family sizes and harvest less amount of firewood. Consequently, differences in the consumption of firewood between age groups was significant.

Distance from the forest did not significantly influence firewood consumption. Generally, local communities living near forest resources benefit from free firewood although they do not necessarily harvest large quantities. They harvest enough firewood to meet their daily requirements. Irrespective of the distance, firewood is a necessity for the rural communities because there are no alternative sources of energy for cooking and heating.

Table 2. Household firewood use in Hoima and Masindi Districts

Firewood used (m^3 /year)	Frequency of response (%)	
	Masindi (n=195)	Hoima (n=210)
<3.0	13.8	13.3
3.1-4.0	26.1	43.3
4.1-5.0	35.4	31.0
5.1 >	22.1	14.8

Table 3. Chi-square analysis of the relationship between levels of fuelwood use and various socio-economic factors

	Masindi			Hoima		
Socio-economic characteristics	X^2	df	P	X^2	df	P
Age	3.7	1	0.05**	6.6	1	0.009***
Sex	3.42	1	0.04**	3.7	1	0.05**
Family size	10.7	1	0.000***	10.9	1	0.000***
Landholding	1.72	1	0.19	1.85	1	0.16
Distance	0.12	1	0.91	0.05	1	0.81
Education	9.04	7	0.24	10.06	7	0.15
Income	0.36	1	0.54	0.13	1	0.01
Ethnic group	7.70	5	0.15	0.32	5	0.56
Occupation	0.86	1	0.35	1.02	1	0.22

Notes: *** and ** Significant at 1%, and 5% respectively.

Willingness to participate in forest management

The majority of the respondents (68%) indicated that they would participate in forest management on condition that not more than two days per month would be needed to do communal forest work. The logistic regression analysis shows that there is a positive and significant relationship between the level of fuelwood consumption and the willingness to manage communal forest resources ($P < 0.05$). Apart from gender and age (significant at $P < 0.05$), all other demographic and socio-economic characteristics did not significantly influence their decision to participate in communal management of forest resources. It was noted that men were more willing to participate in forest management than women because of the common view that forest management is a job for men.

The effect of age on willingness to manage is negative and significant ($P < 0.05$). This implies that the younger the generation, the more interest in collective ownership of a resource that promises benefits. Older people were less willing to invest their energy and resources in forest management.

Conclusions and recommendations

Per capita consumption of firewood was 0.7 m^3 in Masindi and 0.6 m^3 in Hoima Districts. Wood fuel is renewable and its consumption can only be sustained if the rate of harvesting does not exceed the growth rate (Dasmann, 1984). Generally, domestic requirements for firewood exceed supply in Uganda. In Masindi and Hoima Districts, the annual rate of tree growth still exceeds the annual cut (Forestry Department 1992) because of the low population, abundance of forest resources and lack of markets for firewood in the area.

Apart from family size, age and sex, all other demographic and socio-economic factors analyzed did not significantly influence the quantities of firewood consumed at the household level. The demand for firewood increases with the increase in family size. Gender and age significantly influenced the individual's decision to participate in communal management of forest resources.

Since the majority of local communities obtain firewood from forest resources outside protected areas, the following recommendations can be made:-

- Local institutions should be set up to regulate harvesting of firewood from non-gazetted forest resources since the state has limited financial and human resources to manage these resources.
- Conservation of existing fuelwood sources should be encouraged by introducing efficient cook stoves and other energy saving measures.
- Communities should be encouraged and facilitated to plant woodlots so as to reduce their dependance on resources from non-gazetted forest areas.

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