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Percieved socio-economic and environmental effects of wood fuel production and consumption in rural igabi local government area, kaduna state, Nigeria

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Abstract
Rural areas are the major producers and consumers of wood fuel in developing regions. Wood fuel as a source of energy plays a vital role in household energy requirements, due to increasing economic hardship in the country, many people are finding it increasingly difficult to afford conventional fuels in Nigeria. Wood fuel in Kaduna State is the most highly consumed fuel. Therefore creating awareness among people especially rural dwellers in Nigeria about the effects of fuel wood production and consumption is imperative. This study discusses the perceived socio-economic and environmental effects of wood fuel production and consumption in rural Igabi Local Government Area of Kaduna State. The data for this study was acquired from both primary and secondary sources. The primary data was obtained through structured questionnaire survey. The respondents were selected from five rural areas of Igabi LGA. Purposive sampling method was used in administering the questionnaires. The data was analyzed using descriptive statistics. Results showed that fuel wood production and consumption affects socio economic environment through occurrence of drought, erosion, rise in temperature, reduction in plant species and reduced of farmlands. In addition, findings revealed that the demand for fuel wood is higher in rural Igabi where family sizes are higher and the wood fuel sources are more readily available. It was also found that the demand for fuel wood is not only influenced by family size and population growth, but accessibility, affordability and availability are other important determinants. Government should embark on intensive afforestation and mobilize people to engage in public and private afforestation programs in the area. In addition, people should be properly enlightened on the environmental implications on wood fuel consumption in the area. Also, laws regulating cutting down of trees should be reviewed and re-enforced.

Keywords: fuel wood/ wood fuel, production, consumption and igabi LGA

1. Introduction
Wood fuel is a vital source of energy to the rural and urban dwellers in developing countries. It occupies a unique position in rural energy systems due to the fact that it accounts for most of domestic energy consumption, and it is produced within the systems itself (FAO,2012) [7]. Fuel wood is any tree or wood material which is combustible and can be used as fuel. It may be available as firewood (e.g. logs, bolts, and blocks), charcoal, chips, sheets and sawdust. The processes of collecting fuel wood vary by regions and cultures. Some communities have specific fuel wood collection centres while others prepare a plot of land to grow wood for fuel. Fuel wood collection is usually done in group or individually. There are various tools and techniques used for gathering firewood in Africa (Cunningham, 2006) [5]. In Nigeria, the tools mostly used are cutlass, machete, axe, and sometimes machines. Fuel wood is usually the most preferred source of energy by rural dwellers that have very little access to alternative sources of energy. Therefore, fuel wood plays an essential role in meeting basic energy requirements connected with the subsistence of these people who are mostly engaged in primary activities. This is because fuel wood can be gathered easily and used cheaply in the rural areas

According to the UNDP (2002), the share of various energy sources in the total primary energy supply in Nigeria are made up of oil, 10.4%; gas, 6%; hydro, 0.6%; and commercial renewable energy, 83%. The greater portion of the commercial renewable energy is wood, while other agricultural wastes constitute the remaining smaller portion. The over-dependence on fuel wood for energy is chiefly because of its relatively low prices and easy accessibility (Adedayo, 2005) [1]. Other reasons are constraints in the supply of the conventional fuels and the growing population with a larger segment still falling below incomes that cannot afford the cost of conventional fuels (Adedayo, 2005) [1]. This leads to deforestation and triggers soil erosion and desertification. Sambo (2005) [13] found that about 80 million cubic meters (43.4x109kg) of fuel wood is used annually for cooking and other domestic activities in Nigeria. Likewise, Tee *et al* (2009) also found that fuel wood is the major source of both domestic and industrial energy for the residents of Makurdi metropolis in Nigeria.

Daily consumption of firewood by the rural communities in Nigeria is estimated at 27.5 million kilogram per day (Aide Memoire, 2002) [3]. In the drive to satisfy fuel wood requirements, most lands have been stripped bare of vegetation cover. This has resulted in soil exposure and erosion thereby placing a heavy burden on the environment and on the resources base. The scramble for fuel wood has resulted in massive destruction of many wood resources leading to deforestation and increasing desertification in parts of Nigeria and other parts of sub-Saharan Africa (Adedayo, 2005) [1]. The rate of deforestation in Nigeria is estimated at 400,000 hectares per annum. Popoola (2000)

observed that the country's forest reserve which was estimated to be at 10% of the total land area in 1970 has been reduced to just 5% as of 1999, which is alarming. In Katsina state, which is located in Northern Nigeria, it was reported that the major source of firewood is farm trees, whose density is diminishing (Aide Memoire, 2002) [3].

The continuous burning of fossil fuels, fuel wood and bush burning have also contributed to environmental pollution (NEST, 2003) [10]. The increasing current demand on the natural purifiers (trees) for fuel wood without accompanying replenishment is an indication that the forest area will disappear fast, which makes the environmental situation more precarious. If no measures are put in place to check these threats, the environment might not be able to support life after a few years, particularly in the savannah ecological zone that is more fragile relative to the rainforest. It follows from the above that, the utilization of wood resources in the savannah lands should be done with caution.

Igabi LGA is a large area with a fair share of rural dwellers that directly and/or indirectly depends on vegetation for fuel wood. The once abundant forests of the area have been reduced to the lowest posing a great danger to biodiversity and livelihood generally.

Also, the urban area has a high population and a large number of the populace especially the poor, use fuel wood as a source of energy. Determination of the effects of fuel wood production and consumption on socio-economic environment of rural Igabi LGA is therefore imperative.

2. Aim and Objectives of the Study

The study aimed at assessing the perceived socio-economic and environmental effects of wood fuel production and consumption in rural Igabi LGA, Kaduna State.

To achieve the aim the following objectives were observed:

1. To identify the reasons for fuel wood consumption in rural Igabi LGA.
2. To identify the pattern of fuel wood consumption in rural Igabi LGA
3. To examine the effects of fuel wood consumption on the socio economic environment.

3. The Study Area

The study was carried out in Igabi Local Government Area of Kaduna state. The study area is located in the northern part of Nigeria between latitude 09 02' N, 11 33' N and longitude 06 10' E and 08 50' E'. Igabi covers 2,336 km2 and has a population of 430,229 people. The male population is 219,269, while the female population is 210,960 (KDSG, 2006) [8]. Igabi Local Government Area has two distinct seasons, the dry season and the rainy season. The study area experiences high temperature all year round, which is a characteristic of the tropics. The mean daily temperature in the area can be as high as 34°C between months of March and May. Temperature could be as low as 20°C during the December to January. This low temperature is intensified by humidity due to the dry harmattan wind. From November to February the cold dry harmattan wind blows across the area (KDSG, 2006) [8].

The local government area is located in the Sudan savannah which covers both the eastern and western part with prevailing vegetation of short trees is sparsely distributed. The plants here are drought resistant. A common tree here is the baobab which in appearance resembles an oak tree. Also found are acacia trees (KDSG, 2006) [8]. The primary occupation of the people is farming. Livestock keeping is a common activity in most households in the area ranging from poultry, cow, goat, sheep and ram. The semi intensive and intensive livestock management systems are common while the extensive is rare. Igabi local government is an agrarian based economic with agriculture as its major economic activity which serves the bedrock of other activities. These activities include food and cash crop production, livestock rearing, poultry trading and crafts making and fuel wood production.

The major system of farming practiced is the subsistence farming by peasant farmers with few people who invested in commercial farming who produces large quantity of agricultural products. A little dry season farming is practiced in the area by people living close to the rivers in the study area. Tomatoes, pepper, vegetables, onions, okro and sugar-cane are grown in the Fadama areas. Animal rearing is also an important occupation which is carried out in form of subsistence mixed farming apart from the Fulani in the area that depend largely on cattle rearing. These animals supplies organic manure to farm lands, provide income and also are used for consumption. Animals such as cattle, goats, pigs, sheep and poultry are predominant animals reared in the area. Trading activities also form another vital occupation that combines both agricultural and non-agricultural commodities made from crafts. (KDSG, 2006) [8]

4. Materials and Methods

4.1 Sampling technique

Five villages were purposively selected from Igabi Local Government Area due to intensive nature of fuel wood production and marketing in the areas. The selected villages included, Wusono, Dunki, Afaka, Kwarara and Bargu. Estimated 100 wood fuel producers and consumers were drawn from the five rural areas selected for this study.

4.2 Method of Data Collection

Data were collected using structured questionnaire. Detailed information was collected on production, use and marketing of fuel wood. Respondents provided information on sales, locations and price received for their products.

4.3 Tools of Analysis

Descriptive statistics was used to analyse the information from the questionnaires and results were presented using tables for easy understanding.

5. Results and Discussion

The information collected from the questionnaire survey was analyzed and presented in the following sections.

Socio economic characteristics of producers and marketers of fuel wood

The socio-economic characteristics of fuel wood producers and marketers are shown below. These include distribution according to age, marital status, level of education, and average household size of fuel wood producers and consumers.

Table 1: Distribution of Respondents According to Age

Age	Frequency	Percentage
20-30	23	23.0
31-40	31	31.0
41-50	19	19.0
51-60	16	16.0
61-70	11	11.0
Total	100	100

Field survey,(2017).

Distribution of respondents according to age revealed that majority of the respondents age is between the ranges of 31-40 consisting 31%, 20-30 range constitute 23% of the respondents, 41-50 range constitute 19% of the respondent. This may be due to the strenuous nature of fuel wood production which requires a lot of energy. This is in line with the work of Yunana et al (2014) [16] who found that fuel wood producers in Gora Area of Kaduna state are in their active periods and bread winners for their respective family within their communities.

Table 2: Distribution of Respondents According to Sex

Sex	Frequency	Percentage
Male	89	98.0
Female	11	2.0
Total	100	100

Field survey, (2017).

The results observed that majority of the respondents 98.0% were males while only 2% were females, which mean that fuel wood harvesting is more produced by males even though females are involved in consumption of fuel wood in the study area. This could be due to the strenuous nature of fuel wood production. This is in accordance with the work of Isma'il et al (2014) who ascertained that 70% 0f fuel wood producers are males in both rural and urban Ikara LGA.

Table 3: Distribution of Respondents According to Marital Status

Marital status	Frequency	Percentage
Single	15	15.0
Married	82	82.0
Divorced	03	3.0
Total	100	100

Field survey, (2017).

The result shows that 82% of the respondents in rural Igabi were married, 15% were single and 3% were divorced. This result is in line with the findings of Dyaji, (2016) [6] who reported that married people have more responsibilities such as the provision of food, education, health and well-being. This may be the reason why his production and consumption of fuel wood is dominated by the married.

Table 4: Distribution of Respondents According to Educational Level

Level of Education	Frequency	Percentage
Primary	24	0
Secondary	25	25.0
Post-secondary	0	0.0
Adult literacy	16	16.0
Quranic	35	35.0
Total	100	100

Field survey, (2017).

Distribution of respondents according to level of education shows that majority of the respondents have either formal or religious education. 35% of the respondents have quranic education, while 16% of the respondents undergo adult literacy 24% and 25% of the respondents undergo primary and secondary education respectively. One of the limiting factors that bring about environmental change is the low literacy level in rural areas which hinders their rate of awareness on effects of fuel wood production and consumption to the environment.

Table 5: House hold size of the respondents

Size	Frequency	Percentage
1-10	73	73.0
11-20	19	19.0
21-30	4	4.0
31-40	3	3.0
>40	1	1.0
Total	100	100

Field survey,(2017).

Distribution of respondents according to house hold size reveals that majority of the respondents house hold size is in the range of 1-10 persons constituting 73%, 11-20 range consisting 19% of the respondents, then 21-30 range constitute 4% of the respondents while 31-40 range constitute 3% of the respondent while 40 above constitutes 1% of the respondent. This may be due to polygamous marriage of the respondents. This is in agreement with Yahaya (2002) [15] there exists a direct relationship between human population and wood fuel demand.

Table 6: Monthly incomes of the Respondents Income per month

Income Per month	Frequency	Percentage
< 18000	25	25.0
18000-28000	32	32.0
29000-38000	18	18.0
39000-48000	17	17.0
49000 above	8	8.0
Total	100	100

Field survey,(2017).

The result shows that majority of the respondents are of low economic status as only about 17% and 8% of the respondents respectively in rural Igabi earn 39,000 NGN and above per month. Whereas about 25% of the respondents in rural Igabi earn <18000 NGN monthly. Other categories are presented in the table. The finding is in agreement with the finding of Zaku et al (2013) [17] that poverty is a key factor in wood fuel consumption.

Table 7: Factors Responsible for Utilization of Fuel Wood Consumption

Factors	Frequency	Percentage
Cheapness	40	41.0
Availability	33	33.0
Cultural	14	14.0
Others	12	12.0
Total	100	100

I Field survey, (2017).

Table 7 shows that majority of the respondents 41% use fuel wood because it is cheaper, 33% use fuel wood because is available, 14% use fuel wood due the cultural beliefs. Others about 12% include; familiarity, accessibility, abundance etc. the finding is in agreement with Adedayo et al., (2008) [2] who ascertained that over-dependence on fuel-wood for energy is chiefly because of its relatively low prices and easily accessible.

Regularity of Fuel Wood Consumption

Regularity Rural frequency Ikara frequency Total Rural% Ikara %

Table 8

Regularity	Frequency	Percentage
Daily	47	47.0
Weekly	20	20.0
Monthly	21	21.0
Other	12	12.0
Total	100	100

Field survey,(2017).

The table above revealed that about 47% of the respondents in the surrounding rural areas use fuel wood daily; 20% weekly and 21% used it monthly. Whereas about 12% of the respondents use fuel wood occasionally. The finding is in agreement with Ogunsanwo and Ajala, (2002) [11] the daily consumption of fuel wood in rural area is tremendously high.

Sources of Fuel Wood of the Respondents

Table 9

Sources	Frequency	Percentage
Mobile vendor	31	31.0
Farmlands	17	17.0
Stationary vendors	23	23.0
Nearby areas	29	29.0
Total	100	100

Field survey,(2017).

The frequency on the table gives the various sources of the fuel wood in rural Igabi LGA. The results indicate that 31% of the respondents get fuel wood from mobile vendors, 29% of the respondents gets fuel wood from nearby areas and 23% gets fuel wood from stationary vendors while 17% of the respondent's gets the fuel wood from farmlands.

Average Quantity of Daily Fuel Wood Requirement

Bundles used per day

Table 10

Bundles used per Day	Frequency	Percentage
1-5	60	35.0
6-10	35	60.0
11-15	2	2.0
16-20	3	3.0
Total	100	100

Field survey, (2017).

Household size sometimes determines the average quantity of daily fuel wood requirement of households. The table indicates that the demand for fuel wood in the area of study is generally higher when family sizes are high and the fuel wood. It can be seen from the Table above that about 60% of the respondents in rural Igabi require 1–5 bundles daily. Also, about 35% of the respondents use 6 – 10 bundles of fuel wood daily. This is in agreement with the work of Isma'il et al (2014) who found that majority of the people in rural ikara use 1-5 bundles of fuel wood daily.

Reason(s) for Fuel wood Production

Table 11

Reasons	Frequency	Percentage
For sales	45	45.0
For cooking	25	25.0
For farming	17	17.0
For charcoal	13	13.0
Total	100	100

Field survey, 2017

The result explains the reasons for the fuel wood production. The result reveals that 45% of the respondents produce the fuel wood for sales, 25% of the respondents produce the fuel wood for cooking, 13% of the respondents produce the fuel wood for making charcoal and 17% of the respondents harvest the fuel wood for farming purposes.

Environmental Effects of Fuel Wood Production and Consumption

Table 12

Environmental Effects	Frequency	Percentage
Reduction in Vegetation cover	16	47.0
Reduction in plant species	18	20.0
Appearance of soil erosion	13	21.0
Increase in temperature	12	12.0
Occurrence of drought	11	11
Occurrence of flood	10	10
Disappearance of animals	09	09
Appearance of desert like conditions	11	11
Total	100	100

Field survey, (2017).

The results show that 18.0% of the respondents observed a reduction in the plant species, 16.0% of the respondents observed a reduction in vegetation cover and soil erosion carries 13.0%. 12.0% of the respondents observed an increase in temperatures while 11% of the respondents observed the occurrence of drought and appearance of desert like condition respectively, 10% of the respondents observed the occurrence of flood in the area, and, 9.0% of the respondents observed the disappearance of animal. The finding is in agreement with Audu (2013) [4] that increasing harvesting and consumption of fuel wood brings increase in desertification.

6. Conclusion

The study looked at the effects of fuel wood production and consumption on socio economic environment of rural Igabi Local Government Area, Kaduna state. The findings revealed that fuel wood is the major source of energy for the populace of rural Igabi LGA. It is utilized for a variety of purposes both domestic and industrial activities. There is a widening demand for fuel wood, with increasing pressure on the remaining trees. The supply of fuel wood within Igabi LGA is mainly from fuel wood dealers, who obtain it mainly from the free access forest areas and on farm lands. It is therefore concluded that fuel wood production and consumption has negative effect to socio economic environment of rural Igabi LGA, Kaduna state.

7. Recommendations

Based on the findings of this study, the following recommendations are put forward:

1. Alternative sources of energy should be harnessed and provided in the area. This will help to reverse the over reliance on fuel wood. In the mean time, kerosene and cooking gas should be provided at subsidized rates to encourage a shift from fuel wood to more sustainable sources of energy.
2. Government should embark on intensive afforestation in the area. Also, people should be encouraged to participate in public and private afforestation programs. In addition, laws regulating cutting down of trees should be reviewed and enforced by the government.
3. Moreover, government should provide improved seedlings equipments, finance and materials for farmers to establish private woodlots in the area. This will reduce the indiscriminate destruction of natural forests that are highly economical in the area.
4. Government and non-government organizations should embark on public enlightenment campaigns to inform the citizen on the consequences of fuel wood production and consumption such as climate change, environmental pollution, and biodiversity loss.
5. Conservation and preservation strategies adopting community participatory approach should be harnessed following the immense importance of trees to man, not only in maintaining environmental balance, but also for other uses, hence their preservation and conservation is essential for the present and future needs.

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