

Determinants for the Preference of Fuelwood to Other Sources of Energy by the Inhabitants of Northern Taraba

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Abstract:- Several socio-economic factors may be responsible for the preference of fuel-wood to other sources of energy by the inhabitants of Northern Taraba. These factors may therefore be considered as the determinants for the preference of fuel-wood by the inhabitants of Northern Taraba. However, these factors are not studied or documented in the study area and hence the need for this study. A multi-stage sampling technique was adopted for this study and at 30% sampling intensity, a total of 270 respondents were randomly selected for this study. Two hundred and seventy semi-structured questionnaires were developed, validated and administered to the respondents using the method of Adesoye, (2004) to generate data for this study with only 265 retrieved. Data generated was analysed using simple percentages and Logistic regression analysis at $\alpha_{0.05}$. The result on sources of energy used by the inhabitants of Northern Taraba indicated that, 170 respondents representing 64.2% used fuel-wood, 50(18.7%), Kerosene; 25(9.4%), Gas and 20(7.5%), Electricity respectively (Table 1). The result on compendium indicated that, 22 trees belonging to 15 families were found to be used as fuel-wood by the inhabitants of Northern Taraba. They families include: Eurphorbiaceae (1); Bombacaceae (1); Leguminosae (8); Sapotaceae (1); Mimosaceae (1); Verbenaceae (1); Olacaceae (1); Bignoniaceae (1); Caesalpinaceae (1); Lauraceae (1); Meliaceae (1); Anonaceae (1); combretaceae (1); Ulmaceae (1) and Rubiaceae (1) respectively (Table 2). Similarly, the result of logistic regression analysis on the determinants for the preference of fuel-wood to other sources of energy showed; affordability, availability, reliability, Household size and Educational status having the highest odds – ratios of 2955.74; 60.08; 7.21; 6.84 and 3.71 respectively (Table 2). Similarly, variables such as efficiency had odds – ratio 0.02; safety, (0.00); marital status, (0.01); sex, (0.00) and age (0.00) respectively (Table 3). The findings from this study indicated that, fuel-wood, kerosene, gas and electricity are the various sources of energy used by the inhabitants of Northern Taraba. Similarly, affordability, availability, reliability, household size and educational status were found to be the determinants for the preference of fuel-wood energy to other sources of energy used by the inhabitants of Northern Taraba. Based on the major findings above,

the following are recommended; Avoid felling and digging /uprooting as they are capable of killing the entire plant or tree. The use of power chain saws to cut or fell tree should also be regulated. Seedlings of trees used as fuel-wood should be raised by government and non-governmental organisations for onward delivery to farmers for planting on the farms. When farmers plant trees used as fuel-wood in their farms and around their houses, the pressure on wild trees will be reduced. Government should reduce and control the cost of alternative sources of energy like gas, kerosene and electricity. Government should introduce, improve and affordable stores. Government should introduce tree planting as a policy. Government should create alternative sources of income by training respondents on various skills acquisitions. Government should identify and monitor charcoal producers. Government should issue license to fuel-wood harvesters and processor to check their excesses. Government should enhance the implementation of forest laws and policies.

Keywords:- Determinants, Energy, Fuel-wood, Inhabitants and Preference.

I. INTRODUCTION

Fuel-wood energy refers to any energy source that comes from woody biomass. They include firewood, charcoal; wood pellets and saw dust respectively (Adeoti *et al.*, 2001). They may be harvested from trees and shrubs in forest, farmlands, homesteads, common land outside forest and by-products of forest industries. In some cases, fuel - wood are collected from dead woody materials. Fuel-wood has been a major source of energy for many countries across the globe. It is the oldest energy source worldwide. Fuel-wood energy is very important to human's continued existence or survival as it is required for cooking, heating and lighting (Ujih *et al.*, 2016).

Over the years, the demand for fuel-wood has increased with increase in human population (Amuah, 2011). The rate at which trees are felled for fuel-wood is more than the rate at which they are planted today (Heltberg, 2005). This is due largely to the high demand for fuel-wood as a result of the soaring prices of electricity, kerosene and gas used as domestic energy (Ebe, 2014). In the past, the

effect of fuel-wood harvesting was minimal due to low human population (Arnold *et al.*, 2006; Onoja and Emodi, 2012; Ujih *et al.*, 2016). However, as a result of population increase, man’s dependence on wood as a source of domestic energy started showing signs of inadequacy. The high level of poverty and the soaring prices of kerosene, electricity and gas had forced a lot of people to depend on fuel wood extraction as a means of domestic energy requirement (Adeniyi and Felix, 2011; Audu, 2013). This may be seen in the following ways; Type or species of wood not often used by inhabitants as fuel-wood but now being used. Preference of fuel wood energy to other sources of energy due to cash shortage, increased sales of fuel-wood in rural and urban areas and markets of Northern Taraba. Fuel-wood are used to generate income, food preparation, warmth, smoking meat and fish brewing local beers, firing bread and pot, oil extraction, parboiling of rice paddy and burning of bricks respectively. The preference of fuel-wood to other sources of energy is influenced by some socio-economic factors. These factors are not known, studied or documented in the study area. This study therefore intends

to provide information or bring to public glare, the determinants for the preference of fuel-wood to other sources of energy by the inhabitants of Northern Taraba.

II. MATERIALS AND METHODS

➤ *Description and Location of the Study Area*

Taraba State is located in the North-Eastern part of Nigeria. It was named after the Taraba River which traverses the southern part of the state. Taraba State is located between Latitude 6°30’ & 9°36’N and longitude 9°10’ & 11°50’E (TSD, 2014). The State was created out of the former Gongola State on 27th August, 1991 by the military government of General Ibrahim Babangida. Taraba state is bounded in the West by Plateau and Benue states and on the East by Cameroon. The State has sixteen local government areas. It is bounded by Bauchi and Gombe State on the Northern part, Plateau and Nasarawa states on the Western part and Adamawa on the eastern part. Taraba state has a population of 2,300,736 (NPC, 2006; TSD, 2014; Adebayo, 2002, 2012).

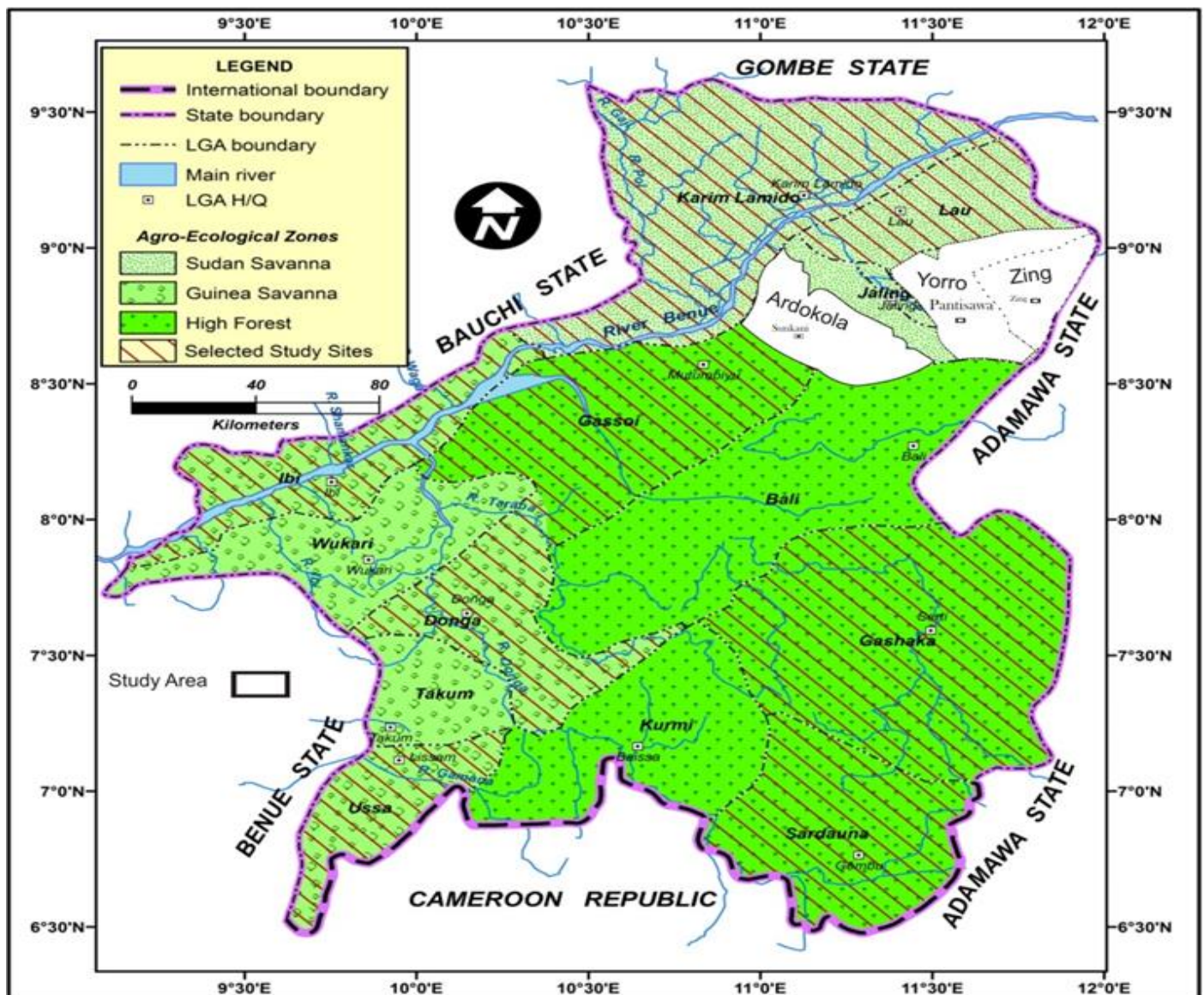


Fig 1 Map of Taraba State showing the study area
Source; Zaku, (2013).

➤ *Sampling Techniques*

A multi-stage sampling technique was used in the selection of sampling population in the study area. The study area has six local government areas namely, Ardo Kola, Karim-Lamido, Lau, Jalingo, Yorro and Zing. In the first stage, three out of the six local government areas in the Northern Taraba senatorial zone were randomly selected. The local government areas are Yorro, Zing, and Ardo Kola. In the second stage, three wards were selected randomly from each selected local government areas given a total of 9 wards for the study. In the third stage, a random selection of thirty (30) respondents from each of the nine (9) wards thereby bringing the total to 270 respondents for the study. The primary data were collected using semi structured questionnaires. A total of 270 copies of semi-structured questionnaire were developed, validated or pre-tested before being administered to respondents from the selected wards using the method of Adesoye, (2004) and Diaw *et al.* (2002).Data generated were analysed using simple percentages and Logistic regression analysis at $\alpha_{0.05}$.The mathematical model for Logistic regression is as follows:

$$\text{Logit}(p) = \log\left(\frac{p}{1-p}\right) = \log(p) - \log(1-P) \dots \dots \text{equation 1}$$

The simplest form of logistic model is expressed as;

$$\text{Logit}(P_i) = a + b x_i \dots \dots \dots \text{equation 2}$$

Where,

P_i = Probability of determinants for preference of fuel wood to other sources of energy used by the inhabitants of Northern Taraba.

X_i = Vector of predictor or independent variables (Determinants for preference of fuel-wood to other sources of energy used by the inhabitants of Northern Taraba.

It can also be represented as follows;

$$\text{Logit}\left(\frac{p}{1-p}\right) = Y = \beta_0 + \beta_1 X_1 + \beta_2 X_2 \dots + \beta_n X_n \dots \dots \dots \text{equation 3}$$

Where;

$\beta_0 \beta_1 \beta_2 \dots \dots \dots \beta_n$ = Regression coefficient or model parameters

The determinants for the preference of fuel wood to other sources of energy investigated were affordability, reliability, efficiency, safety, availability, Educational

status, Marital status, sex, age and household size respectively.

Thus:-

X_1 = Affordability X_2 = Reliability X_3 = Efficiency X_4 = High safety X_5 = Availability

X_6 = Educational status X_7 = Marital status X_8 = Sex X_9 = Age X_{10} = Household size

Y= Determinants for the preference of fuel wood to other sources of energy used by the inhabitants of Northern Taraba.

III. RESULTS AND DISCUSSION

➤ *Sources of Energy used by the Inhabitants of Northern Taraba*

The result on sources of energy used by the inhabitants of Northern Taraba indicated that, 170 respondents representing 64.2% used fuel-wood, 50(18.7%), Kerosene; 25(9.4%), Gas and 20(7.5%), Electricity respectively (Table 1).

Table 1: Sources of Energy used by the Inhabitants of Northern Taraba

S/N	Variables	No. of Respondents	Percentage (%)
1	Fuel-wood	170	64.2
2	Gas	25	9.4
3	Electricity	20	7.5
4	Kerosene	50	18.7
	Total	265	100

Source: Field Survey, 2022

The high number recorded of fuel-wood and kerosene implies that they are the most widely used energy sources in the study area. The findings corroborates Onoja and Emodi, (2012) and Adeniyi and Felix, (2011) respectively.

➤ *Compendium of Trees used as Fuel-Wood by the Inhabitants of Northern Taraba*

A total of 22 trees belonging to 15 families were found to be used as fuel-wood by the inhabitants of Northern Taraba. They families include: Euphorbiaceae (1); Bombacaceae (1); Leguminosae (8); Sapotaceae (1); Mimosaceae (1); Verbenaceae (1); Olacaceae (1); Bignoniaceae (1); Caesalpinaceae (1); Lauraceae (1); Meliaceae (1); Anonaceae (1); Combretaceae (1); Ulmaceae (1) and Rubiaceae (1) respectively (Table 2).

Table 2 Compendium of Trees used as Fuel-Wood by the Inhabitants of Northern Taraba

S/N	Hausa name	Scientific names	Family	Live forms
1	Kafafago	Upacatogoensis	Euphorbiaceae	Tree
2	Kuka	Adansonia digitata	Bombacaceae	Tree
3	Kalgo	Pillistigmathonningii	Leguminosae	Tree
4	Kadanya	Vitellariaparadoxa	Sapotaceae	Tree
5	Gawo'o	Faidherbiaalbida	Mimosaceae	Tree
6	Kirya	Prosopis Africana	Leguminosae	Tree
7	Dorowa	Parkiabiglobosa	Leguminosae	Tree

8	Dinya	Vitexdoniana	Verbenaceae	Tree
9	Tsada	Ximenia americana	Olacaceae	Tree
10	Maje/Kadaura	Daniella Oliveri	Leguminosae	Tree
11	Madrid	Pterocarpuserinaceus	Leguminosae	Tree
12	Hantsargiwa	Kigella Africana	Bignoniaceae	Tree
13	Tsamiya	Tamarindus indica	Leguminosae	Tree
14	Wambo	Brachystegiaeurycoma	Caesalpiniaceae	Tree
15	Konkoli	Beilschmiediamannii	Lauraceae	Tree
16	Madaci	Khaya Senegalensis	Meliaceae	Tree
17	Ice wuta	Leucaenaleucocephala	Leguminosae	Tree
18	Kimba	Xylopiaaethiopica	Annonaceae	Tree
19	Kojoli	Anogeissusleiocarpa	Combretaceae	Tree
20	Ajenana	TremaOrientalis	Ulmaceae	True
21	Kawo	Azalia Africana	Leguminosae	Tree
22	Kasfiya	Crossopteryxfebrifuga	Rubiaceae	Tree

Source: Field Survey, (2022)

The high number of trees belonging to different families used as fuel-wood by the inhabitants of Northern Taraba implies that, Taraba State is diverse in terms of tree composition. The diversity can be seen in terms of the high number of the different species of trees and the different families of the trees recorded in the study area.

The identification of the trees by their vernacular names was very difficult as only few fuel-wood harvesters could do so. Most of these trees are not documented in the study area and the indigenous knowledge of their relevance as fuel-wood is steadily being lost, particularly now that, children who are supposed to inherit this knowledge now spend most of their times in schools than on farms or forest with their parents (Zaku, 2013).

If the fuel-wood harvesters, hunters and medicinal collectors pass away, a huge loss and a large vacuum will be

created in the body of plant knowledge dealing with trees used as fuel-wood. There is therefore the need to harness and document this indigenous knowledge about trees used as fuel-wood in the study area. The finding corroborates Ayodele, (2005) and Ebe, (2014) respectively.

➤ *Determinants for the Preference of Fuel-Wood to Other Sources of Energy by the Inhabitants of Northern Taraba*

The results of logistic regression analysis on determinants for the preference of fuel-wood to other sources of energy by the inhabitants of Northern Taraba indicated that; affordability, availability, reliability, Household size and Educational status had the highest odds – ratios of 2955.74; 60.08; 7.21; 6.84 and 3.71 respectively while variables such as efficiency had odds – ratio 0.02; safety, (0.00); marital status, (0.01); sex, (0.00) and age (0.00) (Table 3).

$$DPFW = 31.04 + 7.99AF + 1.98RB - 1.52EF - 28.81ST + 4.09AV + 1.92EDS - 3.99MS - 38.42SEX - 26.16AGE + 1.31HHS \text{ -----equation 4}$$

n = 265, final loss = 18.78, Chi-square

(df, 10) = 298.29, p = 0.00

Odd ratio (unit change): Constant (1.31); AF(2955.74); RB(7.21); EF(0.02); ST(0.00); AV(60.08); EDS(6.84); MS(0.01); SEX(0.00); AGE(0.00); HHS(3.71)---- equation5

Table 3 Logistic Regression Analysis on Determinants for the Preference of Fuel-Wood to Other Sources of Energy used by the Inhabitants of Northern Taraba

Dependent Variables: Determinants for the Preference of Fuel-Wood (Presence =1; Absence =0)			
S/N	Independent Variables	Coefficient	Odds Ratio
1	Affordability (AF)	7.99	2955.74*
2	Reliability (RB)	1.98	7.21*
3	Efficiency (EF)	-1.52	0.02ns
4	Safety (ST)	-28.81	0.00ns
5	Availability (AV)	4.09	60.08*
6	Educational status (EDS)	1.92	6.84*
7	Marital status (MS)	-3.99	0.01ns
8	Sex (SEX)	-38.42	0.00ns
9	Age (AGE)	-26.16	0.00ns
10	Household size (HHS)	1.31	3.71*
Model $\chi^2(df = 10) = 298.29 *$			

Note P,0.05 ns = Not significant * = Significant

The highest odds – ratios recorded for affordability, availability, reliability household size and educational status implied that, they are the determinants for the preference of fuel-wood to other sources of energy used by the inhabitants of Northern Taraba. The decision rule is that, variables that have odds ratios with negative values or values lower than two are not determinants for the preference of fuel-wood to other sources of energy by the inhabitants of Northern Taraba while variables with ratios two or greater than two are determinants for the preference of fuel-wood to other sources of energy in the study area. This findings corroborates Deeks, (1996) and Bland and Altman, (2000) that, logistic model provides information on the consequence of one variable on the other. In this case, the determinants for the preference of fuel-wood to other sources of energy used by the inhabitants of Northern Taraba (Table 3).

IV. SUMMARY AND CONCLUSION

The findings from this study indicated that, fuel-wood, Kerosene, Gas and Electricity were the sources of energy used by the inhabitants of Northern Taraba. Similarly, a total of 22 trees belonging to 15 families were found to be used as fuel-wood by the inhabitants of Northern Taraba. They families include: *Eurphorbiaceae* (1); *Bombacaceae* (1); *Leguminosae* (8); *Sapotaceae* (1); *Mimosaceae* (1); *Verbenaceae* (1); *Olacaceae* (1); *Bignoniaceae* (1); *Caesalpinaceae* (1); *Lauraceae* (1); *Meliaceae* (1); *Anonaceae* (1); *combretaceae* (1); *Ulmaceae* (1) and *Rubiaceae* (1). Also, affordability, availability, reliability, household size and educational status were found to be the determinants for the preference of fuel-wood energy to other sources of energy used by the inhabitants of Northern Taraba respectively.

RECOMMENDATIONS

- *Based on the Major Findings above, the following are Recommended;*
- *Avoid felling and digging /uprooting as they are capable of killing the entire plant or tree. The use of power chain saws to cut or fell tree should also be avoided.*
- *Seedlings of trees used as fuel wood should be raised by government and non-governmental organisations for onward delivery to farmers for planting on the farms. When farmers plant trees used as fuel wood in their farms and around their houses, the pressure on wild trees will be reduced.*
- *Government should reduce and control the cost of alternative sources of energy like gas, kerosene and electricity.*
- *Government should introduce, improve and affordable stores. Government should introduce tree planting as a policy.*
- *Government should create alternative sources of income by training respondents on various skills acquisitions.*

- *Government should identify and monitor charcoal producers.*
- *Government should issue license to fuel wood harvesters and processor to check their excesses.*
- *Government should enhance the implementation of forest laws and policies*

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