VOLUME-7, ISSUE-6, JUNE-2018 • PRINT ISSN No 2277 - 8160

Original Research Paper

Biological Sciences

ABUNDANCE OF TREE SPECIES USED AS FUELWOOD IN KWATA AREA OF GASSOL LOCAL GOVERNMENT AREA, TARABA STATE, NIGERIA.

Usman D. D.	Department of Biological Sciences, Taraba State University Jalingo, Taraba State, Nigeria,
M. Mbatudde*	Department of Environmental and Agricultural Sciences, Ndejje University, Kampala, Uganda.*Corresponding Author
M. Babagana	Department of Animal Health and Production, College of Agriculture Gujba, Yobe Stae, Nigeria
Y. A. Magama	Department of Biological Sciences, College of Education Gumel, Jigawa State, Nigeria.
K. E. Akwarandu	Department of Forestry Technology, College of Agriculture Gujba, Yobe State, Nigeria
U. U. Alkali	Department of Forestry Technology, College of Agriculture Gujba, Yobe State, Nigeria
A. M. Amshi	Department of Forestry Technology, College of Agriculture Gujba, Yobe State, Nigeria

ABSTRACT

The study was carried out to assess abundance of tree species commonly used as firewood in Kwata village of Gassol Local Government Area of Taraba state, Nigeria. Transect Sampling Plot technique and Descriptive Survey methods were used. A total of 133 respondents comprising of 100 local people and 33 officials of the Department of Forestry selected using Convenient, Snowball and Systematic Random sampling techniques participated in the study. Researcher made closed ended questionnaire was used as instrument of data collection. Line transect was used to measure a 1000 x 1000 m of land (universal plot) in the forest at a distance of 10 KM south of Kwata village. Within the universal plot, 5 smaller plots measuring 100 x100 m were randomly measured and selected from different parts of the universal plot where total number (abundance) of the commonly used trees for firewood (both standing and stumps) as well as the diversity of the areas were determined. All data collected on abundance and diversity of tree species was analysed using Shannon diversity index (H) while Descriptive Statistics was used to analyze data on respondents' demographic characteristics as well as their questionnaire responses. Demographic characteristics of the respondents showed that males had the highest percentage than the females, majority were engaged in farming and fuel wood harvesting, considerable number of them were married and not well educated. The study also revealed that 10 tree species were used as fire wood in the area and the most abundant ones were T. glaucescense, followed by P. Africana, A. anageissus, and P. erinaceus while the less abundant tree species included K. senegalensis, T. indica and B. egyptiaca. Computation of the Shannon-wiener diversity index from the 5 sampled plots showed that plots 2 and 5 were the most diverse of all the plots with 2.2098 and 2.1464 diversity indexes implying that the forest was highly diverse. However, considering the high level of logging coupled with the heavy reliance of the local communities on firewood as the only source of energy and a source of livelihood to many of them, the diverse nature of the forest in terms of tree species as well as its abundance are seriously threatened. Based on these findings and conclusion, it is therefore recommended that cutting down of trees for all purposes should be strictly regulated by laws, other sources of fuel should be made readily available and cheap and more jobs opportunities should be created especially through trainings in vast entrepreneurial skills in order to broaden the people's sources of livelihoods.

KEYWORDS : Abundance, Fuel wood, Gassol, Kwata, Taraba, Tree Species

INTRODUCTION

Wood fuel is wood used as fuel and the burning of wood is currently the largest use of energy derived from solid fuel biomass, wood fuel can be used for cooking and heating, and occasionally for fueling steam engines and steam turbines that generate electricity.

Fuel wood is one of the most important sources of fuel energy especially in developing countries and it is referred to as material used to generate heat and light energy by combustion. Fuel wood or firewood, consists of any unprocessed woody biomass used to fuel a small fire most often for cooking or warmth. In most developing countries, firewood comes from dead woody material and small trees. Fuel wood harvesting and consumption is a universal phenomenon in Africa and most other developing countries. It remains the major source of domestic fuel as well as the main source of energy for the micro economic enterprises. According to Gwandu (1991), fuel wood energy is a pivot on which the domestic and economic lives of people revolves. Over the years, the demand and consumption of fuel wood has increased with increases in human population. More importantly, fuel wood supplies appear to be diminishing in the face of increasing demand. Wood fuel may be available as fire wood e.g. logs, bolts, and blocks, charcoal, chips, sheets, pellets and sawdust. The particular form used depends upon factors such as source, quality, quantity and application. Sawmill waste and construction industry by product also includes various form of lumber tailing. Wood may be burned in a furnace, stove, and fire places or in a camp fire, or used for bonfire. Wood is the most easily available form of fuel, requiring no tools in the case of picking up dead wood or little tools. Although as in some industry, specialized tools such as skidders and hydraulic wood splitters have evolved to mechanize production. Fuel wood is classified as a raw material, as no processing is involved and is usual to cut wood for burning and all refused. Wood generally, but does not include straight logs or poles of any kind (GFC, 1999).

In Nigeria, the total fuel wood consumption in 1985 was recorded 87.587 million cubic metres (Babanyara, 2010). Obuah (2000) stated that, 55 million tones of fuel wood and charcoal were burnt, and it increased to 80 million cubic metres (43.4x109kg) of fuel wood annually for cooking and domestic uses (Sambo, 2005) in

industrialized countries, wood based fuels (fuel wood or firewood and charcoal) have long been replaced by more efficient and convenient sources of fuel. However, in developing regions, less able to afford and access alternative sources of energy, wood has remained a dominant fuel. Huge numbers of subsistence users depend upon it for their domestic energy and a large number of poor people rely on wood fuel trading as a source of income.

In Nigeria, predominantly rural population depends mainly on fuel wood to meet the basic needs for cooking and heating. The growth of urban areas in Nigeria accounts for increase demand on fuel wood. The rural and urban poor populations are increasing and households within these classes depend heavily on fuel wood to provide energy. Majority of these low income earners cannot afford electricity or gas to serve energy needs such as cooking and heating. Recent studies revealed that Nigeria produces about 1 million tons of charcoal annually of which 30% are consumed in the cities. Fuel wood and charcoal account for more than 50% of the natural primary energy consumption. Both household and industrial sector in all ecological zones demands for fuel wood. It has been estimated that about 90% in northern Nigeria depend on fuel wood as their source of domestic energy (Ewah, 2014).

Across different parts of the world especially Africa, different species of tree species are being used as fire wood. According to Tabuti *et al.*, (2003), fourty eight plant species, belonging to 41 genera and 20 families are used as firewood in Bulamogi, Uganda. Most of these species belong to the families Fabaceae, Moraceae,, Combretaceae, Anacardiaceae, Euphorbiaceae and Tiliaceae. Collectively, Acacia species were the most frequently mentioned firewood plants.

STATEMENT OF THE PROBLEM

Forest degradation is on the increase due to the continuous anthropogenic activities mostly for sources such as firewood and timber. Burning of woods subsequently leads to release of greenhouse gases which has resulted in temperature rise both during the day and at night, obstructing the balance between oxygen and carbon dioxide. This has resulted in threatening loss of vegetation, all due to over exploitation of wood plant resources for many domestic and industrial purposes.

Nigeria has the highest rate of fuel wood harvesting in the world according to Food and Agricultural Organization of the UN (FAO). Between 2000 and 2005 the country lost 55.7% of its primary forests, and the rates of forest change increased by 31.2% to 3.12% per annum. The major factors leading to forest degradation in Nigeria is fuel wood harvesting. The usage of fuel wood for cooking and heating is higher in rural areas of the country where more of the population is concentrated. The volume of fuel wood harvesting and its economic and environmental implications are no doubt huge. The major problems are those of pollution and environmental quality reduction. Taraba State, Nigeria has experienced decreases in wood population over the years. Besides, they have also experienced wind storm, soil erosion, leaching, loss of species and biodiversity as well as land use conflicts and desertification.

In most of the villages which constitute the source region for firewood such as Kwata village of Gassol Local Government Area, local communities do complain of increasing soil erosion, decrease in tree species and loss of soil fertility.

Despite efforts put in place by both the state and Local Governments in controlling fuel wood harvesting which include formulation of deforestation laws, imposing heavy taxes on loggers, annual tree planting campaigns and so on, cutting down of trees for different purposes of which firewood leads is still on the increase thereby compounding the impacts of deforestation in the area.

In view of the above, this study was conducted in order to assess the abundance and diversity of tree species most commonly used as sources of firewood in Kwata village of Gassol Local Government Area of Taraba state, Nigeria.

MATERIALS AND METHODS

The study was conducted in Kwata village of Mutum Biyu area in Gassol L.G.A. of Taraba state between the months of July-October, 2017. Line transect was used to measure a 1000 x 1000 m of land (universal plot) in the forest at a distance of 10 KM south of Kwata village. Along the length of the 1x1 km plot measured, 5 plots measuring 100 x100 m were randomly measured and selected at different parts of the universal plot. Thus, 5 sub-plots (100 m^2) were taken from different parts of the universal plot (I km^2) where total number (abundance) of the commonly used trees for firewood (both standing and stumps) were counted. Shannon-Wiener diversity index (H) for each sampled plot was calculated using the formular.

$$H = -\sum_{i=1}^{s} p_i \ln (p_i)$$

Where H is the Shannon-Wiener diversity index, S is the total number of species n the community, Pi is the proportion of S made up of the ith species, Ln is natural logarithm. A total of 133 respondents comprising of 100 local people and 33 officials of the Department of Forestry selected using Convenient, Snowball and Systematic Random Sampling participated in the study. Researcher made closed ended questionnaire and structured Interview Guide were the instruments used to gather data on the respondents demographic characteristics and their perceptions with regards to fuel wood harvesting while data collected was analysed using Shannon-Wiener diversity index (H) computation as well as the Frequency, Percentage, Mean and Standard Deviation distribution tables.

STUDY AREA

Gassol Local Government Area is one of the sixteen (16) LGAs that made up Taraba State and majority of its population are engaged in agricultural activities like crop farming, fishing and hunting, they have a woodland type of vegetation. Mutum-Biyu is the capital town at 8o 38l 00 "N, 10o 46 "E. It has an area of 5,548km2 and a population of 244,749 at the 2006 National Census. On the northern part, it borders Benue River and the Taraba River which flow northwards through the area to its confluence in Benue State. The area has a woodland type of vegetation. Kwata village in Mutum-biyu, Gassol Local Government Area is situated at longitude 10, 7667 (1046l0.120"E), latitude 8, 6333 (837l59.988"N), with an altitude of 137m. Wurkum and Fulani ethnic groups are the dominant tribes in the area (NPC, 2006).

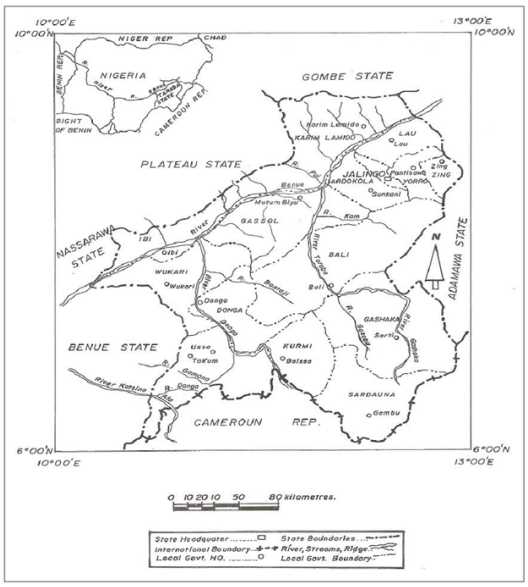

Figure 1: Map of Taraba state showing Gassol L.G.A.

RESULTS ANALYSIS AND INTERPRETATION

Table 1: Demographic characteristics of the respondents

Variables	Frequency	Percentage
Respondent's sex		
Male	71	74%
Female	25	26%
Respondent's age		
15-20	4	4.20%
21-30	11	11.50%
31-40	50	52.10%
41 and above	31	32.3%
Marital status		
Married	60	62.5%
Single	22	22.9%
Separated	10	10.4%
Widower	4	4.2%
Level of education		
Primary	39	40.6%
Secondary	35	35.4%
Diploma/NCE	22	22.9%
HND/Bachelors	1	1.1%
Masters	0	0
Occupation		
Farming	35	36.5%
Wood seller	22	22.9%
Trading	20	20.8%
Civil servant	10	10.4%
Student	9	9.4%
Household size		
1-5	28	29.2%
6-10	26	27.1%
11-15	30	31.3%
16-20	10	10.4%
Above 21	15	15.6%
Number of years in the area		
1-5	10	10,4%
6-10	20	20.8%
11-15	31	32.3%
16-20	20	20.8%
Above 21	15	15.6%
Source of fuel used		
Fuel wood	49	51.1%
Charcoal	25	26.1%
Kerosene	18	18.8%
Electricity	6	6.3%

ABUNDANCE/DIVERSITY OF TREE SPECIES IN THE STUDY LOCATION

Thus, it was discovered that, in the 5 sampled plots demarcated for the study (100m2) each, the total number of trees counted was 213 disproportionately distributed among 10 genera and 10 species. Each of the genera was represented by one (1) species. For each sampled plot, a table showing the abundance of tree species/ percentages was made.

Table 1: Abundance/diversity of tree species in sampled plot 1

S/N	SPECIES NAME	NO. OF TREES	P_i (n/N)	P_i^2	ln P_i	P_i ln P_i
1	*Terminalia glaucescense*	9	0.2143	0.0459	-1.5404	-0.3301
2	*Prosopis africana*	7	0.1667	0.0278	-1.7916	-0.2987
3	*Pterocarpus erinaceus*	6	0.1429	0.0204	-1.9456	-0.2780
4	*Anageissus leiocarpus*	5	0.1191	0.0142	-2.1278	0.2534
5	*Tamaridus indica*	3	0.0714	0.0051	-2.6395	-0.1885
6	*Balanite eagyptiaca*	3	0.0714	0.0051	-2.6395	0.1885
7	*Khaya senegalensis*	4	0.0952	0.0091	-2.3518	-0.2239
8	*Vitellaria paradoxa*	2	0.0476	0.0023	-3.0449	-0.1449
9	*Parkia biglobosa*	2	0.0476	0.0023	-3.0449	-0.1449
10	*Mitragyna inermis*	1	0.0238	0.0006	-3.7381	0.0890
Total	**42**		**0.1328**		**-2.1399**	

S=10
N=42

$$\sum p_1^2 = 0.1328$$

$$\sum pinPi = 2.1399$$

$$H = \sum p_i nP_i = -(-2.1399) = 2.1399$$

$$D = \frac{1}{p_i^2} = \frac{1}{0.1328} = 7.5301$$

The significant figure (H) from this calculation was 2.1399. Hence, the diversity index of sampled plot 1 was 2.1399. The higher the diversity index, the more diverse a sampled plot is in terms of tree species

Table 2: Abundance/diversity of tree species in sampled plot 2

S/N	SPECIES NAME	NO OF TREES	P_i(n/N)	P_i^2	ln P_i	$P_i$ln P_i
1	*Terminalia glaucescense*	10	0.2174	0.0473	-1.5260	-0.3318
2	*Prosopis africana*	4	0.0870	0.0076	-2.4419	-0.2125
3	*Pterocarpus erinaceus*	3	0.0652	0.0043	-2.7303	-0.1780
4	*Anageissus leiocarpus*	6	0.1304	0.0170	-2.0372	0.2657
5	*Tamaridus indica*	5	0.1087	0.0118	-2.2192	-0.2412
6	*Balanite eagyptiaca*	4	0.0870	0.0076	-2.4419	0.2125
7	*Khaya senegalensis*	4	0.0870	0.0076	-2.4419	-0.2125
8	*Vitellaria paradoxa*	5	0.1087	0.0118	-2.2192	-0.2412
9	*Parkia biglobosa*	3	0.0652	0.0043	-2.7303	-0.1780
10	*Mitragyna inermis*	2	0.0435	0.0019	-3.1350	0.1364
Total	**46**		**0.1212**		**-2.2098**	

S=10
N=46

$$\sum p_1^2 = 0.1212$$

$$\sum p_1 InP^1 = -2.2098$$

$$H = \sum pinPi = -(-2.2098) = 2.2098$$

$$D = \frac{1}{p_i^2} = \frac{1}{0.1212} = 8.2508$$

The significant figure (H) from this calculation was 2.2098. Hence, the diversity index of sampled plot 2 is 2.2098. The higher the diversity index, the more diverse a sampled plot is in terms of tree species. Thus, sampled plot 2 is more diverse than sampled plot 1.

Table 3: Abundance/diversity of tress species in sampled plot 3

S/N	SPECIES NAME	NO OF TRESS	$P_i(n/N)$	P_i^2	In P_i	P_i In P_i
1	*Terminalia glaucescense*	7	0.1842	0.0339	-1.6917	-0.3116
2	*Prosopis Africana*	5	0.1316	0.0173	-2.0280	-0.2669
3	*Pterocarpus erinaceus*	3	0.0790	0.0062	-2.5383	-0.2005
4	*Anageissus leiocarpus*	4	0.1053	0.0111	-2.2509	0.2370
5	*Tamaridus indica*	4	0.1053	0.0111	-2.2509	-0.2370
6	*Balanite eagyptiaca*	2	0.0526	0.0028	-2.9450	0.1549
7	*Khaya senegalensis*	3	0.0790	0.0062	-2.5383	-0.2005
8	*Vitellaria paradoxa*	0	0.0000	0.0000	0.0000	-0.0000
9	*Parkia biglobosa*	4	0.1053	0.0111	-2.2509	-0.2370
10	*Mitragyna inermis*	6	0.1579	0.0249	-1.8458	0.2915
Total	**38**		**0.1246**		**-2.1373**	

S=10
N=38

$$N=38$$
$$\sum p_1^2 = 0.1246$$
$$\sum p_1 inPi = -2.1373$$
$$H = \sum pinPi = 2.1373$$
$$D = \frac{1}{p_i^2} = \frac{1}{0.1246} = 8.0257$$

The significant figure (H) from this calculation was 2.1246. Hence, the diversity index of sampled plot 3 was 2.1373. The higher the diversity index, the more diverse a sampled plot is in terms of tree species. Thus, sampled plot 3 is less diverse than sampled plot 2.

Table 4: Abundance/diversity of tree species in sampled plot 4

S/N	SPECIES NAME	NO OF TREES	$P_i(n/N)$	P_i^2	In P_i	P_i In P_i
1	*Terminalia glaucescense*	11	0.2115	0.0447	-1.5535	-0.3286
2	*Prosopis africana*	8	0.1538	0.0237	-1.8721	-0.2879
3	*Pterocarpus erinaceus*	8	0.1538	0.0237	-1.8721	-0.2879
4	*Anageissus leiocarpus*	6	0.1154	0.0133	-2.1594	0.2492
5	*Tamaridus indica*	4	0.0769	0.0059	-2.5652	-0.1973
6	*Balanite eagyptiaca*	5	0.0962	0.0093	-2.6708	0.2569
7	*Khaya senegalensis*	7	0.1346	0.0181	-2.0054	-0.2699
8	*Vitellaria paradoxa*	0	0.0000	0.0000	-0.0000	-0.0000
9	*Parkia biglobosa*	2	0.0385	0.0015	-3.2571	-0.1254
10	*Mitragyna inermis*	1	0.0192	0.0004	-3.9529	0.0759
Total	**52**		**0.1406**		**-2.0786**	

S=10
N=52

$$\sum p_1^2 = 0.1406$$
$$\sum p_1 InP^1 = -2.0786$$
$$H = \sum piInPi = 2.0786$$
$$D = \frac{1}{p_i^2} = \frac{1}{0.1406} = 7.1124$$

The diversity index of sampled plot 4 was found to be 2.0786.

Table 5: Abundance/diversity of tree species in sampled plot 5

S/N	SPECIES NAME	NO OF TREES	$P_i(n/N)$	P_i^2	In P_i	P_i In P_i
1	*Terminalia glaucescense*	9	0.2571	0.0661	-1.3583	-0.3492
2	*Prosopis africana*	5	0.1429	0.0204	-1.9456	-0.2780
3	*Pterocarpus erinaceus*	3	0.0857	0.0073	-2.4569	-0.2106
4	*Anageissus leiocarpus*	4	0.1143	0.0131	-2.1689	0.2479
5	*Tamaridus indica*	3	0.0857	0.0073	-2.4569	-0.2106
6	*Balanite eagyptiaca*	3	0.0857	0.0073	-2.4569	0.2106
7	*Khaya senegalensis*	2	0.0571	0.0033	-2.8629	-0.1636
8	*Vitellaria paradoxa*	1	0.0286	0.0008	-3.5543	-0.1017
9	*Parkia biglobosa*	3	0.0857	0.0073	-2.4569	-0.2106
10	*Mitragyna inermis*	2	0.0571	0.0033	-3.8629	0.1636
Total	**35**		**0.1362**		**-2.1464**	

S=10
N=35

$$\sum p_1^2 = 0.1362$$
$$\sum p_1 InP^1 = -2.1464$$
$$H = \sum piInPi = 2.1464$$
$$D = \frac{1}{p_i^2} = \frac{1}{0.1362} = 7.3421$$

From the calculation of the Shannon Diversity Index of sampled plot 5, it was found that the diversity of index of the plot was 2.1464 meaning the plot was so diverse.

Table 6: Cumulative abundance/diversity of tree species

Tree Species	Local Names	Plot 1	Plot 2	Plot 3	Plot 4	Plot 5	Total	Percentage
Terminalia glaucescense	Baushe	9	10	7	11	9	46	21.60 %
Prosopis africana	Kirya	7	4	5	8	5	29	13.62 %
Pterocarpus erinaceus	Madobiya	6	3	3	8	3	23	10.80 %
Anageissus leicarpus	Marke	5	6	4	6	4	25	11.74 %
Tamaridus indica	Tsamiya	3	5	4	4	3	19	8.92%
Balanites eagyptiaca	Aduwa	3	4	2	5	3	17	8.0%
Khaya senegalensis	Madaci	4	4	3	7	2	20	9.39%
Vitellaria paradoxa	Kadanya	2	5	0	0	1	8	3.76%
Parkia biglobosa	Dorawa	2	3	4	2	3	14	6.57%

Mitragyma inermis	Giyaya	1	2	6	1	2	12	5.63%
Total		**42**	**46**	**38**	**52**	**35**	**213**	**100%**

From the Table it can be seen that *T. glaucescense* was the most abundant tree species (21.6%) followed by *P. Africana* (13.6%), *A. leicarpus* (11.74), *P. arinaceus* (10.80%) and *K. senegalensis* (9.39%)

DISCUSSIONS, CONCLUSION AND RECOMMENDATION

In order to fully understand the findings of the study, it was deemed good to also capture some of the characteristics of the local communities, hence, demographic characteristics of the respondents in terms of sex, age, marital status, level of education, occupation, household size, number of years of residency in the area as well as source of fuel used wood being used.

Firewood or wood fuel serves as a major source of domestic energy for cooking. This natural resource is so important to the inhabitant of rural and some urban communities where it is harvested and stored in order to reduce its moisture content for use as firewood. According to the findings of this study, 74% of the respondents were male while the female sex was 26%. In the administration of the questionnaires, emphasis was mainly given to those respondents concerned with the issue of felling down of trees either directly or indirectly. This could be the reason why majority of the respondents happened to be men, because men were mostly involved in activities relating to logging. Erakhrumen (2008), men are seen to be the major partakers in the business of logging which ranges from cutting down tree species in the forest, rolling the log down the mountain top, transporting the logs from the forest to collection centers and loading the logs onto trailers. The reason is probably due to the nature of the job which is extremely physical and labor intensive and above all risky. The result agrees with the findings of Manfre and Rubin (2012), who reported that men contribute more to household income than women because their forest activities are income generating whereas women are more involved in subsistence activities. This result also agrees with report of the International Labour Organisation (ILO) (2016), that in the United States, only 6.3% of women worked in male denominated occupations in 2016 and only 3.2% is involved in logging.

In terms of age, it was discovered that majority of the respondents were young men of age between 31-40 years while those between the ages of 15-20 and 21-30 were represented by 4.2% and 11.5% respectively. Those above 41 years of age were represented by 32.3%. Analysis of the age related data shows that young men of ages 31-41 were the majority and the ones mostly involved in logging related activities. This finding agrees with the findings of other similar studies such as that of Abdul Rahman et *al*., (2008), who revealed that young, strong and able men with secondary or no secondary education are all major actors in the tree felling or timber extraction. Similarly, the work of Aabeyir *et.al*., (2011) who reported that the major groups involved in commercial fuel wood collection in the communities of Dawadawa and Kunsu respectively falls within the ages of 31-39 years. The high rate of unemployment in the country especially among the majority youth left many young able men with no option but to source means of livelihoods by all means there by engaging in environmentally devastating activities such as deforestation.

Variations in marital status of the respondents showed that, majority of them 62.5% were married while those who were yet to marry were represented by 22.9%. Separated and widowed respondents were represented by 10.4% and 4.2% respectively. This finding further confirms the culture of most communities in the North eastern states of Nigeria where young men and women get married at early ages of 25 years and 15 years respectively. This finding corresponds with that of Omolehin *et. al*., (2007) who reported that married men are more conscious of the need to get better livelihood so that they could meet their family food needs. With regards to their level of education, majority of the respondents 65.6% had only primary and secondary education while only 34.4% claimed to have obtained post secondary educations indicating that majority of the local people end their education after finishing primary or secondary schools. This is common in many rural communities in northern Nigeria where majority of kids engage in farming at early age instead of enrolling in schools.

Just as it is the case in many rural communities in Nigeria, analysis of the respondents' occupation indicated that farmers dominated the categories of the people's occupation with 36.5% followed by fuel wood seller 22.9%. Other categories of occupations found were trading, civil servants and fishermen represented as 20.8%, 10.4% and 9.4% respectively. Typical of many African rural communities, the study found that household sizes in the study area were relatively big ranging from 6-15 family members represented by 58.4%. Besides, 15 respondents 15.6% claimed to have family members above 21. This could be attributed to the fact that, most rural communities in Nigeria lack basic western education as well awareness on family planning because it is believed that the larger a family is the stronger and self reliant it is. Besides, many of the respondents 53.1% stated that they lived in the area for 11- 20 years while only 31.2% lived in the area for 1-10 years with few 15.6% claimed to have resided in the area for more than 21 years. This indicates that, all the respondents 100% were residents of Kwata village.

Expectedly, fuel wood was found to be the most commonly used source of fuel in the area because out of the 96 respondents who participated in the study, 60 (62.5%) stated that they only use firewood as the source of fuel in their houses. This finding further confirms findings of Jinadu (1998) who stated that fuel remains the major source of domestic energy in most part of developing world. Encyclopedia Britannica (2001) reported that in Nigeria for instance, fuel wood is still the main source of domestic fuel even in urban areas and it accounts for more than half of the domestic energy consumption. Similarly, according to Ewah (2014), it has been estimated that about 90% in northern Nigeria depend on fuel wood as their source of domestic energy. Even in many urban areas, as a result of the epileptic power supply in Nigeria, many households depend on charcoal kerosene and gas as their major sources of fuel energy, though few especially the low income earners still use fire woods.

Abundance of tree species used as fuel wood in the study location

Species composition and species richness are important indicators for assessing biodiversity (Husch *et al*., 2001) and may strongly depend and/or be influenced by harvesting different tree species for different purposes. Similarly, harvesting or tree cutting influences the species distribution, especially if only a limited number of trees are removed. However, the impacts of anthropogenic disturbance are felt in the forests which are expected to increase further with the growing population and enhanced accessibility. Forest contains the greatest diversity in terms of species, genetic material and ecological processes of all ecosystems. Forest habitats play a central role in the functioning of the biosphere, as they are the origin of many cultivated plants and animals (EU 2008). From all the sampled plots, it was discovered that a total of 213 trees from 6 families and 10 different genera were counted. The 6 families were *Combretaceae, Fabaceae, Sapotaceae, Zygophyllaceae, Rubiaceae and Meliaceae* however; most of the tree species identified belong to the families *Combretaceae* and *Fabaceae*. This finding further confirms that of Tabuti *et al*., (2003), who reported that, collectively Acacia species were the most frequently mentioned firewood plants and species mostly used belong to the families *Fabaceae, Moraceae, Combretaceae, Anacardiaceae, Euphorbiaceae* and *Tiliaceae.* Similarly, Victor *et al.,* (2013) in a similar study found that tree species belonging to the families *Moraceae, Meliaceae* and *Rubiaceae* were the most abundant species in a Nigerian strict nature reserve.

Besides, each genus was represented by 1 species however *T. glaucescense* was found to be the most abundant tree species (21.6%) despite the fact that it was listed as one of the tree species

mostly used as fire wood. However, it is worth noting that all of the tree species counted were not only used as fire woods but also for medicinal purposes especially *K. senegalensis* which used as a remedy for malaria, stomach problems and headaches, *B. eagyptiaca, T. glaucescense and V. paradoxa* commonly known as sheer butter tree which are used as food sources that are very vital for normal functioning of the body such as improvement of nutrition, good food supplement for nursing mothers etc. The seeds of *P. Africana* and *P. biglobosa* are used locally to prepare a food seasoning called Daddawa. Some of these findings agree with that of Erahkrumen *et al* (2010) who conducted a similar study in Akinyele and Ido areas of Oyo state, Nigeria where he assessed tree species used as traditional medicine and as fuel wood. He discovered some of the dominant tree species used for those reasons to include *A. leiocarpus, P. erinaceus, and P. africana.*

Surprisingly, the 3 least abundant tree species that is *P. biglobosa, M. inermis* and *V. paradoxa* were species commonly used as fire wood among all the ten species counted in addition to being edible. This could be attributed to the fact that, logs from these trees have some peculiar characteristics that made them very good fuel wood possessing good combustion characteristics such as low smoke production, production of good charcoal, production of long lasting hot flame and ember. Others include being easy to split and ignite, able to lose moisture fast, produce ember that if covered with ash can retain fire till the next morning and have a flame that does not produce sparks. Most importantly, they are very abundant and easy to gather.

CONCLUSIONS

In conclusion, it was revealed that, married male youth were the dominant group of persons in the study location majority of whom lack good western education and depended mainly on farming, logging and fire wood selling for livelihoods, With no employable qualifications to acquire white collar jobs elsewhere, these physically fit groups of people would have to continue earning their livelihoods from logging related activities. This was confirmed by the fact that considerable number of the respondents was engaged in fire wood selling. Consequently, abundance and diversity of tree species especially those mainly used as fire woods such *T. glaucescense* and *K. senegalensis* is highly threatened.

With regards to the abundance and diversity of the tree species sampled in 5 plots, it was discovered that a total of 10 trees species from 6 families and 10 different genera were counted. *T. glaucescense* was found to be the most abundant tree species despite the fact that it was listed as one of the tree species mostly used as fire wood followed by *P. Africana*, *A. leicarpus, P. arinaceus* and *K. senegalensis while P. biglobosa, M. inermis* and *V. paradoxa* were the least abundant species. These findings indicate that the area was really diverse in tree species with many found in abundance. However, with the heavy reliance of the local communities on firewood as the major source of domestic energy and the increasing logging activities as well as the reliance of many people on selling fire woods as their source of livelihoods, the abundance and diversity of these tree species are seriously threatened and may soon go into extinction in the area.

RECOMMENDATIONS

Based on the findings made by this study, the following recommendations are hereby proffered:

1. To maintain the natural abundance and diversity of tree species in the area, the cutting down of trees especially those commonly used as firewood and for other purposes should be well regulated. Also, other sources of energy such as charcoal, kerosene and gas should be made readily available and cheap so as to discourage felling down of trees.
2. To be able to tackle such a problem public participation in plantation of trees should be encouraged by way of enlightenment via mass media and green promotion NGOs to awaken the public on the danger of continual dependency of fuel wood. Government should include tree planting as one of the compulsory extracurricular activities or introducing environmental education as a compulsory course of study at all levels of schooling in the entire country.
3. Nursery plots should be established where seedlings of tree species especially those commonly cut down for different purposes so that local communities can be encouraged to pick and plant them so as to curb the impacts of felling down of trees in the area. Orientation of the general public, the solution discussed above will be more effective if general public re oriented on the need to preserve the forest that we have and the adverse effects of continuous destruction of the forest.

References

1. Abdurrahman, H., Wang, C., wood, I. C, and Ebralim, M. (inpress). Integrating and ranking sustainability criteria for housing. Engineering sustainability.
2. Babanyara, Y.Y. and Saleh, U. F. (2010). Urbanization and the choice of fuel wood as a source of energy in Nigeria. Journal of human ecology 31(1): 19-26
3. Encyclopedia Britannica (2001), Deluxe Edition, Cd Rom.
4. Erakhrumen, A.A., (2008). Influence of specific gravity n wood species selection for agroforestry in some local government area of Oyo state, Nigeria. African journal of agricultural research, 3(2): 134-139
5. Erakhrumen, A.A; Ogunsanwo, O.Y And Ajewole., O.I (2010). Assessment of some other traditional uses of accepted agroforestry fuel wood species in Akinyele and Ido Local Government Area, Oyo State, Nigeria. International journal of social forestry (ITSF), 3(1): 49 65
6. Ewah J.O (2014). Exploitation of carbon energy and the integrity of protected rain forest areas in Nigeria. International journal humanities and social science, 4 (6): 206-215
7. GFC (1999). Forestry in Guyuna market summary 1998. GFC report, pp47 – 55.
8. Gwandu, A.A (1991). "The manace of desertification in sokoto state", in K.O Ologe(ed) sustainable development in Nigeria's DryBelt: problems and prospects Nigerian Environmental Study Action Team (NEST), Intec Printers, Ibadan. Page 19-24.
9. Husch, B., Beers, T.W., Kershaw, J.A. (2002). Forest Mensuration. New York (NY): John Wiley & Sans (Google scholars)
10. International Labour Organisation ILO (2016). Guidelines for labour inspectation in forestry.
11. Jinadu A.M(1998). Rural Fuelwood harvesting Problem and Conservation Needs in Nigeria. A paper presented at the National Conference of School of Environmentai Technology (NACOSET'98), the Federal Polytechnic, Bauchi State, Held between 9th – 15th febuary, 1998.
12. Manfre, C and Rubin, D (2012), Integrating gender into forestry research: guide for cifo scientists and programme administrators, cifor, Bogor, Indonesia.
13. Obuah J. (2000). Ecological cost of increasing dependence on biomass fuel as household energy rural Nigeria, boiling point 44:26-30
14. Omolehin, R.A ogunfiditimi, to, and adeniji, O.B, (2007). Factors influencing the adaptation of chemical pest control in cowpeas production among rural farmers i n Makarfi L. G A Kaduna state, Nigeria. Journal of agricultural extension, 10:81-91.
15. Sambo, A.S (2003). Renewable energy for rural development. Science and technology vision, 1:12-22
16. Tabuti, J.R.S, Dhillion S.S, and Iye, K.A, 2013. fire wood use in Bulamogi country, Uganda: species selection, harvesting and consumption patterns biomass and b i o energy 25: 581-596.
17. Victor, A.J.A, adewole, 0.0, and Shadrach, O. A. (2013) Tree Species diversity and structure of a Nigerian strict nature reserve. International society for tropical ecology: 54 (3): 275-289.