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Assessment of Quantities and Seasonal Harvest of Fuel Wood Exploitation in Shiroro Local Government Area, Niger State, Nigeria

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Abstract

This study assessed domestic fuel wood exploitation in Shiroro Local Government Area, Niger State, Nigeria. The objectives of the study were to understand the peak season of fuel wood collection at different time of the year and determine the quantities of fuel wood family members harvest in a week. This study employed mixed methods of multistage and cross sectional research design using questionnaire instrument to generate data. Part of the year with the highest fuel wood collection was late dry season having 33.4% of the response. The season with second highest collection of fuel wood by respondents was all year having 22.1%. This was thirdly followed by early dry season with a response of 19.2%. Thus, 37.1% of the respondents indicated that they harvested 4-6 bundles of fuel wood with their family members in a week. This was seconded by 30% respondents who revealed that 1-3 bundles of fuel wood were harvested in a week. Thus, 25% of the family members harvested 7-9 bundles of fuel wood in a week. The least response was 7.9% who responded that 10 bundles and above of fuel wood were harvested in a week. The study has recommended provision of alternative energy, government to regulate deforestation practice, education and sensitization of local community people on the regulation of fuel wood harvest, practice of tree planting, and alternative employment opportunities to local community people.

Keywords: *Fuel, Harvest, Quantities, Seasonality, Wood*

Introduction

Energy is one of the basic and most critical economic, environmental, and developmental issues facing the world today. Clean, efficient, affordable, and reliable energy services are indispensable for global prosperity [1]. The demand for energy is far greater than ever in our highly technological world. It is a well-known fact that high rate of industrial growth of any country is a function of the amount of energy available and the extent to which this energy is utilized [2]. According to [3] approximately 87 percent of rural households are primarily dependent on biomass as their source of energy with about 90 percent of the total annual round wood products serve as fuel wood and 60 percent of this total is used for household exploitation. The reckless exploitation and in some cases, over exploitation of these resources have often resulted in environmental degradation. The fuel wood issue presents the double sides of energy; it is a source of income for traders yet intensive and discriminate harvest of fuel wood imposes heavy environmental burden [4].

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 part of Sub-Sahara African [5]. With increasing exploitation of fuel wood, forest resources have been degraded, agricultural lands are destroyed. The demand for fuel wood has resulted to extensive deforestation, particularly in areas where there are few alternatives. This loss of trees has disrupted ecosystems, reduce biodiversity and contributed to soil erosion. When trees are removed, soil is more susceptible to erosion and degradation, which can lead to desertification in extreme cases [6]. Exploitation of fuel wood has increased biodiversity loss, soil degradation, climate change and water cycle disruption. Forests play a crucial role in the water cycle, influencing precipitation patterns and maintaining groundwater levels. Deforestation can lead to changes in local and regional climates, resulting in diminished water resources [7].

While fuel wood is an important energy source for many, its unsustainable exploitation poses significant risks to the environment, economy, and human health. Promoting

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sustainable practices, developing alternative energy sources and enforcing regulations can mitigate these impacts and promote a healthier balance between resource use and environmental conservation [8]. Many communities rely on fuel wood as a primary energy source, making them vulnerable to fluctuations in availability and price, leading to economic instability. Thus, reliance on fuel wood may stifle the development of alternative and more sustainable energy sources, hindering technological progress and economic diversification [9]. The long-term costs associated with environmental degradation (e.g., loss of ecosystem services, increased flooding, loss of arable land) can outweigh the short-term benefits of fuel wood exploitation [10]. Burning fuel wood produces smoke that contains harmful pollutants. This has lead to respiratory problems, especially among women and children who may spend the most time near cooking fires. Indoor pollution and food security have been closely related to fuel wood exploitation [11].

Energy use and choice of fuel wood are dependent on price of the relevant energy source, availability of substitutes, fuel preference of consumers, household income and size, cultural factors and cost as well as performance of equipment. Dealing with fuel wood does not only provide additional income for farmers during the off farm seasons, it create jobs for full time dealers. Several factors have been identified as contributing to the increasing demand and consumption of fuel wood [12]. Though Nigeria is a producer of gas, inadequate supply has led to increase in the prices of petroleum products leading to price instability and shortage in supply [13]. This has pushed many households down the energy ladder as they could no longer afford to buy kerosene and cooking gas as such they resort to the use of fuel wood and charcoal as the main source of energy especially for cooking and other domestic purposes. However, instead of collecting it, they now have to buy from vendors, signifying that fuel wood is more affordable than other conventional fuel such as kerosene and cooking gas and other sources of energy [14].

Therefore, the rural populace especially most areas in Shiroro LGA do not have access to sustainable energy and therefore depend on biomass which includes twigs, branches, fuel wood, charcoal ,wood shavings and sawdust. This has therefore created a huge shortage in the supply of fuel wood that might be needed for other industrial and commercial purposes. These fuel wood supply and demand imbalances constitute a real threat to the energy and livelihood security of many rural communities. Indeed, the study area is experiencing a period of rapid urban population growth with a parallel rise in fuel wood demand and exploitation. Therefore, this aim of this study is to assessment of domestic fuel wood exploitation in Shiroro Local Government Area, Niger State, Nigeria.

Materials and Methods

Shiroro is a Local Government Area in Niger State, with its headquarters in Kuta town, located within latitude 9^{o} 20”0’ and 10^{0}.40”0’ N and longitude 6^{o} 20”0’and 7^{o} 0”0’ (Figure 1). It has an area of 5,015 square kilometers (1,936 sq mile). The area is found in guinea savanna of Nigeria. It is made up of relatively low and undulating land surface with some hills such as Bodo hill, Kuta Bare- Kuta hill and Reggae hill among others. River Kaduna on which Shiroro dam was built. The annual rainfall of the area varies between 1100mm and 1600mm [15] The trees of the guinea savannah form fairly close canopies with grasses like Gamba grass species (anthropogonspp and Hyparrheniaspp), the trees include Locust bean, Shea butter for the extreme part of guinea savannah it has more extensive grass cover of (aritida, pennisetumetc) species of isoberienia ferminalla and acacia are the dominant trees. In the dry season, when the sky is cloudless, the temperatures are very high with a mean of 29˚C and 21 daily maxima at the height of this season frequently exceed 30˚C [16].

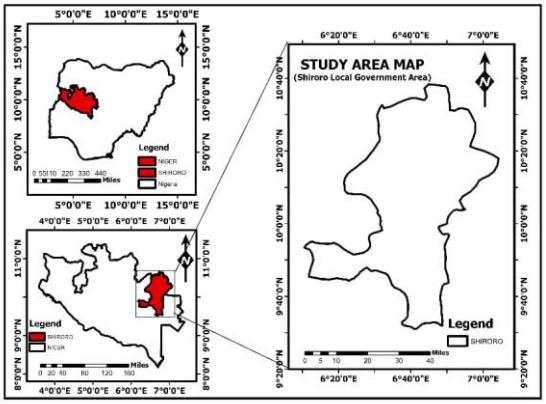

Figure 1: Study area map of Shiroro Local Government Area, Niger State, Nigeria

Population of this study comprises of the nine (9) purposively selected communities in Shiroro Local Government Area. The projected population of the study area is 12,243persons at 3.2% annual growth [17]. The sample size was derived from the total population of 12,243 in Shiroro LGA. The sample size for the study was determined using Yamane (1973) formula which made use of the projected population of 12,243 persons as shown in the equation:

$$n = N/1 + N(e)^2$$

Where:

n = sample size

N = number of people in the population

E = allowable error (%)

N = 12,243

E = 0.05

n = 12,243 /1+12,243 $(0.05)^2$

n = 387 questionnaires

Mixed sampling technique of multi-stage and cluster approaches were used for this study. Out of the fifteen (15) wards in Shiroro LGA, three (3) wards (Manta, Kato/Gijiwa and Bassa) were randomly selected. Three (3) communities were purposively selected in each of the wards such as Bere, Magami, Jiko, Gunugu, Luwa, Kato, Gwadara, Palaili and Kukoki respectively. The communities were observed with high level of domestic fuel wood exploitation in the wards. The size of the community determined the number of

*Corresponding Author: **Yakubu, A. Y.**

questionnaires that were administered in the households (Table 1).

Table 1: Population and Number of Administered Questionnaires

S/N	Community	Population	Number of Questionnaires
1	Bere	1309	43
2	Magami	1509	43
3	Jiko	1835	43
4	Gunugu	1530	43
5	Luwa	1635	43
6	Kato	852	43
7	Gwadara	1206	43
8	Palali	973	43
9	Kukoki	1394	43
	Total	**12243**	**387**

The research instrument used for this study was the structured questionnaire which was used to gather data from the respondents on fuel wood exploitation. The questionnaire was structured in five (5) sections. Section A, was the background information of respondents, section B captured data on major factors responsible for harvesting of fuel wood, section C generated data on peak season of fuel wood collection at different time of the year, section D determined quantities of fuel wood family members harvest in a week and section E determined the major species exploited for domestic fuel wood respectively.

Results and Discussion

Table 2 showed that out of the 387 questionnaires administered, 380 were retrieved (98.2%) due to the fact that the field assistants were hardworking having high engagement with the respondents. The significance of this result showed that a large quantity of the respondents were familiar with current issues of domestic fuel wood exploitation in Shiroro Local Government Area, Niger State, Nigeria, therefore making the result outcome very dependable and reliable.

Table 2: Response Rate

Respondents	Number of Questionnaires Administered	Number of Questionnaires Retrieved	Number Not Retrieved	Retrieved Percentage	Not Retrieved Percentage	Cumulative Percentage
Household questionnaires	387	380	7	98.2	1.8	**100**

The demographic characteristics of respondents influence the result of a study. Therefore, this study considered some demographic variables of respondents who participated in the administered questionnaires (Table 3). The information of respondents was sex, age and occupation. The background information showed 35% male and 65% female who responded to the administered questionnaires. The respondents below 25 years were 12.4%. The respondents at 26-30 years (30.8%) and 31-40 years (37.6%) had the highest engagement, indicating that those in the active age dominated in responding the questionnaires. Farmers (51.8%) had the highest participation in fuel wood collection; this was seconded by fishermen (16.2%) and thirdly by traders (15%). Hunters and civil servants had 6.8% response rate of fuel wood collection in Shiroro study area.

Table 3: Background Information of Respondents

S/N	Characteristics	Respondent's Category	Frequency	Percent
1	Sex	Male	133	35
		Female	247	65
		Total	**380**	**100.0**
2	Age	Below 25 Years	47	12.4
		26-30 years	117	30.8
		31-40 years	143	37.6
		41 years and above	73	19.2
		Total	**380**	**100.0**
3	Occupation	Civil Servant	26	6.8
		Farmer	197	51.8
		Fisherman	61	16.2

*Corresponding Author: **Yakubu, A. Y.**

		Hunter	26	6.8
		Trader	57	15
		Others	13	3.4
		Total	**380**	**100.0**

Table 4 showed the peak season of fuel wood collection at different time of the year. Part of the year with the highest fuel wood collection was late dry season having 33.4% of the response. Late dry season is within the months of January to March. The season with second highest collection of fuel wood by respondents was all year having 22.1%. This was thirdly followed by early dry season with a response of 19.2%. Early and late rainy season had the least response rate of 10.5% and 14.7% respectively. The response showed that fuel wood collection was low during the raining season with peak occurrence during the dry season. This could be attributed to the dryness of wood during the dry season which resulted to its availability. Also, dry season is a period of clearing of bush and peak farming season which made fuel wood to be more available during the season. However, 22.1% of the respondents showed that peak of fuel wood collection is practice that is carried out all year round.

Table 4: Peak Season of Fuel Wood Collection at Different Time of the Year

Time of the Year	Number of Respondents	Percentage of Respondents
Early dry season (October to December)	73	19.2
Late dry season (January to March)	127	33.4
Early raining season (April to June)	40	10.5
Late raining season (July to September)	56	14.7
All year	84	22.1
Total	**380**	**100**

Table 5 showed the data on the quantity of fuel wood harvested per household per week in Shiroro LGA. Thus, 37.1% of the respondents indicated that they harvest 4-6 bundles of fuel wood with their family members in a week. This was seconded by 30% respondents who revealed that 1-3 bundles of fuel wood were harvested in a week. Granted, 25% of the family members harvested 7-9 bundles of fuel wood in a week. The least response was 7.9% who responded that 10 bundles and above of fuel wood were harvested in a week.

Table 5: Quantities of Fuel Wood Family Members Harvest in a Week

Variable	Number of Respondents	Percentage of Respondents
1-3 bundles	114	30
4-6 bundles	141	37.1
7-9 bundles	95	25
10 bundles and above	30	7.9
Total	**380**	**100**

This study showed that fuel wood collection was low during the raining season with peak occurrence during the dry season. This is in tandem with the findings of [18] who investigated species, sources, seasonality and sustainability of fuel wood commercialization in Masaya, Nicaragua. It was revealed that greater quantities of fuel wood (58.9%) were collected and sold to vendors in the dry season than in the rainy. This showed a remarkable similarity that fuel wood collection and sales were carried out more during the dry season due to the availability and accessibility of the forest commodity.

The findings of this study showed that the respondents harvested 4-6 bundles of fuel wood with their family members in a week. This is similar to the result of [19] who investigated fuel wood exploitation and its impacts on residents of Kakau Daji Village, Chikun Local Government Area, Kaduna State, Nigeria. It was revealed that that 34% of the respondents harvest 4-6 bundles of fuel wood with their family members in a week. This showed that most households would collect 16-24 bundles of fuel wood in a month. The rate of collection of fuel wood will result to increased deforestation and extinction of some tree species in the local communities. Fuel wood is preferred by most rural people and many urban dwellers during festivals and ceremonies and special preparations. It is mostly preferred because of its cheapness and availability, compared with conventional fuels. The use of wood fuel for cooking has resulted in large scale deforestation, environmental degradation, loss of biodiversity, climatic problems and natural disasters.

Conclusion

This research was accomplished through intensive and extensive literature review. The data were generated through questionnaire administration thereby contributing to the needed knowledge for planners, managers and policy developers. Shiroro Local Government Area is experiencing massive fuel wood collection and harvest. This has resulted to decline in some tree species, change in land use and

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modification of the biophysical components of the environment as well as loss of ecosystems.

However, findings revealed that more women are engaged in harvesting of fuel wood due to intensive farm practice carried out in the study area. The study revealed that greater number of people in the LGA practice fuel wood collection because it was available and accessible by a good number of the people. The late and early dry seasons were the periods of the year with the greatest harvest of fuel wood and majority of the people harvest 4-6 bundles of fuel wood with their family members in a week. Also, the Iron and Locust Beans Trees were the highest harvested fuel wood in Shiroro Local Government Area thereby leading to intense decline of the tree species. There is high level of unregulated fuel wood collection and harvest in the study area thereby resulting to massive evacuation of important tree species that could be of medicinal values. If the rate of fuel wood collection and harvest continues unattended by government intervention over time, there is going to be consequential changes in the land, water and atmospheric characteristics of Shroro Local Government Area. It is urgent time to provide alternative energy, government to regulate deforestation practice, education and sensitization of local community people on the regulation of fuel wood harvest, practice of tree planting and alternative employment opportunities to local community people.

Competing Interests

Authors have declared that no competing interests exist.

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