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ANALYSIS OF DISTRIBUTION PATTERN OF FUEL WOOD AND CHARCOAL IN ZARIA LOCAL GOVERNMENT AREA, KADUNA STATE, NIGERIA

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ABSTRACT

Energy use is an essential requirement for socioeconomic development of any society. This research aimed at analyzing fuel wood and charcoal distribution pattern in Zaria Local Government Area Kaduna State Nigeria. The aim was achieved through the following objectives which are to: identify the distribution of fuel wood depots in the study area; analyse the distribution pattern of fuel wood in the study area and examine the seasonality, time and mode of fuel wood distribution in the study area. This research used both quantitative and qualitative method in data analysis. Findings from the research revealed two types of fuel wood vendor depots exists in the study area which are classified as either major or minor types which shows that fuel wood vendor depots are mostly concentrated around the residential areas especially within the built-up land, also, charcoal is mostly sourced around Kachia and Lokoja Abuja Express way. Results from in-depth interview with the fuel wood vendors indicates that there are two types of fuel wood vendors: the mobile and the stationary vendors. It has been recommended in this study that the Government should come up with a policy guidelines to regulate and sanitise the number of minor fuel wood depots in the study area for a cleaner, safer and regulated environment. The relevant authorities should promulgate penalties for violators of the policy guidelines in order to ensure that the environment is kept safe from soil degradation as a result of the activities of the fuel wood depots and environmental pollution.

Keywords: Distribution, Pattern, Fuel Wood, Charcoal, Zaria.

INTRODUCTION

Energy use is an essential requirement for socioeconomic development of any society. It is required for lighting, stationary/mobile engines operation, and cooking, heating and other socio-economic activities (FAO, 2005). The energy demand of a country is determined by its population size, socio-economic advancement, and level of urbanization (Sule, *et al.*, 2014). Burning of wood is currently the largest use of energy derived from a solid fuel biomass (FAO, 2016). Fuel wood can be used for cooking and heating, and occasionally for fuelling steam engines and steam turbines that generate electricity. According to Ismai'l, *et a.l,* (2014) Fuel wood refers to any tree or wood material which is combustible and can be used as fuel and may be available as firewood. These, according to FAO (2016) may include: logs, bolts, and blocks; charcoal, chips, sheets and sawdust. Fuel woods represents one third of the global renewable energy consumption, where more than two billion people depends.

Distribution pattern of fuel wood as considered in this study consists of its mode of conveyance from the point of sourcing to the end users. This could be either directly by

the users from family farmlands, plantations, forests etc. or indirectly from fuel wood vendors selling at the markets, wood depots or house to house supplies to the consumer (Adeyemi and Ibe, 2014). In most urban centers of developing countries, most fuel woods are conveyed by truck at a central depot, before being split, bundled and distributed through a chain of local wood piles, itinerant retailers and smaller neighborhood piles from where end users buy from. This process is usually uncontrolled, but competitive and cost-efficient to the dealers who usually sell to the end users (Cline-Cole *et al.*, 1987; Ibrahim, Aliyu and Ibrahim, 2013).

Researches indicate high dependent on the use of fuel wood as major source of heating energy has been recognized as one of the major drivers of biodiversity loss as well as a threat to the existence of the global ecological problem, (Audu, 2013). In Nigeria, for instance, there has been a consistent rise in the number of fuel wood users across the country over a decade as a result of high cost of other alternative sources of household energy and increasing population. This has also brought about diversification in the consumption and distribution patterns of this valuable commodity (fuel wood) (NPC, 2009).

It's evident that the issue of interest here is that, most of the previous studies such as Abdul Hadi, (2016). Adeyemi and Ibe, (2014). Ismai'l, *et a.l,* (2014). Audu, (2013) and Ibrahim, Aliyu and Ibrahim, 2013). paid more attention on fuel wood consumption and exploitation while completely neglecting the distribution pattern which to a large extent determines accessibility of the fuel wood to consumers as well as the level of impacts on vegetation cover, it's in view of the above mentioned fact that this research aimed at analyzing fuel wood and charcoal distribution pattern in Zaria Local Government Area Kaduna State Nigeria. The aim will be achieved through the following objectives which are to: identify the distribution of fuel wood depots in the study area; analyse the distribution pattern of fuel wood in the study area and examine the seasonality, time and mode of fuel wood distribution in the study area.

The Study Area

The study area Zaria Local Government Area is located between Latitudes 10°56"N and 11°80'N of the equator and Longitudes 7°42'E and 7°53'E of the Greenwich meridian. Zaria is the second largest city in Kaduna State consisting of six districts, namely: Birni Da Kewaye (Zaria town and its environs), Dutsen Abba, Gyallesu, Tudun Wada, Tukur Tukur, and Wucicciri (the-nigeria.com, 2011). The study area is made up of thirteen (13) wards including; Anguwan Fatika, Anguwan Juma, Kaura, Kwarbia A, Kwarbia B, Limancin Kona, Dambo, Dutsen Abba, Gyallesu, Kufena, Tudun wada, Tukur-Tukur and Wucicciri. Zaria covers a total land area of 563 km² with an altitude of about 762 meters above sea level (Ogunleye, 2006). Zaria is 156 km south-west of Kano, 84km north-east of Kaduna (Mortimore, 1970). The study area is bounded to the south by Igabi LGA, to the north by Sabon Gari LGA, to the west by Giwa LGA and to the east by Soba LGA (See Figure 1).

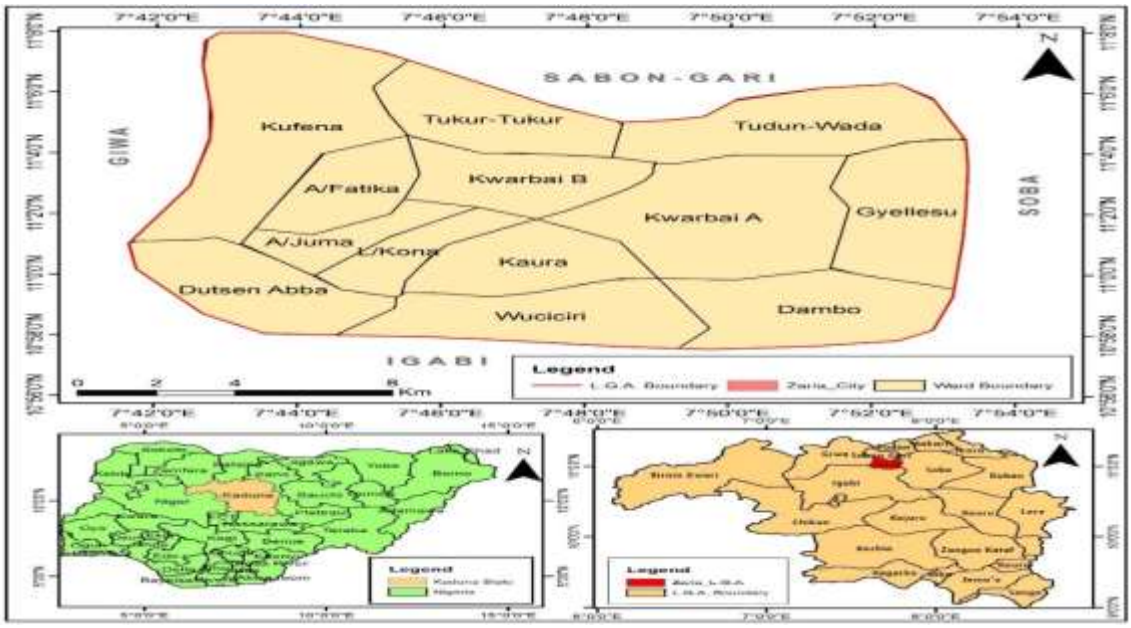

Figure 1: Zaria LGA (Study Area)

Source: Modified From the Administrative Map of Kaduna State (2016).

MATERIALS AND METHODS

This research used both quantitative and qualitative method in data analysis. In order to achieve the stated objectives, 1991census population figure of the study area, which provides data at both LGA and ward level was adopted. The sample size of the study is drawn from the projected population of Zaria, using the NPC (2006) population projection formula adopted to project the population data to the year 2016. This put the population figure of the LGA at 548,493. However, Yamane (1967) ormula of calculating sample size was adopted at 95% confidence level and 5% sampling error giving the sample size of 400 for the study. Therefore, a total of 400 copies of questionnaire were administered to the respondents in the study area. The questionnaire was administered proportionate to the population figure (projected) of each of the 13 wards.

$[Po=P1\ (1+r)^{n}]$

Where Po= projected population,

P1= Initial population,

r= Growth rate (at 3%)

n= Number of years projected

$$n = \frac{N}{1 + N(e)\ 2}$$

Where: n= sample size

N= NPC Estimated population figure = 548,493

e=level of significance (set at 0.05 for this study)

$$q = \frac{n\ x\ 400}{N}$$

Where n= sample size (copies of questionnaire)

n=Population of each ward

N=Projected population figure of the study area.

To select respondents from each of the thirteen (13) wards, a systematic random sampling technique was used which involved sampling the 1st, 5th, 10th 15th 20th etc. (an interval of 5) houses in each streets of the wards. This was done to ensure an unbiased and proportional spatial coverage of responses across the study area. Some of the data collected include: main source of household heating energy and form of fuel wood; the method(s) of fuel wood sourcing and frequency as well as means of conveyance to consumers etc. Out of the 400 copies of questionnaire administered

only 384 returned completed. Responses were encoded in SPSS software version 23 and the results analysed and presented using simple descriptive statistics such as frequency tables, percentages and maps. The results were presented in form of tables and maps. Also, an In-depth interview was conducted to the fuel wood vendors at various wards within the study area. This was done to data on sources of fuel wood, mode of sales and distribution pattern.

RESULTS AND DISCUSIONS

Distribution of fuel wood depots

Figure 1.2 show number of charcoal depots as well as categories of fuel wood depots and their percentages in the study area. These deports' location were mapped in order to understand the nature of their distribution.

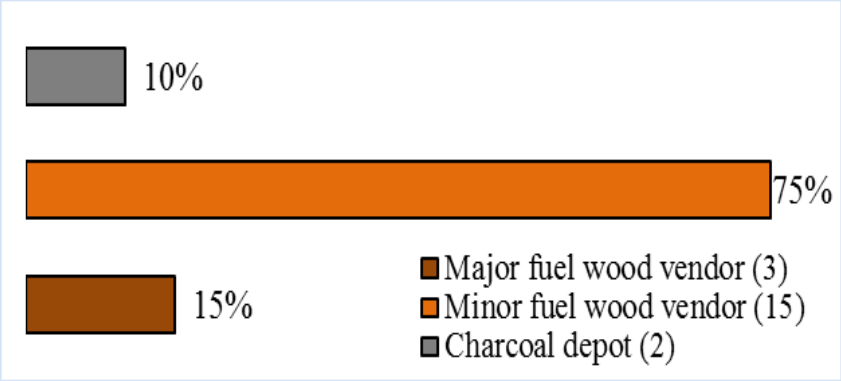

Figure 2: Category of Fuel Wood Depots in Zaria

Source: Field Survey, 2018

From Figure 1.2, two types of fuel wood vendor depots exists in the study area which are classified as either major (i.e. large assemblage, splitting and tying points of woods originally sourced from far distance forests and resold to minor vendors) or minor (i.e. small piles of woods selling mainly to the final consumers) types. This result is in line report with the study of Abdul-Hadi, (2016) on the analysis of the Impact of fuel wood consumption on vegetation cover in Zaria and its environs, Kaduna state, Nigeria. The former encompasses three (3) fuel wood vendor depots representing 15% of the total depots in Zaria. Whereas the latter dominates with 15 (75%). There are also 2 charcoal depots representing 10% only.

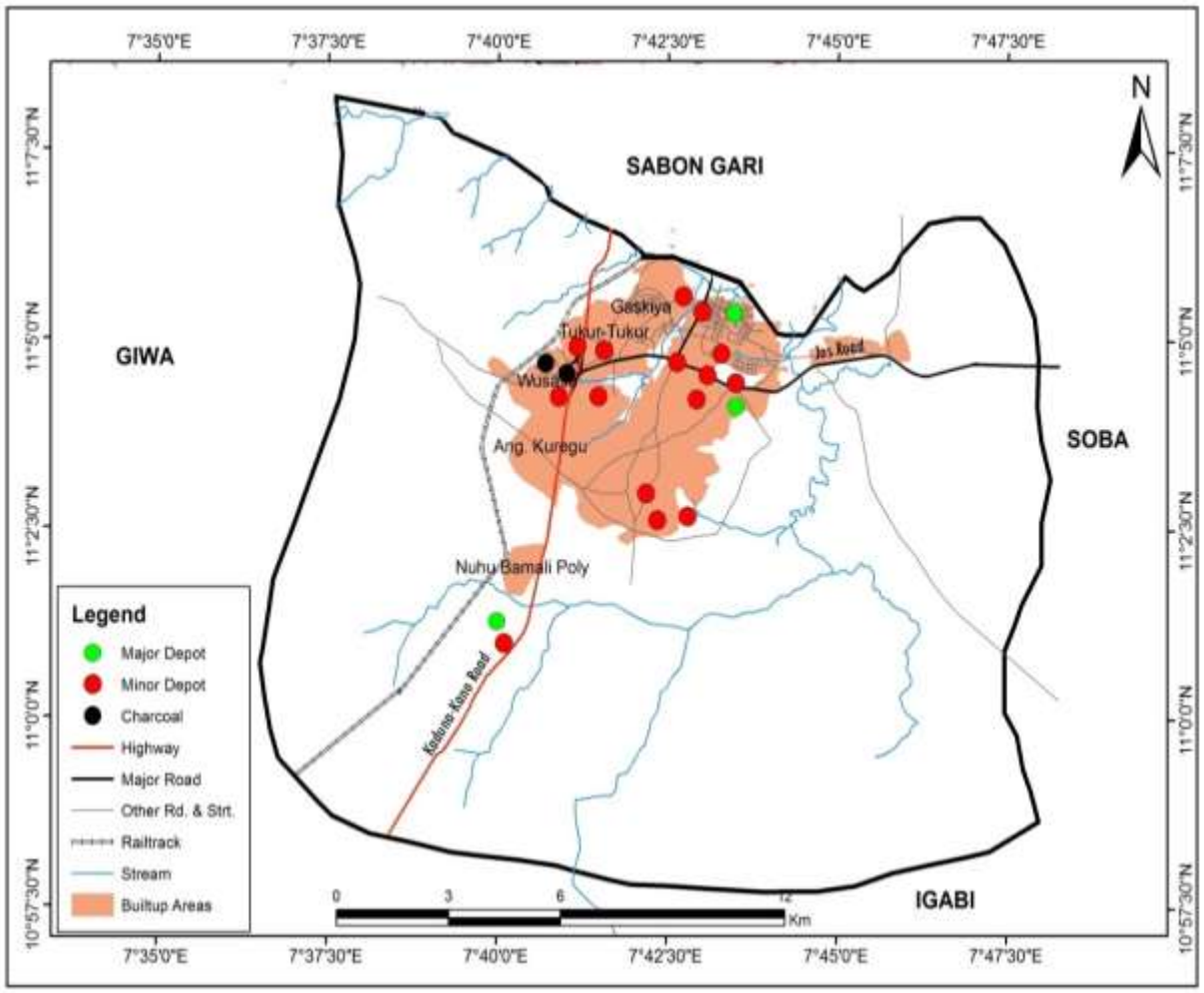

Figure 3 Fuel wood depots in the study area

Source: field survey, 2018

Figure 3 indicated fuel wood depots in the area. Their spread in the study area is found to be concentrated around the residential areas, with concentrations mostly around the built- up land. Whereas, the charcoal depots are located at Wusasa area. This shows that fuel wood vendor depots are mostly concentrated around the residential areas especially within the built-up land which makes it easily accessible to the consumers who may find it difficult to source theirs from the forests or farm lands.

Results from in-depth interview with the fuel wood vendors indicates that there are two types of fuel wood vendors: the mobile and the stationary vendors, the mobile vendors convey and distribute (sell) fuel woods to the major stationary vendors sourced mostly from marketers in the neighbouring States as well as the thin forests around Birnin Gwari, Galadimawa, and Turunku areas. The minor depots obtain their fuel wood mostly by buying from the major depots as well as from the scanty forests within the study area especially in Kufena, Dembo and Dutsen Abba area. Also, charcoal is mostly sourced around Kachia and Lokoja Abuja Express way. In addition, large depots fuel wood dealers convey their logged woods sourced from the forests and external dealers to their depots by the mobile vendors through the use of large trucks and trailer (Roka), while minor dealers transport theirs using vans, wheel barrows etc.This result goes in line with the study of Isma'il, *et al* (2014) in a comparative study of the level of fuel wood utilization in-and-Around Ikara LGA of Kaduna State.

Distribution Pattern of Fuel Wood and Charcoal to Consumers

Figures 1.4 and 1.5 show the distribution pattern of fuel wood and charcoal supplies to final consumers from major and minor depots. The lines as reflected on the maps show how fuel wood is sold to end users from the various minor depots via the different available means of transportation.

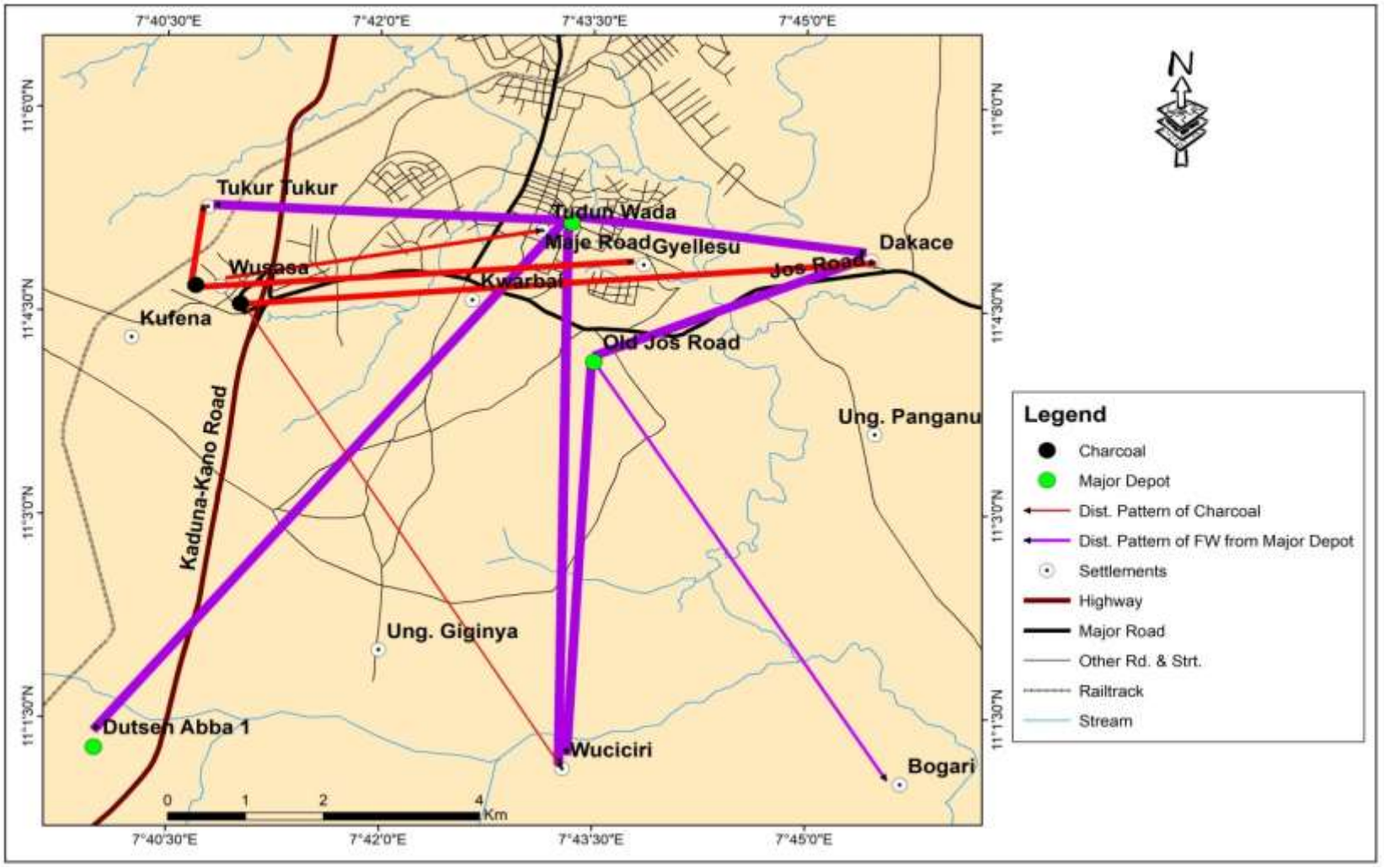

Figure 4 Flow Pattern of Fuel Wood and Charcoal from Major Depots in the Study Area

Source: Field Survey, 2018

Figure 1.4 shows a heavy flow (indicated with thick lines) of fuel wood from major depot at Tudun Wada to settlements around Wuciciri, Turkur Turkur and Dakace. It also shows high volume movement of fuel wood from depot at Old Jos Road towards Dakace and Gyallesu settlements as well as from depot at Dutse Abba towards Tudun -wada. On the other hand, there is a low volume flow from the depot at Old Jos Road to settlements around Tudun-wada. However, the distribution pattern of charcoal reveals high levels of distribution from depot 1 and 2 located at Wusasa to settlements around Tukur Tukur, Gyallesu and Dakace, while low distribution levels is found at settlements around Tudun wada and Wuciciri from both depot 1 and 2 located at Wusasa area.

Conversely, the distribution pattern of fuel wood from minor depots as reflected in Figure 1.5 shows that, there is a high supply of fuel wood from minor depot located at Jibga Road towards settlements around Tukur-Tukur, Unguwan. Bishar, Wusasa, Gaskiya etc. It also shows heavy flow of fuel wood from depot 1 and 2 at Tudun Wada into settlements at Dakace and Unguwan. Panganu. There is also heavy flow of fuel wood supplies from depots from Wusasa 1 and 2 to Tudun wada, Tukur-Tukur and Kwarbai respectively. The result also showed low flow of fuel wood supplies from minor depot located at Tudun wada 4 and 5 towards settlements at Unguwan. Panganu and Wuciciri as well as from depots at Dutse Abba towards Ung. Bishar, Tudun Wada, Gyallesu settlements etc. The end users purchase the fuel wood via trays, bicycles, tricycles, hands etc. This result is in line report with the study of Agarwal, (2019) on changes in fuel wood use and forest resources in Akwaibom State. This finding is also an indication that fuel wood vendors, using various means of conveyance (such as Keke napep, wheel barrows, carts etc) travel as far as into other neighbouring wards within the study area to distribute their goods to the residents. This implies that fuel wood distribution is a highly commercialized venture carried out mainly by wholesale and retail sellers.

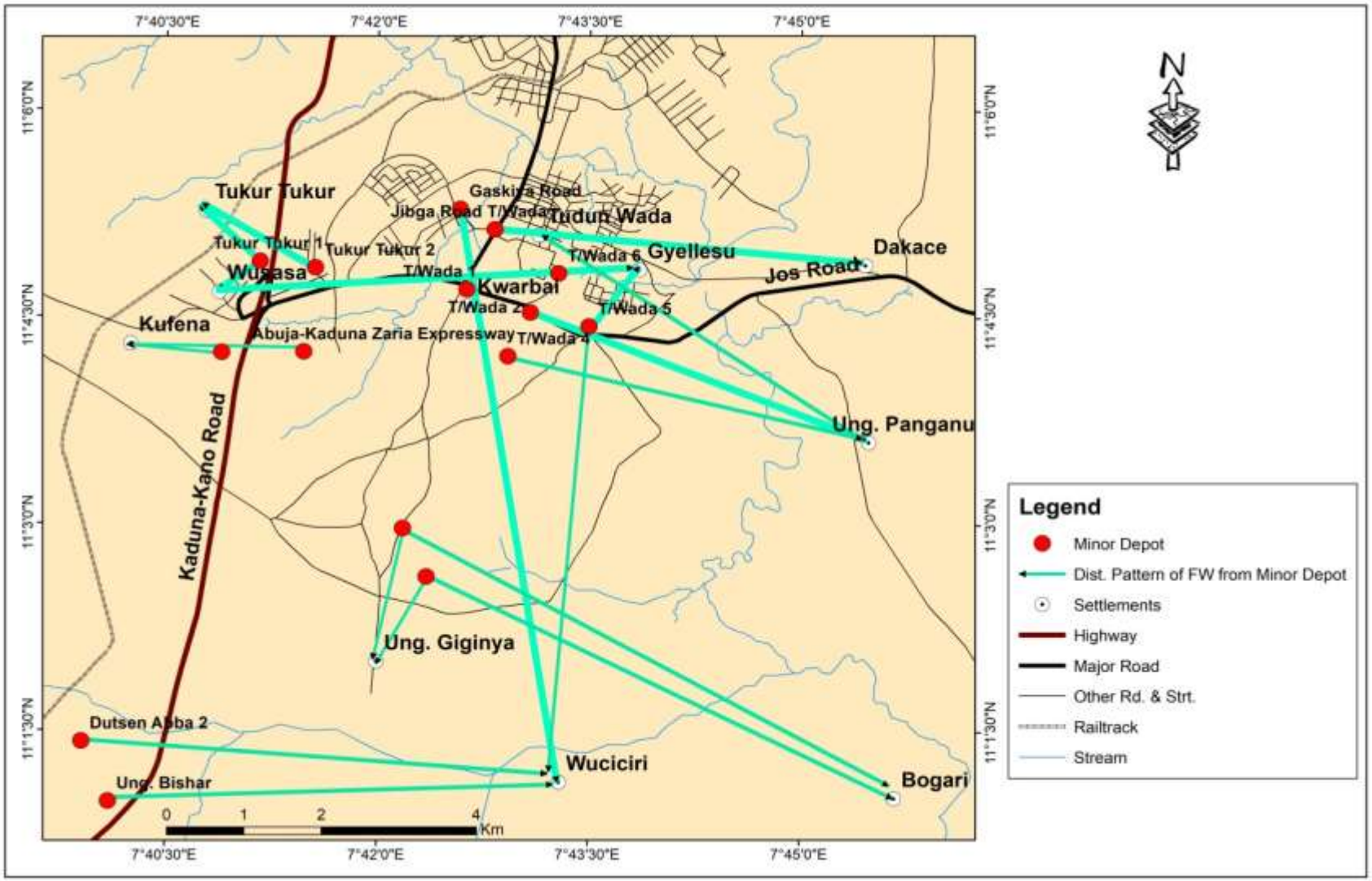

Figure 5: Distribution Pattern of Fuel Wood from Minor Depots in the Study Area

Source: Field Survey, 2018

Seasonality and Time of the day of Fuel Wood Distribution

Figure 1.6 shows the seasonal distribution pattern of fuel wood distribution in the study area. While, Tables 1.1 and 1.2 further show the percentage distribution of results from respondents on the time of the day and mode of fuel wood supplies by the vendors within the study area.

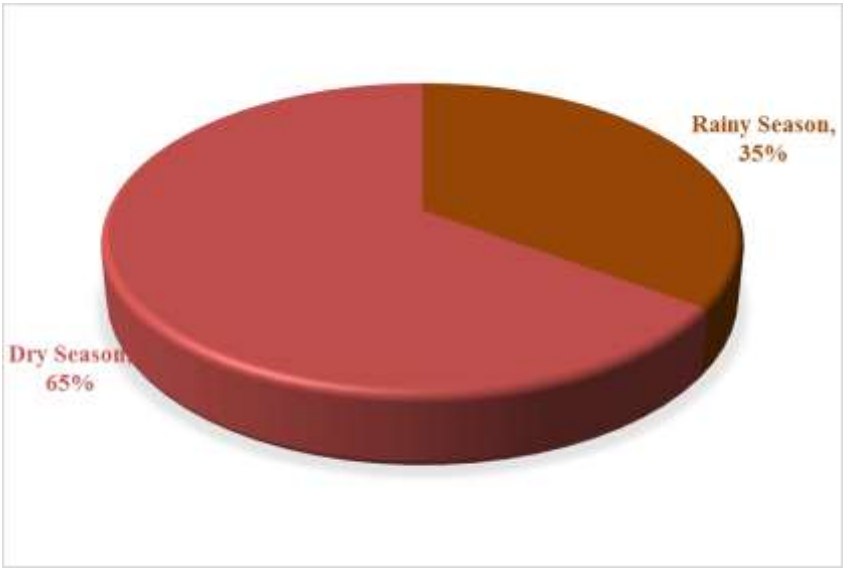

Figure 6: Seasonal Distribution Pattern of Fuel Wood

Source: Field Survey, 2018

Figure 6 showed that distribution of fuel wood by vendors was found to be higher during the dry season as indicated by 65% of the respondents. The low percentage of fuel wood distribution/supply by vendors during the rainy season may be attributed to difficulties in gathering dry wood directly from either the farm lands or forests as most farm lands would have been cultivated and dry wood scarcity in the forests. Hence, increase in fuel wood supplies to the users is on high demands from the users during the dry season. Conversely, the users might use charcoal during the rainy season to makeup the shortfalls from wood logs for energy.

Table 1: Time of the day and Mode of Fuel Wood Distribution by Vendors

Time of the day	Frequency	Percentage
Morning	121	31.5
Afternoon	82	21.4
Evening	55	14.3
Anytime	126	32.8
Total	384	100.0

Source: Field Survey, 2018

Table 1 indicated that fuel wood is mainly distributed to the consumers in the study area at any time of the day as indicated with the highest percentage (32.8%) of the respondents who attested to getting their supplies at any time of the day. This is followed by 31.5% respondents who receive their supplies during the morning hours. The predominance of distribution hours of fuel wood in the study area at "any time of the day" means that residents can afford to buy their fuel wood on the basis of household needs and the amount of financial resources available to them at any point in time. The implication of the fuel wood supply irrespective of time of the day might increase in per capita consumption as well as the exertion of unsustainable pressure on the vegetal resource by the vendors in an attempt to meet their demands and consequently endangering the forest through deforestation.

Table 2: Time of the day and Mode of Fuel Wood Distribution by Vendors

Mode of distribution	Frequency	Percentage
Pickup trucks	213	55.5
Wheel barrow	117	30.5
Animal pushcarts	14	3.6
Others	40	10.4
Total	**384**	**100.0**

Source: Field Survey, 2018

From Table 2 result indicate that pickup trucks constitute the main mode of fuel wood distribution in the study area as indicated by the highest percentage (55%). Result also showed that the least mode of fuel wood distribution is by the use of animal pushcarts with 3.6% which indicate it is an old mode of conveyance. The use of pickup trucks as the highest mode of distribution of fuel wood in the study area is due to the high demand of fuel wood for various domestic usages. This result is in line report on fuel wood distribution pattern in Kano State by Cline-Cole *et al.,* (1987), that fuel wood is distributed to final consumers through a chain of local wood piles, smaller neighbourhood piles and itinerant retailers via trucks, pick-up vans, wheel barrows etc.

CONCLUSION AND RECOMMENDATIONS

From the findings of the study, it can be concluded that two types of fuel wood vendor depots exists in the study area which are classified as either major (i.e. large assemblage, splitting and tying points of woods originally sourced from far distance forests and resold to minor vendors) or minor (i.e. small piles of woods selling mainly to the final consumers) types. This shows that fuel wood vendor depots are mostly concentrated around the residential areas especially within the built-up land which makes it easily accessible to the consumers. Results from in-depth interview with the fuel wood vendors indicates that there are two types of fuel wood vendors: the mobile and the stationary vendors, the mobile vendors convey and distribute (sell) fuel woods to the major stationary vendors. The minor depots obtain their fuel wood mostly by buying from the major depots as well as from the scanty forests within the study area. Also, charcoal is mostly sourced around Kachia and Lokoja Abuja Express way. In addition, large depots fuel wood dealers convey their logged woods sourced from the forests and external dealers to their depots by the mobile vendors through the use of large trucks and trailer (Roka), while minor dealers transport theirs using vans, wheel barrows and final consumers via trays, bicycles, keke napep, wheel barrows and cars. The distribution of fuel wood is mostly done by mobile or stationary vendors which is higher during the dry season and it happens at any time of the day. Findings from the research also shows that there is high flow of fuel wood distribution from major fuel wood depots to minor fuel wood depots including settlements around the major fuel wood depots and low flow from minor depots to settlements in the study area. Also, there is higher population in the three (3) wards (kwarbai B, kaura and tudun wada) where major fuel wood depots are located in the study area. Perhaps, population size is one of the determining factor for the location of the major fuel wood depots in the study area.

Based on the aforementioned findings the following recommendations can be made:

The Government should come up with a policy guidelines to regulate and sanitise the number of minor fuel wood depots in the study area for a cleaner, safer and regulated environment.

The relevant authorities should promulgate penalties for violators of the policy guidelines in order to ensure that the environment is kept safe from soil degradation as a result of the activities of the fuel wood depots.

Both Government and environmental protection agencies should embark on massive campaign against indiscriminate felling of trees for fuel wood and charcoal production by members of the public so as to reduce deforestation/vegetal loss in and around the study area.

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