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FUELWOOD POVERTY AND HOUSEHOLDS' ADAPTION IN JOS NORTH LGA, PLATEAU STATE, NIGERIA

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Abstract

It has been established that fuelwood is the primary source of energy throughout many of the poor countries for achieving domestic chores. This study was conducted in Jos North LGA of Plateau State, with the aim of determining the extent of fuelwood availability, access and how users adapt to unavailability in Angwan Rogo, Angwan Rukuba, Rikkos and Tudun Wada communities. Quantitative research design was adopted and simple random sampling was used to select 4 communties. Data were gathered by administering carefully designed copies of questionnaire to 318 household heads. Data collected were analysed using frequency counts, percentages and mean, aided by SPSS-23, while results were presented in tables. Findings have shown that more females participated in the study, and half of the participants were between 40-49 years old. Nearly all the participants completed various levels of formal education, married and have more than six household members. Many of the respondents earn livelihoods by engaging in non-primary activities, and majority of them belong to the low-to- middle income groups. Furthermore, results showed that anthropogenic activities have caused fuelwood poverty "to a great extent" (mean = 67.0%), of which 90.9% of households were heavily relying on fuelwood. Majority (50.9%) of the respondents averred that fuelwood supply to Jos currently used to come from Bauchi State, and 53.8% of the respondents affirmed that the decline in forest areas and importation of fuelwood from neighbouring States are clear evidence of the existence of fuelwood poverty in the study area. Overall, many (mean = 79.0%) respondents had to device various strategies to cope with fuelwood poverty in the area. The paper recommended the need for increased afforestation, use of improved fuelwood stoves, introduction of clean energy sources, and enlightening the public on best coping strategies in order to safeguard the environment from degradation.

Key words: Fuelwood poverty, Adaptation, Household, Jos North, Environment.

Introduction

Energy is key to development and poverty alleviation which is necessary for achieving the 15th objective of the United Nations' Sustainable Development Goal (SDG), which is to: "protect, restore and promote sustainable use of terrestrial ecosystems, sustainably manage forests, combat desertification, and halt and reverse land degradation, and halt biodiversity loss" (UNDP, 2013; Kroll, Warchold & Prajal, 2019). Wood as fuel has been in use for thousands of years, and still remains the primary source of energy throughout many of the poor countries of the world for performing essential activities to meet human energy needs (Gregory et al. 1999: FAO, 2000; Sangay, 2011). Burning of wood supplies energy needed to cook, heat, process and preserve food for human beings and some domesticated animals, hence it remains the most important renewable source of biomass energy for more than 2.7 billion people in poor countries, including Nigeria (Varinder & Prakash, 2014; IEA, 2014; Naibbi, 2015; Scheid et al., 2018). It accounts for 54% of global wood harvest per annum, and 80% of all household energy consumption in many poor countries of the world.

In India, the number of people relying on the traditional use of biomass for cooking is up to 855 million as at 2009, mainly due to population increase, rising cost of liquid fuels and global recession (Varinder & Prakash, 2014). The consumption of fuelwood in Africa was projected to have increased by 40% in 30 years (2000 - 2030), with about 700 million people depending on these inferior energy sources, while in Asia, more than 1,700 million people are expected to keep relying on fuelwood during the same period (Arnold & Persson, 2003; IEA, 2006; Sangay, 2011). In Sub- Saharan Africa, the production and use of biomass remains an important socio-economic activity, with more than 70% of the population relying on it as their primary energy source (Sola et al., 2016). Prediction shows that throughout the next decade, 2.3 billion people dependent on fuelwood as a source of energy will remain unchanged (Scheid et al., 2018). The rate of fuelwood consumption has been identified to vary due to differences in socio-economic activity, agro- ecological practices and geographical

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location (Bari et al. 1998; Pandey, 2002, Sangay, 2011). It has been established that households in temperate and elevated areas of the tropics like Jos Plateau use more fuelwood for heating, while in tropical lowland areas, fuelwood is generally used for heating (FAO, 1997; CIFOR, 2003, Rawat et al., 2009, Sangay, 2011).

'Fuelwood Poverty' as used here refers to shortage, scarcity, inadequacy, or deficit in fuelwood energy source, manifesting in the decline in forest areas, increase widening in circles of treeless areas around settlements, increased rising in the price of fuelwood, excessive pruning of economic trees, removal of whole life trees, and existence of fuelwood market centres. The word, 'adaption' is regarded as actions or measures taken by fuelwood users to cope with the adversity. Over-dependence on fuelwood and unmanaged harvesting is found to adversely affect the structure, growth and consumption of natural forest, and the future availability of fuelwood resource (Ghilardi et al., 2009; Sangay, 2011). This is because an increase in fuelwood collection can lead to degradation of forests and forested areas, which in turn can lead to physical fuelwood poverty (Scheid et al., 2018). Fuelwood poverty can occur when harvesting practices adversely affect the health and productivity of vegetation. Although coping strategies seek to alter or manage the cause of the problem, often, it is beyond the reach of households to address alone. The detrimental effects of fuelwood deficit and scarcity of alternative sources of energy are mostly felt by women (Aina & Adebiyi, 1998). This is because the fuelwood poverty has been found to impose time, financial cost and labour burden on households, and has linkage with poverty, health and education of the people, both directly and indirectly (Varinder & Prakash, 2014).

The bulk of Nigeria's forest production is for fuelwood, which is consumed directly as fuelwood or processed into charcoal. As at 2005, fuelwood production was estimated at over 61 million cubic metres, harvested mostly near urban areas as logs, bolt, blocks, chips, sheets, pellets, twigs, branches or saw dust (Makinde, 2018). Due to continued fuelwood poverty particularly in Jos North LGA, urban households are developing strategies to cope with the adversity. However, Heltberg et al. (2000) and Scheid et al. (2018) have asserted that fuelwood poverty can adversely affect the nutrition of people in the society. This can happen when users of fuelwood omit or substitute dishes with low-valued nutritious foods. Therefore, given the importance of fuelwood as a cooking option in Nigeria, and Jos North LGA in particular, its supply source needs constant monitoring to avoid the peril of forest degeneration. As a result, fuelwood should be carefully managed and monitored to meet current demand and ensure sustainability. Its presence is vital for numerous purposes, which are essential to the immediate needs of the affected people in order to speed up recovery and build resilience to future shock events (Achoja, 2020).

A lot of literature exists on fuelwood shortage; Arnold et al. (2003) found fuelwood crisis symptoms in Africa and South Asia due to the decline in fuelwood supply and emergence of fuelwood markets, which was also confirmed by Cooke et al., (2008). Several other scholars also found a change in socio-economic behaviour of households to adapt to fuelwood scarcity particularly, Brouver et al. (1997) for Malawi, Aina and Adebiyi (1998) for Nigeria, Ngugi (2002) and Mahiri (2003) for Kenya, Mlambo and Huizing (2004) for Zimbabwe, and Palmer and MacGregor (2009) for Namibia. Thus, the pressing research questions of concern are: What are the causes and extent of the fuelwood poverty being experienced by households in Jos North LGA? Where are the source regions for the supply of fuelwood? What are the known evidence of fuelwood poverty as identified by households in the study area? How do households adapt to the fuelwood poverty in the study area? The major aim of the study was therefore to examine fuelwood poverty and households' adaptation in Jos North LGA. The specific objectives were to: characterise the demographic and socio-economic status of the respondents in Jos North LGA, analyse the extent of fuelwood poverty, identify the source regions of fuelwood supply to the study area, assess evidence of fuelwood poverty, and how households' adapt to the poverty in Jos North LGA of Plateau State.

MATERIALS AND METHODS

Description of the Study Area

Jos metropolis is approximately found between latitudes 9°53'00"N and 9°58'20"N of the Equator; and between longitudes 8°51'30"E and 8°57'00"E of Prime Meridian (Fig. 1). It is a large city situated in central Nigeria, with an area of about 291km². The study area is surrounded by younger granite, aged 160 million years old, which intruded older granite rocks, the Basement Complex Rocks (Ezemokwe, 2011). Its average elevation is about 1,238m above sea level but with outcrops rising up to 1,300m in the North and Northeast axis. Jos lies within the Delimi River basin with the river flowing towards the North to empty its contents into Lake Chad, via River Yobe. The River experiences an annual flood, which sometimes destroys lives and property located on flood plains.

Jos metropolis falls within the Koppen's "Aw" climate type, characterized by two distinct seasons; wet

and dry seasons. The former starts from April through October, while dry season takes the remaining months of the year. The area experiences a near temperate climate, with temperature ranging between 20°C and 26°C. The rainfall total varies between 1,400 and 1,500mm per annum. In Jos, the wet season is warm, muggy and overcast, while dry season is hot and partly cloudy. The climate together with ferruginous tropical soils support Savanna vegetation, consisting of plenty grass, interspersed with deciduous trees. Although, there are wooded valleys in some parts of Jos, dotted with occasional hedges of cacti, and scattered trees. The open grassland is used for grazing and farming, particularly at the outskirts. Most of the original trees have been degraded due to anthropogenic activities, and the scanty original vegetation are only found in inaccessible hilly slopes, Government Reservation Areas (GRAs), the Jos Wildlife Park, Jos National Museum and Zoological garden as well as in areas where culture and tradition of the indigenous ethnic groups prohibit exploitation.

Jos North is a cosmopolitan, multi-cultural and diverse ethnic group of over 429,300 people (NPC, 2006). The city was originally occupied predominantly by indigenous ethnic groups including Berom, Anaguta and Afizere, but the discovery and commercial mining of tin and columbite led to the influx of mostly the Hausa, Yoruba, Igbo and European nationals (Makinde & Dung-Gwom, nd; Makinde, 2018). However, many other tribes of Plateau State such as the Rukuba, Irigwe, Ngas, Mwaghavul, Ron, Goemai, Gbogom and Taroh also reside in Jos, earning their livelihoods by engaging in the primary, secondary, tertiary and quaternary sectors of the economy.

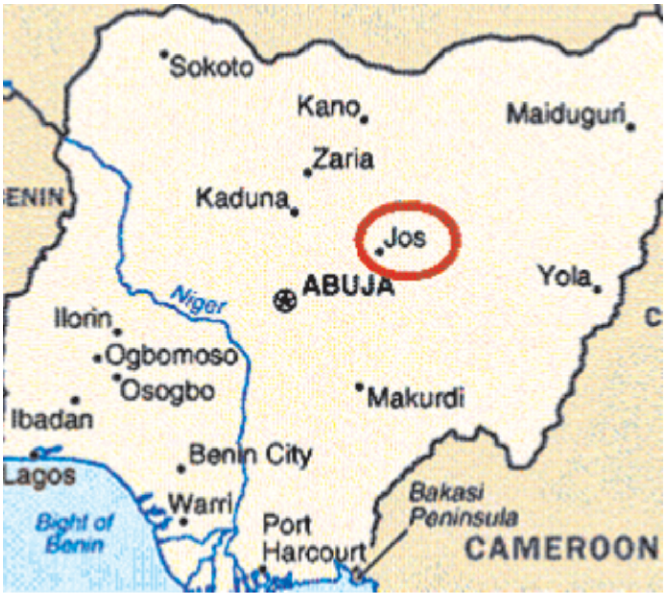

Figure 1: Jos North LGA (Makinde, 2018).

Methodology

Quantitative research design, involving the selection of sample respondents to represent the target households was adopted for the present study. Four out of fourteen electoral wards were selected through simple random sampling and same was adopted to choose a settlement each from the four selected wards as well as the sample size. The selected settlements, with varied households are as follows: Angwan Rogo with 972 households, Angwan Rukuba 246, Rikkos 219 and Tudun Wada 734.

The method adopted in the selection process involved writing names of all the fourteen wards in Jos North LGA on pieces of paper separately and alphabetically. Numbers were assigned to each ward and then collected into a plastic basket with a cover. The basket was thoroughly shuffled, and the first piece of paper picked from the basket was the one selected for the study. Thereafter, the process was repeated until the four wards were all picked. Of the four wards, a settlement was each picked randomly, and a total of 337 households were chosen out of 2,171 for the study. The chosen number represents 15.5% of the total households in these settlements. A sample size of 337 households was determined through the application of Krejcie and Morgan's (1970) formula:

$$S = X^2NP(1-P) \div d^2(N-1) + X^2P(1-P)$$

Where,

S = required sample size; X^2 = the table value of Chi-Square for 1 degree of freedom at the desired confidence level; N = the population size; P = the population proportion (.05); and d = the degree of accuracy expressed as a proportion.

Therefore, using the above formula to compute for 2,171 households 337 was obtained as respondents for the study. A semi-structured questionnaire was

constructed for data collection exercise, serving as the main instrument. This was supplemented by personal observations of fuelwood sale points and interviewing fuelwood vendors of the main supply regions. Reconnaissance was undertaken around December, 2022 and thereafter a pilot study involving the administration of 20 copies of questionnaire to households was conducted in the neighborhoods. This was done to detect ambiguous questions and difficult expressions respondents were likely to encounter, in order to make amends before drafting the final copy for administration to the selected household heads. The questionnaire contains two sections, A and B. Section A sought for respondents' information on personal demographic and socio-economic status, while section B focused on the causes and extent of fuelwood poverty, fuelwood source regions, evidence of fuelwood poverty and strategies adopted by households to cope with the poverty situation. The use of phrases like 'to a great extent'/'to some extent', and 'concur'/'not at all' were employed to enable respondents rate fuelwood poverty and adaptation strategies respectively.

A total of 337 copies of questionnaire were produced for administering to households heads. Four field assistants, from the Department of Geography and Planning of the University of Jos who speak both Hausa and English languages fluently were trained by the authors to help in the field. Copies of questionnaire were distributed proportionally to households in the four settlements. Angwan Rogo had 151 copies, Angwan Rukuba 38, Rikkos 34, and Tudun Wada 114. Heads of households were the target respondents, and whenever they were not available, any mature member of households were given the questionnaire to fill. A total of 318 copies of questionnaire, representing about 94.0% recovery were duly filled and returned, while the remaining 19 (6.0%) copies were partially filled, hence could not be used for analysis. Descriptive statistics was used for analysis, facilitated by Statistical Package for Social Sciences (SPSS) version 23 software. Data from the field were collated, summarised, and presented in frequency tables and percentages. Highlights of the findings were compared with those in the literature.

RESULTS

This section presents the analysed data, and discusses the findings of the study using descriptive statistics of frequency counts, percentages and mean Highlights of the finding were compared with those of the literature as well.

Demographic and Socio-Economic Status of Respondents

Personal information of the respondents in Jos metropolis are presented in table 1. Results have indicated that 54.4% of the respondents were female gender. Over half (50.9%) of the interviewees were within the 40- 49 age bracket, about half (49.7%) attained secondary, with only 10.1% of all the respondents without any formal education. This implies that about 90.0% of the respondents may not have problem filling the questionnaire, hence their responses are likely to be reliable, to a large extent. Further the result shows that over one-tenth (91.2%) of the respondents were married, with nearly two-thirds (64.5%) of respondents having more than 6 households members. About 55.7% of the respondents belong to the tertiary sector of the economy, providing services such as exchange of goods and services, transportation, communication, and banking. However, 57.2% of the respondents belong to the middle-income group followed by 36.5%who are in the low-income category. The preponderance of low income households implies that many of the respondents would be adversely be affected by fuelwood poverty.

Causes and Extent of Fuelwood Poverty

Table 2 shows the causes and extent of fuelwood poverty in the study area. Of the total respondents (318), two-thirds ($\bar{\chi}$=67.0%) identified anthropogenic activities as the cause of fuelwood poverty and was rated "to a great extent", with only 33.0% of the entire respondents rating the magnitude as "to some extent". Results also revealed that the fuelwood poverty is caused mainly by over-dependence of households on fuelwood (90.9%). The present finding exceeds the 69.0% of Jos reported in 2018 (Maton et al., 2018).

Fuelwood Source Regions

Analysis of supply of fuelwood to Jos for domestic chores has been presented in table 3. The result shows that the bulk of fuelwood being supplied to Jos presently used to come from Bauchi State (50.9%), followed by Kaduna State (22.3%), Nasarawa State (11.0%), Plateau State (5.7%) and other areas (1.6%). This implies that there is a decline in forest areas in Jos North LGA, hence creating "fuelwood gap" which has to be filled by importation from the neighbouring areas that have in abundance. The present results are, to some extent in agreement with Makinde and Dung-Gwom (undated) and Makinde (2018) who reported that 70.0% of woodfuel supply to Jos came from Toro LGA of Bauchi

State, while the remaining 30% came from Wamba LGA of Nasarawa State, Binchin Forest in Sangal LGA of Kaduna State, Kaltungo LGA of Gombe State and other areas.

Table 1: **Demographic and Socio-Economic Status of Respondents (N = 318)**

Variables	Respondents	
Genders:	Frequency	%
Male	145	45.6
Female	173	54.4
Age (Years):		
< 30	13	4.1
30- 39	19	6.0
40 - 49	162	50.9
50 - 59	70	22.0
60 +	54	17.0
Education Level:		
Non formal	32	10.1
Primary	77	24.2
Secondary	158	49.7
Post Secondary	51	16.0
Martial Status:		
Married	290	91.2
Unmarried	28	8.8
Household size:		
<4	15	4.7
5-6	98	30.8
>6	205	64.5
Main Occupation:		
Primary	12	3.8
Secondary	103	32.3
Tertiary	177	55.7
Quaternary	26	8.2
Income group:		
Low	116	36.5
Middle	182	57.2
High	20	6.3

Source: Fieldwork, 2022

Evidence of Fuelwood Poverty Known to Respondents

Table 4 is a reflection of households' responses to fuelwood poverty in Jos North LGA. In decreasing order of magnitude, respondents noticed as proofs to fuelwood poverty: decline in forest areas and increasing importation (53.8%), emergence of fuelwood market centres (19.5%), increase rise in the price of fuelwood (11.9%), and scarcity of some fuelwood tree species particularly, *prosopis africana* (local name is "marke") (6.9%). While excessive pruning and felling of whole life trees (4.4%), and reduction in frequency of fuelwood use (3.5%) were not very familiar evidence of fuelwood poverty to some respondents. Evidence of fuelwood poverty as contained in table 4 is in concord with symptoms of fuelwood poverty earlier reported in the literature by several scholars, including Aina and Adebiyi (1998), Mahiri (2003), Palmer and MacGregor (2009) and Akther (2010).

Table 2: Causes and Extent of Fuelwood Poverty

Causes	To a great extent		To some extent	
	Freq.	%	Freq.	%
Over-dependence on fuelwood	287	90.9	29	9.21
Population pressure	277	87.1	41	12.9
Agricultural practices	259	81.4	59	18.6
Industrial explosion	247	77.7	71	22.3
Unsustainable fuelwood production	231	72.6	87	27.4
Demand exceeds supply	227	71.4	91	28.6
Construction work	207	65.1	111	34.9
Emerging fuelwood markets	103	32.4	215	67.6
Charcoal production	85	26.7	233	73.3
Mean	214	67.0	104	33.0

Source: Fieldwork, 2022

Table 3: Main Fuelwood Source Regions

Main region	Freq	%
Bauchi	162	50.9
Kaduna	71	22.3
Nasarawa	35	11.0
Gombe	27	8.5
Plateau	18	5.7
Others	5	1.6
Total	318	100

Source: Fieldwork, 2022

Households Strategies Adaptation

Data on households' coping strategies to fuelwood poverty were analysed and presented in table 5. Overall, majority (mean = 79.0%) of the respondents had to "concur" in order to cope with fuelwood poverty including buying of fuelwood from the market, reducing

the frequency of using fuelwood, extinguishing fire immediately after cooking, modifying fuelwood stoves to heat faster, using combustible materials, increasing labour for fuelwood gathering and reduction in fuelwood use and cooking meals. In spite of the adaptation measures taken by many households, few (mean = 21.0%) rated some of these measures as "not at all" necessary

Table 4: Evidence of Fuelwood Poverty

Evidence	Freq	%
Forest areas decreasing	171	50.9
Emergence of fuelwood markets	62	19.5
Increasing price of fuelwood	38	11.9
Scarcity of some tree species	22	6.9
Excess pruning & cutting trees	14	4.4
Others	11	3.5
Total	318	100

Source: Fieldwork, 2022

Table 5: Households Strategies Adaptation

Strategies	Concur		Not at all	
	Freq.	%	Freq	%
Purchase fuelwood from vendors	293	92.1	25	7.9
Reduce frequency of fuelwood use	284	89.3	34	10.7
Extinguish fire immediately after cooking	281	88.4	37	11.6
Use available crop residues	278	87.4	40	12.6
Modify fuelwood stove to heat faster	272	85.5	46	14.5
Use combustible refuse materials	269	84.6	49	15.4
Soak hard-to-cook food/substitute food	211	66.4	107	33.6
Increase labour for fuelwood collections	189	59.4	129	40.6
Reduce number of cooking meals	194	57.9	134	42.1
Mean	251	79.0	67	21.0

Source: Fieldwork, 2022

Conclusion and Recommendations

The study was conducted in Jos North LGA, with the aim of examining fuelwood poverty and how households used to adapt and cope with the situation. It was discovered that fuelwood poverty exists "to a great extent", which is clearly shown by the rapid decline in forest areas and importation of fuelwood into Jos city from neighbouring states to augment the shortfall. Conscious of this fact, many households have taken measures to cope, which if there is no immediate interventions, households' nutritional and environmental conditions will be adversely affected in the long run. Sequel to this, the following recommendations are proffered:

1. There is need for households to be assisted by the Government, NGOs and philanthropists with wood-stoves that can improve fuelwood burning efficiency in order to save fuelwood, trees and the environment from dereliction.
2. There is need for the Government to intensify tree-planting programmes and encourage individuals to do same in order to ensure sustainable fuelwood supply.
3. There is need for the Government to subsidise prices of clean energy types and make them accessible to households.
4. There should be public enlightenment campaigns to encourage fuelwood users on how they can identify existing coping strategies within their disposal to improve on the efficiency of fuelwood combustion in Jos North LGA.

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