



Assessment of Fuel Wood Consumption Among Rural Households in Michika Local Government of Adamawa State, Nigeria

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ABSTRACT

Although fuel wood is an important and the cheapest source of fuel to many rural and low-income earners, it affect the natural vegetation, destruction of the ecosystem and it led to a lot of land degradation including soil erosion, air pollution among others. The objective of the study was to assess the fuel wood consumption among rural households in Michika LGA of Adamawa State. The factors affecting fuel wood consumption were analyzed. The challenges of sourcing the fuel wood were identified. The environmental effect of the fuel wood consumption was analyzed and the socio-economic effect associated with the strategies adopted to cope with the challenges faced during sourcing the fuel wood were identified. The data were generated by the use of questionnaire. 100 questionnaires were distributed but 80 was returned and was used for the study. Hence, the data were analyzed by simply statics by using tables and chats. The results reveal that fuel wood was slowly becoming unavailable and as such households had developed various strategies to cope with reduced fuel wood availability which include switching to the use of charcoal since it is affordable and readily available in virtually every shop in the neighborhood. The study recommends adoption of other sources of fuel like kerosine and biogas; provision of tree seedlings to promote afforestation; conservation and agroforestry, concessions; provision of solar and biogas equipment at affordable rate; improve access to energy efficient technologies; sustainable forest management and policy advocacy and implementation against tree exploitation.

Keywords: Charcoal, Fuelwood, Land degradation, Pollution, Rural households.

INTRODUCTION

Household is responsible for about 15%- 25% of primary energy use in many developing countries. Though in developing countries a large share is provided by non-commercial fuels that are often not reflected in official statistics. An estimated 2.5 billion people in underdeveloped nations rely on biomass fuels to cover their cooking needs. (Kabeyi & Olanrewaju, 2022) In many rural areas, fuels such as fuel woods, charcoal and agricultural waste constitute a major portion of a total household energy consumption (Zulu, 2010). The efficiency of a traditional fuel wood cooking stove is as low as 10-12%, compared with a Liquefied

Petroleum Gas (LPG) stove efficiency of more than 40% (Zulu, 2010) Harvesting of fuel wood contributes to deforestation, soil erosion, and desertification. In Nigeria, harvesting of fuel wood contributes to deforestation at a rate of about 400,000 hectares per year (Bedir, Hasselaar & Itard, 2013). Use of fuel wood as an energy source can also contribute to the accumulation of CO₂, the main greenhouse gas, both because burning fuel wood produces CO₂, and because deforestation destroys an important CO₂ sink (Bedir, et al., 2013). In addition, use of biomass fuel for cooking is a major cause of health problems in developing countries due to indoor air pollution (Perera, 2017). Energy is critical to the survival and expansion of any



economy, but in Nigeria, energy consumption has been skewed towards household use, and below thresholds for sector driven growth. Most of the energy consumes nowadays comes from hydrocarbons and with crude oil. Wood supply and consumption in Nigeria lead to large fuel wood deficit zones mainly in the north, while in some southern areas production exceeds consumption (Chidumayo & Gumbo, 2012c) (Ezzati, & Kammen. 2001). Therefore, a balance between annual re-growth and consumption has to be struck on a national level. According to the Forest Resources Assessment (2005) Country Report Nigeria, total wood removals from forests in 2005 amounted to 86,626,797m³ and removals for fuel wood from forests in the year 2005 were 72,710,935 m³, the difference being made up by industrial Round wood, which accounted for 13,915,862 m³ (Gram-Hanssen et al., 2004; Kabeyi & Olanrewaju, 2022). However, wood may also come from areas outside forests like scrubland, savannah and grassland as no data are available on these sources in Nigeria, a reasonable estimate has to be made. There exists a direct relationship between human population and wood fuel demand and consumption. The rate of consumption of fuel wood in Nigeria exceeds the rate of production. It is therefore right to say this renewable source of energy will sooner or later be scarce, should these forms of exploitation continue without replacement (Kabeyi & Olanrewaju, 2022).

Households in southwestern part of Nigeria are more associated with kerosene, like the traditional fuel wood usage in northern. For instance, kerosene is the dominant household cooking energy in Ogbomosho, a city in Southwest Nigeria, accounting for 43%, while fuel wood accounted for only 10% (Adebayo, 2004; Ogunniyi, Adepoju, & Olapade-Ogunwale, 2012). Similarly, a rural household survey conducted in Ogun state (also in the

southwest) revealed that kerosene was the dominant household cooking energy in the area, accounting for 79.2%. In many parts of Northern Nigeria however, several studies reveal that fuel wood dominates. Fuel wood accounts for 66.7% of household energy in Katsina state (Adebayo, 2004). Also, a study in Gerei Local Government Area of Adamawa state, reveal the dominance of fuel wood in the area (Adebayo, 2004).

Important Theories which will Guide More In This Study

These are the "Energy ladder" theory; the 'Fuel stacking' theory, the urban household models and Agricultural household models. The 'energy ladder' theory has been a commonly used concept in explaining household fuel use in developing countries. The energy ladder depicts a process by which households, as their income rises, they move away from the use of traditional fuels (e.g., biomass), first to adopt intermediate fuels (kerosene, coal), and then to use modern fuels (gas, electricity). This is also proportional with increase with income of an individual (The Role of Energy in Economic Growth, 2015). The 'Fuel stacking' theory criticized the energy ladder theory on the grounds that it cannot adequately describe the dynamics of households' fuel use. Instead, they note that fuel stacking is common in both urban and rural areas of developing countries (Chen, et al., 2006. The Role of Energy in Economic Growth, 2015). Fuel stacking corresponds to multiple fuel use patterns where households choose a combination of fuels from both lower and upper levels of the ladder. Indeed, modern fuels may serve only as partial, rather than perfect substitutes for traditional fuels (Van der Kroon et al., 2013). Multiple fuel use arises from several reasons, such as, occasional shortages of modern fuels (Kowsari & Zerriffi 2011), high cost of appliances associated with using exclusively



modern fuels, fluctuations of commercial fuel prices (Change, 2023)) and preferences inducing households not to fully adopt modern fuels.

According to Edwards and Langpap (2005), urban household models set up household consumer models to describe the simultaneous consumption of non-commercial and commercial fuels in urban areas. Edwards and Langpap (2005) suppose that households maximize utility through the consumption of fuels, market good and stove. (Change, 2023: Perera, 2017) assume utility defined over consumption of fuels, food, health and other goods. Jones, et al., (2015), agricultural household models are well recognized in the rural households especially in developing countries. They often face absent or incomplete markets, not only for fuels (e.g., firewood, electricity), but also for agricultural products, labor and credit facilities. In the absence of market failure, a rural household may be seen as behaving firstly as a profit maximizing producer, and then as a utility maximizing consumer given the profit realized in the first stage. This study assessed household consumption of various energy in Michika and how it affects the environment and economic growth of the study area (Michika LGA 2024). In time past, vegetation has been good and the environment was conducive but due to the recent consumption of fuelwood among rural household in Michika LGA, it led to environmental degradation. Therefore, the intention of the study is to determine how the consumption of energy affects Michika environment and also how other sources of energy can be considered for consumption among the communities in Michika LGA. The aim of the study is to examine fuel wood consumption by rural households in Michika LGA of Adamawa State. The aim would be achieved through the following objectives: To determine the factors affecting fuel wood

consumption among rural households in the study; to identify the challenges faced in sourcing for fuel wood in the study area; to evaluate the environmental effects of fuel wood consumption in the study area; to find the socio-economic effects associated with the strategies adopted to cope with the various challenges faced in sourcing for fuel wood in the study area.

Description of the Study Area

Michika local government Adamawa state, Nigeria falls within the Basement Complex of the Northeastern Nigeria and covers an area extent of about 188.5km². Located at Latitude 10° 37' 0.0012" N and Longitude 13° 22' 59.9988" E of the Greenwich meridian. It is bordered in the east by Republic of Cameroon, in the North by Madagali local government, in the west by Askira/Uba local government area of Borno State, and to the south, it is bordered by Mubi North and Hong local government areas. Michika has total population of about 720,000 (NPC, 2006) Nigeria. Michika is made of nine districts namely Michika District, Nkafa District, Madzi District, Futu District, Garta District, Bazza/Yambule/Dakwa District, Zah/Ghye District, Vi/Bokka District and Sina/Kamale District (Adebayo, 2004). Major tribes are Kamwe called Higgi. They also have minor tribes like Margi, Kilba, Hausa and very few Fulanis. They are predominantly Christians with few Muslims and traditional worshippers. It has about 26 chiefdoms and 84 villages. It covers an area of about 822.3km² (2022 population projection), with a population of 239,400 (2022 population projection) and a density of 291.2/km². The population continue increasing from 2006 to 2023. The annual population changes are 2.7% (Michika LGA, 2024). It falls within the semi-arid climatic zone of Nigeria in Sub-Saharan Africa two distinct seasons; hot dry season from October to April and rainy season from April to October with

peak rainfall in August to September). Michika gets about 118.97 millimeters (4.68 inches) of rain each year and has 142.31 wet days (38.99% of the time) (Michika LGA,

2024).

The soil is of gravels, coarse sands, loamy and clayey. The yearly temperature is 31.77oC (89.19oF).

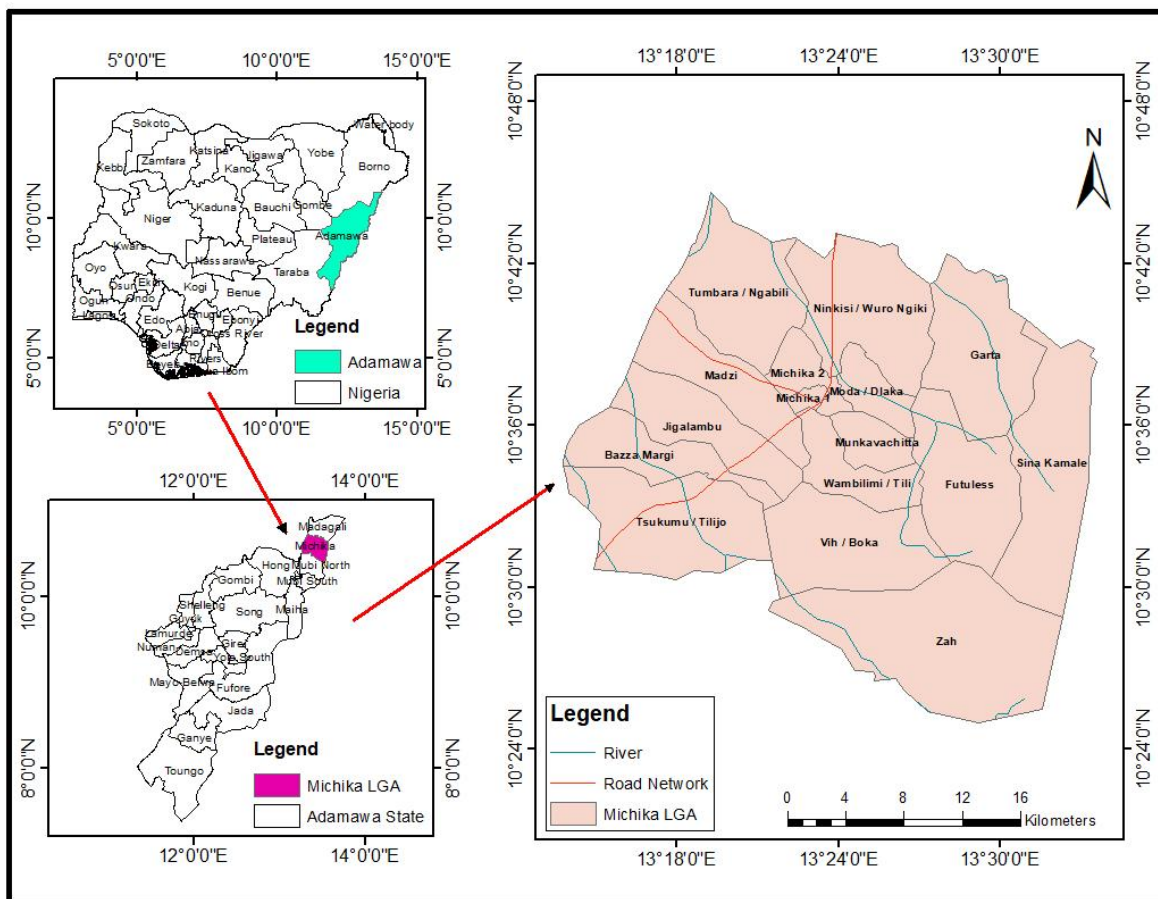


Figure 1: Showing Study area.

Source: Geography, GIS lab, federal University of Kashere, 2024.

MATERIALS AND METHODS

Method of Data Collection

Data were collected through questionnaire administration; 100 questionnaires were distributed but 80 were returned and used for the study. Published and unpublished materials on related literatures.

Data Types and Sources

The data used were mainly primary and secondary data. The primary data were obtained through distribution of a structured

questionnaire to obtain primary data. Secondary data were obtained from published and unpublished related materials.

Data Analysis

The data obtained were analyzed through the use of descriptive statistics of table, chats and simple percentages to standardize values for comparison purposes. The study calculated the proportion of respondents using a particular source of energy, proportion of respondents purchasing energy, proportion of households in each income bracket among others.

RESULTS AND DISCUSSION

Factors Affecting Fuel Wood Consumption

There are various factors affecting energy consumption in the study area which include the followings:

Price

The price of Fuelwood was an indicator of reduced fuel Wood availability. 75% of the

households use fuelwood while 25% use charcoal which leads to reduce in the amount of fuel wood consumed as a result of increase in prices. 30% of the households indicated that the prices of fuelwood had increased in the past one year while 70% of the households consuming charcoal indicated that the price of charcoal had increased in the last one year (table 1).

Table 1: Household size, purchasing price and increase in purchase.

Type Energy	Household size	Purchasing price	Increase in purchasing pice
Fuelwood	75%	30%	30%
Charcoal	25%	70%	70%

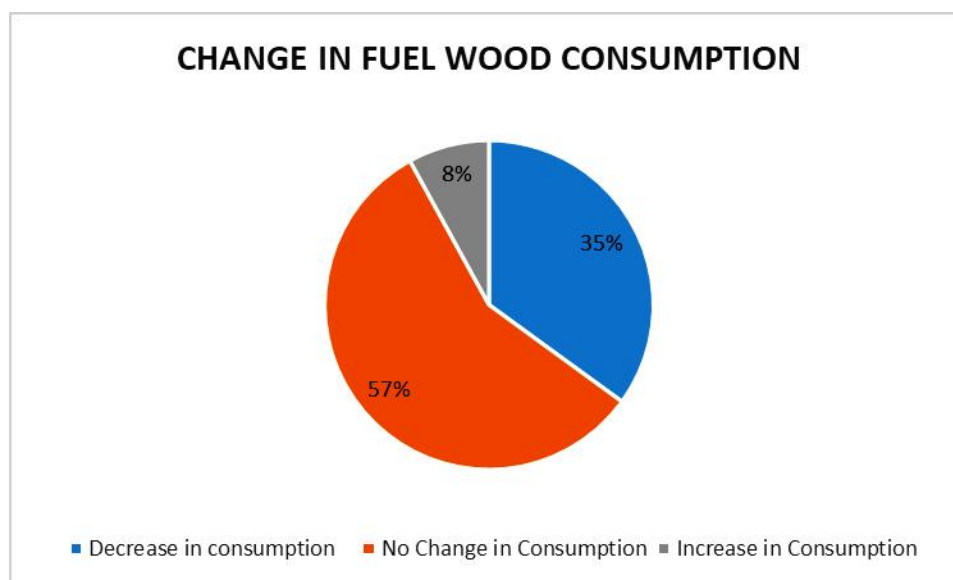


Figure 1: Change in consumption as a result of change in prices of firewood.

Table 2: Change in consumption as a result of increase in prices of charcoal.

Change in charcoal consumption	
Household size 25%	
No change in consumption	60%
Increase in consumption	5%
Decrease in consumption	35%
Percentage	100%

In household size of 25%, it indicates that 60% show no change in consumption. 5%

shows increase in consumption, while 35% shows decrease in consumption of charcoal (table 2). Again 35% shows decrease in fuelwood consumption, 57% shows no change in fuelwood consumption and 8% shows increase in fuelwood consumption (fig.1). Charcoal and firewood accounted for the largest sources of energy in the study area because it is more affordable by many. Price remained a challenge to rural households due to constant increase while the purchasing power remained low (The State of Access to Modern Energy Cooking Services, 2020) the



world bank has recorded similar scenario where the use of charcoal firewood still at high consumption because of affordability.

Challenges Faced to source for Fuel Wood-Distance

Charcoal is easily accessible to households because it is sold in the shops and it is supplied to the homesteads, hence distance is not a barrier to buy. 25% household purchase 70% and the increase in purchase is also 70%. Whereas, in the case of firewood, 75% of the household that uses fuel wood, the purchase is 30% while increase in purchase is 30%. The results indicates that the distance to access firewood has affected the rate of purchase which also affect its consumption compared to charcoal.

Environmental effects of Fuel Wood Consumption

The environmental effect of Fuel Wood consumption in the study area include: deforestation and land degradation, air pollution, climate change and health implication. Fuel wood led to unlawful harvest of tree leading to deforestation and loss of habitat and thread to biodiversity. It can also lead to erosion which causes loss of soil fertility and affect water cycle (Ogunniyi, 2012). Burning of fuel wood releases percolate matters which causes air pollution and health effect to humans. Burning of Fuel wood releases greenhouse gases like carbon dioxide and methane which affect climate change (Masera, 2000).

Excess of fuel wood consumption led to carbon emissions, exacerbating climate change. Deforestation can lead to land degradation which has the tendency to create feedback loops which accelerate climate change (Bruce, 2000). Burning of fuel wood indoors can cause indoor air pollution which affect respiratory sickness and other related diseases in humans. However, implementing sustainable forestry

practice and the alternative sources of energy use such as the use of solar, wind power, kerosene among others can minimize negative effect of fuel wood consumption on the environment and on man.

There are some socio-economic effects of strategies adopted to cope with the challenges of fuel wood consumption in the study area which include: economic implications; social implications; coping strategies and policy implications (Jones, et al., 2015). Economic implications include increase cost of buying alternative sources of fuel and buying from a distance market can both increase household expenses in other to meet up with the family demand. Loss of income can as well reduce access to fuel wood by low-income earner and those who depend solely on fuel wood trading or its collection.

Social implications include time in which both women and children may spend in collecting the fuel wood. This would affect their education and other leisure activities. Due to the burning of fuel wood, smoke and pollutants are expose to the atmosphere which affect human health. Coping strategies include diversification of sources of energy by adopting the use of some other sources of energy like solar or biogas or kerosene can reduce pressure on fuel wood. Again, by implementing energy efficient techniques can also reduce pressure on fuel wood consumption. Community led initiative like afforestation and sustainable forest management policies can also help to reduce unnecessary felling of trees for fuel wood (Jones, et al., 2015).

Good policies like energy policy include government policies to promote sustainable energy source and energy efficiency. Forest management means to ensure long term fuel wood availability for mankind. Poverty reduction simply means addressing poverty



and promoting economic development which reduce reliance on fuel wood and associated challenges of fuel wood consumption in the study area.

CONCLUSION

From the findings of the study, the following conclusions were made; Fuel Wood is the leading source of energy in the study area. Fuel Wood consumption led to major cause of deforestation. Majority of the households in the study area are low-income earners who has little or no ability to buy alternative source of fuel like solar, kerosene among others. The environment is being depleted continually by reliance on fuel wood as a major source of energy. The results in table 3, which in household size of 25%, indicates that 60% shows no change in consumption. It further shows 5% increase in consumption while 35% shows decrease in consumption of charcoal. For fuel wood, 75% use fuel wood while 25% use charcoal. Purchase of charcoal increased from 25% to 75% while fuel wood reduces from 75% to 30% in last year. This is likely due to the availability of charcoal in almost every shop around the houses and possibly due to the distance to cover in order to access the fuel wood. Changes in fuel wood consumption in household of 75% shows that decrease in consumption is 35%. No change in consumption shows 57% while increase in consumption shows 8%. Changes in charcoal consumption in household size of 25% shows that no changes in consumption shows 60%. Increase in consumption shows 5% while decrease in consumption shows 35%. There are some socio-economic effects of strategies adopted to cope with the challenges of fuel wood consumption in the study area which include: economic implications; social implications; coping strategies and policy implications.

Recommendations

Based on the findings of the study, the results shows that the major sources of fuel in the study area is charcoal and fuel wood. It also reveals that felling of trees for fuel wood or charcoal has a lot of environmental and health changes for man and the environment. Hence the study recommends that:

Promotion of Alternative Energy Sources like LPG, solar, and biogas more affordable for low-income households. Reducing taxes on the alternative sources of energy or providing financial assistance to help households.

People should be educated on health benefits and environmental impact of fuel wood consumption. There shall be provision of community-based renewable energy projects, such as solar power initiatives, which can provide a sustainable and collective source of energy for rural households and improved access to Energy-Efficient Technologies: promotion and distribution of energy-efficient cooking stoves that require less wood fuel and produce less smoke. This will not only reduce the amount of fuel wood needed but also improve indoor air quality, reducing health risks.

Sustainable Forest Management such as reforestation programs where fast-growing tree species should be planted to replenish the forest cover should be embarked upon. Community participation should be encouraged to ensure the success and sustainability of these programs. The government should also enforce policies that regulate the harvesting of wood for fuel, ensuring that it is done sustainably. This may include permits for wood collection and penalties for illegal logging.

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