

ECONOMIC ANALYSIS OF FUELWOOD CONSUMPTION IN YOBE STATE, NIGERIA

MUSA AUDU, ABATCHA MELEMI, BABAYO MUSA

Department of Economics and Development Studies, Faculty Management and Social Science, Federal University Gashua, Yobe State, Nigeria. Email: musaaudu208@gmail.com

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ABSTRACT

Since rural and urban poor areas in Nigeria depend mainly on fuelwood (Biomass) as their major energy source, this triggers fuelwood consumption and adversely affects the environment. The analysis focused on fuelwood production as a source of livelihood in rural areas of developing countries. The study employs a purposive sampling technique in selecting case study units within the study area. The selected units include Bade, Damaturu, and Potiskum, respectively. Their selection was based on the population's size and the state's zonal districts. Three hundred and ninety-five respondents from fuelwood collectors have been obtained through stratified and random sampling techniques. Data were collected using a questionnaire, focus group discussion, personal interview, and observations. The finding reveals that more than 85% of people living in the study area use fuelwood collection as their second major source of livelihood after farming. On identifying the importance of fuelwood collection, the study suggested encouraging massive campaigns on tree planting programs, coppicing practices, and applying protective rules safeguarding forests. On the other hand, provision of grant and empowerment projects, and access to modern fuels, among others. Thus, it improves people's ways of living in rural areas, encourages livelihood generation, reduces forest exploitation, and maintains environmental protection.

Keywords: Fuelwood, Consumption, Collection, Livelihood, Economics, Yobe state.

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INTRODUCTION

Fuelwood entrepreneurship enhances the socio-economic moat of rural people in rural communities across the globe. The adventure has been thriving and sustainable over the decades (Pallant and Lee, 2017). The products are purely forest resources, including wood for firewood and charcoal substances. Their trading system involves production/ collection, distribution and consumption (sales). The process has an inherent feature of the value chain concept. The fuelwood formation process involves modifying non-timber wood (trees) for human consumption; the products provide essential services such as a source of energy and employment. It is a rough form of wood that potentially provide all forms of energy requirements, including domestic and commercial uses such as baking bread, burning bricks, processing textile materials, and food processing and preservation, among others (Koul *et al.*, 2022). As a way of sustaining means of subsistence living, many households in rural communities remain fuelwood dependent for their socio-economic ways of life such as means of income generation and wealth creation, demographic formations including family size, household composition, among others, all these are attributed to the availability of traditional fuels and shortage of modern fuels (Safari *et al.*, 2019).

Forest products comprised of woods for firewood, charcoal, and other fuels are vital sources of livelihood in Nigeria's rural communities (Aneni, 2016). Many households dependent on fuelwood as a source of their energy; over 75% of the total energy used in Nigeria is wood-derived fuels, and 87% of the energy used in Africa is equally derived from wood (Muhammad *et al.*, 2022) The role played by NTFPs differs from one community to another depending on the contexts of the societies' global cultural and economic values. For instance, in developed societies, these resources are potentially used for the following purposes: Traditional and recreational activities, forest preservation and biodiversity and the rare aspects of rural economic development. On the other hand, in developing countries, particularly in Africa and Asia, NTFPs are major sources of income and subsistence living. Forest products are regarded as a safety net existing in developing countries to fill in the gaps due to shortfalls in economic activities. If not because of

less attention had been paid to NTFP-based activities, these resources could have enhanced the economic development of rural communities living around forest regions across the globe (Li *et al.*, 2019). As a result of fuelwood potentialities, its annual global production accounted for 1.86 million cubic meters. It provides different forms of energy requirements for residential and commercial uses, and it is also a source of employment opportunity which enhances livelihoods in rural and urban poor communities of developing countries (Pham *et al.*, 2020).

Fuelwood materials comprise all sorts of woody materials used for generating heat, light purposely for cooking and warmth. The substance consists of firewood and charcoal. Firewood looks rough and is directly burned to provide heat and lighting for different uses, while charcoal is extracted by burning wood fuel under a low-oxygen temperature. Charcoal is a black substance made mainly to produce heat resulting in energy for residential and commercial uses. It is produced in kilograms of energy compared to ordinary wood. Wood may refer to industrial fuel used for various purposes, such as welding, iron smelting, and food processing. Some industries use charcoal, some use sawdust, while others use logs of specific species to achieve precise temperatures. However, some materials collected as fuel wood are already dead, and the collection rate is typically below the regeneration rate (Nunes *et al.*, 2020).

Firewood and charcoal were recognized sources of traditional energy to humanity centuries ago. About 1.5 billion people living in rural and urban poor communities are yet to depend heavily on fuelwood. Overdependence on this source will persist for the unforeseeable future. Most of the world's fuelwood energy is consumed in rural households and small-scale rural industries. In many developing countries, the users of fuelwood energy depend largely on it for all their energy prerequisites. Their dependence varies widely in terms of usage between households and industries, averaging 40–50% but reaching much higher levels in some cases (Agency for International Development, 1980). Fuelwood production/harvesting played an essential role in the nation's economic development. Contributions of fuelwood to the rural sector economy depict various forms of economic

development; it encourages the livelihood pattern of the people's lives within the localities. The available estimate shows that 82% of the cooking and heating energy comes from wood generated by local communities, with few contributions of 11% and 7% from kerosene and other alternatives. Historically, wood has been the first energy source from the inception of human life, naturally, it was made for human use. Therefore human life is largely depending on energy for its existence (Nathaniel *et al.*, 2021). Fundamentally, livelihood is derived from a capital asset such as land, water, forest, and a clump of bushes and social factors comprising; community organization, family unity, norms and values, social qualities, participation, and empowerment that enhance human life through the acquirement of deserve knowledge for sustainable development for the well-being of the local communities. In the same sense, livelihood connotes activities such as entitlements, royalties, tributes, fines, and proceed derived through the ownership of capital assets by the members of a community in which people enjoy and sustain their means of living in rural communities. The level of capital asset ownership differentiates the pattern of livelihood enjoyment among the households; those who own a significant share benefit more than the ones with a small share in the same community (Carley and Konisky, 2020).

Arora (2019) United Nations Environment Programme (UNEP) Report fuelwood is obtained from wood-forest surroundings in rural and urban poor communities. Most of the wood is found in unmanaged forests, including savanna lands, clumps of nearby bushes sported around, and agricultural farmlands. Sometimes, governments and individuals use to develop plantation site programs aiding the production of firewood, assisting in meeting the required demands of rural and urban localities. Firewood, if always available and affordable considering its nature, is within a few km radius, and suppliers can obtain it via foot by the households for their consumption. Fuelwood is a major source of livelihood in most rural and poor urban areas of developing communities. Over 3 billion people living in developing countries depend on firewood for their primary sources of energy and means of employment. Despite fuelwood's vital role in human life's existence, its consumption is not without adverse effects on humanity (Pichler *et al.*, 2022).

Therefore, the study examines how fuelwood production/harvesting can influence the generation of livelihood means in rural areas of Nigeria, particularly concerning the study area of Yobe State. The research is therefore guided by the following thought-provoking questions such as: To what extent has fuelwood impacted the lives of people in rural communities? Is there any substantial economic benefit derived from fuelwood collection? There is a plethora of studies on the area under study, but none of these studies has assessed the relationship between fuelwood production/harvesting and livelihoods generation using variables such as; sex distribution, age distribution, level of education, size of household, quantity collected, seasonal variation, cost of labor, and transportation. Furthermore, these studies are separate from Yobe State. Based on this, therefore, the study was undertaken to meet up with these knowledge gaps. The purpose of this research is two-fold: To provide a description and analysis of the existing relationship between fuelwood collection and the socio-economic life of people in rural and urban poor communities, especially in the study area.

We are assessing the contributions of fuelwood collection on livelihood generation and economic development in the rural communities of developing countries. The procedure used by the study in undertaking this project consists of stages; reviewing previous related studies, identifying fuelwood usage through discussion with experts within the study area, describing the pattern of production, distribution and consumption of fuelwood in rural areas of developing countries, assessing programs developed by communities in resolving problems of fuelwood supplies, recognizing socio-economic aspects associated with the level of fuelwood use and designing appropriate ways in which rural communities derived desired benefits from fuelwood collection.

LITERATURE REVIEW

Most studies perceived fuelwood collection as a source of employment in rural communities. Over a long period, rural people have been deriving income through fuelwood collection. It's a source of energy for domestic and local commercial uses. Natural and conventional forests are the main sources of fuelwood. The products are usually used to generate heat in residential and commercial sectors, particularly rural communities. Similarly, fuelwood in developed societies was modified and used in the power sector (Amiel *et al.*, 2020; Muhammad *et al.*, 2022). Oguntoye *et al.* (2020) examine fuelwood as a non-timber forest product that looks rough form made from shrub areas, dead trees, and live branches of trees, and normally catted in various forms for sale. It is a formidable source of livelihood in many communities living adjacent to forest areas in developing countries. Usually, fuelwood provides a source of energy to households and local industries. Harvesting wood to produce fuelwood is among the major economic activities after farming and animal husbandry in the poor communities close to the forest areas. Various fuelwood users comprise domestic usage, and commercial users such as restaurants, bakeries, brick making and institutions such as schools and prisons across the country rely on fuelwood. Over 90% of the energy consumed by these organs depends largely on fuelwood due to its availability, reliability and lack of access to modern forms of energy (Wulaningrum *et al.*, 2022; Muhammad and Salisu, 2019; Bede-Ojimadu and Orisakwe, 2020). Using timber and non-timber products promotes energy production and the facilitation of other socio-economic activities, such as livelihood generation in local communities worldwide. Furthermore, the process of harvesting timber and non-timber products creates employment opportunities and reduces unemployment challenges, particularly in the forest base regions (Muhammad and Ngah, 2021).

Fuelwood provides services such as heating and cooking in rural and urban poor areas of developing countries. More than 80% of primary energy consumed by developing countries was supplied through fuelwood (Ben-Iwo *et al.*, 2016; Olanrewaju *et al.*, 2019). The record has shown that domestic energy demands depend on biomass as their source of energy (Sa'ad and Bugaje, 2016; Jekayinfa *et al.*, 2020). Excessive fuelwood demand in Nigeria led to massive fuelwood production over the years. For instance, between 1990 and 2019, the demand increases from 50.92 million m³ to 66.21 million, about a 23% increase (FAO, 2020; Muhammad *et al.*, 2022). Consequently, besides the economic benefits derived from fuelwood consumption, excessive production promotes forest depletion. The incessant consumption led to the depletion of 8.86 Mha (96%) of the total vegetation of Nigeria (Naibbi, 2015; Bulama *et al.*, 2022) and caused other impacts that include erosion and deforestation (Naibbi, 2015; Ndiboi and Dare, 2020).

Olaniyi *et al.* (2022) examine the socio-economic importance of fuelwood production in the Gambari forest reserve area, Oyo State. They use gross margin analysis to determine profitability within the study period. The level of income generation shows a direct correlation with the following variables: number of households, level of education, cost of labour, and levy imposed by the government, among others. They observed two scenarios resulting from fuelwood consumption; it is a source of employment, but its excessive extraction causes forest degradation over time. Therefore, the study suggested that strict measures are recommended to maintain forest preservation; hence, policies on tree planting and coppicing practices should be advocated for forest conservation and preservation.

Ullah *et al.* (2021) examine the socio-economic impacts of livelihood from fuelwood and timber consumption on the sustainability of the forest environment: evidence from Basho Valley, Baltistan, and Pakistan. The study revealed that the majority of people (82%) living in the study area engaged in agricultural activities, out of which 71% rely on the extraction of forest products such as fuelwood to augment their income base and, conversely, enhance livelihood. The study further observed

that among those who rely on forest resources, 59% depended largely on extracting non-timber resources as a means of livelihood, whereas 18% depended on other non-farm activities for their livelihood. On the other hand, 41% of them engaged in the extraction of timber products. Furthermore, the study revealed no significant difference in benefits derived from forests within seven districts under the study. The number of forest resources extracted depended on the proximity of the forest to the rural settlements; communities that live near the forest benefit more than those living at a distance. The study suggested that policymakers should design sustainable ways of reducing overreliance on forest resources by providing alternative means of living in the region. The study assesses the socio-economic benefit of fuelwood marketing in the host communities of Onigambari forest reserve, Nigeria. They examined that a large proportion of the youth population enjoyed 54,000 nairas every month from fuelwood businesses across the study area. Therefore, there is an indication that the fuelwood business encourages many inhabitants in the study area to acquire various means such as land for building, farmland and vehicles, and haulage vehicle, among others. As a major occupation in the study area, farming activities play an important role supported by the fuelwood business.

Imaobong *et al.* (2017) analyzed fuelwood marketing around the Uyo administrative centre of Akwa, Iboim state, Nigeria. The study revealed that the trade was profitable, generating a monthly income of \$94 (₦34105.20). The coefficient of determination (R^2) is valued at 56.5% of the variation of income from sales. Most traders (84%) in the study area depend on available wood species. They suggested an intensive enlightening campaign towards tree planting, especially the species mostly required within the study area.

Impacts of fuelwood collection

The major disposition deriving excessive fuelwood collection (consumption) is not farfetched from the preferred alternative fuel source as opposed to modern forms of fuel due to its accessibility and affordability. However, due to the growing population rate, excess fuel demand creates employment opportunities due to fuelwood commodification. Thousands of people in rural communities of developing countries rely on fuelwood collection as a source of income. Potentially, fuelwood investment played a significant role in enhancing the means of livelihood and development of the rural economic sector in developing countries, especially Nigeria (Khan and Ali, 2022). It has been reported that the fuelwood sector supported the livelihood of about 2 million people in the rural communities of Nigeria (Arora, 2019). Furthermore, it has been observed that the sector provided support for the development of different forms of local implements such as boards and local haulage vehicles and hence provision of handles of domestic implements and farm tools such as; axes, hoes, knives, pestle, mortar, shovel, rakes, and diggers among others. The practice of fuelwood harvest facilitates the growth of the rural economy; indeed, fuelwood is a natural resource provided to satisfy human wants, under auspicious needs of human desires such as material, environmental and socio-economic needs. It improves the subsistence living of people in rural areas by increasing their livelihood; fuelwood contributes immensely to the record of national energy balances in accordance with international regulations. It is also a vital source of income and an essential source of renewable energy with the capacity to enhance necessary economic growth and development of a nation, and it decreases the over-dependence of under-developed and developing countries on dear cost of energy imports. It provides 80% of household energy around Asia (Ullah *et al.*, 2021).

Adegoke *et al.* (2021) examine the potentialities of fuelwood, including energy generation, source of inputs for the production of orthodox and herbalist medicines, and provision of energy to local industries in rural communities, serving as a source of employment opportunities, and among other in developing countries. It has been observed that Nigeria is among the countries that are blessed with abundant fuelwood resources owing to the present various types of forests. However,

fuelwood remains an indispensable source of wealth creation through the provision of several means of employment, such as making farm tools, local beds, and chewing sticks, among others.

Forest products such as fuelwood play a significant role in reducing poverty across the globe; poverty has been one of the serious challenges to the existence of human life. Data have shown that about six per cent of the world's population is estimated to be poor based on the standard index indicators used, for instance, one dollar per day income. The desire to reduce poverty has in sighted many people worldwide to depend on firewood production, distribution and consumption since the initial cost of starting a business tenable compared to other forms of investments (Amalu, 2015, Amalu and Ajake, 2019). Fuelwood trading is a successful and sustainable venture worldwide, and the sector has operated in an informal pattern over the decades. This is due to its nature which draws no or less government attention. Its distribution network, which exists between rural and urban settlements involving different intermediaries at various levels, the transaction provides sources of employment and income to various participants at all levels. The fuelwood trading system differs depending on the sources on which fuelwood products are obtainable, these including production sites and government policies. Due to certain decisive economic factors, fuelwood entrepreneurship draws the attention of many people toward involvement in the business (Remedio 2002).

Non-timber forest exploitation and livelihood enrichment

Non-timber forest products comprise subshrubs, shrubs, trees, and lianas, all woody plants. Naturally, woods are made up of different types depending on their species; some are hard and strong while others are not though all of them look the same forms. Based on the above classification, hardwoods are usually used for charcoal processing, while people use non-hard woods to produce firewood, all as a source of energy for households and local commercial activities. Fuelwood is the cheapest source of fuel because it is more accessible and more available than other forms of modern energy. The products play a significant role in the economic development of rural and urban poor communities worldwide. Indeed, besides farming activities, fuelwood is the major constituent of the off-farm sector of the rural economy; the sector performs significantly towards the economic development of rural areas. The sector argues the income base of the rural dwellers whereby rural communities living close to the forest regions derive more livelihood benefits, the various forms of assets such as land, houses, farmlands, and vehicles, among others. Therefore, depending on forest products such as harvesting/production of fuelwood and timber constitute a major source of livelihood for people living in rural areas. Forest endowment is a natural benchmark for measuring the level of communities' economic development; as part of this, communities of forest regions derive more economic benefits than the communities living in desert regions (Ndiboi and Dare, 2020). The lifestyle of rural communities depends largely on forest resources, ranging from farming to all other forms of non-farm activities, and however, forests provide a lot of employment opportunities such as firewood collection and charcoal production, among others. As such, these activities bring about the community's economic development from all perspectives. It encourages self-reliance, which promotes private-sector economic development, which is why most people in rural areas depend mainly on agriculture and other non-farm economic activities with a spirit of self-reliance. Therefore, most livelihoods acquired in rural areas are through farming and non-farm activities. In the same vein, social factors such as (community cooperation, family unity, social qualities, participation, and empowerment) for the well-being of humans (knowledge, ability, and skills) are therefore considered necessary for sustainable development. Fuelwood exploration and exploitation due to wood forest products potentially generate a livelihood base for households in rural settlements. Most developing countries recognize forests as a bedrock of livelihood in rural communities. Rural dwellers depend largely on the non-timber forest for most of their economic desires, including goods for direct consumption and commercial purposes such as firewood and charcoal as a source of energy, fabricated

wood for design and construction, sources of medicinal items and food security (Fao and Unicef. 2020).

Worldwide, the projection has shown that a proportional number of people between 1295 and 1945 billion are predicted to depend on forest products for their day-to-day activities. In most developing communities, about 200 million people in the home localities depend mostly on timber and non-timber forest products. Furthermore, about 350 million people who live in the forest regions largely depend on the forests for income generation and major means of livelihood. Available records through prediction indicate that 25–30% of rural people's means of income rely on resources from the environment comprising all forms of forests in rural areas of developing countries. Potentially forests provide a safety net in the event of drought, and other famine situations, such as food insecurity, which occur seasonally. Environmental problems such as deforestation are at an increased rate and were reluctantly ignored by the concerned authorities in the developing countries, and no preventive measures were proffered to provide a remedy against the problem. Verily, this led to the continuous extinction of forests due to over-dependence. Collective effort is expected to enforce in terms of forest management to protect possible livelihoods benefits (Ullah *et al.*, 2021). The increasing rate of household fuelwood demand is evidence of rampant consumption and aiding depletion of the forest worldwide. A report from the world conservation union predicted that considering the rapid population growth rate, wood consumption would continue increasing yearly. However, this phenomenon will lead to the disappearance of forests worldwide.

Conceptual frameworks

The conceptual frameworks comprise various rural development theories and models; they serve as the background tools for every study. The conceptual ideas of these theories provide an essential study guide. Different forms of development index identified using these theories and models, thus.

Livelihood system model

The model examines the aspects of a household's livelihood in rural areas; the idea depends on the availability of entitlements and royalties' ownership resulting from capital asset shares, such as the production and trading of available forest resources within someone's community. The livelihood description in forest regions differs among the people living in the same community. The variation rate of benefits is the drive from quantity share of entitlements and royalties' ownership. Virtually, the benefits attraction varies between large and small share ownerships; families rely on the portion of their resources and common pool property for survival.

Agriculture is the main occupation and means of livelihood in rural communities of developing countries, but it has been observed that off-farm economic activities such as the production of forest products supplement their means of income and subsequently bring about economic enhancement as well as facilitating rural livelihoods in forest-based communities (Kimengsi *et al.*, 2020). In some cases, non-agricultural livelihoods are subjected to fluctuations in seasonal demand. Therefore, their significant support deserves attention in their operation since they formed part of the family's livelihoods in forest communities.

An increase or decrease in entitlements over time can affect the livelihood of rural communities. Hence, it is impossible to have equality in sharing common assets among people living in a given community. Based on the livelihood system model, forest products improve and facilitate the life of forest-based areas in so many ways, that is, through the utilization and trading of forest products such as firewood, shrubs, and fruits. It is a technique that assists scholars and policymakers in planning livelihood issues. It shows how aspects of livelihood opportunities provide means of employment and community development and rises in GDP.

Classical economists theory

The basic idea of this theory depends on concepts of circulation and interrelation effects of variables such as technology, investment, and returns. Based on the assumption, the circulation effects are inherent whereby technology depends on investment and, in return, investment depends on profit and subsequently, profit depends partially on the level of technology and continuous. However, considering this, the classical economist paid less attention to rural development and assumed that economic growth would naturally foster development.

Modernization theory

Proponents of this theory premised based on the replacement of primitive/traditional feudal ideas with a modern technological approach that enhances agricultural production for the attainment of desired goals. It encourages a shift from the traditional approach to a more scientific one for onward progress.

Gandhian model of RD

This model is holistic and people-oriented. It depends on certain societal norms and values; for instance, some societies have a rural origin other than a city. However, based on this model approach, the revitalization of rural areas is highly dependent on control or enforcement of the ban on rural exploitation. According to the proponent of this model, the exploitation of rural areas is a demonstration of violence against communities. He emphasizes the spirit of "simple living and high thinking." It implied less emphasis on materialism and embraced the idea of moral and spiritual indoctrination. The principles of spiritual morality should guide the dignity of everyone's labourship, which leads to subsistence means. Communities are urged to prefer local commodities, services and agencies. Community recognizes the needs and means of satisfying them within the community context since human beings are both the end and the means of development.

MATERIALS AND METHODS

These consist of procedures and materials used in carrying out the research exercise. The procedure refers to the research design pattern, while materials are tools for eliciting the required information to undertake the research work. However, methodology in cooperation with the study area has been an integral part of proper research. Moreover, it provides essential guidance during the study period.

The study area

Yobe state is located between latitude 11 North and longitude 13.5 East, with a total land area of 47,153 square km. It shares national boundaries with Borno state from the eastern and southeastern parts, it shares a border with Jigawa state from the northwest, equally Bauchi and Gombe states from the southwestern part. It borders the Republic of Niger to the North, subsequently, the Republics of Chad and Cameroun to the Northeast and South-Southeast internationally. The population of the State, according to the National Head Count conducted in 2006, is about 2.6 million. The State was created on August 27, 1991, and carved out of the old Borno State with Damaturu as the state capital. The State is agrarian, and more than 80% of the population is involved in small-scale subsistence farming to generate income for livelihood. Cash crops available include groundnut, sesame seed, cotton, and Benny seed. Verily, the State is noted to be the largest producer of Arabic gum in Nigeria. A large population of the State was pastoralists, pastored for commercial, and domestic purposes. The practice includes cattle, sheep, goats, donkeys, and horses. The level of poverty in Yobe State is higher (69%), with a national average of (61%), while the literacy level of the adult male and female population in the State is 24.2% (NBS, 2017). Farming, animal husbandry, fishing, trading, and other non-farm activities are the primary source of livelihood in Yobe State (WFP, 2018; Ali *et al.*, 2022).

Research design and sampling procedure

The study adopted a descriptive research method, and three local government areas were selected as case studies. A purposive sampling technique was employed, and the selection process depended on the size

of the population and the pattern of political district zoning in the State. The high population concentration in these settlements resulted from rural-urban drift. Indeed, the larger population triggers widespread fuelwood consumption in the State (Naibbi, 2015). Significantly, the study's finding remains essential for further investigation of fuelwood activities across the entire State. The information obtained covered major settlements representing the remaining areas (WFP, 2018; Ali *et al.*, 2019). Local government areas were visited during the reconnaissance process, and information on the target population was obtained. However, Bade's local government area has a population of 930 fuelwood collectors, Damaturu 1120 and Potiskum 1000. This brings about 3050 fuelwood collectors as a target population for the study. The study further employed a simple random sampling technique in choosing respondents for the study. Therefore, the population sample size has been determined using Krejcie and Morgan's (1970) formula:

$$S = X2NP (1-P) d2 (N-1) + X2P (1-P)$$

Where,

S = required sample size,

X2 = the table value of Chi-square for 1° of freedom at the desired confidence level,

N= the population size,

P = the population proportion (0.05), and

D = the degree of accuracy expressed as a proportion.

Methods of data collection and analysis

Data have been collected using a questionnaire, focus group discussion (FGDs), personal interviews, and observations. A total of 395 respondents have been used as a sample size for the study. Three research assistants who are trained and understand English and local languages fluently have been employed. This resorted to the easy sourcing of respondents' information. Questions were organized regarding respondents' reactions related to fuelwood collection, for example, why do you involve in fuelwood collection? How does fuelwood collection support your life? Do you derive achievement from the fuelwood collection? The study uses a 3-scale Likert (1932) with appropriate expressions applied to enable the respondent to rate the influence of fuelwood collection on livelihood generation in rural areas. Data have been sorted using frequency tables, percentages and statistical package for the social sciences (SPSS) software package version 22.0.

RESULTS AND DISCUSSION

The results comprise necessary information collected through a field survey. This information was prepared, summarized, presented and analyzed using tables, percentages, mean, and mode. The respondents' demographic characteristics comprise sex, age, marital status, education, occupation, origin, family size, etc. The respondent's personal information is presented in Table 1. The respondent's origins comprise rural and urban people; more than 90% of them are rural dwellers, and about 9.9% are living in urban areas but collect fuelwood from nearby clinch of bushes. Respondent's primary occupations show that most are farmers while some are artisans, civil servants, and others. Further, the table indicates that 64.8% more than half of them are farmers, 25.2% are civil servants, while artisans and others were 7.1% and 2.9%, respectively. There is an indication that people in the study area did not depend on fuelwood collection as their primary occupation but rather as a source of improving their economic base. Sex distribution of the respondents shows that 95% of the fuelwood collectors in the study were male; this is highly connected with African culture, where the male is the dominant gender charged with the responsibility of feeding family members; that is why women's engagement is insignificant as shown in the table. Moreover, respondents' personal information on age distribution indicates that the age group between 40 and 49 years old accounted for 65% of the total responses are more involved in fuelwood collection. This indicated that fuelwood collectors were primarily male adults in their active age capable of responding to the feeding of their family members.

Table 1: Demographic of the respondents

Variables	Frequency	Percentage
Respondent origin		
Rural	375	94.9
Urban	20	5.1
Total	395	100
Sex distribution		
Male	370	93.7
Female	25	6.3
Total	395	100
Age distribution		
11-20	9	2.3
20-29	30	7.6
30-39	75	18.9
40-49	230	58.2
50-59	39	9.9
60 above	11	2.8
Total	395	100
Education level		
No formal education	10	2.5
Primary	67	16.9
Secondary	283	71.6
Tertiary	45	11.4
Total	395	100
Marital status		
Married	337	85.2
Single	58	14.8
Total	395	100
Household size		
1-2	20	5.1
3-4	122	30.9
5-8	219	55.4
9 above	44	11.1
Total	395	100
Respondents initial occupation		
Farmers	202	51.1
Civil servant	60	15.2
Artisans	22	5.6
Traders	15	3.8
Others	06	1.5
Total	395	100

Source: Field Survey 2022

The educational level of respondents shows that 82.5% have attained a secondary school level of education. Nonetheless, an insignificant number of 17.5 of them still need to attain formal education. The implication is that most respondents attained formal education up to secondary school but needed help to further their education in the study area. The marital status of the respondents indicated in the table majority (85.2%), more than half of them are married. However, regarding marital status, information on family size shows that most of them, about 55.1%, have family sizes with a membership of 5-8 people, followed by the group with 3-4 members accounting for 30.9% of the respondents. This indicates the usual large family size of African culture, which mainly depends on economic support and social security for the aged parents. The table shows the initial respondent's occupation before engaging in fuelwood collection. The majority (51.1%) of the respondents are farmers, followed by 15% civil servants, while 5.6% are artisans and 3.8% are traders, remaining in one form of business.

The sources of fuelwood

Table 2 shows various sources of fuelwood for collection comprising natural forest, forest reserves, clinch of bushes, farm lands, and others. Majority (51.5%) of the fuelwood collected from natural forest, follow by 20% collected from clinch of nearby bushes, while collections from farm lands as well as forest reserves and others constitute 15%, 8.3%, and 6.4%, respectively.

Method of fuelwood collection

Fuelwood collection involves using traditional tools, such as daggers, axe, and diggers for extraction purposes. Fuelwood preparation for onward consumption involves cutting and splitting wood stems and branches, followed by making loads or bundles according to the required size for consumption (sales). After collection and preparation, the resources move to designated locations, generally by the roadside nearby human settlements for consumption (sales). Fuelwood load or bundle gives room for easy assessment and conveyance. The volume of fuelwood collection among individual collectors depends on capability and enthusiasm.

Table 3 shows that show majority (63.5%) of the respondents collect five loads per week; this is followed by 22.3% of them collecting (6) loads. Furthermore, 8.4% of them collect (3) loads. About 3.8% and 2.5% collect (7) and (8) loads, respectively. Therefore, the mean measurement of the total load collection shows 5.8 accounting for more than half of the collectors collecting 5–6 loads of fuelwood weekly in the study area. In the same vein, by using percentages, most (85.5%) of the respondents procure not fewer than 5–6 loads of fuelwood weekly.

Total gain from sales of fuelwood weekly

The Table 4 shows that the majority (63.5%) of respondents gain 6000 Naira per week, followed by (22.3%) who secure an income of 5000/week. However, 8.4% gained 3000 Naira, 3.8% gained 7000, and 2.5% gained 8000. The mean measurement value is 5.8 showing that most of the respondents gain 5800 from fuelwood collection weekly. Averagely, the percentage shows the majority (85.5%) of the respondents gain 5800 from fuelwood collection weekly.

Benefits derived from fuelwood collection

Benefits derived from fuelwood collection comprise the followings; land, farm land, haulage vehicles, houses, motorcycles, and among others (Table 5).

The study examines the socio-economic benefits of fuelwood collection in Yobe State. This report considered three local government areas for the case study. The result revealed that the majority (94.9%) of the people involving in fuelwood collection live in rural areas. The activity provides essential services such as; energy generation and employment opportunities, among others; these services promote aspects of human existence in many ways and economic development in rural areas. Finding revealed that apart from farming, fuelwood collection is the dominant non-farm activity that enhances the income base of rural people in the study area. It also shows that requires less or no modern inputs to commence the business; this encourages a large proportion of the population in rural areas to engage in fuelwood collection investment. This result agrees with Bulama (2022) and Carley and Zhen (2021), who establish that fuelwood collection is among the major sources of employment generation in the Gambari and Onigambari forest reserves area in Oyo State. The finding revealed that males were the dominant collectors of fuelwood in the study area. Their involvement is not unconnected with African culture, which saddled the male gender with the responsibility of feeding family members. On the contrary, this finding compared well with the result of Imaobong et al. (2017) in Uyo capital city of Akwa Ibom state in Nigeria, where most fuelwood marketers were women. The result further examined that males who were predominantly fuelwood marketers were the family's breadwinners in rural communities. Hence, it has been realized that fuelwood extraction is a dominantly male-related occupation going on its nature and traditional beliefs in African societies.

The result on age distribution reveals age groups of 40–49 majority (58.2%) and 30–39 up to 18.9% involved in fuelwood collection. Impliedly, more than (77%) of the respondents that engage in fuelwood collection live between the 30–39 and 40–49 age groups at their active age period. Their participation aims at meeting the immediate responsibility of family members and enhancing their economic moats through generating means of livelihood. However, the study further

Table 2: Major sources of fuelwood

Sources	Frequency	Percentage
Natural forest	203	51.4
Clinch of bushes	79	20.1
Farmlands	60	15.2
Forest reserves	31	8.1
Others	24	6.2
Total	395	100

Source: Field survey 2022

Table 3: Number of fuelwood loads collected weekly

No of loads	Frequency	Percentage
3 loads	33	8.4
5 loads	251	63.5
6 loads	88	22.3
7 loads	15	3.8
8 loads	10	2.5

Source: Field survey 2022

Table 4: Gain per load

Sales	Frequency	Percentage
3000	33	8.4
5000	88	22.3
6000	251	63.5
7000	15	3.8
8000	10	2.5
29000	395	100

Source: Field survey 2022

Table 5: Benefits derived from fuelwood collection

Benefits	Frequency	%
House, farmland, haulage vehicle, land, motorcycle, vehicle	50	12.7
House, farmland, haulage vehicle, land, motorcycle	46	11.6
House, farmland, haulage vehicle, land	34	8.6
House, farmland, haulage vehicle	90	22.8
House, farmland, land	20	5.1
Farmland, haulage vehicle and land	22	5.6
Farmland and haulage vehicle	18	4.6
Farmland and house	12	3.0
House and haulage vehicle	30	7.6
Land only	28	7.1
No benefits	44	11.1
Total	395	100

Field Survey 2022

observed that rural communities could quickly attend the desired level of economic development through fuelwood collection with a proportionate number of youths at their active age.

Educational background revealed majority (65%) of the respondents obtained formal education at different levels. Hence, not more than 35% of the respondents do not acquire formal education. This suggested a correlation between fuelwood collection and the level of education in rural communities, especially the study area. However, the study seeks to identify the factors responsible for this relationship among the variables. However, it is also realized that factors such as unemployment, poverty, and underdevelopment, among others, encourage fuelwood collection pervasively in rural areas. This result contradicts the finding by Aneni (2016), which establishes an inverse relationship between the level of education and fuelwood business in the Gambari forest reserve area. Conversely, it implies that people prefer self-reliance as opposed to public service life.

Household size distribution shows different sizes of families depending on the number of people in a given family. A more prominent family consists of 5-8 people, whereas a smaller one consists of 1-2 people. According to the finding, family size is among determining factors that induce family labor size to promote output through fuelwood collection. Therefore, marital status plays a key role in increasing family size and, subsequently, the family labor force toward fuelwood collection and, most often, livelihood generation. The sources of fuelwood comprise natural and conventional forests. Natural forests consist of traditional forests such as; the clinch of nearby bushes, farmlands, and fallow bushes. Most of the communities have these types of forests within their reach. On the other hand, conventional forests consist of government reserve forests, game reserve areas, etc., operating within the study area. These forests are significant sources of non-timber wood for firewood and charcoal use in meeting energy demands such as heat, lighting, warmth, and income generation; among others, these services are essential for domestic and commercial uses within the study area. The cost of fuelwood collection varies between one community and another depending on proximity and forest use regulations. From personal observation, natural factors also determine the cost of fuelwood collection, such as seasonal periods; for instance, fuelwood is cheaper during the dry season than in the rainy season. During the dry season, more people engage in fuelwood collection; this increases fuelwood supply and decreases the price and vice-versa due to farming activities during the rainy season.

Equally, fuelwood collection involves using various tools such as axe, daggers, diggers, rulers, ropes, and hammers. These tools are used for off-rooting, logging, cutting, and splitting non-timber wood for fuelwood collection. Usually, the preparation of fuelwood is measured in size according to existing practice. There are made in the form of loads or bundles depending on the required size. The loads or bundles are made accessible for conveyance purposes using humans, animals, haulage vehicles and vehicles to designated locations for consumption (sales). Ullah supports this result, S. *et al.* (2021) examine the woodlot production and collection in Pakistan from natural forests; perhaps, firewood collected in the form of load or bundle easily signifies the quantity of fuelwood collected by the individual collectors within a specific period depending on personal ability and enthusiasm.

The study forms different groups of fuelwood collectors shown in the table. Classification of these groups depends on individual fuelwood collectors' commitment. To explain this, some collectors collect 6 loads weekly while some collect 4 loads and others collect <4 loads weekly. The result corroborates the finding by (Adewuyi, 2020), who established that the youths' fuelwood loads earned by respondents weekly on their active time enhance income generation in the host community of Onigambari forest in Oyo State. Table 1 shows that fuelwood collection is not the primary occupation of people within the study area. Instead, more than half (51.1%) of the respondents are farmers, whereas 15% are civil servants, 5.6% are artisans, 3.8% are a trader, and 1.5% engage in other businesses as primary occupations. This result agrees with the finding by Muhammad *et al.* (2017) on people's engagement in exploiting non-timber forest products by households' for income generation around Falgore Game Reserve in Kano, Nigeria.

Interviews and personal observation reveal that apart from the desire to improve human living through livelihood, there are factors responsible for massive fuelwood collection in the study area. For instance, factors like seasonal variation, poverty, population, and price of other fuels influence the process of fuelwood collection (consumption). The result shows earnings from fuelwood collection indicate 63.5% of the respondents gain 5000-6000 Naira every week. This is followed by a 22.3% gain between 4000 and 5000 naira on the same basis. This implies that the majority (85.8%) secured an average income of less than 5800 Naira every week. This agrees with the finding of (Imaobong *et al.*, 2017) regarding the Onigambari forest reserve host community, where the majority (80%) of the respondents gains 3000-4000 Naira weekly. This implies that fuelwood collection enhances people's lives

in rural areas. Table 5 shows different economic benefits derived from fuelwood collection in the study area. A potential number of fuelwood collectors realized different means of livelihood, such as; houses, farmlands, land, haulage vehicles, and vehicles. The table shows 12.1% of the respondents own a house, farmland, land, haulage vehicle, motorcycle, and vehicle. About 11.6% of respondents own a house, farmland, land, haulage vehicle or motorcycle. Furthermore, 8.6% possess houses, farmland, land and haulage vehicle. About 22.8% of the respondents possess a house, farmland and haulage vehicle, and 5.1% acquired a house, farmland, and land. About 5.6% of the respondents acquire farmland, haulage vehicle, and land, and 4.6% owns farmland, haulage vehicle. While 3.0% of the respondents own farmland or a house, 7.6% of the respondents own only a house, and 7.1% own land. The table shows 11.1% of the respondents have no benefits. However, the table show majority (89.9%) of the respondents derived achievements from the fuelwood collection. Although, in the same study area 11.1, % of the respondents have only succeeded in feeding their family but have yet to secure any benefit. Thoughtfully, we deduce that fuelwood collection improves subsistent living in rural communities. Hypothetically, the result justifies our study objectives; thus, fuelwood collection impacted people's lives and enhanced livelihood generation in rural areas.

CONCLUSION AND RECOMMENDATION

The study describes improving people's lives and the emergence of livelihood in the study area due to fuelwood collection. Variables including age distribution, gender, household size, transportation, cost of labor, cost of other fuels, poverty, population, and level of commitment determine the economic relationship among variables of the study. The investment brings about improvement in people's lives in rural communities. More than 85% of the respondents earn 5000-6000 naira weekly. This implies that fuelwood collection is among the vital non-farm activities that enhance people's lives in rural areas. However, the overall result shows that possession of various capital assists benefited the respondents in the study area, including; houses, land, haulage vehicles, motorcycles, farmland, vehicles, and car's, among others. As a way forward, fuelwood collection has been recognized among the major constituents that improve people's living and enhance livelihood generation in rural areas, especially the study area. Therefore, despite the environmental consequences associated with fuelwood consumption, its contributions account imperatively for the economic development of nations. Therefore, the study advocated for persistent government support through policies and programs such as tree planting campaigns, coppicing practices, and development of conventional forests to support the activity. On the other hand, facilities such as grants, empowerment projects, and access to modern fuels will mitigate massive consumption of fuelwood and encourage/argue the income base of rural people because personal observation shows that the majority of those who depended on fuelwood collection were initially living in an extreme level of poverty before been alleviated through fuelwood collection. Furthermore, the above-suggested solution will provide the necessary remedy against the growing population in developing countries.

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