Analysis of Fuelwood Consumption in Pampaida (Millenium Village) of Kaduna State, Nigeria

Sule Muhammad Zubairu[1] --- Muhammad Isma'il[2] --- Abdullahi Jibrin[3] --- Odey Emmanuel[4] --- Abduljalal Abdulsalam[5] --- Amina Maiwada[6]

[1,2,3,4]Department of Geography, Ahmadu Bello University, Zaria
[5,6]Department of Geography, Kaduna State University, Kaduna

Abstract

This study examined fuelwood utilisation in Pampaida, a village in Ikara Local Government Area of Kaduna State, Nigeria. Finding of the study revealed that fuelwood is the dominant primary energy used in the area. Majority of the people (90%) preferred fuelwood because it is easily accessible, affordable to them in the area. Most of the fuelwood is obtained freely from the forest, and farmlands. In addition, results showed that the level of fuelwood consumption in the area is very high because close to two-third of the respondents use up between 1-3 bundles of fuelwood daily; and one-third of them require between 4-6 bundles/cords per day. Moreover, it was found that a large part of household expenditure goes to fuelwood. However, majority of the respondents (85%) are unaware of the environmental effects of fuelwood consumption. The study therefore recommended the need for conscious efforts in providing alternative cheap and accessible renewable energy sources for use in Pampaida.

Keywords: Fuelwood consumption, Environmental effects, Pampaida village.

1. Introduction

Energy is essential for economic activities (Alam, 2006) and technological development. There are various sources of energy which comprise of non renewable such as petroleum, coal, and natural gas; as well as renewable such as solar, wind and biomass. Nigeria has both renewable and non renewable energy sources (Okoro and Chikuni, 2007) but fuelwood remains the main source of energy for household activities in the country (Isma'il *et al.*, 2014). Likewise, Chukwu (2000) observed that over 70 percent of the total population of Nigeria relies on fuelwood or charcoal as their major source of energy for cooking and heating purposes. This is because in developing countries wood-based fuels remain the dominant source of energy for the people (Trossero, 2004). Similarly, it is reported that over 80 percent of rural households in Nigeria primarily depend on biomass as their source of energy (Nabinta *et al.*, 2007).

The demand for energy is influenced by population growth and economic development. Indeed, many states in Nigeria experience rapid population growth as a result of urbanisation resulting into increasing demand for energy services. Population growth and socioeconomic transformation is not restricted to towns and cities but has extended to Millennium villages in Nigeria.

Pampaida is a village that can be considered as agro-commercial. In 2006, the United Nations Development Programme (UNDP) adopted Pampaida as a Millennium Village. This sets in motion a rapid and dynamic physical, economic and social transformation coupled with population growth in the village. There is electricity supply, pipe borne water, improved road access and telephone services in the village (United Nations Development Program, 2006).These actions culminated into the development of the formal and informal services in the effort to meet the needs of the growing population in the area. The aim of this research is to examine the pattern of fuelwood consumption among Pampaida residents with a view:
• To identify the sources of fuelwood and pattern of fuelwood sourcing
• To estimate the quantity of fuelwood consumed per household
• To determine the amount spent on fuelwood per household
• To assess the level of awareness of residents on the environmental problems associated with fuelwood consumption.

1.1. The Study Area

Pampaida is located in Saulawa District of Ikara Local Government Area of Kaduna state in northwestern Nigeria. It lies between latitude $11^034'$ and $9^01'$ North of the equator and longitude $6^011'$ and $8^049'$ East of the Greenwich Meridian as shown in Figure 1.

The area experiences two weather seasons, the dry and wet season. The dry season consists of hot and harmattan period stretching between the months of November and March. The harmattan is often cold accompanied by strong wind blowing from North-East Sahara region. The rainy season is experienced between the month of April and October. The average annual rainfall is 164mm while its highest temperature ranges between 270 - 320 C (90°-105° F) in April, and lowest between 140 - 180C (45°-60° F) in January. The water used for domestic and agricultural activities in the area is sourced from various protected and non protected wells, scattered bore holes together with Bambami and Duku rivers (UNDP, 2006).

Pampaida is located on the north central high plains. The topography consists of the rolling terrain with relief situated 450 -500 metres above sea level. It represents the Agro forestry parkland system, characterized by crops and trees with a strong presence of livestock. The area is covered with the Guinea savannah vegetation type, which consists of trees like locust beans, baobab, silk cotton and shrubs. There is no evidence of mineral deposits in the town. However, the laterites and granites are considered quite suitable materials for building. The soil texture is water logged and marshy (UNDP, 2006).

The Millennium Village comprises of 28 clustered settlements with a total landmass of 85km^2. It has a population of 6,738 in 2006, divided into 952 households. Villagers' livelihoods is largely based on pastoralism and small-scale agriculture. Hausa traders and farmers, as well as Fulani pastoralists and agro-pastoralists, are the two dominant ethnic groups. The Pampaida community is served, by a single centrally located, primary health care centre built and operates primarily by the local government, although supported by one of the projects run by the United Nations Development Project. The health centre provides basic preventive and curative services to the people of the community (UNDP, 2006).
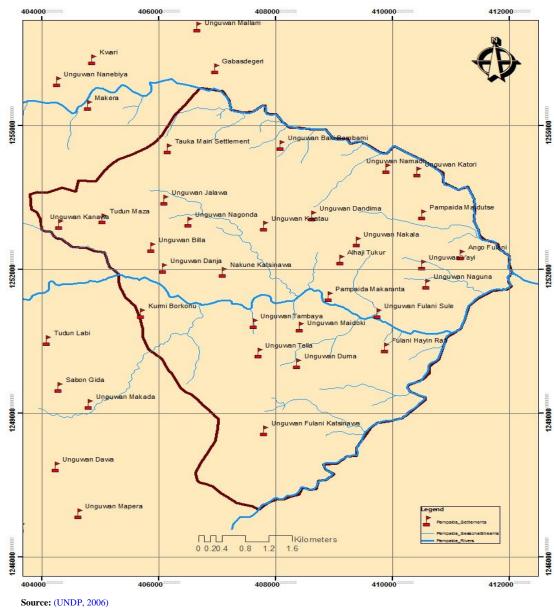
Figure-1. Map of the study area**.**

Source: (UNDP, 2006)

2. Methodology

The data used for this study were obtained from primary and secondary sources.

2.1. Primary sources of data

This involves the collection of data from individuals directly through structured questionnaires, interviews and observation. The questionnaires are administered and confined within the objectives of the study. The questionnaires consisted of both open and close ended questions.

2.2. Secondary sources of data
This consists of data obtained from journals, official statistical books, reports, past projects and other relevant text books.

2.3. Method of Data Collection and Sampling Techniques
The questionnaires were administered to Pampaida community members who must have lived in Pampaida for at least five years, which is usual for most of the residents within the community. Verbal consent was obtained from the Village Head and also from the heads of the households just before the questionnaire survey.

Pampaida is divided into 28 settlements; hence, the sampling technique used was purposive limiting administration of questionnaires to heads of household who may be farmers, traders, civil servants, etc. The administration of questionnaires is based on chance or availability of the respondents in order to avoid wastage of time and mistakes.

Sloven's formula for calculating sample size was used in determining the sample size.

$$n = \frac{N}{1+Ne^2}$$

Where;
n= Sample size
N= Population
1= Constant
e= Confidence level= 0.05

$$n = \frac{6738}{1+6738}$$

$$= \frac{6738}{17.8445}$$

Sample size =   377.58
Total number of questionnaires administered was 378.

2.4. Method of Data Analysis
Descriptive tools such as tables are used to summarize the data collected from the respondents via questionnaires.

3. Results and Discussion
The following sections present the results of the field survey, as well as analyses and discussion of the results.
The subsections are socio demographic characteristics, issues on sources and utilization of fuelwood, quantity of fuelwood consumption per household, cost spent per household on fuelwood, and problems associated with fuelwood consumption.

3.1. Socio-Demographic Characteristics of the Respondents
The age structure of the respondents vary particularly about 15% of the total respondents fall between the age group of 15-24 years, 36.5% of them are between ages 25-34 years and 31% are within 35-44 years as shown in Table 1. Whereas, those of ages 45-54 and 55 and above account for about 12% and 6% respectively of the respondents. It can be inferred that majority of the respondents are between ages 25-34 and make up the productive age of the community. Results also showed that 85% of the respondents are males and only about 15% are females. This can be as a result of the fact that in part of northern Nigeria, women play little role in fetching of wood as they may be secluded, but girls could be employed in carrying wood (Cline-Cole, 1990). More of the information is provided by married men (90%) who are mainly heads of households, and few females participated whom are divorced (5%), widowed (4%) or their husbands are absent. This contradicts the view that fuelwood gathering for domestic use seems to be seen as a management activity for women to attend to alone (FAO, 1999).

Table-1. Age group of respondents

Age	Frequency	Percentage (%)
15-24	56	14.8
25-34	138	36.5
35-44	118	31.2
45-54	44	11.6
55 and above	22	5.8
Total	378	100

Since most of the people live in a rural area, their occupations are closely linked with their environment. Table 2 indicates that a majority of the respondents (about 80%) engage in farming which is a dominant activity in the study area. While about 12% of the respondents are traders, and a small number of the population constituting 2.6% are civil servants; and only about 2% and engaged in other activities.

Table-2. Occupation of the respondents

Occupation	Frequency	Percentage (%)
Farmer	300	79.4
Trade	44	11.6
Student	16	4.2
Civil Servant	10	2.6
Others	8	2.1
Total	378	100

The ability to read and write is often used as one of the social and economic indicators of development in an area. Table 3 shows that 18.5% of the respondents have Quranic education; about 31% hold primary school certificate, and close to 20% are secondary school certificate holders. Only 5.8% attended universities/colleges and about 30% of the respondents have never had any form of formal or informal education. This suggests that the literacy level is very low in the area.

Table-3. Educational qualification of the respondents

Educational attainment	Frequency	Percentage (%)
Quranic Education	70	18.5
Primary Education	118	31.2
Secondary Education	74	19.6
Tertiary Education	22	5.8
None	94	24.9
Others	-	-
Total	378	100

The monthly income of households determines the type and amount of energy used. Most of the respondents are peasant farmers and earn low income. A total of 60.8% of the respondents earn between N1, 000-10,000 (about 6 – 60 USD) monthly, indicating low level of income of these respondents as shown in Table 4. It can also be observed from the Table that 28.6% of the respondents earn between N11, 000-20,000, while 9.5% reported that they earn an average of N21, 000-30,000 per month. A low percentage of the respondents of about 1.1% reported that they earn around N31, 000-40,000 monthly. None of the respondents earn between N41, 000 and above.

Table-4. Household income per month

Income category	Frequency	Percentage (%)
N1,000-N10,000	230	60.8
N11,000-N20,000	108	28.6
N21,000-N30,000	36	9.5
N31,000-N40,000	4	1.1
N41,000 and above	-	-
Total	378	100

3.2. Issues on Sources and Utilization of Fuelwood

Table 5 shows that about 89% of the respondents use fuelwood as their primary type of fuel. About 6% also indicated their preference of charcoal as their primary type of energy, while 4.2% and 0.5% of the respondents claim to use kerosene and gas respectively as their primary type of fuel. Findings revealed that the majority preferred fuelwood because it is more convenient and affordable to them.

Table-5. Primary type of fuel/energy used by respondents

Variables	Frequency	Percentage (%)
Fuelwood	338	89.4
Charcoal	22	5.8
Kerosene	16	4.2
Gas	2	0.5
Others	-	-
Total	378	100

The result from Table 6 revealed that 8.5% of the respondents purchase fuelwood, while about 60% obtained fuelwood from the forest and 28.0% of the respondents fetch fuelwood from their farmlands. This correlates with the report that significant amount of fuelwood are also obtained from trees planted on marginal and farming lands through agroforestry schemes (Food and Agricultural Organization FAO, 1996).

Also, about 3% of the respondents revealed that they fetch fuelwood from roadside that fall from trees and transported by wind; and 0.5% obtain fuelwood from other means. Findings revealed that during periods of fuelwood scarcity, most of the respondents resort to purchasing fuelwood from vendors.

Table-6. Source of Fuelwood

Sources	Frequency	Percentage (%)
Purchased	32	8.5
Forest	226	59.8
Farmland	106	28.0
Roadside	12	3.2
Others	2	0.5
Total	378	100

The distance travelled to source fuelwood contributes to the cost of fuelwood utilisation. About 43% of the respondents each travel a distance of 1-3km and 4-6km respectively to the source of fuelwood as shown in Table 7. Most of them travel to their farmlands or fuelwood vendors. About 9.5% of the respondents go as far as 7-9km to fetch fuelwood. 3.2% and 1.1% of the total respondents go a distance of 10-12km and 13km and above respectively to gather fuelwood. It was also found that about 44% of those responsible for cutting and gathering fuelwood in the area are adult females and 42% are adult males. This is contrary to the situation in many villages in northern Nigeria where males mostly fetch fuelwood. However, about 11% of the respondents claimed that the responsibility of fuelwood gathering is shared among all members of the household.

Table-7. Distance to source of fuelwood

Distance	Frequency	Percentage (%)
1-3Km	164	43.4
4-6Km	162	42.8
7-9Km	36	9.5
10-12Km	12	3.2
13 and above	4	1.1
Total	378	100

3.3. Quantity of Fuelwood Consumed per household

Results from the field survey showed that about 62% of the respondents use between 1-3 bundles/cords of fuelwood daily; and close to 35% require between 4-6 bundles/cords, while 2.7% reported that they require between 7-9 bundles/cords per day as illustrated in Table 8. This suggests that fuelwood consumption in the study area is used in bundles. It was also found that the people in the area use fuelwood in bundles or cords because they are manageable and economical. The amount of bundles/cords that is used is mainly determined by the quantity of fuelwood required per day. Moreover, 50% of the households claimed to use up 100% of the fuelwood, while about 34% use up 70-90%, and about 14% of them use up between 40-60% of fuelwood. This is to show the high level of fuelwood consumption among the residents in the area. It was also found that households who consume less than 100% of their fuelwood use other types of energy either as their primary or secondary type of energy that is being used.

Table-8. Bundle/Cords required per day

Bundle	Frequency	Percentage (%)
1-3	236	62.4
4-6	132	34.9
7-9	10	2.7
10-12	-	-
13 and above	-	-
Total	378	100

In addition, findings revealed that a little more than half of the respondents (50.7%) gather fuelwood monthly, while 27.5% reported that their fuelwood collection is weekly, 8.5% of the respondents indicated that they gather fuelwood daily. However, close to 14% of the respondents claimed to fetch fuelwood whenever there's a need or at moments when they are available i.e. dry for use. It was also found that few of the respondents make trips to gather fuelwood once or twice yearly. This is because they gather fuelwood in large quantities and preserve them for use. Results also showed that about 98% of the respondents use fuelwood daily. This is mainly because of its affordability and availability for use. Another major reason why fuelwood is used daily can be attributed to the closeness of the source region. Other households which make up only 2% of the respondents claim to use fuelwood weekly and this can be linked to their preference and use of other types of fuel/energy like corn stalk, kerosene, gas, etc.

3.4. Household Expenditure on Fuelwood

Table 9 indicates that 85% of the respondents who are mostly housewives spend between N50-100 on fuelwood daily. Respondents who spend between N150-200 on fuelwood have large household members or are mainly traders who engage in selling cooked food. In addition, only about 3% of the respondents reported that they spend N250-300 on fuelwood daily. This usually happens during periods when there is fuelwood scarcity as a result of continuous rainfall. During the rainy season, woods are usually wet and cannot be used. Therefore, fuelwood consumed at this period are mostly purchased from vendors who store woods.

The respondents were also asked whether their expenditure on fuelwood affect other expenses, a large number of them (about 78%) indicated that there is no significant relationship between the two. This is common for respondents in Maidoki, Duma, Kastinawa Fulani, Yayi, PampaidaDutse, Tudun Maza, Kanawa, Ango Fulani, Fulani Sule, Billa and Kwatau. About 14% of the respondents reported that fuelwood purchases affect other household purchases such

as food items, clothing, and also affect household savings. While about 8% expressed that they do not know if fuelwood purchases affect other purchases as they do not keep records of such.

Table-9. Cost spent on fuelwood daily

Amount (N)	Frequency	Percentage (%)
50-100	322	85.2
150-200	44	11.6
250-300	12	3.2
350-450	-	-
450 and above	-	-
Total	378	100

Results of the field survey showed that 83% of the respondents still use fuelwood even when the prices shoot up, reason being that it is readily available. This is common in settlements like PampaidaMakaranta, Duma, Maidoki, Kwatau, KastinawaNakunne, Danja, Nagunda and RafinGaranGarmai. During periods of fuelwood scarcity when prices are inflated by wood vendors, the respondents claim they still purchase fuelwood since they do not have a cheaper substitute other than fuelwood. But more than 11% of the respondents pointed that they do not use fuelwood when prices increase. This is because they have other preference of energy such as kerosene, corn stalk, etc. Only about 5% of the respondents expressed that they do not buy fuelwood, as such do not know if fuelwood prices increase or not. These are found in areas like Tella, Tambaya and Yayi.

3.5. Problems Associated with Fuelwood Consumption

The effects of fuelwood consumption cannot be over emphasized. It is strongly believed that consumption of fuelwood has profound effects on the environment manifesting in climate change. Conversely, about 44% of the respondents indicated that fuelwood consumption do not have any effect on the environment, while 41% of them attested that they do not know if any effect of fuelwood consumption on the environment exist. However, close to 15% of the respondents agreed that fuelwood consumption have effects on the environment. The effects which are mainly negative include deforestation, desertification, erosion, and loss of wild life. Fuelwood consumption is accompanied with some health related problems. Furthermore, 28% of the respondents complained that they experience health related problems which they attributed to fuelwood consumption in the area. These problems include body pains, eye infections, fever, chronic cough, catarrh, injuries and cuts sustained from tree felling.

However, this can only be substantiated after an in depth scientific study on the relationship between these diseases and fuelwood consumption in the area. About 54% reported that they do not experience any health challenges resulting from fuelwood usage, while 18% indicated that they do not know if their illness is as a result of fuelwood consumption or by other means.

4. Conclusion

This study examined fuelwood utilisation in Pampaida, a Millennium Village in Ikara Local Government Area of Kaduna State. Finding of the study revealed that fuelwood is the dominant primary energy in the area in spite of scarcity of supply and price hikes. Majority of the people preferred fuelwood because it is easily accessible, affordable, and more convenient to use. It was found that close to one-third of the people in the area obtain fuelwood freely from the forest, while a little less than one-third of them get it from their farmlands and the rest get fuelwood from vendors and other sources. In addition, the level of fuelwood consumption in the area is very high, because close to two-third of the respondents use up between 1-3 bundles of fuelwood daily; and one-third of them require between 4-6 bundles/cords per day. Moreover, it was found that a large part of household expenditure goes to fuelwood. Majority of the people (85%) are unaware of the fact that fuelwood consumption has effects on the environment. However, close to 15% of them are aware of the environmental effects of fuelwood consumption.

4.1. Recommendations

From the findings of this research and the conclusion therein, the following recommendations are made:

* Alternative source of energy that can be developed for use in the area is solar energy. This is because Pampaida village has abundant supply of sunlight that can be harnessed to accomplish this purpose.
* Other substitutes of fuelwood such as gas, kerosene or electric cooking devices should be provided and made accessible to the community in the area. These devices have higher efficiency than any of the cooking appliances making use of wood.
* Careful management of natural forests especially in communal lands will help reduce or alleviate the problem of uncontrolled exploitation of "free" wood resources in such forests. It will most importantly involve the participation of the community in this area, who will eventually be the beneficiaries of this system.
* Farm forest is a land use system which tries to address the need for trees and food products in a multi-disciplinary manner. Here, trees and other woody perennials, food crops and livestocks are deliberately grown using the same piece of land. This system has the advantage of minimizing the time required to travel to the fuelwood supply sources when the wood sources are located on lands where people live and farm, reducing the income expended by the rural households on transporting or acquiring fuelwood.
* Proper awareness on the impact of fuelwood consumption on human health and also the environment should be carried out by the government. Also, laws guiding environment management and resource utilisation should be implemented and strictly abided, failure to comply which attracts punishment.

- Regenerating and replanting of trees should be encouraged by individuals, NGOs, government agencies so as to ensure environmental sustainability and preservation of tree animals.
- These recommendations if fully implemented will go a long way in improving rural livelihood (economically, socially, and health wise), sustain the environment and also improve general wellbeing of the people in the area.

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