FUDMA Journal of Earth and Environmental Sciences (FUDJEES), Vol. 1, No. 1, 2024

DOMESTIC ENERGY DEMAND AND CONSUMPTION BETWEEN TWO CONTRASTING COMMUNITIES IN GEREI LOCAL GOVERNMENT AREA, ADAMAWA STATE, NIGERIA: IMPLICATIONS FOR SUSTAINABLE ENVIRONMENTAL MANAGEMENT

Da'u Abba Umar, PhD[1], Salisu Lawal Halliru, PhD [2,] Aliyu Shu'aibu Muhammad, PhD[2], and Ramatu Dahiru [3]

[1]Department of Environmental Sciences, Faculty of Physical Sciences, Federal University Dutse, Nigeria.
[2]Department of Geography, Faculty of Arts and Social Sciences, Federal University of Education Kano, Kano State, Nigeria
[3]Government Senior Secondary School Jigawar Tsada Dutse, Jigawa State, Nigeria.

Corresponding author: lhsalisu09@gmail.com: abbaumar.d@fud.edu.ng
https://doi.org/10.33003/jees.2024.0101/9

ABSTRACT
The problem of domestic energy demand and consumption between two contrasting communities, Sangere Village and Modibbo Adama University of Technology Yola (MAUTECH) Campus, in Gerei Local Government has been examined. The study aims to investigate whether the rate and choice of energy utilization of the two different communities will impact sound environmental management. Thus, they highlighted some of the socio-demographic factors that informed the choice of domestic energy types and the volume used as well as some environmental repercussions between these contrasting communities. Data was gathered using a questionnaire survey of 120 adult residents and was complemented by personal observation. The result indicates fuelwood was the highest energy utilized (30%) in the Sangere community, while the highest energy choice in MAUTECH community was cooking gas (27%). The implication of this perpetual fuelwood utilization, especially among Sengere residents will exacerbate deforestation, soil erosion, and air pollution, thereby undermining sustainable environmental management. Thus, a serious awareness campaign is urgently needed among Sangere residents where the literacy rate is low and population growth is visible. The study finally recommends government policies/legislation and public enlightenment/education as a panacea to attitudinal change for sound environmental management in the area.

Keywords: Consumption, Demand, Energy, Environmental Management, Gerei.

INTRODUCTION

Human societies have always exploited the natural environment to meet the necessities of life, such as food, fuel, and shelter. In doing so the balance of nature or ecological equilibrium is altered. It is believed that the perpetual demand for natural resources for man's satisfaction within the environment especially energy demand and consumption poses several obstacles to sound environmental management (Adedotun, 2024). For instance, the demand for fuel wood has exacerbated the rate of deforestation and the subsequent environmental degradation. Also, the smoke or exhaust from cooking gas or firewood has serious consequences on atmospheric greenhouse concentrations thereby increasing the amount of carbon in the atmosphere which affects the entire earth system (Gandapa, 2018).

Energy as an environmental resource is essential for both economic and social development especially where the resources are available and utilized for sustainable development. But for all

the vital benefits energy brings, its consumption beyond equilibrium brings negative effects to the environment through an increase in greenhouse emissions (Adedotun and Ogunbode, 2023). Therefore, continued overuse and misuse of environmental resources especially trees as household energy will lead to serious environmental problems such as deforestation, soil erosion, air pollution, and climate change.

In Africa, including Nigeria, the most dominant sources of energy are fuel wood, and charcoal and it is estimated to account for about 90% of the total energy use and two-thirds of this consumption mostly are consumed as household energy in the region (Ominikari, 2023). This consumption heavily depends on the available biomass in the region that is supposed to control the environment through carbon sequestration and at the same time provide man with food and clean oxygen for survival (Ikurekong et al., 2009).

Continued over-dependence on fuel wood on biomass as primary sources of energy to meet household energy needs has contributed to negative impacts on the environment and contributes to affecting man in different dimensions. In the Sudano-Sahelian region of Nigeria where the trees besides been fewer and scattered, it has been rapidly cut down and consumed as fuel (Ominikari, 2023). This issue of overuse and misuse of fewer trees in the region is becoming more devastating coupled with the nature of poverty and high population growth rate which consequently causes environmental changes as a result of the demand for environmental resources to satisfy the needs of the increasing population (Adebayo and Anyanwu, 2005). The high demand for energy for consumption particularly domestic fuel has imposed even greater direct damage to the resource base, accelerating, deforestation, soil erosion, siltation, and flooding, thereby reinforcing the fuel wood crisis and depleting the necessary ingredient of sustainable environmental management and development (Balogun et al., 2011). Therefore, the level of energy demand and utilization and its environmental repercussions are quite disturbing and have called the attention of environmentalists and non-environmentalists alike.

Domestic energy demand is said to have social and economic characteristics i.e. it is culturally determined and economically affected. In the case of energy consumption, on the other hand, is determined by the level of requirement and utilization, which is further, accentuated by volume or size of the consumers or household size (Adeyemi, 2000). Economically speaking, however, it is estimated that an average person in a high-income country consumes 15 times more energy than an average person in a low-income country (Bolin et al, 1991). It is these perpetual demands and consumptions that pose a threat to sustainable environmental management in most of our rural areas (Umar and Tukur, 2018). Of all the energy consumed locally, fuel wood extraction and consumption is the most touching renewable resource so far identified. Because of the level of poverty among local communities, the fuel wood collection is further intensified every day, thus necessitating research of this nature to bring the public to order and to create awareness more purposely on the environmental consequence of their local actions.

This research is intended to assess the level of energy demand and consumption among two contrasting communities in Girei Local Government of Adamawa state and the subsequent environmental consequences of such demand and consumption on especially sustainable environmental management. It is hoped that at the end of this research, a clear picture of the energy consumption pattern among these communities will be detected and some unknown or unperceivable dangers of local action will be exposed.

STUDY AREA

Gerei Local Government is located at 9.3581° N, 12.5430° E. It approximately covers an area of about 2,450km2, with a population of about 78,290 people (census 1991). Hill and mountain ranges constitute the most striking landform features in Gerei. The area received a mean annual rainfall of about 725.4mm with the highest peak in July (158.2mm) and the average temperature is 32^0C while the maximum temperature reaches about 45^0C (maximum) (Adeyemi, 2000).

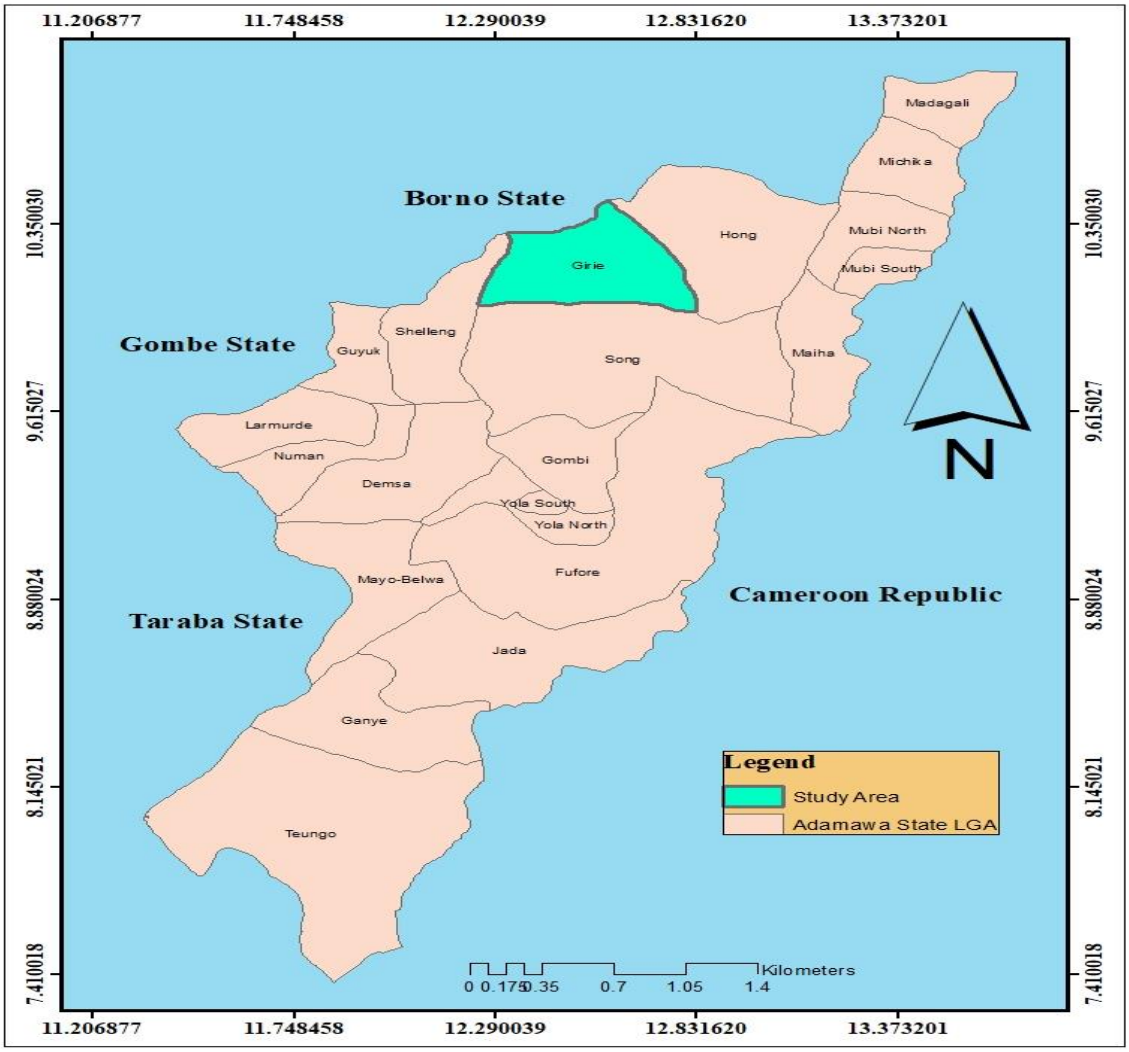

Figure 1: Adamawa State showing Gerei Local Government Area

Sudan savannah vegetation dominated the landscape of the area comprised of tall elephant grass and scattered trees. Most of the soils in this area are immature and weakly developed where glevic luvisol and regosols form the greater part of the soil (Adeyemi, 2000). The predominant occupation of the people in the area is farming mostly subsistence types; animal rearing, civil servants, and small-scale trading constitute another occupational career of the rest of the population.

MATERIALS AND METHODS

The study adopts a survey design to solicit relevant information in line with the objectives of the study. Data were collected through a questionnaire survey of one hundred and twenty (120) adult residents of Gerei Local Government using a purposive sampling technique and calculations based on the Kirche Morgan formula. The questionnaire was distributed proportionately to the population of each area; therefore, 80 questionnaires were distributed to Sangere village and 40

questionnaires were distributed to residents of the MAUTECH campus. The respondents were selected on a stratified sampling procedure. The stratification was based on the existing residential neighborhoods' distribution. The questionnaire sought information on the resident's household size, types and sources of energy used by residents, the effect of high energy demand and consumption, its environmental repercussions, and how to minimize the identified problem(s). Simple statistical techniques were employed to analyze the data and presented in tabular form using simple percentages.

RESULTS AND DISCUSSION

The study examined the respondents' gender, age, marital status, household size, degree of education, and monthly income. The gender distribution of the respondents suggests that fuel wood exploitation activities are more common among women than among men in the study area (Aina and Adejuwon, 1994). This may be explained by the fact that women perform the majority of household tasks, including using fuelwood to meet the family's daily energy needs (Liu and Feng, 2016). People have been seen to be walking farther to locate new supplies, especially fuelwood, and spending a significant amount of time doing so. This is especially the case for mothers and their children.

According to a survey conducted by (Fanan Ujoh et al., 2011), women and their kids now walk an average of two kilometers and spend two hours a day gathering fuelwood. This may be done to address the family's energy needs or to dispute the family's available income (Aju, 2014). In the research area, the majority of respondents were youthful and active. These results are consistent with those of Ndaghu et al. (2011), who found that young are primarily involved in fuelwood exploitation due to the energy costs associated with cutting, transporting, and distributing the material throughout the nation (Uwajumogu et al., 2019).

The respondents were asked about their household size. Table 1 shows the responses expressed in percentages. The variation in household size was the result of educational status, where most of the heads of the household in Sangere are not literate enough, and they always wish to have children for old age support and general social security. In this vein Ifatimehin and Musa, (2009) discovered a positive correlation between the number of people living in a home and how frequently they utilize firewood to meet their energy needs. People who live next to or close to conservation areas frequently claim ownership of these places and use the resources illegally as a result (Nathaniel, 2019). No matter how many people live in the family, this claim has made it feasible for them to all cut down trees to meet their high energy needs or to earn money from the sale of fuelwood.

Table 1: Household Size for both Areas

Response	MAUTECH (%)	Sangere (%)
1-15	45.75	14.80
15-30	39.45	39.45
30-Above	14.80	45.75
Total	**100.00**	**100.00**

Source: Fieldwork (2023)

On the Occupational status of the respondents, the result from Table 2, shows that a greater proportion of the respondents from the MAUTECH environment belong to the civil servant category, subsequently followed by businessmen then the artisans and lastly the other categories specified by the respondents accordingly. On the other hand, a greater proportion of the

respondents from Sangere village were artisans followed by civil servants and then businessmen. This information has further clarified the literacy gap between the two communities.

Table 2: Occupational Career of the Respondents

Occupation	MAUTECH (%)	Sangere (%)
Civil Servants	45.9	25.9
Business	25.1	15.1
Artisan	15.2	45.2
Other	13.8	13.8
Total	**100.00**	**100.00**

Source: Fieldwork (2023)

Types of Energy

Respondent were asked to mention the most important types of energy used in their houses. Four major types of energy used were identified. In addition, some homes use more than one type of energy in combination. Table 3 summarizes the responses.

Table 3: Types of Energy Used

Energy Types	MAUTECH (%)	Sangere (%)
Fuelwood	9.61	**30.33**
Kerosene	20.42	17.42
Cooking Gas	**27.33**	3.90
Electricity	6.90	5.71
Fuel Wood and Kerosene	15.82	16.82
Kerosene and Cooking Gas	10.31	9.61
Cooking Gas and Electricity	8.71	6.90
Other Combination	0.90	9.31
Total	**100.00**	**100.00**

Source: Fieldwork (2023)

As shown in Table 3, cooking gas constitutes the most common type of energy used at FUTY followed by kerosene, then fuel wood and kerosene together, followed by cooking gas and kerosene combined, then fuel wood alone, cooking gas and electricity combined were second to the last option, and the last option is another combination with 0.90%.

However, at Sangere village, the most common type of energy used is fuel wood (30.33%), kerosene (17.42%), followed by fuel wood and kerosene combined (16.82%), then kerosene and cooking gas together (9.61%) and other combination constitute (9.31%) then cooking gas and electricity, then electricity alone. Lastly, is the cooking gas alone (3.90%). It seems reasonable to expect income as the major determining factor in the choice of one or another type of energy used or consumed differently.

Sources of Energy

An attempt was made to identify the major sources of energy consumed by households in their respective houses. Two major sources were identified with other categories specified by the respondent as indicated in table 4.

Table 4: Sources of Energy Used

Sources	MAUTECH (%)	Sangere (%)
Bush	2.51	55.7
Market	45.7	25.1
Others	29.2	19.2
Total	**100.00**	**100.00**

Source: Fieldwork (2023)

To the respondents at the MAUTECT campus, their major source of energy is the market. However, respondents from Sangere village heavily depend on the bush for their energy. One should be contradicted since their major energy used is fuel wood or on the alternative, they used kerosene which is obtainable from the market. These results were supported by the work of Adedotun, 2024). Similarly, respondents were also asked to itemize some of the problems that they observed themselves in their various localities. Table 6 presents these problems.

Table 6: Identified Environmental Problems

Responses	MAUTECH (%)	Sangere (%)
Deforestation	35.9	45.9
Erosion	20.1	25.1
Air Pollution	30.2	15.2
Others	13.8	13.8
Total	**100.00**	**100.00**

Source: Fieldwork (2023)

From Table 6, the respondents of MAUTECT residents were also able to highlight deforestation as a major observable environmental problem and then followed by air pollution and then soil erosion. Similarly, it is abundantly clear that deforestation is equally the major observable problem in the Sangere area followed by erosion. This is so because the trees that provide anchorage to the soil have been removed via fuel wood collection. This provides a smooth ground for soil erosion. Air pollution is not noticeable here according to the respondents. This shows a low level of awareness.

Respondents were asked to suggest some measures to minimize the observed problems. The responses are shown in Table 7.

Table 7: Solution to the Observed Problems.

Measures/Solution	MAUTECH (%)	Sangere (%)
Government Policies	56.2	46.2
Public Awareness	24.2	34.2
Others	19.6	19.6
Total	**100.00**	**100.00**

Source: Fieldwork (2023)

From both communities, the solution to these problems should lie with the government by enacting laws or edits and enforcing policies, and by mounting a serious campaign aimed at public awareness for the effective control and or minimization of these menaces. This outcome is consistent with the research by Adedotun and Ogunbode (2023), which found that most respondents in the Girei communities had some degree of education, particularly University staff. Given that the majority of respondents held a formal education in MAUTECT, there is a greater likelihood that the study regions will support tree conservation efforts so that they and future generations can continue to benefit from the trees (Anghileri et al., 2018). Communities should educate their members on the risks associated with overusing their resources.

In the study area, the high cost of alternative energy sources such as cooking gas, electricity, and kerosene contributed to the rate of fuelwood exploitation and usage. Further findings from this study indicated that fuelwood utilization was influenced by socio-demographic factors, including age, household size, marital status, and monthly income. For this reason, the government needs to subsidize the cost of alternative energy sources, such as electricity, cooking gas, and kerosene, in order to lessen the pressure of fuelwood exploitation and to start afforestation and reforestation projects in the area. This has also been established by Adedotun (2024) in his study on domestic fuel wood utilization in the same study area (Girei Local Government).

CONCLUSION

The problem of energy demand and consumption among two contrasting communities in Girei Local Government has been examined. The result of the study indicates that the residents of the MAUTECH campus are aware of the environmental repercussions of high energy demand and consumption. Most of the residents agreed that energy demand and consumption have some negative effects on the environment such as deforestation, soil erosion, and air pollution. The study further identified that income level and household size were the major determining factors that differentiate household energy consumption patterns among these two contrasting communities. It is, therefore, reasonable to state here that high-income levels and fewer household sizes among MAUTECH residents were the reasons behind their choices of such energy types as cooking gas kerosene, and electricity as identified by this research. Thus, very little effort is needed to enhance public awareness at the MAUTECH campus to strengthen sound environmental management. Contrariwise, the case at Sangere village is more sympathetic, where low-income levels and large household sizes have forced the residents to concentrate on the cheaply available energy sources around them, which is fuel wood, for their domestic cooking. Because of this low income, very little attention was paid to other types of energy such as cooking gas and kerosene.

This perpetual fuel wood collection and utilization has therefore exacerbated deforestation, soil erosion, and air pollution, to the extent of posing serious implications to sustainable environmental management. Thus, a serious awareness campaign is urgently needed among Sangere residents.

RECOMMENDATIONS

In line with the respondent's suggestion, the study has identified the following recommendations for effective environmental management in the study area.

Public enlightenment/education: The cooperation and involvement of people in combating environmental problems are very essential, therefore there is a need to mount serious public educational programs that will create more awareness making people understand the effects of their local actions. Such programs should also spell out the provision of the law and the roles of the community members in helping law enforcement agencies to fulfill their assignments.

Government policies/legislation: This has to do with the enactment of environmental laws and regulations. Although the laws are partially put in place but government should make sure that, the laws are enforced where and whenever necessary.

To ensure compliance with environmental protection laws, the government should make other energy sources cheaply available such as kerosene, and cooking gas, and to make electricity potentially stable. The scarcity of other energy sources is and will always be implicative to sound environmental management. Many residents perpetually concentrate on fuel wood energy types because other energy types are not cheaply tenable. Thus, government policies cannot be effectively implemented without solving this important issue.

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