Global Journal of Research and Review (GJRR)
www.gjrr.org

Original Article

Comparative Analysis of Fuelwood Utilization In-and-Aroud Ikara Local Government Area of Kaduna State, Nigeria

Muhammad Isma'il*[1], Amina Maiwada[2], Anas Bashir[1], Ibrahim Jaro Musa[1], Gaddafi Adamu[3] and Hannatu Babajo[3]

[1]*Department of Geography, Ahmadu Bello University, Zaria, Nigeria*
[2]*Department of Geography, Kaduna State University, Kaduna, Nigeria*
[3]*Department of Geography, Federal College of Education, Zaria, Nigeria*

*Corresponding author e-mail: mgeogjameel@yahoo.com

ABSTRACT

This study compared the level of fuelwood utilization in and around Ikara Local Government Area of Kaduna state. The data for this study was acquired from both primary and secondary sources. The primary data was obtained through structured interview and questionnaire survey. The respondents were selected from both rural and urban Ikara. Stratified sampling method was used in administering the questionnaires. The data was analyzed using descriptive and inferential statistics. Results showed that Baobab (*Adansonia digitata*) is the predominant tree used for fuelwood in the area. Other tree species that are used for fuelwood in the area include Locust bean (*Parkia biglobosa*), Acacia (*senegalia greggii*), Tamarindus (*Tamarindus indica*), and Neem (*Azadirachta indica*). In addition, findings revealed that the demand for fuelwood is higher in rural Ikara where family sizes are higher and the fuelwood sources are more readily available than in urban Ikara. It was also found that the demand for fuelwood is not only influenced by family size and population growth, but accessibility, affordability and availability are other important determinants. Government should embark on intensive afforestation and mobilize people to engage in public and private afforestation programs in the area. In addition, people should be properly enlightened on the environmental implications on fuelwood consumption in the area. Also, laws regulating cutting down of trees should be reviewed and enforced by the government.

Keywords: Fuelwood; Utilization; Rural Ikara; Urban Ikara.

 ISSN 2393-8854

INTRODUCTION

Fuelwood is a vital source of energy to the rural and urban dwellers in developing countries. It occupies a unique position in rural energy systems due to the fact that it accounts for most of domestic energy consumption, and it is produced within the systems itself[1]. Fuelwood is any tree or wood material which is combustible and can be used as fuel. It may be available as firewood (e.g. logs, bolts, and blocks), charcoal, chips, sheets and sawdust. The processes of collecting fuelwood vary by regions and cultures. Some communities have specific fuelwood collection centers while others prepare a plot of land to grow wood for fuel. Fuelwood collection is usually done in group or individually. There are various tools and techniques used for gathering firewood[2] in Africa. In Nigeria, the tools mostly used are cutlass, machete, axe, and sometimes machines.

Fuelwood is usually the most preferred source of energy by rural dwellers that have very little access to alternative sources of energy. Therefore, fuelwood plays an essential role in meeting basic energy requirements connected with the subsistence of these people who are mostly engaged in primary activities. This is because fuelwood can be gathered easily and used cheaply in the rural areas.

In Nigeria, fuelwood is also an important fuel for many rural industries, which satisfy the basic human needs in stimulating and supporting economic growth. It is also reported that fuelwood accounted for over 70% of total energy used by households in Nigeria[3]. This leads to deforestation and triggers soil erosion and desertification. Likewise, Sambo (2005)[4] found that about 80 million cubic meters (43.4x109kg) of fuelwood is used annually for cooking and other domestic activities in Nigeria. Moreover, Tee *et al*.[5] found that fuelwood is the major source of both domestic and industrial energy for the residents of Makurdi metropolis in Nigeria. They also discovered that increasing demand for fuelwood and limited supply have resulted into increasing pressure on the tree species used for fuelwood, eventually driving them to extinction in the area. Likewise, Babanyara and Saleh[6] found that the factors causing fuelwood demand in urban areas include rural-urban migration, urbanization, as well as rising cost of other fuels. It is observed that there is correlation between economic status of a country and the demand for fuelwood. The poorer countries use more fuelwood than richer countries[7]. Fuelwood accounts for two thirds (2/3) of all energy other than human and animal energy used in Africa, for nearly one third (1/3) in Asia, and for one fifth (1/5) in Latin America. But in developed countries, fuelwood accounts for one third (1/3) of one percent of the total energy demand[8].

Ikara town is an urban area with reduced vegetation, hence reduced fuelwood sources compared to the rural environs surrounding it that has rich forest resources. Also, the urban area has a higher population compared to its surrounding rural areas, and the population size determines the number of households and consequently the demand for energy in the areas. It is therefore assumed that the utilization of fuelwood will differ over space. The aim of this study is to compare the level of fuelwood utilization in and around Ikara rural areas, with a view to find out whether there is variation in the level of fuelwood consumption among the people in the areas for proper energy policy formulation and implementation..

Research Hypothesis

The null hypothesis (H_o): there is no significant difference in the rate of fuelwood utilization among residents of households of Ikara town and the surrounding rural areas.

While the alternative hypothesis (H_2) is: there is significant difference in the rate of fuelwood utilization among residents of Ikara town and the surrounding rural areas.

The Study Area

Ikara is the headquarters of Ikara local government located between latitude 11° 02" and 8° 08" and longitude 12° 02"E as shown in Fig. 1. The study area is within the Zaria closed settled zone of Kaduna and covers an area of 1,614 (sqkm). It is situated on a plateau of a height of about 2200ft above sea level. In other words, the area is located at the center of northern Nigeria[9].

Ikara falls under Aw Koppen's climatic classification, which is typically wet and dry. There are two airmasses influencing the climate in the area. One of them is the northeast trade blowing from Sahara desert and results to harmattan. The other one is the tropical maritime which is monsoonal in character and is composed of moist and relatively cool air. It originates from the southwest across the Gulf of Guinea. The rainfall in the area is less than 1300mm. The period of rainy season starts from months of March and April with August being the wettest month, while coolest months are December and January. The mean annual temperature in the area is about 26^0C. The soil in the area is mainly leached ferruginous. The natural vegetation of Ikara is the Sudan savannah type also called woodland savannah. The indigenous tree species include Shea butter, Locust bean, Mango, Isoberlina, Neem, Baobab, Tamarindus and various species of Acacia[9]. However, due to human pressure on land resources through various economic activities such as intensive agriculture, indiscriminate bush burning, firewood harvesting, hunting, intensive grazing, the natural vegetation of the town is gradually modified.

Ikara has a population of 194,723 people, with annual growth rate of 3%[10]. The major ethnic groups in the area are Hausa and Fulani. The minor tribes include Yoruba, Igbo, Kataf, Chawai, Karei-karei e.t.c. The number of ethnic groups and the population is increasing due to the available job opportunities and peaceful coexistence among the people in the area. The major occupation in the area is agriculture. The investment opportunities centered on agricultural production, food processing, solid minerals, mining and tourism. The arts and craft practiced in the area are weaving, pottery, blacksmithing, tanning and leather works. The culture of the people in Ikara local government is diverse as the people themselves[9].

MATERIALS AND METHODS

Types and Sources of Data

The data for this study was acquired from both primary and secondary sources**.** The primary data was obtained through questionnaire survey and structured interview with community heads, fuelwood sellers, and environment officials. The questionnaire consisted of open and close ended questions and was administered to respondents sampled randomly from each stratum in the area. The information obtained from the questionnaire include source of fuelwood, quantity of fuelwood consumed per household or business center, and the amount of money spent on fuelwood per household. The secondary data was obtained from journals, official statistical books, and magazines.

Sampling Technique

An extensive field survey was carried out in the study area for three days. During the survey, observation was made on a number of variables. The primary data was obtained through questionnaire survey. A total of 150 questionnaires were distributed

to all the sampled areas under study. Stratified sampling method was used in order to ensure comparability between Ikara town and its surrounding rural areas. The study area was stratified into 6, 3 selected within Ikara municipality, and 3 selected from surrounding rural areas. The number of questionnaire administered in each area is presented in Table 1. The urban areas have higher population density and therefore 30 questionnaires were administered in each area within the municipality; while 20 questionnaires were administered in each rural area.

Method of Data Analysis

The data obtained from field survey was analyzed using descriptive and inferential statistics. The inferential statistics that was used is Student's t-Test in order to ensure efficient and accurate comparison of fuelwood utilization in Ikara local government area.. The t-Test was employed to compare between two samples collected independently from rural and urban Ikara.

The Student's t-Test formula is given as:

$$t = |x - y| \quad \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots$$

Equation 1

Where t is Student's t-Test, x and y are the two variables.

RESULTS AND DISCUSSION

The information collected from the questionnaire survey was analyzed and presented in the following sections.

Socioeconomic characteristics of the respondents

Results showed that over 70% of the respondents in both rural and urban Ikara were males. However, 63% of the respondents in Ikara town were married, 14% were single and 22% were divorced; which contrasts with that of rural Ikara in which about 80% of the respondents were married, about 13% were single and 17% were divorced. The age structure of the respondents as presented in Table 2 shows that 31% of the respondents fall within the age group 20-29, and 33% fall under 30-39 and about 26% fall under the age group 40-49 in urban areas. While in rural areas about 20% of the respondents fall within the age group 20-29, and 27% fall under 30-39 and about 40% belong to 40-49 age group. It can be observed from Table 2 that only about 4% and 10% of the respondents respectively belong to 50 years and above in urban and rural Ikara. These imply that the respondents are responsible and capable of providing reliable information on household activities which are relevant to this study.

Table 3 indicates clearly the contrast in terms of economic activities between the two areas in which about 44%, 24%, and 17% of the respondents in urban Ikara are civil servants, traders and farmers respectively; while about 41%, 33%, and I5% are farmers, traders, and civil servants respectively in the rural areas. The occupation of a household determines their level of income which in turn influence the choice of energy used for domestic activities.

Table 4 shows that about 67% and 37% of the respondents respectively in urban and rural Ikara had Qur'anic education; and about 18% of the respondents in both areas attended primary school. It is obvious that the literacy level is higher in urban areas with about 21% and 23% having secondary and tertiary educational qualification, as against the rural populace whereby only 10% and 5% of the respondents had attended secondary and tertiary schools respectively.

Table 5 shows that the economic status of majority of the respondents is very low as only about 13% and 5% of the respondents respectively in urban and rural Ikara earn 49,000 NGN and above (equivalent to 300 USD and above) per month. Whereas

about 22% and 28% of the respondents respectively in rural and urban Ikara earn <18000 NGN (equivalent to 120 USD) monthly. Other categories are presented in Table 5.

Family size influences the demand for fuelwood in a household. Table 6 indicates that although family sizes in rural Ikara are larger than those of urban Ikara, family sizes are generally large in the area. This affects the demand for fuelwood in the area. Other determining factors of fuelwood demand in the area are outlined in Table 7. They include affordability, availability, and familiarity. However, Table 8 revealed that about 58% of the respondents in the surrounding rural areas use fuelwood daily; 27% weekly and only 10% used it monthly. Whereas, about 57% of the respondents in urban areas use fuelwood daily, and about 14% and 17% of them use it on weekly and monthly basis respectively.

Table 9 revealed that about 53% of the respondents in the rural areas usually obtain their fuelwood from their farmlands, 30% get it from stationary firewood vendors, and 17% obtain it from nearby rural areas. But in urban Ikara, about 43% of the respondents obtain fuelwood from mobile fuelwood vendors, while 24% of them obtain it from stationary fuelwood vendors, 20% get it from nearby rural areas, and 12% of the respondents source fuelwood from farmlands around.

Fuelwood Consumption Pattern in Ikara

Tree species used as fuelwood in the study area

Findings revealed that the following tree species are used for fuelwood in the area: Baobab (*Adansonia digitata)*, Locust bean (*Parkia biglobosa)*, Acacia (*senegalia greggii*), Tamarindus (*Tamarindus indica*) and Neem (*Azadirachta indica)*. But Baobab is mostly used for fuelwood due to its availability in the area.

Household size sometimes determines the average quantity of daily fuelwood requirement of households. Table 10 indicates that the demand for fuelwood in the area of study is generally high but higher in rural Ikara where family sizes are higher and the fuelwood sources are easily obtainable than in urban Ikara. It can be seen from Table 10 that about 50% of the respondents in rural Ikara require 1 – 5 bundles daily compared to 70% in urban Ikara. Also, about 45% of the respondents in rural Ikara use 6 – 10 bundles of fuelwood daily. This is more than twice the respondents (22%) that use the same quantity of fuelwood per day in urban Ikara.

Average cost per bundle of fuelwood

Findings revealed that there is variation in the cost per bundle of fuelwood in and within rural and urban Ikara Local Government Area. This is usually due to distance covered to collect the fuelwood. Results showed that 45% of the respondents in rural areas spent N20-59 (about ½ USD) per bundle of fuelwood, 17% spend N100-139 (about 1 USD), while about 17% don't buy wood because they obtain it from their farmlands. In urban Ikara, result indicates that 32% of the respondents spend N20-59 (about ½ USD) per bundle, 5% spend N20-99, 6% spend N100- 139 (about 1 USD), 4% spent N140-179 (about 1 USD), and 5% spend N180-219 (about 1½ USD) on fuelwood per bundle.

It was found that many problems are associated with fuelwood consumption in the area. These include scarcity due to increasing demand resulting to high cost of fuelwood, inadequate ware housing/storage facilities resulting to theft of fuelwood in the area. Other problems may be attributed to inadequate supply of alternatives such as kerosene and cooking gas. This is because in Ikara municipal, there are only two filling stations that serve as wholesalers of kerosene and cooking gas, with few retailers in areas

like Jibis Barrack and Sabuwar Kasuwa. While in the rural areas, there is no filling station that sells kerosene and cooking gas. The nature of economic activities (bakeries, restaurants, grilled meat spots, pottery, oven baking, smoking fish and charcoal production) in-and-around Ikara Local Government Area is somehow similar.

Alternative to fuelwood consumption

When the respondents were asked whether they could stop using fuelwood, about 82% in rural areas of Ikara claimed they could not, while about 19% confirmed that they would prefer alternative to fuelwood. Majority of the respondents in the rural areas claimed they could not do without fuelwood because most of the vast available renewable energy sources are not well developed and consequently underutilized[11]. But in urban Ikara, about 64% of the respondents confirmed that they could stop using fuelwood, while 36% claimed they could not. It can be observed that there is a significant number of people hoping to stop using fuelwood in both rural and urban Ikara. This number can be increased through educating and enlightening the populace on the environmental consequences of fuelwood consumption in the area. This will go a long way to encourage and motivate the people in the area to switch to alternative cleaner sources of energy. The implication of this is there will be reduction on over dependence on fuelwood in the area to achieve environmental sustainability. This is in line with Isma'il *et al*.[12] who stressed the need to educate people on the causes of climate change as a pre-requisite to motivate them to engage with climate change and take necessary action.

Moreover, field survey revealed that availability of kerosene and cooking gas, as well electricity supply are valid alternatives that would be accepted by the respondents to curb excessive fuelwood consumption in the area. These are measures that can be adopted in the short term toward sustainable development[11].There is also the need to enact and enforce stringent laws to ban or regulate excessive deforestation in the area.

Environmental consequences of continuous use of fuelwood

Results from field survey suggest that the respondents have some knowledge of environmental implications of fuelwood consumption. For instance, in rural Ikara, 38% of the respondents see increase in violent windstorm as one of the environmental effects of fuelwood utilization, 37% mentioned desertification, 18% identified erosion, and only about 7% linked biodiversity loss to fuelwood consumption in the area. However, about 39% of the respondents in urban Ikara see increase in violent windstorm as one of the environmental effects of fuelwood consumption in the area, 33% of them mentioned erosion, 21% each attributed desertification and biodiversity loss to fuelwood consumption in the area.

Findings revealed that catarrh is the most prevalent disease which has been linked to fuelwood utilization in-and-around Ikara Local Government Area.

Hypothesis Testing and Analysis

This study hypothesized that there is no significant difference in the rate of fuelwood utilization in-and-around Ikara Local Government area. Alternatively, there is significant difference in the rate of fuelwood utilization in-and-around Ikara Local Government Area. To test these hypotheses, data on the amount of money spent on fuelwood and regularity of fuelwood utilization per day, weekly, and monthly was subjected to Student's t-Test to determine a probability that the populations of rural and urban Ikara are the same with respect to these variables. The results are presented in the following subsections.

Average amount of money spent on fuelwood per day in the study area

The data on average spent on fuelwood per day in the area were analyzed by the use of Student's t-Test. It was found that at 0.05 level of significance, the calculated value was 0.80 and the tabulated value was 2.23. Since the calculated value of T-test is less than the critical value at the chosen level of significance, we accept the null hypothesis and hence concluded that, there is no significant difference in the average money spent on fuelwood in-and-around Ikara Local Government Area.

Regularity of fuelwood Utilization in the area

The data on households' size in-and-around Ikara Local Government was also analyzed by the use of Student's T-test. Results showed that at 0.05 level of significance, the calculated value was 0.01 and the tabulated value was 2.31. Since the calculated value of T-test is less than the critical value at the chosen level of significance, we accept the null hypothesis and therefore concluded that, there is no significant difference in fuelwood utilization in-and-around-Ikara Local Government Area.

CONCLUSION

This study compared the level of fuelwood consumption among socio-economic groups within Ikara town and rural areas for proper energy policy formulation and implementation. Findings revealed that the demand for fuelwood in the area of study is generally high but higher in rural Ikara where family sizes are higher and the fuelwood sources are readily available than in urban Ikara. The tree species that are used for fuelwood in the area include Baobab (*Adansonia digitata)*, Locust bean (*Parkia biglobosa)*, Acacia (*senegalia greggii*), Tamarindus (*Tamarindus indica*) and Neem (*Azadirachta indica)*. But Baobab tree is mainly used for fuelwood due to its accessibility in the area. The demand for fuelwood is not only determined by family size and population growth, but accessibility, affordability and availability are other significant determinants.

RECOMMENDATIONS

Based on the findings of this study, the following recommendations are put forward:

1. Alternative sources of energy such as biogas and solar energy should be harnessed and provided in the area. This will help to reverse the unfavorable reliance on fuelwood in the area. In the mean time, kerosene and cooking gas should be provided at subsidized rates to encourage a shift from environmentally unfriendly fuelwood to more sustainable sources of energy.
2. Government should embark on intensive afforestation in the area. Also, people should be encouraged to participate in public and private afforestation programs. In addition, laws regulating cutting down of trees should be reviewed and enforced by the government.
3. Moreover, government should provide improved seedlings for farmers to establish private woodlots in the area. This will reduce the indiscriminate destruction of natural forests that are highly economical in the area.

Government and non-government organizations should embark on public enlightenment campaigns to inform the citizen on the consequences of fuelwood consumption such as climate change, environmental pollution, and biodiversity loss.

REFERENCES

1. Food and Agricultural Organization, FAO, 2012: *Year book of forest productions,*

1994-1998. FAO forestry series; No. 155. Rome.
2. Cunningham W. P., 2006: *Principle of Environmental Science, Inquiry and Application*. M.C. Graw-Hill Companies Inc.
3. Iwayemi A., 2008: "*Nigeria's Dual Energy Problems: Policy Issues and Challenges*". International Association for Energy Economics, Turkey,
4. Sambo A. S., 2005: Renewable Energy for Rural Development: The Nigeria Perspective. *ISESCO: Science and Technology Vision*, 1:12-22.
5. Tee N. T., P. U. Ancha, and J. Asue, 2009: Evaluation of fuelwood consumption and implications on the environment: case study of Makurdi area in Benue state, Nigeria. *Journal of Applied Biosciences*, 19: 1041 – 1048.
6. Babanyara Y. Y., and U. F. Saleh, 2010: Urbanisation and the Choice of Fuel Wood as a Source of Energy in Nigeria. *J Hum Ecol*, 31(1): 19-26.
7. Yahaya S. B., 2002: *The Development and Adoption of Local Alternative Sources of Energy against fuelwood*. A paper presented at a two-day training workshop on Agroforestry management, for sustainable agricultural production. Manpower Development Centre: Office of the Head of Service, Kano State, Nigeria.
8. Energy Commission of Nigeria, 2012: National Policy on Fuelwood Crisis. *012 NEC Report Series*, No 1, Abuja, Nigeria.
9. IKACPA (Ikara Community Progressive Association), 2012: *Handbook on Ikara. Information and Protocol Unit*. Ikara Local Government Secretariat, Ikara, Kaduna State, Nigeria.
10. National Population Commission, 2004: National Policy on Population for Sustainable Development. *NPC Report Series,* No. 1. Abuja, Nigeria.
11. Isma'il M., I. J. Musa, A. A. Ibrahim, U. A. Kibbon, S. Abbas, I. Kim, and A. A. Jajere, 2014: Energy and Climate Change Policy for Nigeria. *Current Advances in Environmental Science (CAES)*, Volume 2, Issue 1, PP. 38-45.
12. Isma'il M., I. J. Musa, A. Salisu, S. M. Zubairu, I. Kim, I. Musa, I. D. Ibrahim, and Z. D. Muhammed, 2014: Visualising the Relationship between Energy Use and Climate Change. *Current Advances in Environmental Science (CAES)*, Volume 2, Issue 1, PP. 1-10.

 ISSN 2393-8854

Table 1. Sampling frame

Area	No of questionnaire
Magajin Gari (Suburb)	30
Tsohuwar Kasuwa (Suburb)	30
Sabuwar Tasha (Suburb)	30
Jamfalan (Rural)	20
Zage-zagi (Rural)	20
Auchanawa (Rural)	20
Total	150

Table 2. Age structure of the respondents

Ages[years]	Rural frequency	Urban frequency	Total	Rural%	Ikara%
< 20	2	5	17	3.30	5.50
20-29	12	28	40	20	31.10
39-39	16	30	46	26.70	33.30
40-49	24	23	47	40	25.50
50 above	6	4	10	10	4.40
Total	60	90	150	100	100

Table 3. Occupational structure of the respondents

Occupation	Rural frequency	Ikara frequency	Total	Rural %	Ikara %
Farming	25	15	40	41.70	16.70
Driving	6	13	10	10	14.40
Trading	20	22	33.30	33.30	24.40
Civil service	9	40	49	15	44.40
Total	60	90	150	100	100

Table 4. Educational qualification of the respondents

Educational status	Rural frequency	Ikara frequency	Total	Rural %	Ikara %
Qur'an	40	33	73	66.70	36.70
Primary	11	17	28	18.30	18.90
Secondary	6	19	25	10	21.11
Tertiary	3	21	24	5	23.30
Total	60	90	150	100	100

Table 5. Monthly incomes of the respondents

Income per month (NGN)	Rural frequency	Ikara frequency	Total	Rural %	Ikara %
< 18000	17	20	37	28.30	22.20
18000-28000	19	23	42	31.70	25.50
29000-38000	10	19	29	16.70	21.10
39000-48000	11	16	27	18.30	17.78
49000 above	3	12	15	5	13.30
Total	60	90	150	100	100

Table 6. Households size of the respondents

No of persons	Rural frequency	Ikara frequency	Total	Rural %	Ikara %
0-5	3	40	43	5	44.40
6-10	16	10	26	26.70	11.11
11-15	11	9	20	18.30	10
16-20	17	21	38	28.30	23.30
21 above	13	10	23	21.70	11.10
Total	60	90	150	100	100

Table 7. Factors responsible for utilization of fuelwood consumption

Factors	Rural frequency	Ikara frequency	Total	Rural	Ikara
Cheapness	16	45	61	26.70	50
Availability	23	40	63	38.30	44.40
Cultural acceptance	19	4	23	31.70	4.40
Others	2	1	3	3.30	1.10
Total	60	79	139	100	100

Table 8. Regularity of fuel wood consumption

Regularity	Rural frequency	Ikara frequency	Total	Rural %	Ikara %
Daily	35	51	96	58.33	56.67
Weekly	16	13	29	26.67	14.44
Monthly	6	15	21	10	16.67
Other	3	11	14	5	12.22
Total	60	90	150	100	100

Table 9. Sources of fuelwood of the respondents

Sources	Rural frequency	Ikara frequency	Total	Rural %	Ikara %
Mobile vendor	0	39	39	0	43.30
Farmland	32	11	43	53.30	12.20
Stationary vendors	18	22	40	30	24.40
Nearby area	10	18	28	16.70	20
Total	60	90	150	100	100

Table 10. Average quantity of daily fuelwood requirement

Bundles used per day	Rural %	Urban %
1 – 5	50%	71%
6 – 10	45%	22%
11 – 15	2%	2%
16 – 20	3%	1%
➢ 20	0	4%
Total	100	100

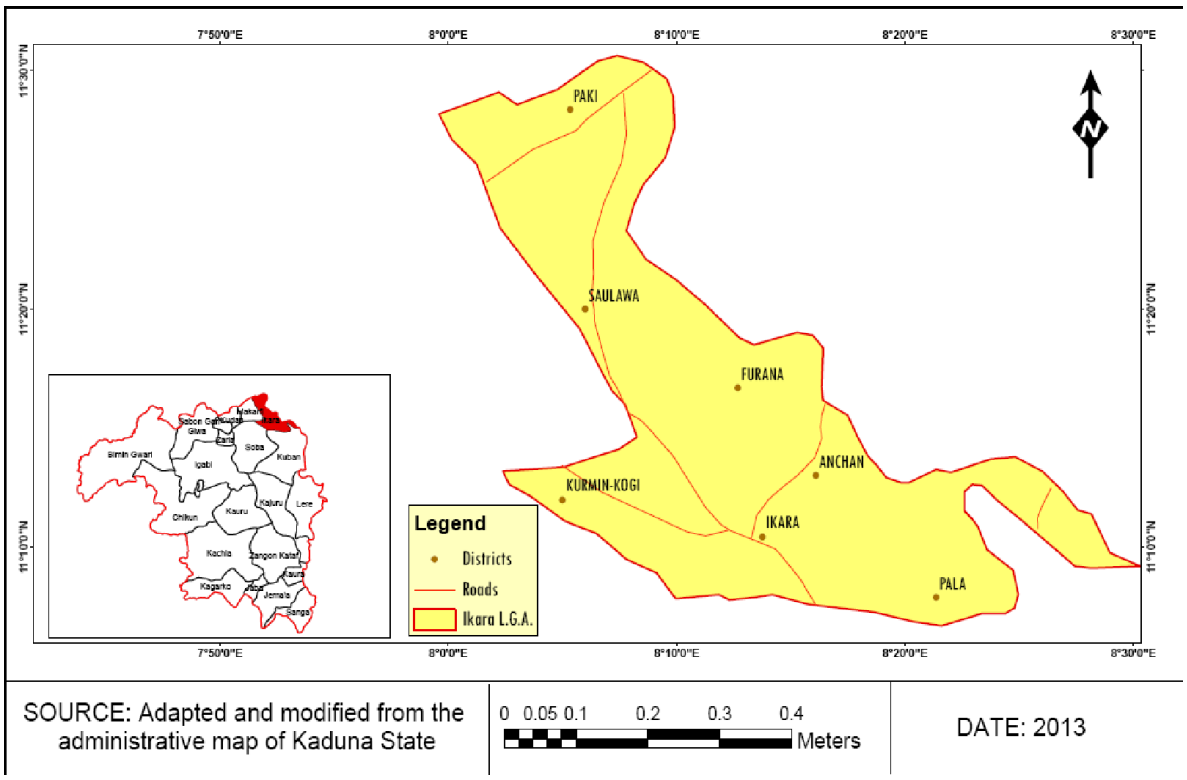

Figure 1. Map of Ikara Local Government Area