

ASSESSMENT OF DOMESTIC CHARCOAL CONSUMPTION IN ILORIN, KWARA STATE

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Abstract

This study analyzes domestic charcoal consumption in Ilorin metropolis. The objectives of the study were to estimate per capita charcoal consumption within the metropolis and calculate the quantity of wood to be planted in order to replace the wood harvested for charcoal production. Data for the study were obtained from structured questionnaire administered to selected households from the twenty traditional wards in Ilorin metropolis. The findings of the study show that the domestic charcoal consumption in Ilorin ranges from 0.33 to 0.7 kg per person per day. The estimated volume of wood consumed per annum within the metropolis from domestic charcoal usage is 560,000 m³, hence about 745,127 trees is required for reforestation. It is recommended that government should initiate efficient management of existing forest and facilitate a smooth shift from charcoal to cleaner household fuels.

Introduction

Charcoal is a black or dark grey form of carbon which is produced locally by heating forest wood or other organic substance in an enclosed space. Charcoal is also produced by heating wood in airtight ovens or retorts, in chambers with various gases, or in kilns supplied with limited and controlled amounts of air. High-temperature heating by all methods breaks down the wood into gases, a watery tar mixture, and the familiar solid carbon material which is commonly known as charcoal.

Charcoal has been an important domestic product for many years and has wide market acceptance (USDA, 1961). In developed countries like the United States, its greatest use is for home and outdoor recreational cooking (Wenger, 1984). Half of the world's population uses biomass fuels for cooking and charcoal supplies about 95 percent of the domestic and commercial cooking energy needs in developing countries (FAO, 2000). Over two billion people in developing countries rely on biomass energy in the form of firewood, charcoal, crop residues, and animal wastes to meet their cooking and heating requirements (MEA, 2005). Fuel wood and charcoal consumption in tropical countries is projected to increase from 1.34 billion m³ in 1991 to 1.81 billion m³ in 2010 (FAO, 1993).

In Africa, it was observed that as population increases, charcoal consumption increases by 14 percent (Agyeman et al., 2012). The number of people relying on fuel wood is expected to keep increasing up to about three quarters of the total residential energy in Africa by 2030 (IEA, 2002). Hence quite a large number of households in Africa will continue to rely on traditional biomass fuels like charcoal. However future availability of charcoal is uncertain due to dwindling biomass resource (Kituyi, 2004). Many households in Nigeria are facing challenges of convenient cooking fuel. The major sources of cooking energy in Nigeria are electricity, liquefied natural gas (popularly known as cooking gas), kerosene, charcoal, firewood, wood waste, and agricultural waste. The use of any of these sources of cooking fuel by a household has been faced with some challenges and also depends on affordability, preference and availability.

There has been long years of inconsistency in the supply of electricity while kerosene is faced with persistence scarcity and increase in price (Adelekan and Jerome, 2006; Babalola, 2011). Cooking gas is also very expensive and out of reach for the poor and low-income class. The increase in prices of petroleum products adversely impacts negatively on majority of poor households in Nigeria (Tomori *et al.*, 2005). On the other hand, charcoal is readily available and cheap in Nigeria that is why it is popular among rural dwellers and the low-income class within urban areas (Babalola, 2011).

This study is therefore aimed at assessing domestic charcoal

consumption in Ilorin metropolis, Kwara State, Nigeria. It specifically seeks to estimate per capita charcoal consumption within the metropolis and calculate the quantity of wood to be planted in order to replace the wood harvested in the forest at a particular period.

Study Area

The study area; Ilorin, is the major commercial and capital of Kwara State in Nigeria. The geographical location of Ilorin in Kwara State is shown in Figure 1. It is located between latitudes $8^{\circ}25'35''$ and $8^{\circ}31'30''$ North of the equator and longitudes $4^{\circ}28'20''$ and $4^{\circ}35'45''$ East of the Greenwich Meridian. The strategic position of Ilorin in north-central Nigeria makes it the gateway between the north-western and the south-western part of the country. Ilorin metropolis is made up of three Local Government Areas namely Ilorin East, Ilorin West, and Ilorin South. According to the 2006 National population census report, the population of Ilorin metropolis is over 777,000 (NPC, 2007). The climate is characterized by alternate dry and wet seasons and each lasting about six months. The wet season usually starts from the end of March and lasts till October while the annual rainfall is between 1120 and 1500 mm. The dry season commences in November and lasts till early March (Emielu, 1991).

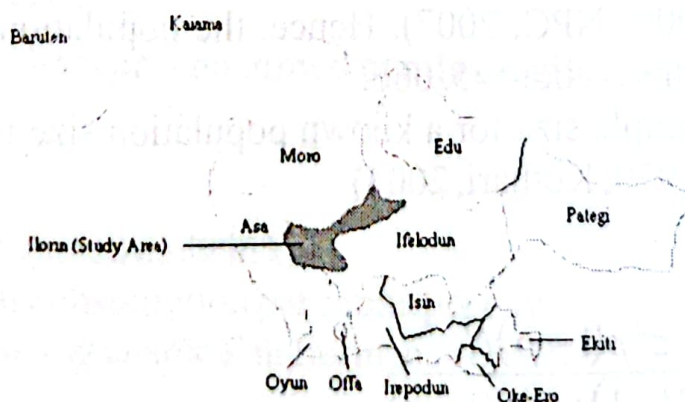


Figure 1 Map of Kwara State showing the location of Ilorin (the study area)

The mean total annual rainfall is 1,200 mm (Olaniran, 2002). The grains grown in Ilorin include millets, maize, sorghum and rice while the common root crops are yam, cassava, potatoes and cocoyam. The vegetation is woody Savanna grass land and the common trees are shear butter tree (*Vitellariaparadoxa Sp*) and locust bean tree (*Parkiabiglobosa*). Due to the favourable climate and geographical location of Ilorin, several other economic trees can also be found within the city and neighbouring communities. Charcoal has become a popular domestic fuel within the low and some middle income earners in Ilorin perhaps because of its availability, cost and the increasing cost of other cooking fuels. Hence almost all dry-woods are used as fuel wood in Ilorin, however tree species such as *P. erinaceus*, *P. biglobosa*, *P. Africana*, *T. emetica*, *A. leiocarpus*, *D. oliveri*, *K. senegalensis*, *T. grandis*, *M. excelsa* and *V. paradoxa* are predominantly used (Abdulrahman et al., 2006).

Methodology

Two stages of sampling were employed in this study. First, the existing traditional wards within the metropolis were identified. Secondly, random sampling technique was used to choose the target respondents, that is, those households that use charcoal as their primary, secondary or occasional household fuel. A total of 5.8% of the residents in Kwara State use charcoal as major source of cooking fuel (NBS, 2012b). Also the population of Ilorin metropolis after the 2006 National Population Census is over 777, 000 (NPC, 2007). Hence, the population using charcoal in Ilorin metropolis is about 45, 066.

The sample size for a known population size is given as (Krejcie and Morgan, 1970; Kothari, 2004):

$$n = \frac{z^2 p(1-p)N}{e^2(N-1) + z^2 p(1-p)} \quad (1)$$

Where

n is the sample size;

z = standard variate at a given confidence level;

P = sample proportion

e = margin of error

N = population size (Number of households using charcoal in Ilorin)

N_p = Number of people using charcoal in Ilorin (45, 066) (2)

P_h = Average number of people per household = 4.1 (NBS, 2012a)

Therefore $N = 10,992$

For $N = 10,992$, at 95 % confidence level ($z = 1.96$) and 7% margin of error ($e = 0.07$), 50% baseline level of indicators ($P = 0.5$), a sample size (n) of 193 respondents is appropriate for the study based on Equation (1). A total of 200 respondents were chosen from the twenty (20) traditional wards in Ilorin metropolis for the study. The wards are Sabon-Gari I, Oloje, Ajikobi, Ubandawaki, Adewole, Ogidi, Oke-Ogun, Sarumi, Oju Ekun, Balogun Fulani, Sabon-Gari II, Baboko, Alanamu, Zango, Ibagun, Badari, Okaka, Gambari, Magaji-Gari, and Magaji-Are. Respondents spread across the twenty wards were served the questionnaire. The completed questionnaires were retrieved and analyzed.

The net amount of charcoal consumed per day is given as:

$$k = z \times N_p \quad (3)$$

Where:

k = Net charcoal consumed daily in kg

z = Average charcoal consumption per capita per day

N_p = the population using charcoal in Ilorin metropolis

Volume of wood to replace per annum = Amount of wood consumed daily x

Number of days in a year

(4)

$$\text{Number of trees to be planted} = \frac{\text{Volume of wood to be replaced}}{\text{Volume of a typical tree}} \quad (5)$$

Results and Discussion

Figure 2 shows the percentage distribution of respondents by the amount of charcoal (in kilogram) used. A little above half of the total respondents (51%) use between 5kg and 10kg of charcoal daily while 3.5% of the respondents use above 20kg daily.

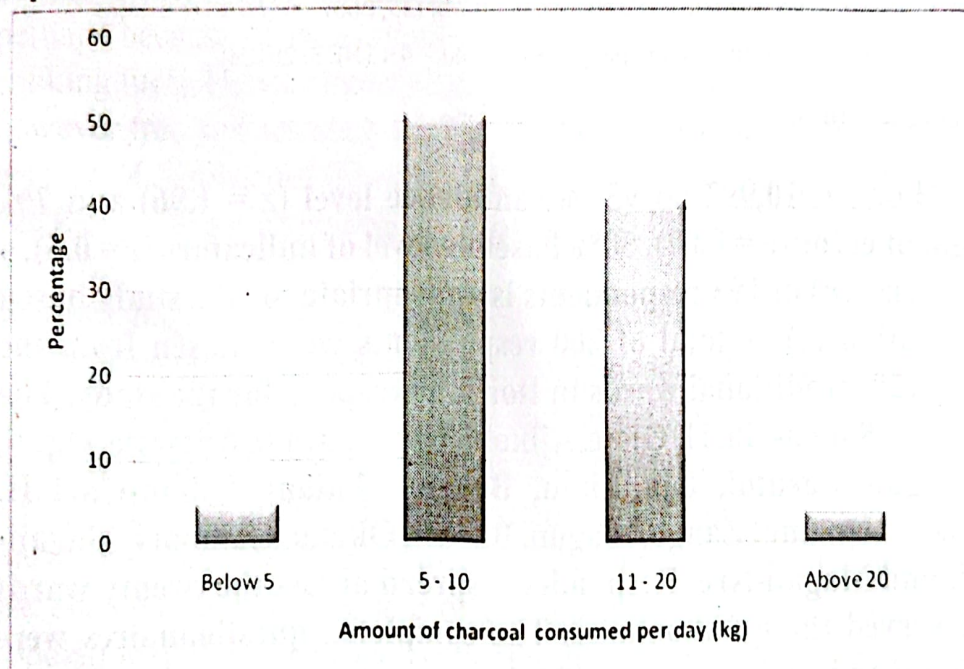


Figure 2: Percentage distribution of respondents by amount of charcoal used per day. The per capita charcoal consumption of various wards located within Ilorin ranges from 0.33 and 0.7 kg per person. The percentage distribution of charcoal consumption among the twenty wards in Ilorin metropolis is presented in Table 1. Ogidi ward has the highest contribution (7.56 percent) to charcoal usage in Ilorin with an average of 0.65 kg/person while Ibagun contributes the lowest percentage (average of 0.325 kg/person).

Table 1: Percentage distribution of charcoal consumption among the twenty wards in Ilorin

Ward	Percentage of overall charcoal consumption
Sabon Gari I	4.57
Oloje	6.87
Ajikobi	4.72
Uban Dawaki	3.79
Adewole	4.95
Ogidi	7.56
Oke Ogun	4.60
Zarumi	4.28
Oju Ekun	4.01
Balogun Fulani	4.91
Sabon Gari II	6.04
Baboko	5.14
Alanamu	4.07
Zango	5.81
Ibagun	3.78
Badari	5.67
Okaka	3.78
Gambari	4.46
Magaji- Gari	5.76
Magaji-Are	5.23

The average charcoal consumption per capita per day (z) estimated by finding the average of all the values extracted from the questionnaires is 0.52 kg

$$N_p = 45,066$$

From Equation 3, the net charcoal consumed daily, k, is therefore equal to 23,434 kg.

According to FAO (1983),

$$1 \text{ m}^3 \text{ of fuel wood} = 750 \text{ kg of wet fuel wood}$$

$$\therefore \text{Volume of fuel wood} = \frac{23,434}{750} \times 1 \text{ m}^3 = 219 \text{ m}^3$$

To produce 23,434 kg of charcoal requires 219 m³ of fuel wood. This is equivalent to 164,038 kg of wet fuel wood when the conversion ratio of wet wood to dry wood is 7 to 1.

Volume of wood consumed daily = $219 \times 7m^3 = 1533m^3$

From Equation 4, the volume of wood to be replaced per annum is equal to 560,000.

The volume of a typical tree for charcoal production is 0.75155 (Wallace, 2005). Also using Equation 5, the number of trees to be planted per annum is therefore 745,127.

Conclusion

Charcoal is a predominant domestic and commercial cooking fuel in Ilorin, Kwara State. The charcoal consumption in the study area ranges from 0.33 to 0.7 kg per capita per day. The volume of wood consumed within the metropolis from charcoal usage is about 560,000 m³ per annum. Hence the number of trees to be replaced or planted annually in order to prevent deforestation is about 745,127. It is recommended that the government should initiate efficient management of existing forests and plantations so as to have sustainable supply of wood for charcoal production increase its investment and encouragement in community participation in wood-related development.

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