Survey of Species Preference and Method of Charcoal Production in Kaduna, Nigeria.

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Research

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Abstract

Traditional fuel in the form of firewood and charcoal has been, and is still the predominant source of energy for domestic cooking in sub-Saharan Africa. However, charcoal burning is associated with deforestation. The aim of this study was to assess the preference as well method of production of charcoal in Kaduna State, Nigeria. Purposive sampling was used to select Kajuru, Kachia and Chikin. Species enumeration was performed and method of production were recorded at each production centres. a total of 250 interviewed schedule was administered to ascertain the perceive effect. Research shows that *P. Africana* has the highest mean while *D. guinees* has lowest mean. furthermore the most widely method used is earth pit kiln with 55% and suitable trunk size was big trunk with 31% couple with the most preferred tree species, *P africana* 27.41%. in conclusion, the finding of the work reveal that certain tree species were threaten by charcoal production due to the quantum of yield extracted.

Introduction

Charcoal is the dark grey residue consisting of impure carbon obtained from vegetation substance, and is produced by slow pyrolysis, the heating of wood or other substances in the absence of oxygen (World Bank, 2018). FAO (2017) sees charcoal as a soft, brittle, lightweight, black, and porous material that resembles coal. Charcoal burning is probably the oldest chemical process known to man. For a number of developing countries, including Nigeria, issues relating to household energy choice and transitions are important from a policy standpoint. Efforts at encouraging households to make substitutions that will result in more efficient energy use and less adverse environmental, social and health impacts are advocated in many of these countries.

Despite a major shift in the use of household energy, many households rely solely on charcoal as their primary source of cooking energy, especially in urban areas. The popularity of the transition to charcoal was brought to the fore following the acute scarcity of firewood and kerosene as well as their exorbitant prices. Gabriel (2017) reports that the kerosene scarcity led to the invention of “*Abacha Coal Pot*” a locally made stove that use charcoal. Over the years, the cooking technology of the coal pot became widely accepted and used (Babalola & Opii, 2012), hence the high initial investment cost of kerosene stove, gas cylinder and electric cookers, coupled with low generation, and cost of electricity discouraged the use of alternative fuels in favour of charcoal.

Methodology Of The Study

The Study Area

Kaduna State (7°25'E longitude, 10°31'N latitude) which is located in the northern part of Nigeria, occupies 48,473.2 km² and has a projected population of over 6.1 million, over 80% of them were involved in agriculture (Olujimi and Ogunsey, 2016).

Kaduna State has two distinct seasons, a rainy season from April to October and a dry season from November to March. Kaduna lies under the Tropical Continental climate and experiences seasonal alternation of moist maritime air mass and dry continental air mass. The temperature is high throughout the year attaining its peak in March and April (37°C). Humidity is constantly high (above 60%) at mid-day and close to 100% at night during the rainy season and the vegetation extends from the Guinea Savanna in the southern part of the State to the Sudan Savanna in the northern part (Adamu *et al.*, 2017).

Sampling Procedure

The research purposively selected Kajuru, Kachia and Chikun Local Governments Area of Kaduna state. Respondents were randomly selected and interviewed in their respective communities within Kaduna state where charcoal production becomes a permanent business.

Sampling Frame

The sampling frame is made up of all charcoal production centres within the selected Local Government Areas of Kachia, Chikun, and Kajuru of Kaduna state.

Data Collection

Data were collected through field enumeration and measurement of tree parameters (diameter at base, middle and top). Structured interview schedule were administered to charcoal producers to ascertain the perceive effect of charcoal burning to the environment.

Data Analysis

Data were analyzed using descriptive statistics (frequencies and percentages) to achieved demographic characteristics of the respondent.

Results

Demographic characteristics of the respondents

Figure 1: indicates that respondents at the ages between 40-50s years have the highest frequency 36.33%. While 9.67% fall under the age category of 80 and above years and less than 40 were hereby classified as is the second with 33.33%.

Furthermore the figure shows gender of the respondents is a very significant factor in charcoal production. It revealed that 76.88% percent of the respondent were male whereas 23.11% percent were female. This means that there were more males than females into charcoal production is labour based activity.

Similarly the figure indicates that 33.87% of the respondent were married followed by the divorced, while widow were the least in charcoal production activities. The literacy determines the level at which the production and conservation technique is practiced. This variable is closely related to social status and income of charcoal producers. All these can trigger fuel switching to charcoal, as well as the quality of

charcoal that is needed in the household. The literacy level categorization is shown in. it shows that 31.18% percent attained primary school followed by non-formal education which is 25.26%. While tertiary education 18.81 % were the least.

The figure also indicates that charcoal producers with highest percentage 27.95% play a significant role in charcoal production as it is their primary source of livelihood, trading with 25.29% also contributed in distribution and marketing of charcoal product. Also cropping, being the second with 20.96% play significant role due to their associated work within the forest area whereas fishing with least 20.96% poised little damage to the forest.

Demographic characteristics of the respondents

This research aimed at getting the quantity of charcoal produced and conversion efficiency of the species from the study area in order to ascertain the quantum of damage caused as a result of the said activities in Kaduna state.

To achieve this, the demographic information of the respondents in order to forecast the perceive effects of charcoal production to the inhabitants of the study area was staid. The demographic distribution of the respondents indicates that respondents at the ages between 40–50 of years had the highest percentage (33.33%), this shows that they were in their productive age, this is in agreement with (Timothy, 2013), while (9.67%) of the respondents are of the age more than 80 years. Gender as a factor, is very significant in charcoal production, which shows that males were much into the activities, females were least, this also agreed with Jonathan (2013) demographic characteristics of charcoal producers. Marital status showcase in Fig. 1 that majority of the respondents were married, followed by widows that took the business as their means of living.

Literacy determined the level at which production and conservation technique is practiced. This variable is closely related to social status and income of charcoal producers. All these can trigger fuel switch to charcoal, as well as the quantity of charcoal that needed by the households. It was observed that most of the respondents attends primary school, while tertiary education were the least, which is in supported by (Jonathan et al., 2013). Furthermore, it was observed that majority of the populace in the study area were directly or indirectly into charcoal and charcoal related activities. Therefore the full-time charcoal producer had the highest respondents, follows by traders.

Method of charcoal production

Figure 2: indicates that earth mound kiln with 55.37% was the common means of charcoal production in the study area followed by earth pit kiln with 15.05% and the other medium with least percentage 15.05%.

Method of charcoal production

As revealed in Table 2, traditional method of charcoal production (earth mound kiln and earth pit kiln) is used in the study area. 55% use earth pit kiln method, 30% of the producers use earth mound kiln method while 15%. The most prominent among the two methods is earth mound kiln (65%). Agyeman et al.

(2012), also reported the prominent use of earth mound kiln method for charcoal production. The use of drums and improvised kilns methods are not adopted, this may be due to the fact that they are expensive. However, the methods of production are always constant over time.

Adeniji *et al.*, (2015) assessed charcoal kiln efficiencies for traditional earth-mound kilns and improved basic earth-mound kilns (IBEK) in Kilosa, revealed that average yield for five traditional earth-mound kilns ranged from 16.8 to 21.01% which is lower than the values obtained in this study.

Moreover, Ogundele et al., (2012) comparably studied the charcoal yield of some species from improved and traditional methods in south western Nigeria. Their results revealed that the improved techniques can increase the charcoal production and reduce the air pollution where one can obtain up to 3 bags of charcoal in 1 m³ of wood. But result of Timothy (2013), reveal that earth pit kiln give optimum yield in north central part of Nigeria because of less labour and technical input required and this is in support of the finding of this research that earth pit kiln gave the best in charcoal production.

Suitable trunk size use in charcoal production

Trunk size determine the amount of yield to be harvested. This study indicates that's big trunk 30.64 % was more suitable for charcoal production, this agree with (Mba, 2018). But according to (Menemencioglu, 2014) mix size arrange uniformly gave proper burning and produces quality coal and this could be as a result of scarcity of suitable tree. Small size trunk is the least suitable size in charcoal production in the study area.

Most preferred tree species for charcoal production in the study area

According to Fig. 4, *Prosopis africana* is the most preferred tree species used by charcoal producers in the study area for charcoal production with mean 27.41 % which indicates that charcoal producers in the study area prefer to use this specie *Vitellaria* is the second most preferred tree species 19.35%. While *Anogeissus*, even though is one of the suitable tree specie for charcoal production has the lowest mean from the study area 4.30 %.

Most preferred tree species for charcoal production in the study area

According to Fig. 4, *Prosopis Africana* 27.41 % was the most preferred tree species used by charcoal producers in the study area for charcoal production and this indicates that charcoal producers in the study area preferred to use this species, it was revealed that *Prosopis africana* was widely used because it is hardwood. *Vitellaria* 19.35% was the second most preferred tree species. While *Anageissus* even though was one of the suitable tree specie for charcoal production has the lowest mean 4.30 % due to the amount of pressure exerted on it from the study area, this support the work of (Stephen, 2011).

According to Oduorn *et al.*, (2012) Species selection, climatic conditions, tree growth rate and management practices are some of the most critical factors in sustainable charcoal production.

Conclusions And Recommendations

In conclusion, research shows that charcoal production is now widespread and the commodity is sold along most roads in Kaduna state, signaling that more forests are being, and will continue to be, affected until there is a deliberate policy shift.

It was discovered that certain trees species especially *Prosopis*, *Vitalleria* and *Deterium* species are most widely use species in the study area due to the high quality charcoal produced from such species couple with good conversion efficiency. The amount of pressure exerted on these tree species cannot be over emphasized due to the number of volume exploited day in day out, of which if proper management practice is not taking could eventually lead to threat.

Availability of plant materials in the area and choice of species for charcoal production is based on the quality of the wood. Due to the over extraction of vegetative resource without replacement, there existence of imbalance to the extent that even if this cutting is left unharnessed, it would take many years for it the trees to reproduce and for an environmental balance to be achieved. It is important to embargos the exploitation of wild species for charcoal production into the reforestation plans, especially multi-purpose species that are already considered to be endangered locally. The result of investigation revealed that the plant diversity in the study area was progressively being depleted. Therefore, in order to alleviate the challenges, it may better to take the following measures:

- The work revealed that charcoal production plays a significant roles in depletion of forest trees in study area. Therefore other work should be carried out to provide more information on charcoal from the state.
- From the result obtained shows that people involved in charcoal production are not knowledgeable enough on the impact of genepool destruction, in line with that knowledge, attitude and perception on forest conservation should be carried out.
- The quantum of yield produce from the study area culminate that expansion of alternative energy source to reduce dependency on charcoal should be provided.
- The outcomes of the research recommends that local communities should engage in reforestation program for sustainable development
- The work recommend that government should create job opportunities for the communities in order to reduce the dependency on forest resources.

References

1. Adamu, Idris Tanko; David, Jeb; Bala, Dogo;. (2017). Geospatial analysis of urban expansion and its impact on vegetation cover in kaduna metropolis, nigeria. (w. d. danielle, ed.) *asian journal of*

environment & ecology, 3(2), 1-11. doi:10.9734/AJEE/2016/31149

2. Adeniji, O. A., Zaccheaus, O. S., Ojo, & Adedeji. (2015). *Charcoal production and producers' tree species preference in borgu local government area of niger state, nigeria. journal of energy technologies and policy*, 5, No.11, , 1-3. Retrieved from <http://www.iiste.org>
3. Agyeman, K. O., Amponsah, O., Braimah, I., & Lurumuah, S. (2012). Commercial charcoal production and sustainable community development of the Upper West Region, Ghana. *Journal of Sustainable Development*, 5(4). <https://doi.org/10.5539/jsd.v5n4p149>
4. Babalola., F. D., & Opii, E. E. (2012). Factors influencing consumption of charcoal as household energy in Benue State, Nigeria. *International Journal of Organic Agriculture Research and Development*, p2-4.
5. Food and Agricultural Organisation. (2017). *Greening Zambia's charcoal business for improved livelihoods and forest management through strong producer groups*. Rome: Food and Agriculture Organization of the United Nations, p46-51.
6. Gabriel, E. (2017). *Abuja residents resort to charcoal over hike in kerosine price*. Retrieved August 25, 2019, from Vanguard News: <https://www.vanguardngr.com/2017/01/Abuja-resident-resort-charcoal-hike-kerosine-price/>, p79-87
7. Jonathan, O., And, A., & Asobo Victor, M. (2013a). Assessment of Socio-economic Factors Affecting Household Charcoal use in Makurdi Urban Area of Benue State, Nigeria. *E3 Journal of Environmental Research and Management*, 3(7), pp180–188. Retrieved from <http://www.e3journals.org>
8. Ogundele, A. T., Eludoyin, O. S., & Oladapo, O. S. (2011). Assessment of impacts of charcoal production on soil properties in the derived savanna, Oyo state, Nigeria. *Journal of Soil Science and Environmental Management*, pp142-146.
9. Olujimi, O. O., G. R. E. E, A., & Ogunsey, O. O. (2016). Air quality index from charcoal production sites, carboxyhemoglobin and lung function among occupationally exposed charcoal workers in South Western Nigeria. *springer plus journal*, 2-7. doi: 10.1186/s40064-016-3227-9
10. Stephen, L. (2011). *The economic and environmental effects of commercial charcoal production in the upper west region of Ghana College of Architecture and Planning*, pp. 149-164.
11. Timothy, Y. A. (2013). Major Role of Locally Made Charcoal Business in Promoting Entrepreneurial Status in Nigeria. *Mediterranean Journal of Social Sciences*, Vol 4 No 12, 139-145. doi:Doi:10.5901/mjss.2013.v4n12p139
12. World, Bank. (2007). *Conversion Table for Sawn Mahogany (Swietenia macrophylla) Methodology for Developing National Volume Conversion Tables (Standing Volume & Export Grade Sawnwood) Roberto Kometter Edgar Maravi. C*(September), 1–32.
13. World, Bank. (2018). *Liberia Forest Sector Project, Opportunities for Charcoal and Sustainable Forest Management*. Washington DC: The World Bank, pp. 1-33.
14. Menemencioglu, K. (2014). *Traditional wood charcoal production labour in Turkish forestry (Çank ı r ı Traditional wood charcoal production labour in Turkish forestry (Çank ı r ı sample)*. (June).

15. Oduorn, Nellie M. Wairimu, N. T. wa G. (2012). *Sustainable Tree Management for Charcoal Production* (E. B. and K. W. (PAC U. H. W. (PAC EA), ed.). kenya.

Figures

Figure 1
Demographic distribution of the respondents

Figure 2

Method of charcoal production

Figure 3

Suitable trunk size use

Figure 4

Most preferred tree species for charcoal production in the study area