



ASSESSMENT OF COMMERCIAL CHARCOAL PRODUCTION RATE IN NASARAWA STATE.

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ABSTRACT

Charcoal is one of the most utilized derivative of our natural woodlands, it has remained an important source of energy in both rural and urban communities globally. It is now an export commodity in Africa, with a large market in the Europe, USA and Asia. However, the rate of dependence on savannah woodlands for commercial charcoal production (CCP) has exposed the forests to degradation. This study assessed commercial charcoal production in Nasarawa State, Nigeria, with the specific aim of assessing the magnitude of the activity in other to establish its unsustainability. A descriptive-survey research design was used in the study based on the mixed approach of quantitative and qualitative data capturing and analysis. Purposive and simple random sampling techniques were employed to select three Local Government Areas (LGAs) from which two main CCP communities were selected and sampled. A total of 450 commercial charcoal producers were sampled for the study. Ten key informants were also selected from relevant institutions and among community leaders. Data were acquired using questionnaire, interview, Focus Group Discussion, field observation and measurements. Descriptive s and geospatial techniques of data analysis were used. Results showed that Surrounding woodland is the main source of wood either directly or through a licenced operator. A large percentage of respondents are engaged in the charcoal business on daily basis, the other percentage are engaged weekly and monthly. This implies the rate and magnitude of commercial charcoal production. There is no policy specifically targeted at ensuring sustainable utilization of woodland for charcoal business and existing related policies were mostly end-users based. It was concluded that although commercial charcoal producers in the state were aware of the environmental consequences of their activities, they are motivated by the associated financial benefits. Thus it is recommended that emerging policies on commercial charcoal production should be geared towards improving alternative source of

income, medical services and charcoal production efficiency to increase charcoal yield through introduction of new and innovative ways of producing charcoal more efficiently and cost effectively and the frequency of engagement should be regulated.

Keywords: Charcoal, Nasarawa, Sustainable, Magnitude, Production

INTRODUCTION

Forest and woodlands contribute immensely to the economic, social and ecological wellbeing of the environment. The relevance of charcoal gotten from forested woodlands, on the energy requirements of developing nations cannot be ignored. It supplies about 95 percent of the cooking energy needs in the developing countries (Food and Agriculture Organisation-FAO, 2011). In spite of the benefits derived from the forest and forest products, the world's forest is rapidly depleting due to the rate of dependence on the savannah woodlands, these has attracted concerned sectors of the world government in finding ways to curtail this increasing menace against nature. The 2014 New York Declaration on Forests (Section 1), a non-legally binding political declaration that grew out of dialogue among governments, companies and civil society, spurred by the Secretary-General, noted that world leaders endorsed a global timeline to cut natural forest loss in half by 2020, and strive to end it by 2030. It also calls for restoring forests and croplands of an area larger than India. Meeting these goals would cut between 4.5 and 8.8 billion tons of carbon pollution every year – about as much as the current emissions of the United States. The Declaration is endorsed by dozens of governments, 30 of the world's biggest companies, and more than 50 influential civil society and indigenous organizations.

However, charcoal has remained a source of energy for several purposes in both rural and urban centres globally. It is now an export commodity in Africa, with a large market in the Europe, USA and Asia. The prices range from \$170 - \$300/ton depending on the packaging. Tropical Africa accounts for 70% of the exports and the market is all year round with a slight drop between July and September (The Thy consulting 2011). According to The Food and Agricultural Organization (FAO, 2011) of the United Nations, over 40million metric tonnes of charcoal are consumed globally and approximately 2.4billion people rely on wood and charcoal for domestic consumption. Charcoal provides 82% of urban

and 34% of rural household energy in Kenya (RoK, 2004). The charcoal industry in Kenya employs over 700,000 people directly who support over 2 million dependants (Muchiri, 2008). In Tanzania, the income from the sale of charcoal was also found to be above the minimum wage paid to most of the government and private sectors employees (Mndeme, 2008). This makes it difficult for the SDGs and other initiatives to succeed unless alternative source of energy, income and sustainable practices are adopted by affected communities.

Over the years, sustainable management of forest resources has been of primary concern due to its potential impact on biological diversity and importance in maintaining global ecological functions. Given the observed growing significance of charcoal in rural and urban livelihoods, particularly in Nasarawa state, the attention of several authors has been recently drawn to the environmental consequences of its production. (Omoakin Jelili, Ismail Saliu, Falaye and Abiola 2015) who studied Charcoal Production in Oriire Local Government Area, Oyo State, Nigeria: Environmental and Socio-Economic Questions. In their study, they examined the processes involved in charcoal production and evaluated its environmental and socio-economic correlates in Oriire Local government area of Oyo state, Nigeria.

However, tackling deforestation and forest degradation requires a good understanding of the players in the extraction forest resources, what drives them and the roles they play. In the process, other possibilities – including alternative pathways that might treat and value carbon as part of complex, lived-in landscapes, or respond more adaptively to less equilibrium people–forest relations, are excluded. (Leach and Scoones 2013). The findings from the study will also provide baseline information to Nasarawa State Government for actions towards ensuring sustainable utilization of forest resources for commercial production in the state.

Additionally, charcoal production is an important cross cutting issue and is never exhaustive through a single research. This study also will add to the scientific community thereby contributing to research on the minimization of the negative environmental consequences of charcoal production. The entire study could serve as one of the reference materials for future researches.

MATERIALS

This study adopted the concept of forest degradation and the theory of environmental prisoner's dilemma and various literatures relevant to the subject matter. It also considered the geography of the study area.

Forest Degradation

Forest degradation refers to the reduction of the capacity of a forest to produce goods and services (ITTO 2002). Capacity includes the maintenance of ecosystem structure and functions (ITTO 2005). A degraded forest delivers a reduced supply of goods and services from a given site and maintains only limited biological diversity. It has lost the structure, function, species composition and/or productivity normally associated with the natural forest type expected at that site. (ITTO 2002). According to the International Union of Forest Research Organizations-IUFRO (2000), it refers to a damage to the chemical, biological and/or physical structure of a soil (soil degradation) and to the forest itself (forest degradation), as a result of incorrect use or management, and which, if not ameliorated, will reduce or destroy the production potential of a forest ecosystem (in perpetuity). Intergovernmental Panel on Climate Change-IPCC (2003) defined the concept as a direct human-induced long-term loss (persisting for X years or more) of at least Y% of forest carbon stocks (and forest values) since time T and not qualifying as deforestation or an elected activity.

The Theory of the Environmental Prisoners' Dilemma

The theory of the environmental prisoners' dilemma (Hardin 1968; Mainagwa, 2010) explains that in the use of common natural resources such as the woodland, the benefits of the action of an individual charcoal producer on the woodland is enjoyed by the individual producer alone while the problems associated with that individual's action on the resource are borne by all. It is therefore more motivating to sacrifice the collective interest for individual interests. Consequently, there is a greater tendency to create environmental problems for all by seeking personal interest than sacrificing individual interest for the collective interest. Furthermore, the theory acknowledges that in situations like this, no single individual can solve common resource problems and that there must be trust among actors that they will sacrifice their individual interests for the collective interest in the use of the woodland. This requires that woodland owners and users recognise that they have a common interest in the

woodland. Therefore, the action or inaction of one affects the interest of the rest. It also requires chiefs to initiate and enforce punitive measures against community members who violate rules of access to woodlands and control benefits from the woodlands in a transparent manner (Lambini & Nguyen, 2014).

STUDY AREA

Nasarawa state has an approximate land area of about 27,271.50 square kilometres. The State is located in the basement complex of northern central Nigeria between longitude 6° 45' 03'' and 9° 45' 03'' of the Greenwich meridian and latitude 7° 45' 00'' and 9° 35' 00'' of the equator. It stands at an elevation of 400 meter above sea level. It was created on October first, 1996 and is undergoing rapid population growth and infrastructural development due to its proximity to the Federal Capital Territory, Abuja. It shares geographical boundaries with Kaduna state in the north, Abuja Federal Capital Territory (FCT) in the west, Kogi and Benue states in the south, Taraba and Plateau states in the east respectively. The state is a gate way to the Federal Capital of Nigeria for it share border with the centre of unity. It has a population of 1,869,377 and 1,926,221 as the current projected population with a population density of 75/km² (190/sq mi) making it one of the most densely populated States in the country (NPC, 2006).

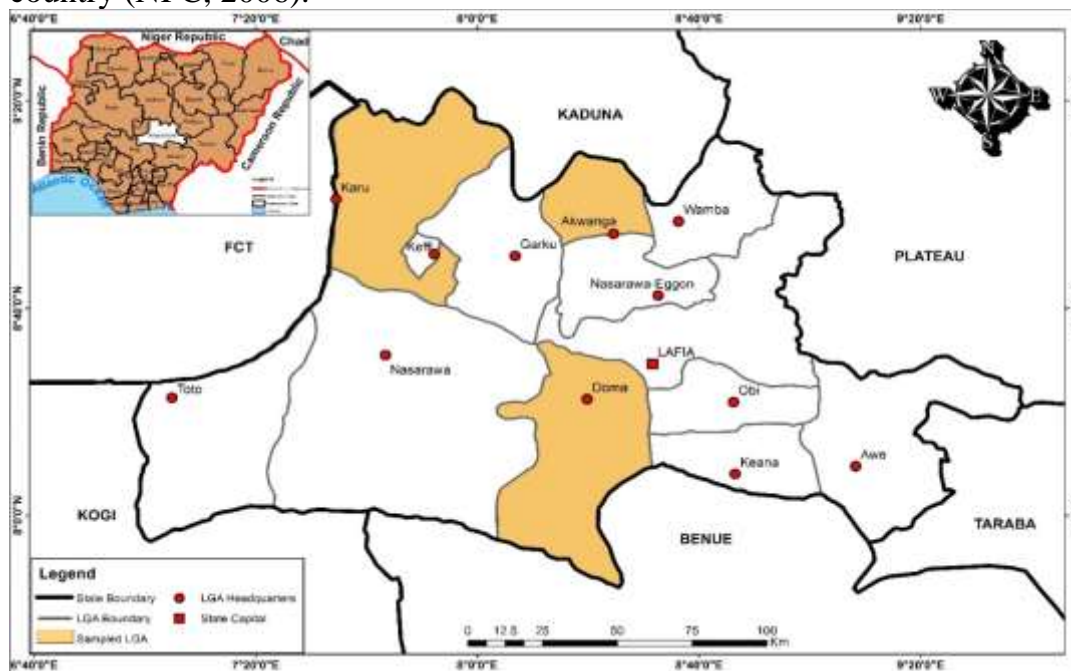


Figure 1: Nasarawa State Showing the LGAs

Source: Geography Department, Nasarawa State University, Keffi

METHODOLOGY

Research Design

This study adopted a descriptive-survey research design whereby both quantitative and qualitative types of data were collected. Direct and indirect modes of inquiries were employed to seek opinions and knowledge of a sampled population of respondents on commercial charcoal production in Nasarawa State. The descriptive survey design also entailed, description of the characteristics of phenomena, opinions, preferences, and perceptions of people in the study area regarding investigated issues of commercial charcoal production and its sustainability and that of forest/woodland resources. The tools used did exposed what exist and how it influenced the present event; such as gender, age, occupation and education level that pointed to factors influencing the choice of household energy sources.

Sources and Types of Data

The data collected were specific to the set objective of the study.

The study drew from both primary and secondary sources of data. Primary data such as: socioeconomic status of the people involved in commercial charcoal production; how often they engage in charcoal production and sources of the wood lot used. Secondary data were obtained from publications, annual and quarterly reports and books (hard and soft copies) that deals with the concepts and issues of charcoal production and tree biodiversity and also Images of Global Forest Change of the University of Maryland, Department of Geographical Sciences version 1.6 was also utilized. Methods of data collection like reconnaissance survey, survey questionnaire, interview, field measurement, and photography were adopted for the study.

Methods of Data Collection

In order to achieve the set objective, Reconnaissance Survey, Survey Questionnaire, Focus group Interview Were carried out. This enabled familiarization, as well as obtaining of first-hand information about the study area through observation and casual interactions with the people, it helped to generate information on their views about the possible alternative sources of energy and livelihood in respect of devising means to establishing a balance between commercial charcoal production and sustainability of tree biodiversity.

Field Observation, Global positioning system, Measurements and photography were equally employed to capture information on charcoal production activities, physical features of degraded woodland areas, stages of charcoal production activity as well as the techniques adopted for charcoal production in the study area.

Sampling Techniques and Procedures

A multi-stage sampling technique which included: stratified random sampling, purposive sampling and simple random sampling techniques.

Stratified random technique was used in this research to divide Nasarawa state into three stratum basically which fell into the three senatorial districts; Nasarawa West (Nasarawa-Toto, Karu, Keffi, Kokona) Nasarawa North (Wamba, Akwanga, Nasarawa Eggon) And Nasarawa South (Keana, Doma, Lafia, Awe, Obi). This method made it possible to reduce the sample and achieve precision.

A purposive sampling was used to select one local government area from each senatorial district and these local government areas were selected based on the observed ongoing intensity of savannah woodland utilization for commercial charcoal production. Two communities constituting major commercial charcoal production sites were selected from each of the local government areas. This sampling represents a group of different non-probability sampling techniques and the researcher zeroed in on the target population group, interviewing those involved in commercial charcoal production. The main goal of the purposive sampling was to focus on particular characteristics of a population that are of interest, which best enabled the study to answer the research questions.

A simple random sampling was adopted in selecting respondents for questionnaire administration. Most of the respondents were randomly sampled at production site and with their assistance, in addition to information obtained through reconnaissance survey; other producers who were not actively involved in production during the period of the study were also randomly sampled.

Population and Sample Size Determination

Based on the number of producers identified involved in commercial charcoal production in each of the six study communities, the Krejcie and Morgan's sample size determination table (Krejcie and Morgan 1970) was used to select

appropriate samples for the study. One senior officer was selected from each of the mentioned agencies, in addition to the heads of the six sampled communities, making a total of 10 key informants. The number of producers identified in each community and its associated sample size are presented in table 3.1.

Table 1: Sample Size Determination

LGA	Community	Population	Sample Size
Akwanga	Aricha	85	70
	Gudi	85	70
Doma	Agwashi	55	48
	Idadu	90	73
Karu	Songo-Gitata	120	92
	Sangingye-Panda	130	97
Total			450

Source: Reconnaissance Survey/ Krejcie and Morgan (1970)

Method of Data Analysis; statistical, descriptive and geospatial methods of data analysis were employed.

Data on socioeconomic status of the commercial charcoal producers, frequency of commercial charcoal production and sources of woodlot in the study area were analysed using descriptive tools: (frequencies, means, percentages and cross-tabulation) and inferential tools: The results of the analysis were presented in form of graphs, tables and charts.

Qualitative Data Analysis

Data obtained from key informants and focus group discussions which were stored in audio recordings were analysed based on the techniques outlined by Milles and Huberman (1994) which stated that qualitative data analysis should consist of three stages; data reduction, data display, and conclusion drawing.

RESULTS

Magnitude of Commercial Charcoal Production

The magnitude of charcoal production was measured in terms of the frequency of involvement in commercial charcoal production, sources of and nature of

wood used, charcoal production process, the processing technology employed and the kiln (popularly referred to as Gidan Charcoal) capacity in terms of wood consumption and amount of charcoal yielded per production. All of these are good indicators charcoal production effect on savanna woodlands.

Frequency of Involvement in Commercial Charcoal Production

The degree of involvement in commercial charcoal production among producers in the study area is presented in table below;

Table 2: Level of Involvement in Commercial Charcoal Production

Variable	AKWANGA		DOMA		KARU		Total	
	N	%	N	%	N	%	N	%
Daily	58	41.4	61	50.4	83	43.9	202	44.9
Weekly	33	23.6	5	4.1	10	5.3	48	10.7
Monthly	3	2.1	5	4.1	6	3.2	14	3.1
Others	46	32.9	50	41.3	90	47.6	186	41.3
	140	100.0	121	100.0	189	100.0	450	100.0
When I have urgent need for money	14	30.4	16	32.0	58	64.4	88	48.1
After wet season/festive period	28	60.9	26	52.0	11	12.2	65	35.5
On demand	4	8.7	8	16.0	16	23.3	28	15.3
Sub Total for others	46	100.0	62	100.0	71	100.0	183	100.0

Source: Field Data Analysis 2018

Table shows that commercial charcoal production has become one of the main economic activities in the study area considering that 44.9% respondents claimed that their involvement in the activity is on daily basis. The relevance of commercial charcoal production among economic activities was further buttressed by another 41.3% who gave other scales of involvement out which 48.1% claimed that they produce charcoal for sales whenever they have urgent need for money, 35.5% said they take on charcoal production usually after the wet (planting) season or during festive periods while the rest 15.3% comprised of those who produces only based on demand. Furthermore, 10.7% of the respondents were of the opinion that they produce on weekly basis, while rest 3.1 comprised of monthly producers. It was observed through FDG and interviews that majority of the respondents who claimed to engage in commercial production on monthly, need and season induced as well as on

demand basis, comprised of those who take commercial charcoal production as secondary economic activities. Also, the high daily involvement in commercial charcoal production could be attributed to the findings of Arnold *et al*, (2006) and Zulu and Richardson, (2013) that despite increasing per capita income, higher electrification rates, and significant renewable energy potential, charcoal still remains the dominant source of cooking and heating energy for eighty percent of households in Sub Saharan Africa, hence the high demand and market availability for producers. Even in countries where electrification rates are at their highest, as in Nigeria or Ghana, 60-70% of the population still use charcoal for cooking and heating (World Bank 2014). Beatrice (2014) also noted that the high demand for charcoal is a key driver to commercial charcoal production as there is ready market for the product.

There were more daily commercial producers in Doma 50.4% than in Karu 43.9% and Akwanga 41.4%. Conversely, 23.6% of the respondents engaged in commercial charcoal production on weekly basis in Akwanga LGA, followed by 5.3% in Karu and 4.1% in Doma. Those who produced on monthly basis accounted for 4.1% of the respondents in Doma, followed by 3.2% in Karu while the least number (2.1%) of monthly basis producers was recorded in Akwanga. Those who claimed that they engage in commercial charcoal production on other time scale basis were 47.6% in Karu out of which 64.4% said they produce when they have urgent need, 12.2% produce after wet season and during festival periods while 23.3% claimed they produce on specific demand. In Doma, it was 41.3% out of which 32.0% produced charcoal for urgent money needs, 52% during wet and festive seasons and 16% produced on demand; while for Akwanga, it was 32.9% out of which those who produced due to urgent needs for money accounted for 30.4% and those who produce after wet season and during festivities accounted for 60.9% while 8.7% were those who produces based on demand. This high number of people engaging in commercial charcoal production in Doma could be attributed to the farmers-herdsmen crisis that forced many to avoid their farms as indicated below:

Sources and Nature of Wood used for Commercial Charcoal Production

Table 3: Source and Nature of Wood (Multiple Response)

Sources	AKWANGA		DOMA		KARU		Total	
	N	%	N	%	N	%	N	%
Farmlands	90	64.3	39	32.2	28	14.8	157	34.9
Surrounding forests	81	57.9	81	66.9	146	77.3	308	68.4
Buy from operators	133	95.0	105	86.8	187	98.9	425	94.4
Nature of Wood used for Charcoal Production								

Logs from freshly cut trees	117	83.6	106	87.6	155	82.0	378	84.0
Fallen Dry wood	23	16.4	15	12.4	34	18.0	72	16.0
No of Respondents	150	100.0	121	100.0	189	100.0	450	100.0

Source: Field Data Analysis 2018

Table revealed that majority (94.4%) of commercial charcoal producers in the study area do not cut the trees they use for commercial charcoal production themselves rather they buy from those who have obtained tree cutting licence from ministry of environment. A discussant from Aricha community stated that: *“Many of us cannot cut the tree by ourselves because we do not have licence and mechanical saw, you will be fined if caught by forest guards in the act of cutting trees”*. However, in many cases people often cut the ones in their lands by paying operators to assist them.

Apart from buying woods from operators, another 68.4% of commercial charcoal producers claimed that they obtain their wood from fringes of surrounding forests while the rest 34.9% accounted for those who gets theirs from farmlands. None of the producers made mention of woodlot and this implies that the production areas do not have woodlots and this indicates poor tree planting habit/projects among the producers and relevant government authorities in the study area. The same pattern of tree sourcing for charcoal production was reflected across the individual production areas of Akwanga, Doma and Karu LGA. This corroborates Beatrice *et al.*, (2014) that in Ghana, wood for charcoal production is usually obtained from the natural vegetation as well as from land clearing for farming, especially in the yam production systems in the forest-savanna transition. Kaale (2005) also noted that the largest share of charcoal comes from natural forests while plantations and woodlots play only a small role on charcoal production.

Also, the high dependency on freshly cut trees for charcoal production among farmers in the study area points to high tree cover depletion. It was observed as shown in table 4.9 that 83.6% of the respondents who obtained their wood from any of the three identified sources did so through cutting of fresh wood while on the contrary, the rest 15.56% accounted for those who depend on already fallen and dry trees or wood for their production.

Conclusion and Recommendation

Based on the findings of the study, it was concluded that commercial charcoal production has over time become an indispensable means of livelihood among rural settlers in Nasarawa State. However, the production process has remained undeveloped with the traditional earth mound kiln being the only charcoal processing technology adopted by the producers. Though cost effective in comparison to other technologies, the traditional earth mound has been proven to be both inefficient and ineffective towards sustainable utilization of savanna woodland resources

This push to decrease consumption levels has potentially unexpected consequences for the rural charcoal producers. reductions in charcoal use can be significant with regards to deforestation and land degradation impacts. The commercial producers depend daily, weekly and monthly on charcoal production. It is therefore recommended that it should be regulated by laws and policies. The employment of forest guards is necessary to limit the dependency on the woodlot.

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