

# Charcoal Production in Oriire Local Government Area, Oyo State, Nigeria: Environmental and Socio-Economic Questions

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## Abstract

Just as it is difficult for most successive governments, at local or national level, to fight and conquer poverty, it is hard for most households of the poor communities in developing countries, particularly in South-western Nigeria, to live and work environmentally-sustainably, as most of their survival activities have negative implications for the environment. The poverty-induced type of energy use of most households in these communities calls for the concern of stakeholders in environmental sustainability issues. Against this backdrop, this paper examines the process of charcoal production (a major energy source of poor communities in South-western Nigeria) and its environmental and socio-economic correlates, using a case study of three rural communities, where the activity has assumed a 'professional' status. It is found that unless and until serious intervention measures aimed at addressing poverty and other socio-economic issues are put in place and effectively enforced, the problem of sustainable environmental development will be a mirage in the area and in areas with similar environmental and socio-economic problems. It therefore, recommends effective policy measures directed at poverty and related issues to take place before enforcement of necessary legislation, also recommended against indiscriminate felling and burning of trees.

## Introduction

The environment can be broadly categorized into physical environment: land, air and water and the non-physical environment: cultural and socio-economic environment (Smart, 1988). All these culminate to form the sum total of all conditions that surround man at any point in time on the earth surface (Hagget, 1975). When one component is impacted upon, all or, at least one other component feels the impulse. Man being a rational animal is endowed with knowledge, wisdom and skills to modify the natural environment to suit his needs at any point in time. Of paramount importance to man is the need for energy from different sources like the sun (solar), water (hydro-electric), fossil fuels (oil, gas and wood) for survival and sustenance. The extent to which these energy sources are exploited depends on the available technology, financial resources and the level of demand for energy. These energy sources generate power that is applied for both domestic and industrial purposes. Demand for electricity, which appears to be one of the major energy sources, has been on the increase in Nigeria for long. However, this energy source is considered to be grossly inadequate for the teeming population of the country. This rapid population growth, coupled with uncontrolled urbanization, overused infrastructures and the resultant increased poverty level makes people and firms to fall back on natural sources of energy such as firewood otherwise referred to as fuel wood and charcoal (Ogwumike and Ozughalu, 2001).

The social conditions in Nigeria in general present a perplexing paradox. In spite of a robust endowment in natural and human resources, the level of poverty of her people stands in contrast to the country's enormous wealth (Babatunde, Olorunsanya and Adejola, 2008; Otu Judith et al, 2011). The problem has been a serious issue since the 1980s when international oil price crashed, and compounded by the mal-administration of the successive military regimes of the 1980s and 1990s. For example, available statistics from the National Bureau of Statistics (2012), cited in Oseni et al (2012) has it that the incidence of poverty in the country rose from 28.1 percent in 1980 to 42.7 and 65.6 in 1992 and 1996 respectively. Though, declined to 54.4 percent in 2004 as a result of gains of democratic rule of the early 2000s, it also gathered momentum and increased to about 69 percent in 2010, and perhaps higher today due to the low capability of the present administration to tackle the problems of civil unrests, insurgencies, political and ethno-religious crises, which have bedeviled the country since 2009 and 2010, and more recently the decline in crude oil price in the world market. All this confirms the fact that there is poverty in the land. What is the nexus between this poverty phenomenon and the environment or environmental sustainability, particularly in Nigerian context?

It is also observed that the increasing use of firewood and charcoal is an indication that the general welfare of the people is yet to improve substantially. However, the use of firewood and charcoal as explained by Ogwumike and Ozughalu (2001) may have adverse effects on the environment, as most of the activities associated with charcoal production are carried out without the knowledge of its consequences, which may include its environmental cost, health implications, environmental degradation, decline in environmental productivity, loss of biodiversity, increase in evaporation and transpiration, disruption of hydrological cycle, accumulation of green house gases which heighten unsustainable environment.

In most developing countries including Nigeria, the problem of poverty and increased demand for fuel has made the use of charcoal a popular phenomenon. The demand for this has been on the increase because most

people cannot afford petroleum products such as kerosene and gas for cooking due to its incessant price increase and artificial scarcity. Charcoal and firewood are therefore seen as the available alternatives, but the use of charcoal is preferred in the sense that it produces little or no flame; it is portable and has a better energy efficiency (Eweoya, 2006). The increasing use of charcoal however raises questions which this paper seeks to provide answers to. These include: Why do people engage in charcoal production in large quantities? What are the processes of charcoal production? Are these processes environmental-friendly? What effects does the process of producing charcoal have on the environment? To what extent are the people involved in the production and use of charcoal aware of the implications of charcoal for environmental sustainability? How can the problems associated with the processes of charcoal production be controlled?

### **Aim and objectives**

The study seeks to examine the processes involved in charcoal production and evaluate its environmental and socio-economic correlates in Oriire Local government area of Oyo state, Nigeria.

The following objectives are formulated in order to achieve the aim above.

- To examine the level of poverty (via analysis of socio-economic characteristics) of residents of Oriire local government area
- To examine the incidence and processes of charcoal production activity in the affected villages in the study area
- To evaluate the perceived environmental impacts of charcoal production in the affected villages in the study area
- To assess the level of residents' awareness of the implications of charcoal production on the environment and sustainability measures that can be adopted

### **Hypotheses**

1. People's involvement in charcoal production and use is not related to their poverty level and socio-economic characteristics in general
2. The process of charcoal production is environmental-friendly

### **The study area**

Oriire Local Government Area in Oyo State is the study area. It is located around latitude  $8^{\circ}30'N$  of the equator and longitude  $3^{\circ}54'S$  of the Greenwich meridian. Oriire Local Government Area is in derived savanna climatic zone where agricultural products such as yam, melon, cashew, mango, shea-butter, cocoa, kola nut, palm-oil etc can be found. Therefore, most of the inhabitants engaged in farming as their major occupation while some are hunters, traders, fish farmers, etc. (Alalade, 2000). In the relatively recent time, charcoal production has also become a popular occupation of many household heads in the area. The area extends from Ipeba river along Oyo-Ogbomoso road to Doogo junction near Igbeti, Oyo state Nigeria. It covers a total estimated land area of 2,040 km<sup>2</sup>, inhabiting over 100 communities such as Tewure, Iluju, Apiko, Saamo, Igbori, Odun-Ifa and Olokoto among many others. For the purpose of this study, however, only three villages which are prominent in charcoal production were selected. These include Olokoto, Igbori and Odun-Ifa.

### **Literature Review**

The present day forest cover is approximately half of what existed in pre-agricultural times, the majority of which has been lost in the last three decades (FAO, 2005). This decline has been attributed to various factors, which include changing livelihood patterns, such as the transition from hunting-gathering to sedentary agriculture (Sunderlin et al., 2005) and socio-economic demands of development for timber, wood fuels, fibres and urban expansion (Middleton, 2003). Of particular concern is the increasing felling of trees for charcoal. The world's largest consumption of charcoal is on the African continent with an attendant air emissions and the related environmental problems (Kammen and Laws, 2005; Kituyi, 2004). The extraction of timber for fuel wood accounts for 61% of total wood removals (FAO, 2005). This shows the importance of this fuel in the energy mix of many countries.

Energy provision is a basic human need and consumption is closely related to the level of a country's development (UN-Energy, 2005). This is observed in the poor Human Development Index (HDI: measure of development based on life expectancy, education and standard of living) scores. The low energy consumption of Sub-Saharan Africa as well as many other developing countries is heavily dependent upon fuel wood for their energy requirement (Arnold and Persson, 2005).

In most African countries, charcoal is the primary energy source for cooking and heating as well as major source of income generation and environmental degradation in rural area (Kammen and Laws, 2003). A significant proportion of trees used for charcoal production is unsustainably harvested. The bulk of charcoal wood is clear cut from secondary and in some cases primary forest. This practice ultimately leads to increased

CO<sub>2</sub> emission which is a major greenhouse gas, hence, destruction of carbon sink property of forest, thus contributing to global warming (Bradley, 1991). Emissions during charcoal production are significant compared to those from charcoal burning. Measurements from studies have indicated the global warming potential of the emissions during combustion (Icaux et al., 1994; Hao and Ward, 1994; Smith and Thorneleo, 1992).

The effect of charcoal production on human health cuts across the production cycle, ranging from wood logging, transportation, and wood residue carbonization in the kiln, to cooling, sieving, packaging and storage of bio char. The most deleterious impact emanates from the carbonization stage which is the stage where most gaseous emission takes place. Long term exposure of humans to gaseous emission during burning leads to respiratory problem and ultimately diseases such as Acute Respiratory Infection (ARI), lung cancer, Otitis media (middle ear infection), low birth weight (Ezzati and Kammen, 2002). Others include asthma, cough, breathlessness, wheezing and difficulties to inhale or exhale (Ellegard, 1974).

In spite of these serious tendencies the process of charcoal production continues unchecked. The Food and Agriculture Organization (FAO) has estimated that the total charcoal production in 1992 was 24 million tones. Using the FAO dry weight conversion efficiency of 23%, one finds that about 100 million tones of wood are annually cut for charcoal production (Saliu, 2007).

Armitage and Schramm, (1989) emphasized that in most African countries, about 80% of charcoal wood used is obtained from land cleared for crop production and livestock purposes. This is termed a wise practice, considering the fact that the fallen trees may rot and be wasted but combining the sustained activity of charcoal production with the unsustainable activity of deforestation may result in forest clearing solely for charcoal production. The bulk of charcoal wood is clear-cut from secondary and in some cases primary forest (Brandley, 1991). Emissions during charcoal production are significant and contribute heavily to global climate change impact. Charcoal is produced via pyrolysis or thermal degradation of biomass, this results in formation of products of incomplete combustion (PIC) such as CH<sub>4</sub>, CO<sub>2</sub> alkanes, alkenes, oxygenated compound and particulate matter. Icaux, et al., (1994) took the first measurement of CO<sub>2</sub> and traced gas emission from a charcoal kiln in the field. The data are from one burn cycle from a traditional mound kiln in West Africa. The charcoal kiln emission ration of CO, CH<sub>4</sub>, NMHC, and NH<sub>3</sub> to CO<sub>2</sub> are larger than those from savannah burning because CO, CH<sub>4</sub>, NMHC have much higher global warming potential than CO<sub>2</sub>. Emissions from charcoal production may pose a serious peril to the upper atmosphere.

In his own study, Tryon (1984) observes that charcoal production has a positive effect on the moisture content, pH and germination of seeds. Also, another major impact of charcoal on soils is an increase in nutrient retention through an improved Cation Exchange Capacity (CEC) (Liang et al., 2006) and potential for larger fungal and mycorrhizal activity (Warnock et al., 2007). Most of the research on the effect of charcoal on soil has been resulting to beneficial to plant growth. The charcoal production and trade seem to be suitable ways the rural and even urban poor find employment and livelihood. However, tradition has it that, charcoal producers were looked down upon by the society. Bad remarks such as “go away, you charcoal producers!” and “a charcoal producer never wears a white shirt” indicate the charcoal producer’s probably low socio-economic status in the community (Ministry of Pastoral Development & Environment, 2004).

Moving beyond this, very few studies have been undertaken in West Africa to assess the ecological or environmental impact associated with charcoal production. For instance, the extent of devegetation, forest degradation and deforestation in Nigeria due to inefficient charcoal production and utilization technology is not known. This study would contribute to the existing body of knowledge on the subject in this regard.

## Methodology

Both primary and secondary data were used in this study. Primary data were sourced through questionnaire administration, personal observations and recordings. Secondary data used in this research include base map, population size and other relevant information obtained from the local government headquarters. A reconnaissance survey of the study area was also carried out to have an overview of the socio-economic activities and environmental state of the study area.

The entire population of the three villages provided a convenient sample frame. An adult was selected based on convenience from each dwelling unit for interview guided by structured questionnaire. Out of 59 houses in Olokoto, only 50(84%) had residents at home and available for questionnaire administration, 50 (75.76%) residents were sampled out of a total of 66 dwelling units in Igbori and 20 (80%) of the total 25 dwelling units in Odun-Ifa village was sampled.

Descriptive statistics such as frequency counts and percentages, as well as charts were used to summarize the data. The perceived effects of charcoal production on the people was assessed using Likert scale, giving weights of 5,4,3,2,1 to such responses as: strongly agree, agree, indifferent/no response, disagree and strongly disagree respectively.

## Findings and Discussions

### Processes of charcoal production in Oriire Local Government Area

Materials needed include: logs of wood, grasses, leaves, earth and source of fire.

In setting up the logs of wood for the production, two or more long slender stems are placed parallel to one another at equidistance, and then the logs are placed perpendicularly on them. The essence of the initial long slender stems is to avoid direct contact between the logs and the ground/soil/earth. The logs are covered with grasses/leaves and thereafter, the leaves are covered with earth. The leaves/grasses serve as a lagging material between the logs of wood and the earth covering the entire setup. While covering, a small portion of the heap is left uncovered on any side of the entire setup for the introduction of fire. After lighting the opening is covered and tiny holes are created in various parts of the heap so as to enable the inflow of oxygen for combustion.







An exit of white fumes through the holes created indicate successful combustion into charcoal while exit of red smoke on the other hand signifies an unsuccessful combustion in to charcoal but rather, into ashes. The duration of combustion is subject to the state of the logs in terms of dryness, quantity and the prevailing weather conditions at the time of production. Harvesting is done after the entire logs are transformed into charcoal. The harvested charcoal is bagged and transported to the point of sale.

#### **Socio-Economic Characteristics of Charcoal Producers**

A large proportion of the sampled population is male (76%, 76%, and 95% in Olokoto, Igbori, and Odun-Ifa respectively). The level of literacy in these villages is very low as it was observed that up to 44%, 48% and 40% of the population in Olokoto, Igbori and Odun-Ifa respectively had no formal education. This encouraged early marriage as it was also observed that 62%, 72% and 75% of the people living in these three villages were already married. More so, it accounts for their uncontrolled involvement in charcoal production, as they hardly appreciate the implications of uncontrolled felling of trees and burning of logs for charcoal. None of the sampled respondents is in the civil service. They are either farmers (66%) or traders (24%). Meanwhile a considerable proportion (10%) of the entire population was artisans, engaged in vocations like carpentry, tailoring, among others, many of whom are unskilled labour. It is interesting to observe however that virtually all adult males in the villages have at one time or the other engaged in the process of charcoal production, and the production is assuming a significant and dominant industry of the local economy, as the product (charcoal) is not only sold to the local market but also taken as to as far as the neighbouring countries like Chad and Cameroun, among others.



#### **Incidence of Charcoal Production in the Area**

On the average, about 12 bags of charcoal are produced per week per village in the area. This may, however,

vary from week to week and village to village from about 5 to 20 bags per week. Only on rare cases do they produce larger quantities. Nevertheless, the rate of production is higher in Odun-Ifa than in other villages.

Table 1: Rate of Charcoal Production in Selected Villages of Oriire Local Government, Nigeria

No of Bags	Olokoto		Igbori		Odun-Ifa		Total	
	No	%	No	%	No	%	No	%
1-20	15	75	10	66.6	11	78.6	36	73.6
21-40	3	15	-	-	3	21.4	6	12.2
41-60	2	10	3	20	-	-	5	10.2
61-80	-	-	2	13.4	-	-	2	4
Total	20	100	15	100	14	100	49	100

Source: Authors' Field Survey, 2011

A large percentage of the wood used in the production of charcoal in these three villages is obtained from trees intentionally felled for the purpose of charcoal production. Only a few proportions of such woods are obtained from trees that die naturally (33.3%), 22.2%, 21.4% in Olokoto, Igbori and Odun-Ifa respectively). This reveals the high rate of deforestation tendency in these villages without any effort towards afforestation. This results into a great loss of biodiversity and the forest region at large as well as increased soil erosion. Machines rather than manual tools such as cutlass and axe are mainly used for felling trees in the study area. These machines produce a high intensity of noise which scare away forest animals and also constitute air pollution, earring loss and other psychological damages. No doubt, charcoal production has contributed significantly to atmospheric contamination in the study area. One could readily perceive the odour of obnoxious gasses that are released during the production process. Residents in the three villages strongly agree with this and also with the fact that charcoal production has equally been a major source of income for them. On the other hand, they disagreed with the fact that charcoal production has a negative impact on crop yield especially on the land where such activity is carried out. While this is their perception, on crop yield, they agreed largely that charcoal production has increased the rate of soil erosion in the area. This conflict in their responses can therefore be attributed to their low level of education. However, the study shows that even though the residents are aware of the negative impacts of charcoal production, they still support it due to the fact that it is their major source of income and it has ripple effects in promoting other trade sectors of their economy as well as reducing social vices, which some poverty-ridden elements of the communities may have perpetrated, were it not for charcoal production.

### Recommendations and Conclusion

- a. Since it could be difficult to completely abolish felling of trees for charcoal production given the prevailing poverty problem and inadequate and unaffordable cleaner other energy sources, government should enforce tree planting policies, forest development/management policies and other measures to encourage afforestation within the study area. However:
  - Government should monitor tree cutters so as to ensure that not just single specie of tree is being cut down. This will help to prevent the extinction of such endangered species
  - Government should also give prior consideration to public participation at all stages of decision making to make the plan functional. Public enlightenment and awareness should be carried out to educate the general public on the importance of agro-forestry. Forest and environmental conservation should be embarked upon by all tiers of government.
  - Establishment of research organizations that will look into improvement of affordable, healthy, safe and efficient energy production and use in households should be encouraged.
  - Government should try as much as possible to subsidize fuel price and ensure its stability in order to give the poor masses a privilege to afford it.
  - Mechanisms for methane capture should be developed and adopted so as to collect the emissions during charcoal production process. This gas can be used to generate energy while protecting the environment from pollution and global warming.
  - The charcoal producers through their associations should co-operate with the government in her effort to protect the forest regions.

### Conclusion

The demand for charcoal has extended from national to international market. And the supply can hardly meet up with the demand. Even though wood which is the major raw material for its production is obtained from a renewable source, its source cannot be renewed if deliberate efforts are not taken. Prohibition of charcoal production in a bid to prevent ecological disaster is not feasible because of the absence of cheaper alternatives and its direct linkage with the economy of the study area.

In order to enjoy the benefits of this charcoal as well as ensure minimal adverse effects, the practice should adopt all the recommendations offered in this work.

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