

SUBSISTENCE LIVING AND GLOBAL CLIMATE CHANGE: IMPLICATIONS OF BIOCHARCOAL PRODUCTION FOR FARMERS IN RURAL AREAS OF NIGERIA

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Abstract

The study examines socio-economic implications of charcoal production for farmers of rural communities in Nigeria using selected communities in Ifedapo Region of Oyo State. From a total of 67 charcoal producing rural communities identified in the region, 16(30%) was proportionally selected using three sampling techniques (stratified, purposive and simple random sampling). A total of 32 colliers and 8 middle traders (wholesalers) were selected as respondents to form the representative sample of the studied population. A-25 item questionnaire was the instrument used for the study. The survey reveals that charcoal producers are mainly male, married adult farmers with little or no education. The charcoal enterprise has been on part-time basis, undertaken as a coping strategy, and the forest is depleting due to uncontrolled and indiscriminate exploitation of mature and nearly-mature trees. Its production would not stop because available alternatives are limited and expensive. Consequently, creating short-term employment during off-season period for farmers, subsidising agricultural inputs, an appropriate policy that delivers gas and kerosene to the end-users for domestic use at affordable price, community participation in forest management, researches into the use of wind and solar energies, law against cutting down of trees without replacement and implementation of the components of the national planning programmes, which pertain to afforestation, discourage farmers from charcoal production.

Keywords: Fuelwood, Deforestation, Biocharcoal, Subsistence Living

Introduction

Charcoal export started in Nigeria in 1904 (Light and Sound, 2009). In 2000, 67,767,000 cubic metres (2.4 billion cubic feet) of round wood were produced, 85 % for fuel. In the same year, Nigeria's consumption of fuel wood and charcoal was the third highest in Africa (Olori, 2009). Of the country's population of over 144 million, about 70% live in rural areas and are directly or indirectly dependent on forest resources— especially wood - to meet both domestic and economic energy needs. This activity is leading to destruction of forest cover, a situation aggravated by illegal commercial logging (Olori 2009). FAO (2005) indicates that between 1990 and 2005, Nigeria lost 35.7% of its forest cover and only 12.2% of the country's land is currently forested while 350,000 hectares of land in the country are lost to desertification annually.

Problems posed by the production of charcoal are numerous. Adeniyi (1995) and Wikipedia Encyclopedia (2005) noted that the problems in

Nigeria include environmental pollution from smoke, deforestation which causes erosion hazard and exposes the soil to direct sunshine, thereby reducing the fertility of the soil and the health problems to the producers and the entire community as a whole.

Charcoal production is associated with felling of both mature and nearly-mature trees in the study area. The study, therefore, aims at examining the charcoal production, method and the reason(s) for the production, with a view to identify the social and economic implications of the activity to the colliers (farmers) and problems posed by the commercial production of charcoal to the environment. Mitchell, (2009) noted that deforestation is a global emergency, the importance of which the business world must wake up to, especially, to mitigate the effect of global climatic change. It also suggests solutions that could improve production and mitigate the adverse effects of charcoal production, and provoke policy towards deforestation in Nigeria.

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Study Area

Ifedapo region in Oyo State of Nigeria is used as a case study. The region provides a representative insight into the socio-economic conditions of farmers as regards to the production of charcoal in Nigeria. There are 36 states in Nigeria of which Oyo State is one. Oyo state has five administrative zones, namely Ibadan, Ibarapa, Oyo, Ogbomoso, and Oke-Ogun. Oke-Ogun comprises four regions: Iseyin, Irepodun, Kajola and Ifedapo (Ajadi, 2004). Ifedapo region is located in the northern part (savannah belt) of Oyo State, Nigeria. It comprises three local government areas out of the 33 local government areas in Oyo State: Saki west (Saki town), Saki east (Ago-Amodu) and ATISBO (Tede). Saki town, which is the major urban town in the region, is about 184 and 320 kilometres from Ibadan and Lagos respectively, and the major occupation of the people is farming.

The region is within the savannah belt of Nigeria and is located on Latitude 8.5⁰ N and Longitude 3.5⁰ E. In the rainy season, there are broad, green leaves trees characterised by fire-resistant, thick bark and deep tap root. Such trees include *viteloria paracloxum* (Emin) trees, *Khaya ivorensis* (Ogano), *Triplochiton scleroxylon* (Arere), *Anogeissus leiocarpus* (Ayin), *Burkea africana* (Asapa), *Distemonanthus benthamianus* (Ayan), *Perkia bigolobosa* (Igba), *Terminalia avicenniocles* (Idi), *Gmelina arborea* (Igi Isana), *Milicia excelsa* (Iroko), *Tectona grandis* (Gedu) and so on. The study area experiences tropical climatic condition, which include wet and dry seasons which occur from April to October and February to April respectively. Harmattan, which is a cool dry wind from the Sahara, occurs between November and February. The temperature ranges from 20°C to 36° C and the average relative

humidity is 10% but can be up to 85% in the night and low as 59% in the afternoon. It has an annual rainfall of 102mm (Udo, 1987; Popoola, 2009).

Methodology

The methodology of this study involves the use of library books, journals, magazines, newspapers, internet sources and primary sources. The population of the study comprises all the villagers involved in charcoal production and sale in Saki West, Saki East and ATISBO Local Government areas. Three sampling techniques (purposive, stratified and simple random sampling) were adopted for selecting the sample of the study population. The whole region was divided (stratified) into three sub-study areas according to local government areas, which the region is currently made of. A total number of 53 charcoal producing communities were identified from the three local governments through a purposive interview of 8 selected wholesalers in Saki town, Ago-Are, Agunrege and Oje-Owode charcoal depots. These are Saki West (13) Saki East (23) and ATISBO (17) from which 16 (30%) charcoal-producing communities were proportionally selected. Only 16 (30%) communities were selected through simple random sampling technique (lucky dip/blind dip method). A total of 32 respondents (2 colliers per community) were selected to form the representative sample of the study population. The main instrument of this study was a 25-item questionnaire. The data collected from primary source was coded and further analyse by descriptive technique in the form of frequency tables. Moreover, 8 major middle traders (wholesalers) were purposively selected for interview orally to solicit for cost of transportation, problems faced and suggestions towards improving the business of charcoal.

Table 1 Number of identified charcoal communities, charcoal communities selected and the number of respondents' selected

| Local Government | Charcoal Communities | Number Charcoal Communities Selected | Respondents Sampled | % |
|------------------|----------------------|--------------------------------------|---------------------|---------------|
| Saki West | 13 | 4 | 8 | 25.00 |
| Saki East | 23 | 7 | 14 | 43.00 |
| ATISBO | 17 | 5 | 10 | 31.00 |
| Total | 53 | 16 | 32 | 100.00 |

Source Field Survey, January, 2008 -December 2009.

Results and Discussion

Charcoal Production Operation in the Study Area

Charcoal production in the study area, as observed during the study, generally consists of piling billets of wood on their end so as to form a conical pile, openings being left at the bottom to admit air, with a central shaft to serve as fuel. The whole pile is covered with turf or moistened clay. The firing is begun at the bottom of the flue and gradually spreads outwards and upwards. The

collier and his assistants kept a wary eye on the steaming, smoking pile to guard against blowouts that might lead to flaming of the pile. Colliers often had to cut or dig holes at various spots on the pile to ensure proper air flow. During the first twenty-four hours, the collier would have to occasionally “jump the pile”. This dangerous task requires the collier to climb on top of the smoking mass, so as to compact the pile and assure an even burn. As the burn continues and the smoke and steam subside, the raking out begins.

Table 2 Socio-economic Characteristics of the Respondents

| Age Characteristics of the Respondents | | |
|----------------------------------------------------------|------------------------------|---------------|
| Characteristics | Number of Respondents | % |
| 18 – 22 | 1 | 3.00 |
| 23 – 27 | 1 | 3.00 |
| 28 – 32 | 11 | 35.00 |
| 33 – 37 | 9 | 28.00 |
| 38 – 42 | 7 | 22.00 |
| 42 -46 | 2 | 6.00 |
| Above 46 | 1 | 3.00 |
| Total | 32 | 100 |
| Sex Structure of the Respondents | | |
| Sex | | |
| Male | 32 | 100 |
| Female | - | 0 |
| Total | 32 | 100 |
| Marital Status Characteristics of the Respondents | | |
| Single | - | |
| Married | 27 | 85.00 |
| Widower | 3 | 9.00 |
| Divorce/separated | 2 | 6.00 |
| Total | 32 | 100.00 |
| Religion of the Respondents | | |
| Characteristic | | |
| Islam | 16 | 50.00 |
| Christianity | 10 | 31.00 |
| ATR | 06 | 19.00 |
| Total | | 100.00 |
| Educational Status of the Respondents | | |
| Characteristics | Number of Respondents | % |
| No formal education | 21 | 65.00 |
| Primary education not completed | 07 | 22.00 |
| Primary Education completed | 04 | 13.00 |
| Secondary Education completed | - | |
| Tertiary Education completed | - | |
| Total | 32 | 100.00 |
| Main Occupation of the Respondents | | |
| Characteristic | Number of Respondents | % |
| Farming only | 27 | 85.00 |

| | | |
|---------------------------------------------------------------|------------------------------|---------------|
| Farming & Trading | 03 | 9.00 |
| Farming & Hunting | 02 | 6.00 |
| Others | - | - |
| Total | 32 | 100.00 |
| Family Size of the Respondents | | |
| Characteristic | Number of Respondents | % |
| 0 – 5 | 1 | 3.00 |
| 6 – 10 | 17 | 53.00 |
| 11 – 16 | 12 | 38.00 |
| Above 16 | 02 | 6.00 |
| Total | 32 | 100.00 |
| Nationality of the Respondents | | |
| Characteristics | Number of Respondents | % |
| Nigerians | 13 | 41.00 |
| Others | 19 | 59.00 |
| Total | 32 | 100.00 |
| Region within the Country (Nigeria) of the Respondents | | |
| Characteristics | Number of Respondents | % |
| Ifedapo | 3 | 23.00 |
| Outside Ifedapo Region | 10 | 77.00 |
| Total | 13 | 100.00 |

Source: Field Survey, January 2008-December 2009.

Result in Table 2 shows that a higher percentage of the colliers are Non-Nigerians and most of the colliers from Nigeria came outside the region (Ifedapo).

The price of a bag of charcoal is not uniform among the producing communities, but fluctuates seasonally (Table 3). The price could be as low as between N100.00 and N150.00 and between N250.00 and N300.00 in the dry and rainy seasons respectively. But the prices in the urban areas are relatively stable within a season. The rise in price is due to trucked transportation into urban centres

from even-greater distances (Table 4). The result in table 5 indicates the comparative average profit of a bag (15 kg) of charcoal in the producing communities and the urban cities. The table shows that higher profits are made in urban areas and this encourages the involvement in the sale of charcoal by the urban dwellers. The result in table 6 indicates that it is cheaper to use charcoal for cooking. The increase in the profit level encouraged hoarding during the dry season. The cheapest fuel used for domestic purpose is charcoal (Table 7).

Table 3 Seasonal Average Selling Price of a Bag of Charcoal (15kg) in the Producing Communities (Villages)

| Characteristics (in Naira) | Number of Communities (Dry Season-November) | Number of Communities (Wet Season- July) |
|----------------------------|---------------------------------------------|------------------------------------------|
| N100 – N150 | 1 | - |
| N151 – N200 | 13 | - |
| N201 – N250 | 16 | - |
| N251 – N300 | 2 | 26 |
| N301 – N350 | - | 6 |
| Total | 32 | 32 |

Source: Field Survey, January 2008 - December 2009.

Table 4 Seasonal Average Price of a Bag (15g) of Charcoal in the Producing Communities and in the Urban Areas

| Settlements | Average prices/15kg (in naira) in the dry season (November) | Average prices/15kg (in naira) in the rainy season (July) | Differences | Percentage increase |
|-----------------------|-------------------------------------------------------------|-----------------------------------------------------------|-------------|---------------------|
| Producing Communities | N150.00 | N250.00 | N100.00 | 66 |
| Saki | N300.00 | N600.00 | N300.00 | 100 |
| Ogbomosh/Oyo | N500.00 | N900.00 | N400.00 | 80 |
| Ibadan | N600.00 | N1500.00 | N900.00 | 150 |
| Lagos | N1200.00 | N3000.00 | N1800.00 | 150 |

Source: Field Survey, January 2008-December 2009 (\$1 to =N=156.00)

Table 5 Average Profit on a Bag (15kg) of Charcoal in the Producing Communities and in the Urban Areas (Rainy Season -July)

| Settlements | Average prices/15kg [naira] rainy season [July] | Differences | Percentage increase (%) |
|-----------------------|-------------------------------------------------|-------------|-------------------------|
| Producing Communities | N250.00 | | |
| Saki | N600.00 | N350.00 | 140 |
| Ogbomosh/Oyo | N900.00 | N650.00 | 260 |
| Ibadan | N1500.00 | N1250.00 | 500 |
| Lagos | N3000.00 | N2750.00 | 1100 |

Source: Field Survey, January 2008-December 2009. (\$1 to =N=156.00)

Table 6 Average Price of Alternative Source of Domestic Fuel (Kerosene and Gas)

| Urban Centres | Average price of kerosene /litre | Average price of domestic gas /12.5kg |
|---------------|----------------------------------|---------------------------------------|
| Saki | N140.00 | N3800.00 |
| Ogbomosh/Oyo | N140.00 | N3800.00 |
| Ibadan | N130.00 | N3500.00 |
| Lagos | N140.00 | N 3500.00 |

Source: Field Survey, January 2008- December 2009(\$1 to =N=156.00)

Table 7 Average Usage of Sources of Domestic Fuel [Kerosene, Gas and Charcoal] in Saki, Oyo, Ogbomoso, Ibadan and Lagos

| Domestic Fuel | Average Usage For a Family of Five /Month | Average Amount per Month (Naira) |
|---------------|-------------------------------------------|----------------------------------|
| Kerosene | 35litres | N4900.00 |
| Gas | 12.5 kg | N3500.00 |
| Charcoal | 1 bag | N1500.00 |

Source: Field Survey, January 2008-December 2009 (\$1 to =N=156.00)

Table 8 The Main Determinants of the Price of Charcoal

| Characteristics(Determinants) | Number of respondents(Collier) | Total Number of 'Yes' Respondents | % of 'Yes' Respondents |
|---------------------------------|---------------------------------|-----------------------------------|------------------------|
| Demand | 32 | 32 | 100 |
| Quality of the product | 32 | 32 | 100 |
| Availability of wood | 32 | 32 | 100 |
| Cost of transportation/Distance | 32 | 32 | 100 |
| Supply | 32 | 32 | 100 |
| Total | 160 | 160 | |

Source: Field Survey, January2008-December 2009.

The finding shows that a producer produces an average of 11 – 15 bags of charcoal per week especially in the dry season. It could be inferred from Tables 4 and 8 that there is great demand for charcoal in urban areas. The reasons attributed to the fact is that charcoal burns much hotter than cut wood, lighter to transport and available alternative is limited and expensive both in the rural and urban communities. It was also observed that charcoal last in storage without degradation many years longer than fuel wood and therefore the preference for charcoal (Table 9).

The results show that the charcoal production is often a seasonal activity and the rainy season may

close down operations or the labour force may traditionally be employed at certain times in harvesting or planting operations in agriculture (Tables 2, 10 and 11). This shows that charcoal production is not being undertaken by the people because of its profit and viability, but rather as coping strategy to supplement the high price of farming input of the subsequent season. It also serves as the stabilising tool for partial farming off-season unemployment. It could also be inferred from the result in Table 12, as it indicates that charcoal production is a low profit yielding enterprise to the collier as compared to middle traders (wholesalers) as revealed by the oral interview and therefore it could not be said to be a highly profitable enterprise.

Table 9 Reasons for High Demand of Charcoal

| Reason | No of respondents | Total no of 'yes' Respondents | Percentage of 'Yes' Respondents |
|-------------------|-------------------|-------------------------------|---------------------------------|
| Price of charcoal | 32 | 32 | 100 |
| Burns much Hotter | 32 | 32 | 100 |
| Lighter to carry | 32 | 32 | 100 |
| Last in storage | 32 | 32 | 100 |
| Availability | 32 | 32 | 100 |

Source: Field Survey, January 2008-December 2009.

Table 10 Seasonal Participation in the Production of Charcoal by the Respondents

| Season | No of Respondents | % |
|--------------------|-------------------|---------------|
| Wet | 01 | 3.00 |
| Dry | 30 | 94.00 |
| Both (Wet and Dry) | 01 | 3.00 |
| Total | 32 | 100.00 |

Source: Field Survey, January2008-December 2009

Table 11 Terms of Production by the Respondents

| Term | No | % |
|--------------|-----------|---------------|
| Full time | 01 | 3.00 |
| Part time | 31 | 97.00 |
| Total | 32 | 100.00 |

Source: Field Survey, January2008-December 2009.

Table 12 Problems of Charcoal Production

| Problems | Strongly agreed | Agreed | Indifferent | Not Agreed | Strongly not agreed | Total No. of Respondents |
|-----------------------|-----------------|--------|-------------|------------|---------------------|--------------------------|
| Labour intensive | 29 | 3 | - | - | - | 32 |
| Capital intensive | | | - | 11 | 21 | 32 |
| Scarcity of Hardwood | 17 | 15 | - | - | - | 32 |
| Land tenure | 00 | 03 | 09 | - | 20 | 32 |
| Bon-fire lingering | - | - | - | - | 32 | 32 |
| Distance of the mound | 19 | 13 | - | - | - | 32 |
| Law enforcing agents | - | - | - | 3 | 29 | 32 |
| Low profit margin | 32 | - | - | - | - | 32 |

Source: Field Survey, January 2008-December 2009.

Result in Table 12 further shows that other problems include the scarcity of mature hardwood which calls for a greater distance-travel and incursion into the government forest reserves to produce the charcoal. This shows that deforestation or consumption of mature hardwood exceeds regeneration if any (Table 13). This means that the forest is gradually shrinking due to uncontrolled (by the government officials) and indiscriminate exploitation or felling of mature or nearly mature trees of the privately-owned forest for charcoal and fuelwood (Table 14).

The study revealed that the majority of the colliers did not obey the law owing to lack of will and discipline to observe and implement laws by compromised local government officials, forest guard and so on. The study also revealed that there was no record of production in terms of the number of trees cut, the weight of trees used to produce certain number of bags of charcoal, and daily, monthly and annual production and sales of charcoal. This made it impossible for the authors to know whether there is relationship between variables, the direction of the relationship or/and the strength of the correlation.

Table 13 Regeneration of the Forest by the Collier

| Responses | No of Respondents | % |
|--------------|-------------------|---------------|
| Yes | 0 | 0 |
| No | 32 | 100 |
| Total | 32 | 100.00 |

Source: Field Survey, January-December 2009.

Table 14 Regulation of Private Forest Tree Felling by the Local Government Officials

| Responses | No of Respondents | % |
|--------------|-------------------|---------------|
| Yes | 0 | 0 |
| No | 32 | 100 |
| Total | 32 | 100.00 |

Source: Field Survey, January 2008-December 2009.

Menne and Bertollini (2000) describe five major global environmental problems, which points to the potential impact on future generations. These are climate change, ozone layer depletion, desertification, deforestation and child mortality, loss of biodiversity and, charcoal

production and greenhouse emission source. From nearly 470 million tons of wood consumed in 2000 in homes in sub-Saharan Africa in the form of firewood and charcoal, more wood per capita than any other region in the world, Hao and Liu (1994) estimate that of these fires, 10% is

attributed to deforestation and emissions from traditional cooking in Africa are significant enough to influence the tropical and subtropical atmosphere, they concluded. Marufu (1999) concludes by stressing that with the rapidly growing urban-poor populations in sub-Saharan African countries (urbanisation rates of 4.8%) the demand for charcoal is also growing with similar implications for local and regional air pollution.

Conclusion and Recommendations

From the foregoing, it could be inferred from the study that one of the environmental problems in Nigeria in particular and Africa in general is the way our forests are fast-disappearing due to uncontrolled and indiscriminate felling of trees for use as fuel or charcoal both of which are the means of cooking for most families. It is therefore important to say that if there is any justifiable reason for the removal of subsidies from all other petroleum products, government subsidies on domestic gas and kerosene should be maintained in order to save our forests from further depletion. There should be an appropriate policy that delivers gas and kerosene to end-users for domestic use at affordable prices.

There should not be a great sense of urgency to stop the production of charcoal since the availability of alternative to charcoal is not only limited but also expensive to get to all nooks and crannies of the country. What is required now is a measure to control or regulate the cutting of trees for fuel. This could be done through monitoring the formation of registered associations, for example, Collier Association like the Miners' Association, which would be saddled with taking records of felled trees and sales among other functions. This would go a long way in enhancing reforestation enlightenment.

There should be a development and promotion of other energy sources such as solar and wind energies. The development of the two may alleviate the problem of supplying kerosene and gas to domestic users.

Creating short-term employment during the farming off-season period for farmers, so that minimal amount of income to buy food and the successive season farm inputs will help to discourage farmers from charcoal production. Already, the profit margin is low and the enterprise is labour intensive. Subsidising the farm

input can help in solving the problem of deforestation for traditional fuels. When farm inputs are adequately subsidised by the government, the farmers can easily buy their farm input without recourse to any labour-intensive enterprise as charcoal.

Also instead of taxing charcoal at source, and by the forest department, it should be taxed at the point of sale and by the local government council through the local planning authorities. This would facilitate the reforestation programme.

Apart from educating and enlightening the communities on the importance of forest resources and conservation of same, greater community participation in forest management is vital. Forestry plantation project would assist in reversing the present declining Nigeria's forests through its expansion. People in the rural communities should be encouraged on reforestation and afforestation with species yielding fruit, gum and other crops that are of economic value to the communities.

There should be laws that guard against the cutting down of trees for charcoal in both private and public forest areas without planting others as replacement. But legislation alone cannot protect our forests without religiously enforcing them. It is a lot easier to disseminate charcoal in large scale than fossil fuels, because there is a well-developed market and there is no need for expensive infrastructure like refineries and processing. So, even though fossil fuels are in fact better for health and better for climate, they are more expensive and a lot harder to get out. There should be an appropriate policy that delivers gas and kerosene to end users for domestic use at affordable prices, which is possible with strong political will.

Finally, Nigeria has the financial and human resources to pipe gas into homes for domestic use. The problem in Nigeria is that most residential areas in Nigeria (both rural and urban settlements) are not well planned and this makes piping of gas into residential houses for domestic use difficult both in the rural and urban areas. To this, therefore, concerted efforts of government at all levels in Nigeria are required towards national physical development planning, state planning and local planning programmes which are useful components of National Development Planning (Adedipe,2007).

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