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ASSESSMENT OF CHARCOAL PRODUCTION ON DEFORESTATION IN SELECTED AGRARIANCOMMUNITIES OF OYO STATE, NIGERIA

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ABSTRACT

Charcoal production is considered as one of the major drives for deforestation .Its production is beginning to have negative impact on the environment. This study examined the assessment of charcoal production on deforestation in selected agrarian communities of Oyo State. Simple random sampling procedure was used to select 160 respondents from a sample frame of 320 charcoal producers in Saki West and Ibarapa North Local Government Areas. Interview guide and Focus Group Discussions were used to obtain data on charcoal producers' socio-economic characteristics and their perception of deforestation. Primary data were analyzed using frequency counts, percentages and Chi-square. Findings revealed that 57.5% of the respondents were male, 32.5% were within the age group of 40-49 years, while 45.0% and 42.5% had primary and secondary school education, respectively. Also, 32.5 % of the respondents had 16 - 20 years' experience in charcoal production. The study revealed that Vitellaria paradoxa (68.8%, 85.0%) , Anogeissus leiocarpus (77.5%,66.3%) and Bridelia ferruginea (58.8%,65.0%) were the most preferred tree species used for charcoal production in Ibarapa North and Saki West Local Government Areas respectively. Majority (73.8%) perceived that charcoal production is a serious threat to the environment. Chi-square result showed significant ($p<0.05$) associations between charcoal producers' educational level ($\chi^2 = 11.938$, df = 3) and perceived effect of charcoal production on deforestation. The study concluded that charcoal production is one of the major causes of deforestation in the study area. It is therefore recommended that organize afforestation and reforestation programmes should be encourage and enlightenment campaign on the threat on charcoal programme on the environment.

Keyword: Charcoal production, Deforestation, Agrarian Communities, Perception

INTRODUCTION

Forest industries in developing countries contribute about 2.7% of the GDP and play a significant role economically in developing country (Awe *et al*., 2012). Nigeria is well endowed with forest resources, accounting for about 2.5 percent of the Gross Domestic Products (FAO, 2010). It has a vast area of land with different climatic and ecological zones, rich in biodiversity with a wide array of fauna and flora. Demand for forest products has place pressure on forest resources which eventually has resulted in degeneration, deforestation, desertification and subsequently lead to environmental degradation. Deforestation is one of the major factors affecting the forest as a result of urbanization. It refers to the conversion of forest to an alternative permanent land use such as agriculture, grazing, industries etc. (van Kooten and Bulte, 2000). However, it influences the micrometeorological processes, concentration of carbon dioxide in the atmosphere, resulting to global change. This effect disrupts the normal weather patterns; create hotter and drier weather, drought, and desertification, crop failures, melting of the polar ice caps, coastal flooding and displacement of major vegetation regimes. In Africa, charcoal production is considered as the major drive for deforestation; almost all charcoal is

produced in rural areas, especially in forested areas surrounding the urban centers (Chidumayo, 2011; BTG, 2010). It contributes greatly to the deterioration of the environment in Nigeria resulting in increase of carbon-dioxide in the atmosphere where these trees are being felled causing global warming and health problems (Tunde *et al*., 2013). Broad issues such as poverty, population pressures, unequal political power, and lack of opportunities have led to charcoal production which serves as a means of livelihood.

The growing demand for charcoal has resulted in de forestation in vulnerable areas (Salau and Keshinro, 2015). It has been predicted that if the present trend continues the tropical rainforest would completely disappear by the year 2020 due to deforestation induced by fuel wood, charcoal production and conversion of forest to other uses. Rural people who are the major custodians of forest resources survive by exploiting wood resources without caution and concern (Mogaka, 2001), causing economic trees to disappear. Omoogun and Odok (2013) argued that there is a direct link between environmental awareness and human activities on the environment. Deforestation and the general despoliation of the planet continue to accelerate. It is often contended that overpopulation, playing itself out through a 'Tragedy of the Commons', as the primary cause (The Wild Peak, 2012). The theory was written by an ecologist Garrett Hardin in 1968. The theory is about the despoliation of common resources in a manner that it does not allow for the regeneration and or reproduction of those resources (Abdul, 2017). Therefore, the theory underpins the activity of charcoal producers based on wood exploitation for charcoal burning resulting in forest destruction which charcoal producers are aware of, but they will continue to explore it because of the selfish economic gains which at the long run has long term impacts on the environment and forest ecosystem. The tragedy of the commons can be avoided if it is appropriately regulated. Over time forest areas experience desert encroachment; which in turn alter the weather pattern. The use of trees for charcoal production presents a threat to the future of forest resources. This study seeks to assess charcoal production on deforestation in selected agrarian communities in Oyo state. The objectives of the study were to examine the socio-economic characteristics of charcoal producers', the choice of trees used for charcoal production and ascertain producers'

MATERIALS AND METHOD

Study Area

The study was conducted in Oyo State Nigeria (Figure 1). It is an inland state in south-western Nigeria, with its capital at Ibadan. It is bounded in the south by Ogun State and in the north by Kwara State, in the west is bounded partly by Ogun State and partly by the Republic of Benin while in the east it is bounded by Osun State. The state is divided into four agricultural zones namely: Ibadan/Ibarapa (Forest and derived savannah), Oyo (Derived savannah), Ogbomosho (Derived savannah) and Saki (Guinea savannah).The state is predominately agriculture based with about 70 percent rural population. The land area covers a vast landmass of 32,249.10 km^2 out of which 27.10793km^2 is cultivable (OYSADEP, 2001). The study was carried out in Ibarapa North and Saki West Local Government Area of Oyo State due to the concentration of charcoal production in the area. Ibarapa North is on longitude of 7.6833^o North and 3.1833^o East. Ibarapa comprises of seven towns which are: Igangan, Tapa, Aiyete, Idere, Igboora, Eruwa and Lanlate, popularly referred to as Ibarapa meje. These towns are divided into three Local Governments Areas (LGAs) which are: Igangan, Tapa and Aiyete in Ibarapa North Local Government Area LGAs with Aiyete as the Head-quarter. The name of the community at large 'Ibarapa' was derived from a common plant known as 'Ibara,' otherwise known as melon. Ibarapa North Local Government LGA is pre-dominantly an agrarian community (Ogunlesi, 1989). Saki- West LGA of Oke - Ogun in Oyo State is located in the Western part of Nigeria. Saki West is located on the longitude 8^o 40 North and latitude 3^o 24 East. The vegetation within the study area can be described as typical Guinea savannah vegetation zone with favorable rainfall and adequate soils. There are 11 wards in Saki West LGA. It consists of about 224 villages (A Report of village listing survey in Oyo State, 2001) which include Idi-apa, Sannisala, Alabafe, Aba-Adenye, etc. The predominant occupations of the people in the study area are farming and trading.

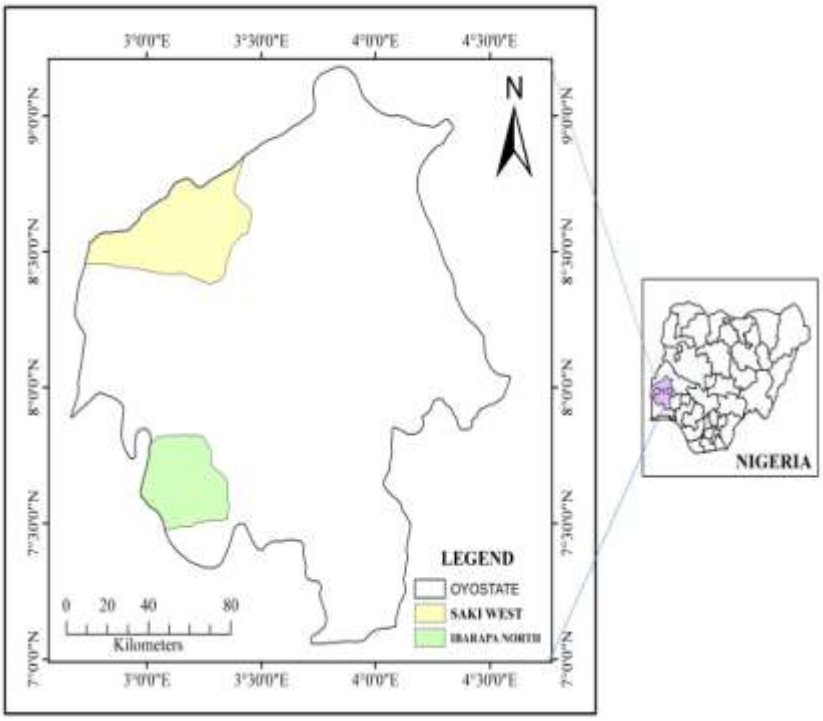

Figure 1: Map of the Saki West and Ibarapa North Local Government Areas (Source: Ministry of Land and Survey Ibadan, Oyo State)

Experimental Procedure

Charcoal producers in Ibarapa North and Saki West LGAs constitute the sampling frame for the study. The respondents were selected through a multi-stage sampling technique. At first, the study adopted purposive sampling technique in the choice of the studying area. The factors that informed the choice of area was the concentration of the charcoal production in the study area in Oyo state. Secondly,from the state, two agricultural zones (Ibadan/Ibarapa and Saki zones) were also selected purposively based on presence of charcoal producers. Thirdly,from each of the Local Government Areas (LGAs), four villages were purposively selected from Ibarapa North which are Aiyete, Akowe, Asunnara, and Ajegunle while the villages in Saki West include: Sannisala, Alabafe,Aba-Adenye and Ayate, making a total of eight villages. Lastly, twenty (20) charcoal producers were selected from each villages to make a total of 160 charcoal producers.

Data Analysis

Descriptive and inferential statistics such as tables, frequencies, percentage and Chi-square were used to analysis information on socio-economic characteristics, choice of trees used, charcoal producers perceived effect on deforestation; and estimate the perceived effect of charcoal production on deforestation respectively.

RESULTS

Socio-economic-characteristics of respondents

The results in Table 1 revealed that 57.5% of the charcoal producers were males while 42.5%were females. The mean age of the respondents is 42.9 years and most of them were native of the study areas. Results show that respondents have basic education and their major occupation is farming (56.3%). Due to their early involvement in the charcoal enterprises, respondents' years of experience fall between 16-20 years (32.5%) with the mean of 12.8years.

Table 1: Distribution based on the socio-economic characteristics of the respondents (n=160)

Variables	Classes	Frequency	Percentage (%)	Mean
Sex	Male	92	57.5	
	Female	68	42.5	
Age	20-29	23	14.4	
	30-39	34	21.3	
	40-49	52	32.5	42.9
	50-59	48	30.0	
	Above 60	3	1.9	
Ancestry	Native	94	58.8	
	Non-Native	66	40.2	
Educational Level	Non Formal	13	8.1	
	Primary	68	42.5	
	Secondary	72	45.0	
	Tertiary	7	4.4	
Occupation	Farmers	90	56.3	
	Traders	67	41.9	
	Civil Servants	9	5.6	
	Artisans	4	2.5	
Years of Experience	1-5	25	15.6	
	6-10	40	25.0	
	11-15	26	16.3	12.8
	16-20	52	32.5	
	Above 20	17	10.6	

Charcoal Producers Choice of Trees used for Charcoal Production.

Results shown on Table 2 revealed that respondents from Ibarapa North and Saki West use *Vitellaria paradoxa* and *Anogeissus leiocarpus* (77.5 %, 66.3 %) respectively. Other tree species that are frequently used by the respondents in Ibarapa North and Saki West were *Bridelia ferruginea* (58.8 %, 65.0 %), *Terminilia spp* (41.3 %, 56.3%) and *Pericopsis laxiflora* (37.5 %, 33.8 %) respectively.

Table 2: Distribution Based on Respondents' Choice of Trees Used for Charcoal Production

Scientific Name	Common Name	Local Name	Ibarapa North		Saki West	
			Frequency	Percentage (%)	Frequency	Percentage (%)
Vitellaria paradoxa	Shea tree	Emi	55	68.8	68	85.0
Pericopsis laxiflora	Pericopsis	Ayan/Ayanre	30	37.5	27	33.8
Anogeissus leiocarpus	Axle wood	Ayin	62	77.5	53	66.3
Bridelia ferruginea	Guinea	Ara	47	58.8	52	65.0
Terminalia spp	Tropical almond tree	Idi	33	41.3	45	56.3
Harungana madagascariensis	Dragon's blood tree	Adin	16	20.0	7	8.8

Charcoal Producers' Perceived Effect of Charcoal Production on Deforestation in The Study Area

Majority (93.8%) of the respondents strongly agreed that charcoal production is one of the primary causes of deforestation in the study area. Majority (93.8%) of the respondents agreed that there was no need for tree regeneration because they perceived that the forest can regenerate naturally, while 3.8% disagreed on the statement. Most (83.7%) of the respondents agreed that charcoal production causes erosion in the study area. Also, about half of the respondents perceived that charcoal production causes land degradation in the study area. This study is in line with Jamala *et al*., (2013) that charcoal production is one of the primary causes of deforestation leading to land degradation in areas involved in the business. Earth kiln method is not good for environmental sustainability, majority (74.4%) of the respondents strongly agreed to this statement. This is because earth kiln method involves escalating top soil which will aggravate erosion and flooding and at the long run it is not environmentally suitable.

Table 3: Distribution of Respondent Based on Their Perceived Effect of Charcoal Production on Deforestation

Perception Statement	SA (%)	A(%)	U(%)	D(%)	SD(%)	Mean
Charcoal is one of the primary causes of deforestation	150(93.8)	10(6.3)	-	-	-	4.94
It is not necessary to replant trees because forest can regenerate naturally	67 (41.9)	83(51.9)	4(2.5)	4(2.5)	2(1.3)	4.31
Charcoal production causes erosion	89 (55.6)	45(28.1)	14(8.8)	8(5.0)	4(2.5)	4.29
Charcoal production causes land degradation	90(56.3)	29(18.1)	17(10.6)	21(13.1)	3(1.9)	4.14
Earth kiln method is not suitable for the environment	80(50.0)	39(24.4)	21(13.1)	20(12.5)	-	4.12

SA – Strong agreed; A – Agreed; U – undecided; D – Disagreed; SD – Strong Agreed
Figures in parentheses are percentages

DISCUSSION

From Table 1 above, there is an indication that there are more males than females in charcoal production; this is due to the rigorous activity involved in charcoal production. The study also revealed that majority (87.5%) of the respondents had elementary education (secondary and primary school), which implies the low level of formal education will influence charcoal producers into the enterprise early since the skill acquisition does not require rigorous process and this will make them more experienced in the business . This study supports that of Adejumobi and Eniola (2011) findings about charcoal producers in Oke-Ogun, that their level of education is low. Also, the active group falls between 20-39 years (62.5%), this denotes that respondents within this age active group suite the enterprise because of the energy exertion required during production. However, the study correlates with Adeniyi et al (2015) that the active age group for charcoal production in Niger State was 20-39 years. Most of the respondents in the study area were native of the communities; this suggests that respondents were familiar with the terrain of the area and will be able to explore other forest areas in the study area. Farming is the predominate occupation of the respondents, this infers that respondents will have the opportunity to venture into charcoal production during the off farm season.

The results on Table 2 shows that respondents prefer to use trees like *Vitellaria paradoxa, Anogeissus leiocarpus, Bridelia ferruginea, Terminalia spp,and Pericopsis laxiflora*. This is because of the unique features of these trees to produce good quality charcoal. These trees are endangered and the exploitation of these few species of tree will adversely affect biodiversity. However, the tree species are very much important in the production of charcoal as there are specific trees species known to favour charcoal production due to dense and hard charcoal they produce, with

higher calorific value (Izekor & Modugu 2011). They have a high economic value such as timber, food and fruits etc; some are protected but are fell illegal. This study affirms with Tunde et al (2013) that trees such as Axle wood (*Anogeissus leiocarpus*), Burkea (*Burkea africana*), Shea butter (*Vitellaria paradoxa*), Hymenocardia (*Hymenocardia acida*) and Pericopsis (*Pericopsis laxiflora*) were good and strong wood that will give good quality of charcoal. This finding is in line with Netherlands Programmes Sustainable Biomass study (BTG, 2010), that charcoal producers prefer tree species with slow-burning features for charcoal, however, these tree species are majorly economic trees, which are slow growing and are therefore particularly vulnerable to over exploitation. Also, the study confirms that Vitellaria paradoxa and Anogeissus leiocarpus are the most preferred tree species used in Ibarapa North and in Saki West. The study is in line with Olarinde and Olasimbo 2018 that these trees are mostly used in Oke-Ogun area of Oyo state.

Results on Table 3 showed that respondents perceived in the study area perceived charcoal production has the major activity that contributes to deforestation. This implies that among numerous activities carried out on the forest in the study area, charcoal production is pinpointed as decadence to the well-being of the forest. Also, due to the high influx in charcoal business, the rate of deforestation will constantly be on the increase in the study area. This study is in line with Adejumobi and Eniola, (2011) that 89.5% of the respondents in their study agreed that charcoal production causes deforestation in Oke-Ogun area.

Most of the respondents perceived that there is no need to resuscitate the forest. This shows that the forest area will not regain its biomass on time and will suffer environmental degradation for a while. This study supports BTG (2010) that charcoal producers perceived that trees have a way of growing back once it is not uprooted from the soil. Respondents agreed that charcoal production causes erosion and flood in the study area. This is because trees that are supposed to curb the washing away of the topmost soils had been removed during the process of charcoal production. Also, respondents affirmed that charcoal production causes land degradation in the study area. This implies that the deforestation activity that takes place in the study area will aggravates land degradation in the study area. This study is in line with Jamala *et al.* (2013) that charcoal production is one of the primary causes of deforestation that leads to land degradation in areas involved in the business. Respondents affirmed that earth kiln method is not environmentally sustainable. This is because earth kiln method involves escalating top soil which will aggravate erosion and flooding. Also, the earth kiln method contributes significantly to atmospheric contamination and the emissions are usually released as part of the smoke into the atmosphere, posing an air-pollution problem

Results of Chi-Square Analyses on the Dependence of Socio-Economic Characteristics of Charcoal Producers on Deforestation

The result of the Chi-square analysis on Table 4 showed that there is a significant relationship between educational level ($\chi 2 = 11.938$, df = 3, $p<0.05$) and perceived effect of charcoal producers on deforestation. Since charcoal producers level of education is low, it will affect their knowledge on the effects of charcoal production on the environment. This indicates that an increase in the educational level of the respondents will improve their perception on the effect of charcoal production on deforestation. This study is in support of Tunde *et al*., (2013) and Jelili *et al*., (2015) that charcoal producers' low level of education has a negative impact on the forest sustainability. Therefore, the null hypothesis was rejected.

Table 4: Chi-square analysis of socio-economic characteristics and perceived effect of charcoal production on deforestation among charcoal producers

Variables	$\chi 2$	Df	p-value	Decision
Sex	1.626	1	0.20	NS
Marital status	5.911	3	0.12	NS
Religion	3.018	2	0.21	NS
Ancestry	5.288	2	0.05	NS
Educational level	11.938	3	0.01	S
Belong to association	2.517	1	0.11	NS

CONCLUSION

The study concluded that more males were involved in charcoal production than the females due to the energy involved in the process, this can also be linked to the fact that charcoal producers in the study areas were still in their active age for charcoal production. Also, the level of education among charcoal producers was low and they tend to have more experience in the production of charcoal. This is because they would prefer to learn how to produce charcoal than to complete their studies. Charcoal producers perceived that charcoal production is one of the major causes of deforestation in the study area.

Recommendation

1. There is need for an alternative source of energy in order to reduce the demand on charcoal.
2. There is need for Government to encourage sustainable forest management in order to curb indiscriminate felling of trees.

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