Income levels and inequality among charcoal producers in the Southwestern states, Nigeria.

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Abstract: The Income levels and inequality of charcoal producers were investigated in the Southwestern Nigeria. Multi-stage sampling technique was used to select 600 respondents, out of which the responses obtained from 487 were used for data analysis. Primary data were collected with the use of structured questionnaires. Data were analyzed using descriptive statistics and Gini coefficient index. The estimated Gini Index measured on group A was 0.28 for Oyo and Ogun state while the contribution of income variability to which is inequality were 0.12 and 0.13 for both state respectively. The result from annual average income for producers with other sources of income of the respondents were (₦117,039 and ₦114,264.3), while income from charcoal (₦90,142.45 and ₦ 91,584.01) respectively. The inequality result from other sources of income was higher in Oyo state (0.23) than Ogun (0.21) state. Income inequality was generally low among charcoal producers. Average annual income was higher for producers with other sources of income. Generally, low income of less than $1 per day is prevalent among the charcoal producers and the situation predisposes them to poverty which could warrant the need for destruction of the available forests in order to survive. It is recommended that Local, State, Federal and Private organization should endeavour to involve in policy and livelihood programs that can improve the welfare of the people and reduce environmental harmful practices.

Introduction

Forests have been extensively utilized and continue to be exploited over the centuries by the rural poor (World Bank, 2013). Many relied on it basically for subsistence strategy to supplement inputs such as energy source, food and medicinal plants, or to help diversify the source of income in times of hardship (Shackleton *et al*., 2006). For others, forest resources me*et al*most all of their daily needs (Sunderlin *et al*., 2005). Hence, there exist a strong nexus between forests, livelihood sustainability and poverty reduction. Although the global rural population was estimated to be forty-nine percent (49%) of total population, seventy percent (70%) of the world's poor live in the rural area (TWSG, 2012). In Nigeria, rural population was estimated to be 51.40% of the total population (Indexmundi, 2019) and this population partly or fully depended on forest resources to meet their needs. It provides employment for over two million people, particularly in the harvesting of fuel wood and poles, more than 80,000 people work in the log processing industries, especially in the southern part forest zones (FAO, 2010) and millions of people depended on forest resources for livelihood sustainability (Akindele, 2011).

Consequently, this has lead to an environmental menace called Deforestation. According to the Food and Agricultural Organization (FAO) in 2004, Nigeria has one of the highest rates of deforestation of primary forests where more than 50% of such forests have been lost in the past (Mfon *et al*., 2014). The global rate of

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deforestation in the humid tropics was estimated at about 11 million hectares during the late 1970s and 16.8 million hectares in 1990 with forest degradation as a result of harvesting fuelwood and other minor products contributing also the annual rate of deforestation (Ehigiator & Anyata, 2011). Deforestation has had a trend beginning from pre – colonial times. Between 1500 and 1900, the rainforest was reduced as a result of the demand for wood by the colonial masters. From 1900 to 1960, the remaining rainforests were reduced to two large blocks with scattered fragments (Mfon et al., 2014). Bamba, et al. (2011) opine that deforestation is usually caused by agricultural practices, timber exploitation and charcoal and firewood consumption and these factors are exacerbated by population growth. Anyanwu, et al. (2013), large scale deforestation occurs in Anambra state of Nigeria as a result of ignorance of intrinsic value, inadequate environmental laws, poor forest management as well as agricultural practices. They further added poverty as a major cause for deforestation in major African countries. Poverty is a cause of deforestation as many rural dwellers who cannot afford other sources of energy rely on forest resources for energy. Otum, et al. (2017) state that most of the activities that can lead to deforestation are human initiated and are for economic purposes. They also add that forest exploitations are done on two levels: firstly, by local people for the survival and livelihood and secondly, a more commercial level which involves commercial logging, land conversion for agricultural purposes. According to Ogunwale (2015), the unwise use of the natural environment due to ignorance, poverty, greed and overpopulation amongst others have led to deforestation and degradation of the environment. Ogundele, et al. (2016), also add urbanization, industrialization, infrastructural development, tourism, bush burning, mining, logging and fuelwood collection, corruption and political cause as some causative factors responsible for deforestation in Nigeria. Rural dwellers depend heavily on forest resources for survival and livelihood especially with fuel wood being used as the major source of energy leading a great reduction and clearing of this resource.

Investigation into Nigeria's levels of income and inequality indicated that they have remained unstable. For example, between 2010 and 2015 there was a decrease in the level of inequality as a result of increase in income for both the bottom and middle class brackets. However in 2016, there was a downward trajectory in income levels as a result of economic growth retardation. Since then, average incomes kept going down (World Inequality Report 2022). Furthermore, in 2015, Ogbeide and Agu adopted Granger causality technique to probe any causal relationship between poverty and inequality in Nigeria and found out that there was a direct line of causality between poverty and inequality as well as indirect channels through unemployment and low life expectancy which exacerbated poverty. Poverty is a limiting factor in economic development and the dearth of opportunities is strengthened by inequality. According to the UNDP (2013) programme, Human Development Index (HDI) for the Sub-Sahara African countries was 0.475 in 2012 from 0.366 in 1980 and this was alluded to be the worst compared to the other regions of the world. The World Bank (2009) also reported that absolute poverty (income less than $1 per day) has been on the increase since the 80s in Sub Sahara Africa and millions of people are still living in it. Given the large resources in Nigeria, it is paradoxical to note that there exist a situation of increase rate of poverty with high unemployment rate, high income inequality, low quality human capital and high level of migration. In 2004, Bulama submitted that there exists a correlation between inequality, poverty and economic growth and this is corroborated by National Bureau of Statistics – NBS (2012) that millions of people in Nigeria live in absolute poverty.

In 2009/2010 and 2012/2013, the Per capita poverty rate in Nigeria was 35.2 and 33.1 percent of the population respectively. At the rural level, per capita poverty rate was at 46.3 and 44.9 percent of the population in 2009/2010 and 2012/2013 respectively whereas at the urban level it was 15.8 and 12.6 percent of the population. This indicated that the urban areas in Nigeria experience both a significantly lower poverty rate and measurable progress in poverty reduction, while poverty remains high in the rural areas (NER, 2014). The most widely used inequality indicator, the "Gini index" increased from 0.33 to 0.34 equivalents to about 3 percent increase in inequality in 2 years (NER, 2014). Other inequality indices consistently indicated an increase in inequality both at national level and in rural areas. A large share of the Nigerian population appears vulnerable to the poverty line and in rural areas, this number reaches almost 70%. If converted into internationally comparable terms, 140% of the poverty line is close to $2 a day. Thus for the case of national and rural populations, a small standard of living shock could potentially put many more Nigerians in the group below the poverty line. A large share of the Nigerian poor is close to the poverty line, implying that a slight increment in the standard of living for this group could reduce the poverty rate

significantly (NER, 2014). In 2014, Nigeria Economic Report shows an increase inequality and income polarization in Nigeria.

Charcoal production is an enterprise which is essentially common in the rural communities and suggestions made in the past to address income inequality among rural dwellers which include: land reform that promote equitable distribution and easy access to land; investment in rural infrastructures such as roads, irrigation, and storage facilities, to improve the productivity and reduce costs.

Provision of support such as access to credit, training, and marketing assistance, have not seen the light of the day. However, there is a major image issue with charcoal: it is generally viewed as an unclean and ineffective fuel that causes major environmental and social problems, particularly deforestation and forest destruction (Adam Branch et al., 2022). Thus, the question of charcoal is central to the planning of the continent's energy future. In fact, as a potentially sustainable energy source, charcoal is currently receiving more attention in national and international policy and research (Sola et al., 2019). Although this is a positive development, we contend that it needs serious critical analysis, if it is to help develop just and sustainable energy for Nigeria.

Income inequality among rural based enterprises can result in a number of negative consequences such as poverty, hunger, social disorder and economic down-turn. It is therefore pertinent that continuous investigation be made on the state of income generation, inequality and poverty status among charcoal producers in order to ascertain their state of socio-economic development for enhance strategic planning economic development.

Methodology

The Study Area

The study area comprises of Oyo and Ogun States located in the Southwest, Nigeria. Oyo State is located between longitude 2040'E – 4055'E and latitude 7000'N - 9000'N, (Figure 1). The State consists of 33 Local Government Areas and has a total population of five million, five hundred and eighty thousand, eight hundred and ninety-four (5,580,894) people (NPC, 2010), covering 27,249 square kilometres land mass. It is bounded in the south by Ogun State, in the north by Kwara State, in the west it is partly bounded by Ogun State and partly by the Republic of Benin, while in the East by Osun State. Common occupation includes; farming, trade in agriculture and craft manufacturing. There are also artisans and civil servants in the State. The vegetation pattern is that of rain forest in the south and guinea savannah in the north. Thick forest in the south gives way to grassland interspersed with trees in

the north. The climate favours the cultivation of crops like Maize, Yam, Cassava, Millet, Rice, Plantain, Cocoa tree, Palm tree and Cashew (OYG, 2016).
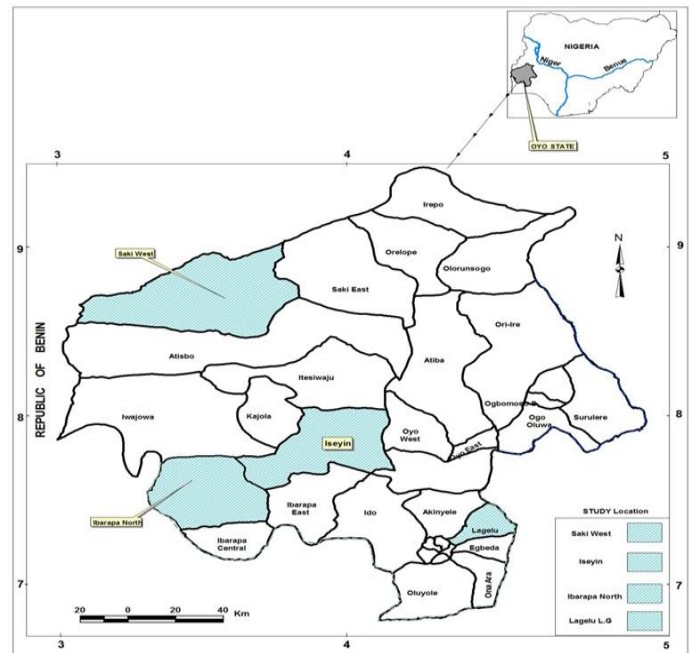
Results

Figure 1: Map of Oyo State showing the study site.

Ogun State lies between Longitude 30 20'E and 4037'E and Latitude 70 15'N and 60 00'N, (Figure 2). It is bounded in the West by the Republic of Benin, in the East by Ondo and Osun States, in the North by Oyo State while in the south by Lagos State and Atlantic Ocean. The total population is said to be three million, seven hundred and fifty-one thousands one hundred and forty (3,751,140) people. However, the projected population as at 2011 Census is 4,397,604 (OSG, 2016). It has twenty (20) Local Government Areas with a land area of about 16,980.55Km2 (NPC, 2010).

The two main rivers in the State are Ogun and Oyan rivers both flowing from Oyo North around Igbeti and Saki respectively in Oyo State and drains into the western part of the State forming a confluence North of Abeokuta, the capital of Ogun State. The most important dam in the State is built on river Oyan. There is also the Osun river in the state which takes its source from Kwara, draining the Eastern half of the State mainly the Ijebu Areas (OSG, 2016).

Ogun State lies within a lowland area with an altitude of between 0 – 200m above sea level. The rainfall pattern allows for two distinct seasons; dry season and wet season. The dry season lasts from November to March while the wet season starts from April and ends in October. The natural vegetation can be broadly grouped into two. These are the forest and savannah. The forest vegetation types consist of fresh water swamp and lowland rain forest. The lowland rain forest is mostly found in the southern part.
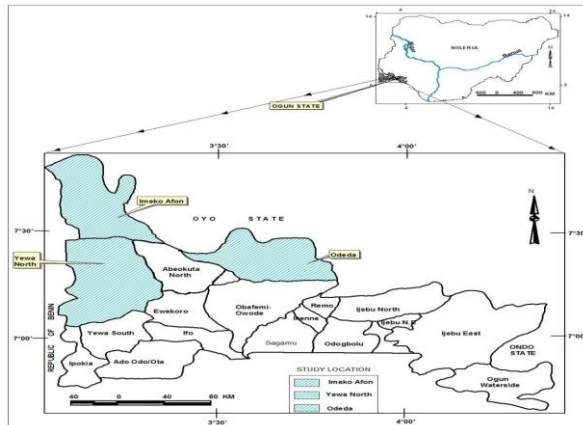
Figure 2: Map of Ogun State showing the study site

Data Collection and Procedures

A detailed appraisal of the various aspects of the objectives was carried out with the use of a structured questionnaire and oral interview; the content comprised open and close questions. The targeted respondents were the charcoal producers in the study area.

Sampling method

Multistage sampling technique was adopted. The first stage involved the stratification of the States into its Local Government Areas (LGAs).

There are 33 LGAs in Oyo State and 20 LGAs in Ogun State. The second stage involved the purposive selection of LGAs notable for charcoal production based on pre-test survey information. In the third stage, systematic sampling procedure was employed to select respondents from the sampled LGAs; after determining the number of respondents to be selected and randomly selecting the ith respondent from the first K sampling interval, then (i+ K)th, (i+2K) th, (i +3K) th was taken and so on. The systematic random sampling was determined with Probability Proportionate to Size (PPS) based on the population distribution of the targeted respondents in the strata. The LGAs selected in Ogun State were; ImekoAfon, Yewa North and jjOdeda, while the LGAs selected in Oyo State were Ibarapa North, Lagelu, Iseyin, and Saki West. Out of six hundred (600) questionnaires administered, a total of four hundred and eighty-seven (487) questionnaires were retrieved and utilized for analysis.

Data analysis

The analytical tools used in this study were descriptive statistics and Gini Index (GI)

Descriptive statistics such as frequency, percentage and means were used to describe the demographic conditions, occupational structure and other resource endowment of respondents in the study area.

Gini Index

Gini index, was used to calculate income inequality and distribution based on the covariance terms as described by Lorenzo GovanniBellu (Easypol, 2006) where the value of '0' signify total equality and the value of '1' expresses maximal inequality.

Gini index have the ability to provide a simple understandable and universally applicable measure of inequality, it allow for comparison among diverse population and time periods and it is useful to access inequality in various context beyond income, such as wealth, access to services and so on .

Decomposition of Inequality was employed by means of generalized entropy (GE). It enabled to distinguish inequality (W), which is the inequality due to the variability of income within each group and between inequality (B), which is the inequality due to the variability of income across different groups.

The Gini index (G) equation:

$$G = \sum_{k=1}^{m} \frac{2}{y} COV[Y\kappa_1, F\{y\}]$$
$$COV = \Sigma XY = (x - \bar{x})(y - \bar{Y})/N$$

Where G = Gini Index
M = total number of income sources
K = an income source
Y = income

Results and Discussion

Socioeconomic characteristics of respondents

The descriptive statistics of the characteristics are presented in Table 1. The table shows the average age is in each state: 46.86% in Oyo and 45.82% in Ogun State. This shows that the majority of the charcoal producers in the study area are within the working age (active age), This is similar to the mean age (41.62) of farmers recorded by Umunna *et al* (Ummuna *et al*., 2018) in Igabi Local Government Area of Kaduna State.. Also, there is a substantial percentage to replace the ageing workforce. The average household size is 6.17 and 6.18, respectively. Households with large family sizes are usually associated with low per capita income, especially in resource-constrained economies. In other words, large family size is associated with poverty. The majority of these households may struggle to meet their basic needs, which can further

Table 1: Socio-economic Characteristics of the Respondents

Variables	Oyo	Ogun
Age (Mean values)	46.86± 0.06	45.82±0.67
Household size (Mean values)	6.17±0.13	6.18±0.14
Years of Experience(Mean values)	15.33±0.30	13.59±0.39
Gender		
Male	294(96.7)	175(95.6)
Female	10(3.3)	8(4.4)
Marital Status		
Married	292 (96.1)	181 (98.9)
Single	8 (2.6)	1 (0.5)
Divorced	3 (1.0)	1 (0.5)
Widow	1 (0.3)	0 (0)
Educational Levels		
No formal Education	21 (6.9)	6 (3.3)
Primary six certificate	28 (9.2)	21 (11.5)
Post primary	240 (79)	150 (81.9)
Tertiary	12 (3.9)	6 (3.3)
Others	3 (1.0)	0 (0)
Disaggregation by other Jobs		
Wage	4 (4.26)	1 (1.82)
Artisan	22 (23.40)	9 (16.36)
Trading	12 (12.77)	8 (14.56)
Farming	43 (45.74)	28 (50.91)
Pension	2 (2.13)	2 (3.64)
Rent	6 (6.38)	3 (5.45)
Hunting	5 (5.32)	4 (7.27)
None	210 (69.08)	128 (69.4)
Income from sources other than charcoal		
≤ 10,000	10 (10.64)	1 (1.82)
10,001 - 20,000	21 (22.34)	9 (16.36)
20,001 – 30,000	17 (18.09)	16 (29.09)
30,001 – 40,000	25 (26.60)	21 (38.18)
40,001 – 50,000	17 (18.09)	7 (12.73)
50,001 – 60,000	4 (4.26)	1 (1.82)

Values in Parentheses are in Percentages (%)

perpetuate cycles of poverty and limit opportunities for education and economic advancement. Additionally, the reliance on charcoal production as a primary income source may hinder diversification into more sustainable livelihoods, thereby affecting overall community resilience. The majority of the households, 96.1% and 98.9%, are married in both states, while 2.6% are single among the respondents in Oyo and 0.5% in Ogun, married people dominate agricultural production activities in Nigeria (Onwubuya & Ajani (2012). 79% and 81.9% have post-primary education, and 9.2% and 11.5% have primary education, while 6.9% and 3.3% have no formal education. The years of experience in charcoal production of the respondents in Oyo are 15 years and above, while the respondents in Ogun are 13 years. Eight years is the average amount of work experience. This is long enough to gain sufficient experience in activities that can help generate revenue. The majority of the respondents in the study area, 45.74% and 50.91%, are farmers, while others engage in other businesses like artisan work, trading and hunting, etc. The other source of income made apart from the charcoal business is the amount made between 30,001 and 40,000 (26.60% and 38.18%) and the amount made between 20,001 and 30,000 (18.09% and 29.09%), while the least amount made is <10,000 (10.64% and 1.82%).

Income inequality among charcoal producers in the study area

Income inequality among charcoal producers in the study area is revealed in Table 2. The respondents in each State were decomposed into two groups. Group "A" were producers whose source of income was from charcoal only while group "B" were producers with income from charcoal and other means of livelihood. The inequality "Within" and "Between" these two groups were captured. The "within inequality" captures the inequality due to the variability of income within each group, while the "between inequality" captures the inequality due to the variability of income across different groups. Population shares, income shares and the Gini Index were calculated for each group. Those who earned income from charcoal only represented 68.8% and 70.5% of the total population and shared 62.9% and 65.7% of the total income in Oyo and Ogun States respectively. The Gini Index (GI) measured on group "A" was 0.28 for Oyo and Ogun States each while the contributions of income variability to "within inequality" were 0.12 and 0.13 for Oyo and Ogun States respectively.

Table 2: Income inequality among charcoal producers in the study area

Variables	Oyo State	Ogun State
Group A: (Charcoal only)		
Population share	0.6875	0.704918
Income share	0.628861	0.656914
Mean income	90142.45	91584.01
Covariance	12744.67	13114.93
Gini group A	0.282767	0.282441
Contribution to G (Within)	0.122252	0.13079
Group B: (Charcoal and other sources)		
Population share	0.3125	0.295082
Income share	0.371139	0.343086
Mean income	117039.9	114264.3
Covariance	13591.32	12933.54
Gini group B	0.232251	0.214028
Contribution to G (Within)	0.026937	0.021668
Gini (Within)	0.149187	0.152458
Gini (Between)	0.058639	0.048004
Gini original distribution	0.274431	0.266898
Gini (BET) + Gini (WIT)	0.207828	0.200462
Residual (K)	0.066603	0.066436

NB: "K" represents the inequality due to the fact that the rank of the individual in the overall income distribution is not the same as its rank in the within-group income distribution.

Group "B" represented 31% (Oyo) and 30% (Ogun) of the total population and they shared 37% and 34% of total income in Oyo and Ogun States respectively. The GI measured on group "B" was 0.23 (Oyo state) and 0.21 (Ogun state) while the contributions of income variability to within inequality were 0.03 and 0.02 for Oyo and Ogun states respectively. The calculated Gini Index within the group was 0.15 for each of the States.

The Gini Index between group "A" and "B" was 0.06 (Oyo state) and 0.05 (Ogun state) while the GI was 0.21 (Oyo State) and 0.20 (Ogun State) for the total population. The residual (K) was 0.6 for each of the States.

Income inequality was generally low among charcoal producers in the study area while the Gini Index (GI) was higher for the charcoal producers only. This could be as a result of the existence of association and various producer groups which ensure equal marketing price per unit of the product. Despite the evidence of low variability in the income of the respondents, average annual income for producers with other sources of income was higher (N117,039.90 and N114,264.30) than those with income from charcoal only (N90,142.45 and N91,584.01) in Oyo and Ogun States respectively. These incomes were below $1.25 a day following the global poverty rate as stated by Hillebrand, (2009) and quoted by CHAPOSA (2002). It is important here to state that low income of less than $1 per day is prevalent among the charcoal producers in the study areas and the situation predisposes them to poverty which warrants the wanton destruction of the available forests in order to survive.

Gini Index (GI) was the same (0.28) for charcoal producers in both states. However, for charcoal producers with other sources of income, inequality was higher in Oyo State (0.23) than Ogun (0.21) State.

Conclusion

Income inequality was generally low among charcoal producers. Average annual income was higher for producers with other sources of income. Generally, low income of less than $1 per day is prevalent among the charcoal producers and the situation predisposes them to poverty which could warrant the need for destruction of the available forests in order to survive.

It is therefore recommended that Government and private organization should promote efficient, higher yielding kilns and training to raise yield per tree, encourage Agroforestry and sustainable woodlot, provide alternative livelihood supports to reduce dependency on charcoal and design a regulatory measure by shifting from punitive enforcement to incentive based sustainable supply that can make the poor to avoid illegal lower value activities.

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