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Effects of Non-Timber Forest Products (NTFPs) incomes on Income Inequality in Forest Communities: The Case of Afaka Forest Reserve, Kaduna State, Nigeria

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Abstract
The study was conducted in eight forest communities of the Afaka Forest Reserve in Kaduna State, Nigeria. A multi-stage sampling technique was used to select two hundred and twenty (220) household heads. Questionnaire was used to obtain data on Non-timber forest products (NTFPs) collection for the year, 2015. Data was analysed using descriptive statistics, and the Lerman and Yitzhaki Gini model. The effect of NTFP income on total income was significant ($p<0.01$). The Gini coefficient for total income in the area was 0.3427 which was decomposed to reveal an NTFP income Gini coefficient of 0.4426, and a negative marginal income effect of 0.0664 on total income Gini coefficient, meaning that a 10 percent rise in NTFP incomes would result to a 0.664 percent decrease in total income inequality in the area. The reduction in income inequality from NTFP incomes revealed the positive contribution of NTFPs to household welfare in the study area. The study recommends continuous sensitization of inhabitants of these communities on the need to adopt sustainable NTFPs harvesting methods as they strive towards augmenting their incomes with NTFP incomes.

Keywords: Forest Communities, Income, Inequality, Gini Coefficient

Introduction
A forest can be defined as "Land spanning more than 0.5 hectares with trees higher than 5 meters and a canopy cover of more than 10 percent, or trees able to reach these thresholds in situ. It does not include land that is predominantly under agricultural or urban land use" (FAO, 2010). Forest communities are essentially rural communities which are within or contiguous to forest. The term 'rural' refers to 'areas of any country with extensive land uses such as agriculture and forestry and containing spatially distinct settlements with non-urban environment (FGN, 2009). At least 350 million people live inside or close to dense forests, largely dependent on these areas for subsistence and income, while about 60 million indigenous people are almost wholly dependent on forests (Zaman *et al.*, 2013; World Bank, 2006).

Non-timber forest products (NTFPs) are all tangible animal and plant forest products other than industrial wood coming from natural forests, managed secondary forests, and enriched forests (Ros-Tonen *et al.*, 1998). Non-timber forest products are part of forests. The interest on these products evolved as paradigm shift from the focus on trees to a more inclusive and wider approach in relation to contemporary concerns about climate change and environmental sustainability taking into cognizance the pivotal role of forests in carbon storage and sequestration. Since NTFPs provide food and energy security, medicines, raw materials and platforms for protecting their cultures amongst other benefits, the forest communities therefore have an incentive to protect their forests and this constitutes a multi-functional and sustainable livelihood matrix.

Income inequality is related to both welfare and poverty. It is the uneven distribution of resources or well-being within the economy which gives a 'normative economic' perspective, a picture of 'unfairness'. Inequality focuses on the distribution of attributes, such as income or consumption, across the whole population (the rich, well-off or non-poor and the poor). Inequality re-enforces poverty and either of these can change without affecting the other (Haughton and Khandker, 2009).

According to the UNRISD (2010), poverty and inequality must be considered as interconnected parts of the same problem given that high levels of

inequality make it harder to reduce poverty even when economies are growing. Evidences from global economic outlook have revealed that inequality is generally more predominant in poor countries than in rich ones (World Bank, 2016). Poverty is also closely related to various dimensions of inequality, including income status, gender, ethnicity and location.

Research Methodology

Afaka Forest Reserve was established in 1954 as an experimental plantation site by the Federal Government of Nigeria with the primary aim of curtailing the imminent deterioration and loss of the semi – arid environment of the Northern – Guinea Savannah of Nigeria to the threat of desertification. It is located on a plain with flat ridges and gentle slopes that is dissected by small and medium sized streams. Afaka Forest Reserve occupies an area of about 7,093.12 hectares of land and lies between Latitudes 10° $36^{'}$ $18^{''}$ N and 10° $37^{'}$ $48^{''}$ N and Longitudes 7° $14^{'}$ $34^{''}$ E and 7° $21^{'}$ $58^{''}$ E (Otiwa, 2015; Yahaya, 2015; JICA, 1991). The forest area spreads across Igabi and Chikun Local Government Areas of Kaduna State.

The study was conducted in eight contiguous communities around the reserve. Multistage sampling was used for sample selection. The first stage of the sampling procedure was the purposive selection of three (3) communities in Chikun Local Government Area, namely, Udawa, Buruku and Kuriga on the basis of relative closeness to the Reserve. But, out of the ten (10) communities around the Reserve in Igabi Local Government, five (5) communities were randomly selected which were Rigasa, Mando (Sabon-Afaka), Likora, Gwazaye, and Hayin Dan-mani. More communities were selected from Igabi than from Chikum Local Government area because the former had more communities contiguous to the Afaka Forest than the latter. Household was the unit of study and household heads constituted the respondents. A sample size of 220 households was determined for study from a population of 475 households in the eight study communities (Kaduna State Bureau of Statistics). The sample size was determined using the Yamane (1967) given as:

$$n = \frac{N}{1+Ne^2} \quad \ldots \quad (1)$$

where, n = sample size
N = Population size
e = margin error (5%).

Households were sampled in proportion to the population as follows: Rigasa (60), Mando (50), Gwazaye (25), Likora (10) and Hayin Dan-mani (10) all in Igabi Local government Area. While the samples from Chikun Local government Area were Buruku (30), Udawa (25) and Kuriga (10). Households were sampled using systematic sampling technique. Hence a total of two hundred and twenty (220) questionnaires were administered while two hundred and four (204) were returned.

Data Analysis

Structured questionnaires administered to household heads in the study communities were used to collect data from December, 2016 to March, 2017. Descriptive statistics such: student *t-test*, and the Gini coefficient model were used to analyse the data. STATA (version13) software was used for the data analysis.

Results and Discussion

Most commonly harvested NTFPs from Afaka Forest Reserve.

The study revealed that there were a total of nineteen (19) NTFPs commonly harvested by the communities in the area (Figure 1) which were consumed, given out as gifts or sold. Firewood collection had the highest participation of 93.4% in the year under consideration (2015), followed by wild fruits (83.4 %), while the least involvement (6%) was in dyes and resins (3.3 %). This high involvement in fuel wood collection is in tandem with the report of International Energy Agency (2013) which stated that of the estimated 2.6 billion people who globally relied on biomass for domestic cooking, most of them are found in sub-Saharan Africa. This is in line with the work of Adewuyi and Olofin (2015) which concluded that the high use of fuel wood in Kaduna metropolis was attributed to the fact that although electricity cost per unit was cheaper than using fuel wood, its unstable supply made it a non-substitute while other sources of energy like kerosene and cooking gas were relatively more expensive and beyond the reach of most consumers.

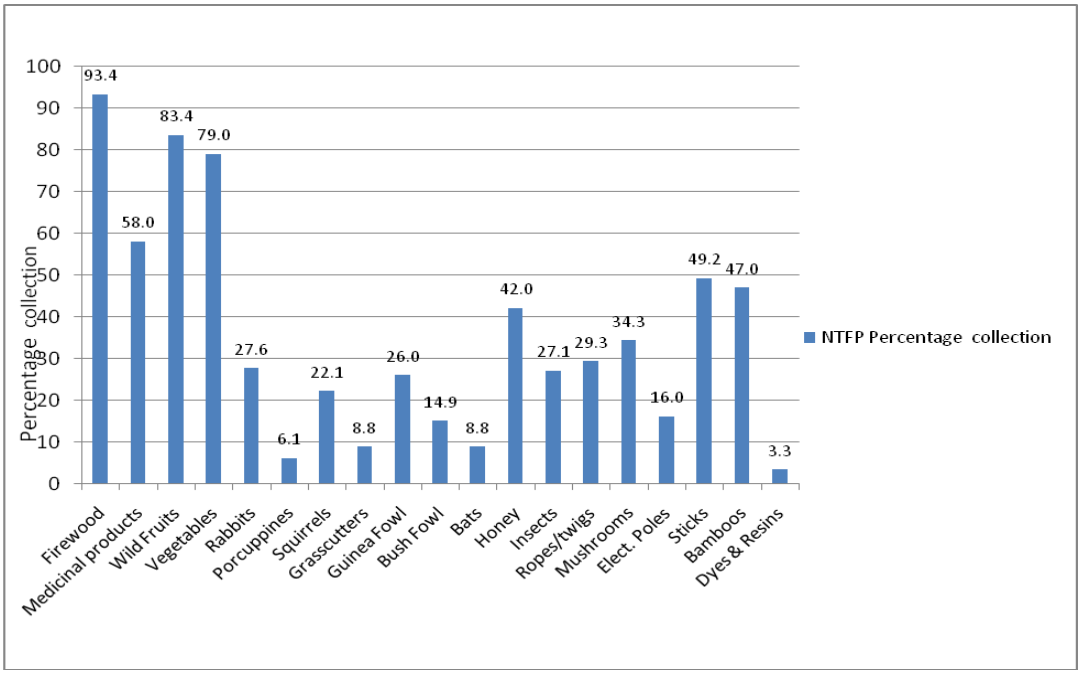


Figure 1: Distribution of respondents according to NTFP percentage collection in 2015

***Source**: Field Survey, 2017.*

Effects of NTFP incomes on Total Income

Although 204 questionnaires were returned the information on NTFP incomes was provided by 181 respondents. The effects of NTFP incomes on total income were measured using paired t-test (Table 1). Here, a comparison of the per capita monthly household incomes ($PCMHHI_1$) of respondents involved in NTFP collection when their NTFP income component was included with when excluded ($PCMHHI_2$). The test result (Angelsen *et al.*, 2011). revealed that $PCMHHI_1$ was statistically different from $PCMHHI_2$ ($p<0.001$). In other words, incomes from NTFPs improved the per capita incomes and welfare of the people in the surrounding Afaka communities who collected NTFPs. This is important because the exclusion of NTFP incomes in national income accounting implies a misrepresentation of the contribution of forest communities to the national economy

Table 1: Per capita monthly household income of respondents with or without NTFP collection from the Afaka Forest Reserve

Variable	Observations	Mean	Std. Err.(S.E)	Std. Dev.	t	P>|t|
$PCMHHI_1$	181	11,685.52	1277.158	17182.4	5.7460	0.000***
$PCMHHI_2$	181	5,360.64	410.9154	5528.301		
Diff	181	6,324.87	1100.749	14809.06		

Note: ***= significance @ 1%; $PCMHHI_1$ = per capita monthly household income including NTFP incomes; $PCMHHI_2$ = per capita monthly household income excluding NTFP incomes.

Source: Field Survey, 2017.

Decomposition of Income Inequality - The Gini coefficient

The Gini coefficient describes the spread or inequality of a distribution. It has been widely used for analysis of income and wealth across individuals or households (Fisher, 2004). It is the most popular index of income inequality which has been applied to analyse social welfare functions, thus an important tool in the field of welfare analysis (FAO, 2006; Lambert, 1993; Lerman & Yitzhaki, 1985). It is a ratio with values between 0 and 1, such that, 0 corresponds to perfect income equality (meaning everyone has the same income) while 1 corresponds to perfect income inequality (meaning one person has all the income, while everyone else has zero income).

Therefore to estimate the effect of NTFP income on inequality, the Gini coefficient model proposed by Lerman and Yitzhaki (1985) and adopted by Fonta and Ayuk (2013), and Idoko and Ikpeze (2014) was adopted.

Assuming k is any income source [and in this study incomes from: NTFPs (x_1), farming (x_2), crafts (x_3), trading (x_4), paid employment (x_5), and pension

(x_6)], the Gini Coefficient for any particular income source k is computed as:

$$G_k = 2\frac{COV[Y_k k, F(Y_k)]}{\mu_k} \quad \ldots\ldots\ldots\ldots \quad (2)$$

Where; G_k = the income of the household (i.e. NTFP and other income sources)

F (Y_k) = the cumulative distribution of income source k, and

μ_K = mean household income.

Similarly, assume G_T as the Gini coefficient of total income, then the Gini coefficient (G_T) of total household income is given by:

$$G_T = 2\sum_{k=1}^{k} COV[Y_k, F(Y_k)]/\mu_T \ldots\ldots\ldots\ldots\ldots (3)$$

This also equates:

$$G_T = \sum_{k=1}^{k} S_k G_k R_k \ldots (4)$$

Where S_k, represents the share of household income k on total income, G_k measures the Gini coefficient of each income source k, while R_k measures the Gini correlation between income source k and the distribution of total income.

Decomposition of Gini index by Income Sources

People living around forests are engaged in various economic activities which provide them with multiple streams of income. The study communities' main sources of income were six (6) namely NTFPs, farming, crafts, trading, paid employment and pension (Table 2). Decomposing inequality by income sources is particularly useful to understand whether total inequality is concentrated in specific income sources or not. It provides a clear idea on how each component contributes to the total inequality (Araar, 2006; Lorenzo and Liberati, 2006). The total income distribution in the area was estimated to have a Gini coefficient of 0.3427. This coefficient is lower than the figure for Kaduna State (0.4005) as at 2010 (NBS, 2012).

But the decomposition of total income showed that farming contributed the highest income (59 %), but had a Gini coefficient of 0.4028. Apart from incomes from paid employment (AMPDINC) which had positive marginal effect on total income Gini coefficient, all the incomes sources had negative marginal effects. With reference to NTFPs, this source contributed just 8 percent of total income sources with a Gini coefficient of 0.4426 and a marginal contribution of -0.0664 to total income inequality, meaning, a 10 percent rise in NTFP income would result to a 0.664 percent decrease in households' income inequality, and this re-affirms the significance of NTFP income effects on total income as presented on Table 1. This finding was in tandem with the findings of Fonta and Ayuk (2013), and Fisher (2004), who separately reported that forest income reduced total income inequality by 0.96% and 12 %, respectively.

Table 2: Decomposition of Inequality According to Income Sources among Respondents.

Income Sources (monthly Averages)	Income share (S_k)	Gini Correlation (R_k)	Gini Coefficient (G_k)	Absolute Contribution(S_k*R_k*G_k)	Relative Contribution (S_k*R_k*G_k/G)	MEF_G (S_k*R_k*G_k/G) - S_k
NTFP	0.0842	0.1635	0.4426	0.0061	0.0178	-0.0664
Farm	0.5975	0.7229	0.4028	0.1740	0.5078	-0.0897
Crafts	0.0450	0.2577	0.8808	0.0102	0.0298	-0.0152
Trade	0.0073	-0.3844	0.8281	-0.0023	-0.0068	-0.0141
Paid employment	0.2390	0.7753	0.8062	0.1494	0.4360	0.1970
Pensions	0.0270	0.2051	0.9541	0.0053	0.0154	-0.0116
Total	1.0000	---	---	0.3427	1.0000	

Note: MEF_G – Marginal effect on Gini of total income
Source: Field survey, 2017.

Decomposition of NTFP income Gini index by groups

It is important to analyze how NTFP incomes are distributed amongst the different categories of the population. Apart from inequality decomposition by income sources, the Gini coefficient is also used to decompose inequality by the population categories, for identification of intergroup inequalities so as to measure the distance between two or more distributions (Lopez-Feldman, 2006) such as sex, education and occupation. By

establishing the difference between inequalities within each group (intra-group measurements) and inequalities between the various groups (inter-group measurements), the decomposition portray to what extent inequalities are due to income differences within groups or to income differences between the groups (Zouhair*et al.*, 2011).

The decomposition of respondents according to sex (Table 3) shows that, female headed households had a relatively higher Gini coefficient of 0.4711 than their male counterparts, although their income share in the population was just 6 percent. Even though the males had a lower Gini coefficient (0.4017), their relative contribution was expectedly high (0.7978) due to their larger population share (88 percent). But the within group relative contribution was much higher (0.8052) than between the groups (0.1376) meaning that, difference in sex was not a serious dimension of inequality in the study area. This was contrary to *a priori* expectation as sex is considered a key dimension of inequality and women tended to be disadvantaged vis-à-vis men in most spheres of lives, not just in the forest sub-sector (Rani and Furrer, 2016; Zouhair*et al.*, 2011; UNRISD, 2010).

Table 3: Decomposition of NTFP Income According to Sex of Household Head

Group	Gini Coefficient	Population Share	Income share	Absolute contribution	Relative contribution
Male-Headed HH	0.4017	0.8847	0.9425	0.3350	0.7978
Female-Headed HH	0.4711	0.1153	0.0575	0.0031	0.0074
Within Group	---	---	---	0.3381	0.8052
Between Group	---	---	---	0.0578	0.1376
Overlap	---	---	---	0.0240	0.0572
Population (Total)	0.4199	1.0000	1.0000	0.4199	1.0000

Source: Field Survey, 2017

The decomposition by educational status of the household heads (Table 4) shows that although those with tertiary education have the lowest Gini coefficient (0.37), their share in NTFP incomes was just 9 %. This is in harmony with the expected outcome that those with higher education would generally have better paying jobs and would usually gather NTFPs to supplement their regular incomes (Angelsen *et al.*, 2014; Fonta *et al.,* 2010). The 'between group' relative contribution of education to NTFP income inequality (0.2122) was smaller than that of the 'overlap' from the various educational levels (0.5254), meaning that, differences in educational status of household head is not a dominant cause of inequality. Although education is very important is a means towards earning an income, it is not an end with respect to high incomes, as higher education does not automatically translate into higher incomes. This is in tandem with the findings of Rani and Furrer (2016) who reported that employment status had overtaken education in ranking as factors affecting income inequality given their corresponding ratios in France (15.2:7.6), Italy (13.2:5.8), Spain (19.1:6.2), UK (21.7:7.1), and USA (20.8:11.6).

Table 4: Decomposition of NTFP income according to educational status of household head

Group (Education)	Gini Coefficient	Population Share	Income share	Absolute contribution	Relative contribution
Non-Formal	0.4741	0.3334	0.36673	0.0386	0.0919
Primary	0.4245	0.2038	0.2339	0.0202	0.0482
Secondary	0.4826	0.3104	0.3083	0.0462	0.1100
Tertiary	0.3747	0.1525	0.0905	0.0052	0.0123
Within Group	---	---	---	0.1102	0.2624
Between Group	---	---	---	0.0891	0.2122
Overlap	---	---	---	0.2206	0.5254
Population (Total)	0.4199	1.0000	1.0000	0.4199	1.0000

Source: Field Survey, 2017

Further analysis by occupation (Table 5) depicted that respondents with paid employment had the highest coefficient (0.49) in their NTFP segment of total incomes although their income share was just 17 percent. Therefore, the most important category was the farmers not just because their income-share (64 percent), but also due to being the largest share of the population (57 percent). An improvement in the incomes and distribution of farmers who collected NTFPs would therefore improve the welfare of the communities around the Reserve.

Table 5: Decomposition of NTFP Gini index by occupation of household head

Group	Gini Coefficient	Population Share	Income share	Absolute contribution	Relative contribution
Farming	0.3966	0.5699	0.6428	0.1453	0.3460
Hunting	0.1969	0.0224	0.0308	0.0001	0.0003
Trading	0.4882	0.0934	0.0782	0.0036	0.0085
Paid Employment	0.4889	0.2120	0.1713	0.0178	0.0423
Others	0.3712	0.1022	0.0769	0.0016	0.0039
Within Group	---	---	---	0.1684	0.4010
Between Group	---	---	---	0.0872	0.2076
Overlap	---	---	---	0.1643	0.3913
Population (Total)	0.4199	1.0000	1.0000	0.4199	1.0000

Source: Field survey, 2017

Conclusion

Forest communities around the Afaka Forest Reserve are mainly constituted by farmers who depend on NTFPs and other sources of incomes for their livelihood. Firewood collection had the highest participation by communities in the year under consideration (2015). Non-timber forest products' incomes were found to be not just significant to the incomes of the forest communities, but also important in reducing income inequality. The study recommends continuous sensitization of inhabitants of these communities to adopt sustainable NTFPs harvesting approaches.

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