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Contribution of forest resources to the livelihood of adjacent communities around forest concessions: The case of Eyumojock area, Southwest region of Cameroon.

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Abstract

The expectation of a healthy and buoyant future of the forests remains a mirage until community dependence on the forest is effectively compensated. Forest communities depend greatly on the forest for food, income, shelter and medicine, and will always agitate once their livelihood is greatly threatened. Objectively quantifying and sufficient compensation of community dependence on the forest is a key challenge faced while trying to balance forest use with conservation. This paper quantifies livelihood strategies for rural households, assesses the proportion of household income obtained from the forest, and explore the relationship between the quantities of NTFPs exploited and the household non-forest income in the Southwest Region of Cameroon. 471 households in Eyumojock area were sampled using semi-structured questionnaires and PRA tools. Descriptive and inferential (OLS) statistics were used for data analysis. The results reveal Agriculture (Cocoa, Plantain, Cassava), Forest (Irvingia, Bushmeat, Gnetum), Animal rearing (Pigs, Goats and Poultry) and Petty-trade as diverse income sources in order of priority (75%,17%, 1% and 7%). With a Gross annual household income in the range 420 – 51,410 \$ and mean gross annual household income of 5,792 \$, 81.7% of households have a gross annual income in the lower ranges of 3,636 - 7,272 \$. Increase in the quantities of (Irvingia sp) Bush mango (QIV), and (Gnetum sp) Eru (QER) collected will increase household income from non - forest sources (GINF). On the other hand, increase in gross non-forest income (GINF) will reduce the quantities of Garcinia kola, Irvingia sp, Gnetum africanum, Ricinodendron heudelotii, Afrostryrax lepidophyllus, Piper nigrum L and Bushmeat significantly contribute to gross household income ($p < 0.05$), with the quantity of Bushmeat having the greatest influence. Focusing on education and skill-building programs that will offer locals better employment opportunities, improve crop production and enhance the domestication of major NTFPs is a better option for sustainable forest management efforts.

Keywords: [Agriculture, bushmeat, forest concession, household income, non-timber forest product.]

1. Introduction, scope and main objectives

1.0. Introduction

The existence of a healthy and vibrant forest is determined to a large extent by the attitudes and perceptions of adjacent dependent communities. Besides being a source of food and fibre, forest-based industries provide employment and income for millions of households (Angelsen et al., 2014; Levang et al., 2015). Estimates show that about 1.6 billion rural people depend on products derived from local forests (Bwalya, 2011). In the Sub-Saharan Africa region, more than 15 million people earn their cash income from forest-related enterprises (Oksanen & Mersmann, 2002; Oksanen et al., 2003). To ensure healthy and vibrant forest governments have adopted the management of forests through huge blocks called concessions. Concession management is expected to enhance the livelihoods of forest-dependent communities through active participation in the implementation of conservation and rural development projects (Coomes et al., 2004). However, the results have been limiting probably due to poor management systems or the lack of appropriate incentives to promote active participation (Soe & Yeo-Chang, 2019). Recently, recurrent conflicts around the forest concessions under sustainable management has drawn local, regional and global interest into the contribution of natural forest to the income and development of rural communities (Newton et al., 2016).

Cameroon has the second largest forest resources base in Central Africa after the Democratic Republic of Congo (Kehinde et al., 2009), covering five Regions (South West, East, Centre, South and littoral) and representing a surface area of about 20 million hectares of the national territory (Djeukam, Gerber, & Veuthey, 2013; Jonie, 1999). Most of Cameroon's forest is currently under concession regime which has greatly reduced community access to forest resources and reduced available land for agricultural expansion. Also, the expected community financial benefits from concession management have been limited to a few local elites and traditional decision-makers who dominate local forest management committees (Adhikari, Di Falco, & Lovett, 2004). The exclusion of adjacent poor masses from a fair sharing of both forest products and financial benefits from timber exploitation has given rise to recurrent conflicts between the rural poor, the elites and timber companies, thus, threatening sustainability efforts.

Studies have observed that rural households depend extensively on forest resources for their daily economic and social needs (V. Ingram et al., 2017; Levang et al., 2015; Ndumbe et al., 2019). Some works have exposed the potential profitability, value and market chain for NTFPs in central Africa and the South West region of Cameroon-Eyumojock area inclusive (Fuashi et al., 2012; Ingram, 2014; Ndumbe et al., 2009; Nkwatoh et al., 2010). Other research papers have criticized the Cameroon 1994 forestry legislation and the disruptive nature of governance which undermines the place of NTFPs in the lives of rural communities (Ndumbe et al., 2009; Ingram & Schure, 2010; FAO, 2017). Community agitations have resulted in recurrent and persistent conflicts around forest concessions in Cameroon. If community agitations are not sustainably handled, as is the case in Eyumojock forest areas, community members resort to illegal exploitation and subsequent deforestation. There is a critical need for objective quantification of community dependence on the forest, and a sufficient income compensation plan put in place if a healthy and vibrant future is envisaged for this rich forest.

1.1. Scope and theoretical framework

This study is limited to the villages around the forest concessions in Eyumojock area. Forest dependence is conceptualized in line with other works as the different ways in which the community use the forest; subsistence, commercial extraction of NTFPs, tourism, education or research to (Willhelm & Firey, 1961; Mujawamariya & Karimov, 2014; Munanura et al., 2014; Suleiman et al., 2017). Mean gross household income is used as a proxy variable for livelihood.

1.2. Main Objective

This study was designed to quantify the effect of forest on the livelihood of rural households in Eyumojock forest area, South West Cameroon. Specifically, the study aimed to identify livelihood strategies for rural households, assess the contribution of the forest to livelihood, and model the relationship between the quantities of NTFPs collected and livelihood.

2. Methodology

2.0. Study Area

This study was conducted in Eyumojock Sub-Division, Manyu Division, in the South West Region of Cameroon. As can be seen in **Figure 1**, neighboring administrative units and natural features are the Cross River State of Nigeria to the West and North, Meme and Fako Divisions to the South and Akwaya Sub- Division to the East (Athanasius Fuashi et al., 2012; Fuashi, Popoola, Mosua, & Wehmbazeyi, 2010).

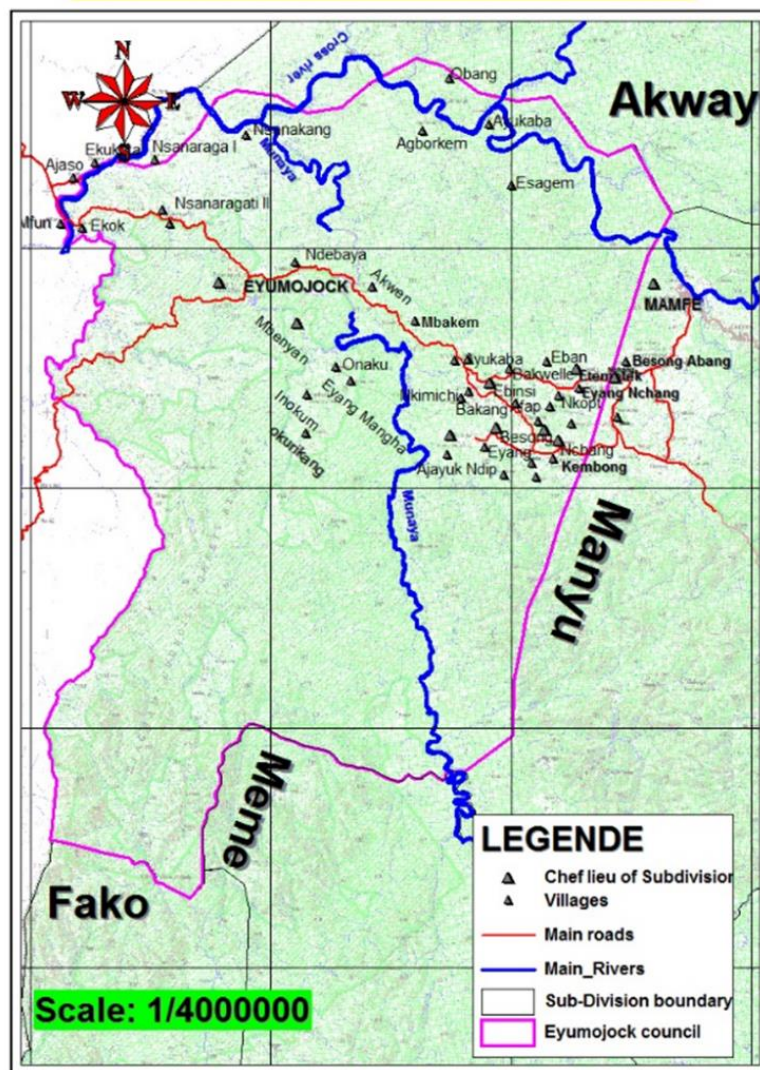


Figure 1: Map showing Eyumojock area.

Eyumojoek Sub-Division is host to two forest management units (FMU 11-005 and FMU 11-001) as shown in **Figure 2** below, and shares one, FMU 11-003 with Akwaya Sub-Division. This study made use of primary cross-sectional data collected from randomly selected direct impact villages around FMUs 11-001 and 11-005.

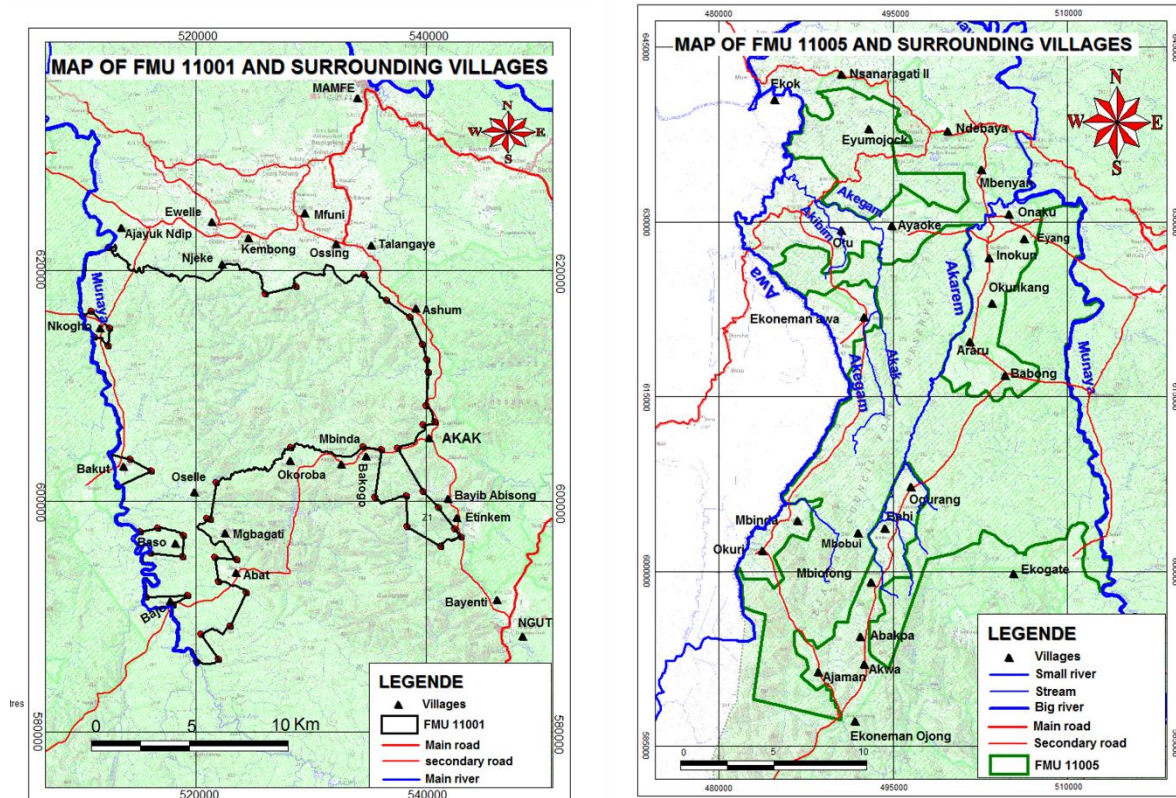


Figure 2: FMU 11-001 and FMU 11-005 showing surrounding villages.

2.1. Data collection

A reconnaissance survey was used to inform all stakeholders, and to pre-test formulated questionnaires to ascertain their validity within the expected time. The fieldwork combined elements of purposive, random and systematic sampling designs. Eyumojoek Sub-Divisions was purposively selected due to the presence of three active forest management units (FMUs). Two of the three FMUs (FMU 11001 and FMU- 11005) were selected because the designated direct impact villages cut across the three clans of Eyumojoek council area (Obang, Central Ejagham and Ejagham-njemaya). 60% of direct impact villages were randomly selected through the lucky dip procedure, and an average of 20 questionnaires was systematically administered to each community in a similar way described by Chilalo & Wiersum, (2011). A total of 480 questionnaires were administered to 24 villages in Eyumojoek council area. However, 471 questionnaires were analyzed after eliminating questionnaires with incomplete responses.

2.2. Data Analysis

Descriptive and inferential data analysis tools were employed. Gross household income was computed as the sum of income from all livelihood sources indicated by all members of each household. It

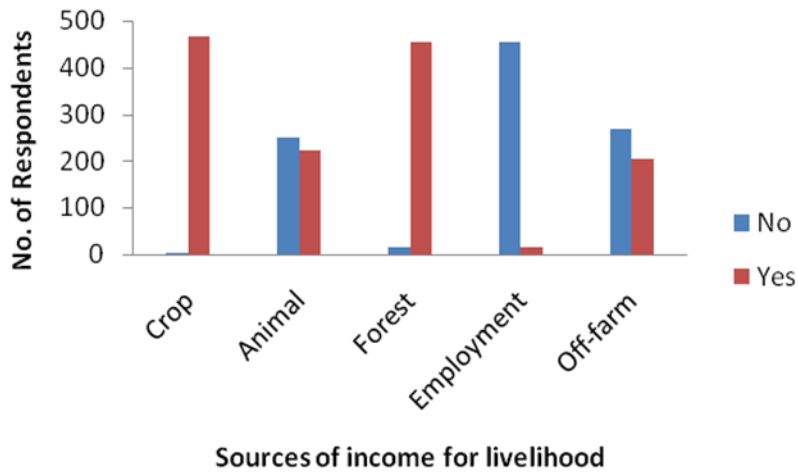


Figure 3: Livelihood Sources in Eyumojock Forest Area

3.1. Dependence on Non-Timber Forest Products

In the study area, forest contributed the second-largest share (17%) to mean annual gross household income. As can be seen in **Error! Reference source not found.** below, 43% of the forest income came from *Irvingia* sp (Bush mango), 35% came from Bushmeat, 15% from *Gnetum africanum* (Eru), while *Garcinia kola* (Country kola), *Ricinodendron heudelotii* (Njangsang), *Afrostryrax lipidophyllus* (Country onion), *Hyparrhenia rufa* (thatches) contributed the remaining 7%.

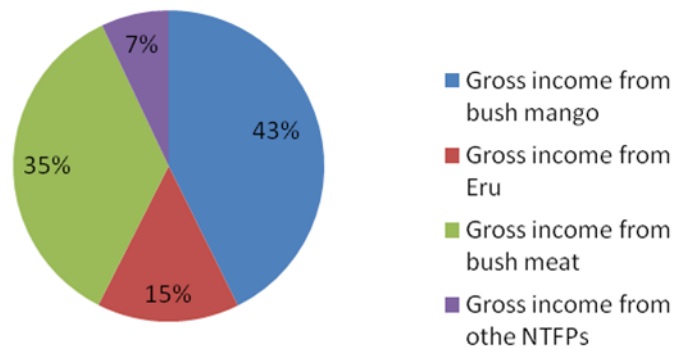


Figure 4: Contribution of NTFPs to Gross Forest Income in Eyumojock Forest area

3.2 Effect of forest resources on gross household income

The income of rural households has a direct relationship with income from non-forest sources and the quantities of non-timber forest resources collected and sold. As can be seen in **Table 1** below, the pairwise correlation shows that the quantities of Bitter cola (QBC), Native cola (QNC), Njangsa (QNJ), Country onion (QCO), Bush pepper (QBP), and Bushmeat are each negatively associated with gross non-forest income (GINF).

Table 1: Pair wise correlation between the quantities of NTFPs and Gross Non-forest income.

	GINF	QBC	QIV	QER	QNC	QNJ	QCO	QTH	QBP	QBM
GINF	1									
QBC	-0.01	1								
QIV	0.03	0.27	1							
QER	0.02	0.07	0.11	1						
QNC	-0.02	0.02	0.03	-0.01	1					
QNJ	-0.04	0.00	0.02	0.14	0.10	1				
QCO	-0.01	0.01	-0.02	0.00	-0.01	0.02	1			
QTH	0.00	0.09	0.16	0.00	-0.02	-0.01	0.02	1		
QBP	-0.01	-0.01	0.07	0.09	0.00	0.07	-0.02	-0.01	1	
QBM	-0.02	0.09	0.12	0.15	0.22	0.11	0.00	0.10	0.00	1

On the other hand, the quantities of (*Irvingia* sp) Bush mango (QIV), (*Gnetum* spp.) and Eru (QER) are positively associated with gross non-forest income (GINF). Although leptokurtic with a long left tail, the data was significantly normally distributed with Jarque-Bera statistic of 342.45, greater than its theoretical value.

Table 2 below quantifies the relationship between the number of NTFPs collected and the gross household income. The signs of the coefficients of all predictor variables are positive and in agreement with apriori expectation. The signs of the predictor variables are statistically valid in the quantitative specification with calculated t-values all greater than tabulated values at 1% level of significance. Their influences on gross household income are statistically significant.

Table 2: Ordinary Least Square Regression Results of the Effect of NTFPs on Household Income
Dependent Variable: GHI, Sample: 1 471, Included observations: 470, Excluded observations: 1

Variable	Coefficient	Std. Error	t-Statistic	Prob.
GINF	1.00	0.00	588.67	0.00
QBC	1.00	0.13	7.44	0.00
QIV	1.38	0.04	34.42	0.00
QER	1.02	0.02	41.32	0.00
QNC	2.31	0.22	10.67	0.00
QNJ	0.01	0.00	5.83	0.00
QCO	1.54	0.57	2.70	0.01
QBP	0.67	0.09	7.88	0.00
QBM	4.26	0.06	71.60	0.00
C	37482.00	9329.94	4.02	0.00
R-squared	1.00	Mean dependent var	3186200.	
Adjusted R-squared	1.00	S.D. dependent var	2920910.	
S.E. of regression	105371.80	Akaike info criterion	25.99	
Sum squared resid	5.10E+12	Schwarz criterion	26.09	
Log likelihood	-6097.00	F-statistic	35992.05	
Durbin-Watson stat	0.87	Prob(F-statistic)	0.00	

GINF=household income from non-forest sources, **QBC**= Quantity of bitter cola, **QTH** =Quantity of Thatches, **QIV**=Quantity of *Irvingia*, **QER**= Quantity of Eru, **QCO**= Quantity of Country onion,

QNC= Quantity of Native cola, **QNJ**= Quantity of Njangsa, **QBP**= Quantity of Bush pepper,
QBM= Quantity of Bushmeat, **QER²**= Square of the quantity of Eru, **QBC²** = Square of quantity of Bitter cola.
*significant at 1% level; **significant at 5% level.

4. Discussion

4.0. Livelihood strategies

The first objective of this study was to explore livelihood strategies for households in Eyumojock forest area. The trend of livelihood diversification in Eyumojock forest area is in line with the results of prior studies in Bolivia, Southeast Nigeria and around the Falgore Game Reserve in Kano, Nigeria reporting that forest-dependent communities diversify their sources of income to sustain their lives (Zenteno et al., 2013, Odoh et al., 2011; Suleiman et al., 2017). With a gross annual household income in the range of 420 – 51,410 USD and mean gross annual household income of 5,792 USD, 81.7% of respondent households fall in the lower income range between 3,636 – 7,272 USD. This result is similar to that of Inoni (2009), who reported the majority of rural dwellers as low-income earners in Delta state – Nigeria. Because most rural inhabitants lack assets and skills, they remain unemployed and unable to invest in high income-generating activities, thereby remaining poor. This, together with other factors like the enclave nature of the area with poor roads, and lack of markets could be associated with the larger number of households having a low mean gross annual household income. Low mean gross household income and high inequality fuels diversification to sustain livelihoods and exacerbates the pressure on common-pool resources resulting in consequent degradation of natural resources (Dokken & Angelsen, 2015; Inoni, 2009; Suleiman et al., 2017).

4.1. Contribution of NTFPs to Household income

2. The second objective explored the contribution of NTFPs to household income. The forest or NTFPs is the second most important livelihood source in Eyumojock and most forest areas in Cameroon. This result supports the report of Mamo et al., (2007), where income from forest resources was second in contribution to total household income. However, the percentage contribution of the forest is numerically lower, compared to the 20% contribution to household income reported in other case studies (Cavendish, 2000; Fisher, 2004). A possible explanation could be the price difference of NTFPs. According to Newton et al.,(2016), the level of education attained by household head determines the nature of his/her income and the extent of dependence on the forest.

As can be seen in **Figure 4** below, 62% and 26% of household heads having studied up to primary and secondary school respectively. With most household heads having primary education and a few with secondary, their lack of requisite skills restricts engagement in high-income generation activities with the government and private sectors. Thus, they depend on the forest for livelihood. The enclave nature of the area which forces those with higher education level or better skills to move out for better jobs, lack of access to better markets which strains the sales of agricultural produce at good prices restrains the income level of households and increase dependence on forest common pool resources.

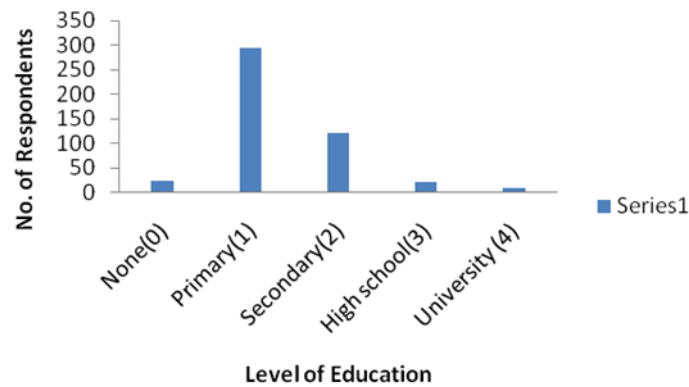


Figure 4: Educational attainment of household heads in Eyumojock forest area.

To reduce dependence on the forest, policymakers, conservation and development experts should focus on the implementation of appropriate educative programs to build necessary skills to either gain alternate employment or enhance agricultural productivity of households and access to better markets. Among the diverse forest resources harvested, *Irvingia sp* (bush mango), Bushmeat and *Gnetum sp* (Eru) are major contributors to household forest income in the order of importance. The dominant contribution of Bush mango (*Irvingia sp*) to forest income has been reported in the Southern Cameroons and across the Congo basin forest (V. Ingram et al., 2017). *Irvingia sp*, Bushmeat and *Gnetum spp.* are mostly distributed far in the forest, meaning pressure on these NTFPs greatly disturb and fragment the forest especially as the harvesting is unsustainable. To reduce pressure on the forest and avoid forest disturbance and fragmentation from unsustainable harvesting of these major NTFPs, policymakers, conservation and development experts should focus on the domestication of these NTFPs and the guarantee of better markets.

4.2. Relationship between the quantity of NTFPs collected and household income.

The third objective was to establish the relationship between the number of NTFPs collected and the gross non-forest income. The positive correlation between gross non-forest income (GINF) and the quantities of (*Irvingia sp*) Bush mango (QIV), and (*Gnetum sp*) Eru (QER) means that increase in the quantities collected will increase household income from non - forest sources (GINF). This result implies continuous pressure on the forest for *Irvingia sp* (Bush mango) and *Gnetum sp* (Eru), everything being equal. Therefore, training communities on the domestication of Bush mango and Eru would be the best option for policymakers, conservation and development projects. On the other hand, the negative association between gross non-forest income (GINF) and the quantities of Bitter cola (QBC), Native cola (QNC), Njangsa (QNJ), Country onion (QCO), Bush pepper (QBP), and Bushmeat imply that increase in gross non-forest income (GINF) will reduce the quantities of these NTFPs collected, thus, reduce pressure on the forest for these resources. Once income from non-forest sources is increased, the collection of Bitter cola, Native cola, Njangsang, Country onion and Bush pepper will be limited for consumption while Bush meat as a source of protein will be largely replaced with animal rearing projects.

On the aspect of modelling the influence of the quantities NTFPs collected on household income, all explanatory variables exert a significant positive influence on household income. This implies that

everything being equal, a gram increase in the quantities of NTFPs (QBC, QIV, QER, QNJ, QCO, QBP, QBM) collected will increase household income by 0.0018, 0.0025, 0.0019, 0.000018, 0.0028, 0.0012 and 0.0077 USD respectively. This result corroborates other studies where quantities of resources collected were found to directly influence the income of rural poor (Cavendish, 2000; Kerapeletswe, 2001), and contradicts the work of Ambrose-Oji (2003) which reported that NTFPs do not significantly contribute to household income in Cameroon.

The positive sign of the GINF coefficient conforms with apriori expectations and its influence on household income is significant. When other explanatory variables are kept constant, a 0.0018 USD increase in gross non-forest income will increase gross household income by almost 1.0 dollar. This result corroborates the findings of Sunderlin, et al. (2005), and Jain & Sajjad (2016) saying that increased agricultural productivity, off-farm employment opportunities and farm livestock reduces forest dependence. The estimated results are statistically reliable, with the regression line that captured 99 percent of the total variation in household income explained by variations in the explanatory variables. Also, the joint test of significance for all parameter estimates (F-test) with an observed F-ratio of 35992.05, significantly greater than its theoretical value ($P < 0.001$) adds reliability to the results. This result is important to policy makers and development actors as programmes that domesticate NTFPs and increase production and income from agricultural, off-farm employment opportunities and farm livestock will reduce pressure on the forest for these NTFPs.

5. Conclusions/ wider implications of findings

This work characterized livelihood sources, quantified the contribution of these sources to household income, explored the relationship between quantities of NTFPs collected and household income from non – forest sources and modelled the relationship between NTFPs and household income. The key results are as follows;

1. Livelihood sources are diverse, comprising of agriculture, NTFP collection and off-farm employment. Agriculture and non-timber forest products are major livelihood strategies for communities around forest concessions in Eyumojock area. Cocoa, Plantain, and Cassava are three main crops with a major contribution to the household income while *Irvingia sp*, Bushmeat and *Gnetum sp* (Eru) are major NTFPs based on their contribution to household income.
2. The second-largest livelihood source is the Forest (NTFPs), with a 17% contribution to household income coming mostly from *Irvingia sp*, Bushmeat and *Gnetum sp*.
3. Increase in the quantities of (*Irvingia sp*) Bush mango (QIV), and (*Gnetum sp*) Eru (QER) collected will increase household income from non - forest sources (GINF). On the other hand, increase in gross non-forest income (GINF) will reduce the quantities of Bitter cola (QBC), Native cola (QNC), Njangsa (QNJ), Country onion (QCO), Bush pepper (QBP), and Bushmeat collected and reduce pressure on the forest for these resources.
4. A gram increase in the quantities of each NTFPs (QBC, QIV, QER, QNJ, QCO, QBP, QBM) collected will significantly increase household income by 0.0018, 0.0025, 0.0019, 0.000018, 0.0028, 0.0012 and 0.0077 USD respectively.

The results of this study codes information needed by policymakers and development actors to focus on options that increase income from non-forest sources. This primarily includes investing in projects

and programmes to increase income from agriculture, or provide alternative employment for people in forest areas. Such projects would range from better agricultural practices to processing of products and dis-enclave the areas by providing access roads to markets. For the NTFPs with a direct positive relationship with non-forest income (Irvingia sp) Bush mango (QIV), (Gnetum sp) Eru (QER) and thatch), domestication programmes would reduce pressure on the forest. Interventions for proper processing and preservation of the products would be encouraged. Once the household income is significantly increased from non-forest sources, the pressure on the forest for NTFPs with an inverse relationship with income from non-forest sources will naturally drop. In the event where communities own the perception that programmes are empowering them to a better livelihood, they will automatically become natural checks for illegal logging, deforestation, and willing to participate in efforts that will guarantee a healthy and resilient future for the forest around them.

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