

AVAILABILITY OF NON- TIMBER FOREST PRODUCTS IN HOME GARDENS AND SACRED FORESTS IN CROSS RIVER STATE, NIGERIA

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Abstract

Survey was conducted to assess the socio-economic importance and management practices of some non-timber forest products (NTFPs) in home gardens and sacred forests in six Local Government Areas (LGAs) of Cross River State, namely, Akpabuyo, Akamkpa, Obubra, Ikom, Boki and Obudu. Three locations were purposively selected based on their vegetation types. Also, a simple close traverse survey approach was adopted for area determination of home gardens and sacred forests sizes while stock survey approach was used for identification, enumeration and measurements of NTFPs species. One thousand and fifty (1,050) questionnaires were administered on respondents randomly selected from 30 communities in the six LGAs, to provide data on NTFPs. Majority of the respondents (62.90%) were females. The results showed 69.5% of the people were involved in home garden farming while 61.5% were involved in sacred forest conservation and protection. The results also showed that 64.2% of the respondents were arable crop farmers while 21% were involved in NTFPs production and usage to supplement farm income. Thus, NTFPs contribute significantly to household food security, income generation and tourism. The NTFPs in the sacred forests in the six study locations were not significantly different from each other. The results showed that NTFPs in some home gardens and sacred forests were largely similar.

Keywords: Non-Timber Forest Products, Ecotype, Home Gardens, Sacred Forest. Management

Introduction

Non-timber forest products (NTFPs) in Nigeria are biological resources other than timber, derived from forests, wooded lands and trees. Non-timber Forest Products are extracted from the forest (Ahenkan and Boon, 2010; Shrestha *et al.*, 2020). Rural communities relied on them for daily food, income, medicine and cultural purposes. They are being used for subsistence and trade in Nigeria for centuries, long before formal availability systems were established. Before commercialization and formal markets, the availability of these products was locally managed through traditional systems, seasonal harvesting, and community practices. NTFPs include a variety of wild and partially domesticated

biological resources that are obtained by local household and communities from areas surrounding home gardens, fields and sacred forest (Hadish, 2018) Therefore, as part of the national drive to source adequate information on NTFPs and their importance so as to complement the existing knowledge in NTFPs potentials. Non-Timber Forest Products (NTFPs) were for long over-shadowed by timber products and has received increased policy and research attention only in the last few decades. These prepositions encouraged researchers to put more effort on the determination of monetary values of NTFPs as well as their contribution to overall livelihood. NTFPs contributed from 20% to over 50% of the total livelihood

income in some areas. Also, some studies made it clear that most rural communities do not depend exclusively on NTFPs for their livelihood, but complements with other livelihood activities (Shrestha *et al.*, 2020).

NTFPs are classified as heterogeneous group of forest resources: because they are collected and consumed for different reasons by different people. Some are consumed without any further processing and play no role in the market place.

Non-timber forest Products (NTFPs) are collected from a wide range of ecotypes, including high forests, farm fallow; otherwise disturb forest and farm lands or home gardens (Pasaribu *et al.*, 2021). Therefore, the extraction, processing and trading of NTFPs is often seen as the only source of employment available for the population in remote rural areas (Ita and Offiong, 2013). This has led to the cultivation of some of these NTFPs in home gardens-an integral component of the traditional agro forestry system and also an ecosystem for in situ conservation of biodiversity (Offiong *et al.*, 2022). The cultivation of NTFPs in home gardens do not only preserve important forest resources for mankind but also provides significant economic and nutritional benefits for the rural poor. This has led to a visible increase in the expansion of many kitchen gardens and compound farms, both in terms of size and diversity since it is a low-cost production system with a constant and relatively high productivity, and it is the center around which other field systems revolve at various distances from the homestead or home depending on the topographic and micro-ecological conditions (Zivojinovic *et al.*, 2017; Harbi

et al., 2018; Kurniasih *et al.*, 2021). Many women involved in this activity noted that the benefits derived from these gardens include a drop in health care expenditure as more traditional home remedies are available. In addition, the high value of many medicinal plants and local spices means that a surplus beyond immediate home consumption provides a significant income to the household as many of these products are prepared, packaged and sold in local markets (Harbi *et al.*, 2018).

NTFPs are also of great cultural importance and their preservation in groves is fundamental to the maintenance and continuation of many traditional ways of life. Sacred groves portray a fine example of community-based nature conservation without any extra-mural support (David *et al.*, 2019). The current resurgence of interest in the system is mostly due to its invaluable contribution towards conservation of biodiversity and important ecosystem services. Harvesting from the sacred grove is banned or carefully controlled or regulated by elders, and mostly allowed for the extraction of medicinal plants. This regulated access to the groves helps to conserve a large number of NTFPs for future use and also as a source of germ-plasma for establishing useful NTFPs on gardens (Derebe *et al.*, 2023). The objective of the study was to assess the management practices of NTFPs in home gardens and scared forest. Such a framework can serve as the mechanism for equitable distribution of benefits, community participation in resource management and generation of revenues from NTFPs.

Materials and Methods

Study area

Cross River State is located in the equatorial rainforest zone, which lies between longitudes 7^o50' and 9^o28' east of the greenish meridian and latitudes 4^o28' and 6^o55 north of the equator. It is bounded on the south south of Nigeria by Akwa Ibom State and the Atlantic Ocean and on the south east Ebonyi State, Middle belt, Benue State and the united republic of Cameroon. It has a total landmass of about 23000sq km and the population size of 2,892,988 (NPC, 2006) with density of 110 person per square kilometer. These areas are within the tropical rainforest zones with annual rainfall ranging from 2000 to 3000 mm, the rainy season spans from march through October, with a high rainfall in July and August and the temperature ranges between 25^oC and 27^oC while in July has a relatively high humidity ranging between 70% and 90% which becomes drier towards the end of the year during harmattan period (Dey and Islam, 2015).

The study area experiences a unique climate with two very distinct seasons: dry and rainy seasons. These two seasons are almost evenly distributed. The dry season begins in November to April with and average temperature ranging between 30^o-32^oc. The rainy season spans from March through October, with a high rainfall in July and August. In the rainy season, the dominant winds are the southern-Western Monsoon Moisture bearing type which provokes heavy precipitation. The vegetation is dense equatorial forest

undergrowth, with luxuriant species of trees of various height and sizes.

Sampling Methods

Six Local Government Areas within the state were randomly selected, namely: Akamkpa, Akpabuyo, Obubra, Ikom, Boki and Obudu (Figure1).

Stratified Multi-stage randomly sampling technique was used to ensure equal chance of selecting each of the study sites. This minimized bias due to sampling. Six Local Government Areas out of 18 Local Government Areas were purposively selected based on vegetation types, namely: rainforest/fresh water swamp mosaic as ecotype 1 for Akamkpa and Akpabuyo, tropical high forest as ecotype2 for Ikom and Obubra, and rain forest/Savannah mosaic as ecotype 3 for Boki and Obudu LGAs respectively. At the second stage, five communities in each LGA were also selected randomly. The random selection was achieved using the scientific calculator to ensure unbiased, systematic results, without human patten. At the third and final stages, ten home gardens and two sacred forests were randomly selected as study blocks in each LGA.

Hence, two local government areas, ten communities, four sacred forest and twenty home gardens constituted a study block for each ecotype. Altogether, six (6) local government areas, thirty (30) communities, twelve (12) sacred forests and sixty (60) home gardens made up the entire study sites (Table 1)

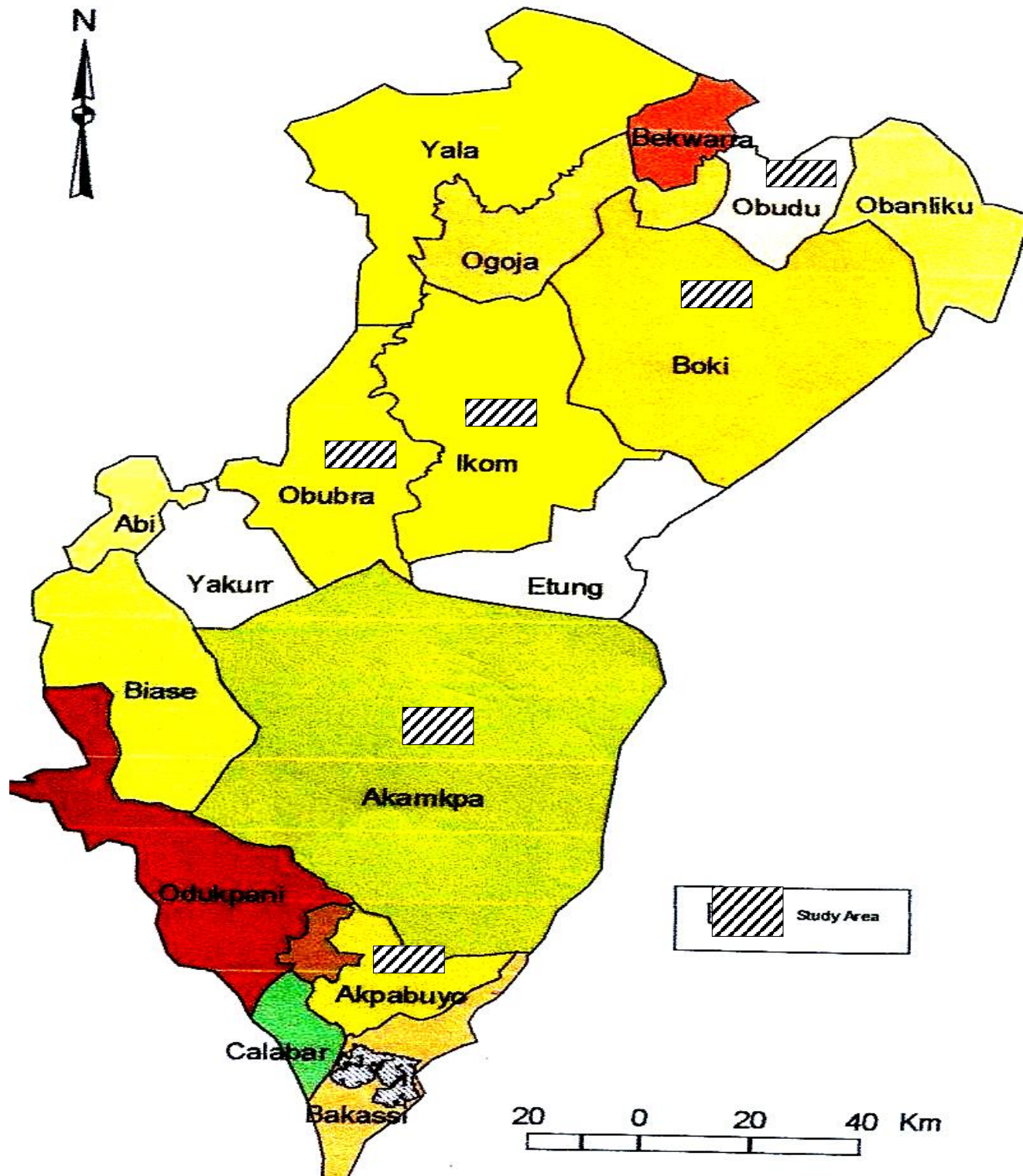


Fig1: Map of Cross River State Showing the Study Area

Table 1: Number of LGAs, communities, sacred forests and home gardens select in each of the vegetation types

VegetationType (zone)/LGAS	No. of LGAs per senatorial district	LGAs randomly selected in each ecotype	No. of communities randomly selected per ecotype	No. of sacred forest randomly selected/ecotype	No. of home gardens randomly selected per ecotype
Ecotype 1: Rainforest/fresh water swamp mosaic (Akamkpa & Akpabuyo)	7	2	10	4	20
Ecotype 2: Rainforest/tropical high forest (Ikom & Obubra)	6	2	10	4	20
Ecotype 3 Forest/Savannah mosaic (Boki & Obudu)	5	2	10	4	20
Total	18	6	30	12	60

Data collection

Data used for this study were gathered from primary and secondary Sources. The primary source was based on the administration of 1050 structured questionnaire on respondents, oral interview and personal field observations.

Data analysis

Data obtained from the field were processed, tabulated, and analyzed qualitatively as well as quantitatively. Data were processed using a more appropriate computer program namely “Predictive analytical software (PASW) version”18.0, and Microsoft Excel. Data were summarized and presented by using tables, histograms and figures. Descriptive

statistical presentations were in the form of frequency and percentage distribution. Inferential statistic such as chi-square was used to test the hypotheses.

Also, logic regression model was used for 1000 respondents in the study areas to evaluate the effects of important NTFPs in promoting the practice of sacred forests and home gardens by the respondents. In binary logic models, the explained or predicted variable has response which is dichotomous, typically the two possible outcomes are assigned the values of 0 or 1. In this study, respondents accepting NTFPs as a stimulus to the practice of sacred forests and home gardens were assigned the value of 1 while rejecting the concept

attracts a value of 0. Models to be tested were obtained by fitting all the independent variables together and the best subset model was obtained through the use of backward elimination: The variables investigated include contribution to annual income (CAI), size of the forest/garden(SFG), prevalence of illegal harvester (PIH); High dependence on NTFP (DIN), Lack of Information on NTFP (LIN); Increase Land used pressure and population (ILP); Community involvement in sacred forest management (CIM), existence of conflicts between community and NTFPs (CCN), unsustainable harvesting of NTFPs (UHN). Evaluation entailed fitting all the independent variables affecting the existence of important NTFPs in both sacred forest and home garden and by backward elimination obtained the best subset models which were assessed and compared on the basis of the chi-square goodness of fit statistics, coefficient of determination, the final loss on accuracy computed using maximum likelihood estimation and odds ratio (Bagheri, 2025,).

Binary logit models are often plausible especially where the dependent or response variable is binary or dichotomous in nature. This means that the response variable has two possible outcomes or values i.e., yes and no or 1 and 0 respectively. It also describes the relationship between a categorical response variable and a set of explanatory variables. Apparently, it will indicate the variable that really support or determine the availability of important NTFPs in sacred forests and home gardens. The logit of a response P between 0 and 1 is given as:

$$\text{Logit (p)} = \log (p/1-p) \text{ -----} \text{ (1)}$$

$$= \log p - \log (1-p) \text{ --} \text{ (2)}$$

Meanwhile the simplest form of logit model is expressed as;

$$\text{Logit (P}_i) = a + bX_i \text{ -----} \text{ (3)}$$

Where;

X = vector of predictor or independent variables

P_i = probability of a respondent accepting availability of important NTFPs in sacred forests and home gardens

a and b = regression parameters.

Another inferential statistic that was adopted in this study was correlation analysis which determines the strength of association between dependent (AIN) and independent variables such as X₁, X₂, X₃, X₄, X₅, X₆, X₇, X₈ and X₉. Also, chi-square test of independence was used to determine whether the response variable (AIN) is independent of X₁, X₂, X₃, X₄, X₅, X₆, X₇, X₈ and X₉

All data gathered were processed using logistic regression (logit) option of predictive analytics software (PASW) ver. 18.0.

The factors investigated were:

AIN = Availability of important NTFPs (available = 1, not available = 0)

X₁ = Size of the Forest/Garden (Large 1, small = 0)

X₂ = Prevalence of Illegal Harvesters (Prevalence =1, not prevalence = 0)

X₃ = Contribution to Annual Income (Contribute = 1, not contribute = 0)

X₄ = High dependence on important NTFPs by rural communities (Depend = 1; not depend = 0)

X₅ = Information on NTFPs (Available = 1; not available = 0)
 X₆ = Increase land use pressure and population density (Increase = 1, not increase = 0)
 X₇ = Involvement of community in forest management (Involvement = 1; not involvement = 0)
 X₈ = Conflict between community and NTFPs investors (Conflict = 1, no conflict = 0)
 X₉ = Unsustainable harvesting of NTFPs (Sustainable = 1, unsustainable = 0).

Local Government Areas (LGAs) and communities involved in the study:
 Six LGAs = location of respondents (Akpabuyo = 1, Akamkpa = 2;

Results

A simple close traverse technique was adopted to determine the area of each home gardens and sacred forests in all randomly selected communities and households. Measurements of sacred forests and home gardens boundaries were carried out and recorded for area determination (Tables 2 and 3).

Table 2: Variation in Sizes and geographical position system (GPS) of selected home garden in the study area.

LGAs	Community		Size of Hg (Ha)	DHG (m)	GPS	
Akamkpa	Oban Town	a	0.074	32.3	N062 ⁰ 5'34.6"	
		b	0.067	35.6	E09 ⁰ 18'20.5"	
	Neghe	a	0.076	36.7	N06 ⁰ 19'21"	
		b	0.078	40.7	E06 ⁰ 14'41"	
	Awi	a	0.074	23.7	N06 ⁰ 23'31"	
		b	0.101	21.8	E06 ⁰ 25'35"	
	Mbarakom	a	0.095	23.4	N06 ⁰ 21'36"	
		b	0.071	14.2	E0625'11"	
	Akpabuyo	Ojor	a	0.095	15.2	N0624'59.1"
			b	0.082	10.5	E0918'28.8"
Akansoko		a	0.051	33.0	N062 ⁰ 5'34.6"	
		b	0.038	22.2	E09 ⁰ 18'20.5"	
Ikot Edimodo		a	0.067	34.5	N0624'59.1"	
		b	0.068	15.1	E0918'28.8"	
Ikot Offiong		a	0.075	19.6	N06 ⁰ 19'21"	
		b	0.059	27.1	E06 ⁰ 14'41"	
Mbai		a	0.112	9.6	N06 ⁰ 21'36"	
		b	0.032	15.0	E0625'11"	
Esuk Mbat	a	0.063	21.7	N062 ⁰ 5'34.6"		
	b	0.065	18.0	E09 ⁰ 18'20.5"		
Akwa Ikot Effanga	a	0.063	21.7	N062 ⁰ 5'34.6"		
	b	0.065	18.0	E09 ⁰ 18'20.5"		
Obubra	Ochon	a	0.109	11.0	N06 ⁰ 29'28.8"	

		b	0.074	6.3	
	Edondon	a	0.058	12.7	N06 ⁰ 21'36"
		b	0.067	5.6	E0625'11"
	Ohana	a	0.035	4.8	N062 ⁰ 5'34.6"
		b	0.049	7.9	E09 ⁰ 18'20.5"
	Isabang	a	0.070	15.5	E06 ⁰ 14'41"
		b	0.113	12.7	N06 ⁰ 21'36"
	Odonget	a	0.053	5.0	N06 ⁰ 23'31"
		b	0.738	7.8	E06 ⁰ 25'35"
Ikom	Etayip	a	0.071	17.5	N0624'59.1"
		b	0.10	15.0	E0918'28.8"
	Bokomo	a	0.081	10.6	N06 ⁰ 21'36"
		b	0.083	9.7	E0625'11"
	Enoighi	a	0.084	6.8	N062 ⁰ 5'34.6"
		b	0.048	11.0	E09 ⁰ 18'20.5"
	Asanesen	a	0.084	14.5	N0624'59.1"
		b	0.078	12.6	E0918'28.8"
	Enini	a	0.068	7.8	N06 ⁰ 21'36"
		b	0.119	9.6	E0625'11"
Boki	Ndemenchang	a	0.102	13.4	N062 ⁰ 5'34.6"
		b	0.073	11.3	E09 ⁰ 18'20.5"
	Bunyah	a	0.087	17.6	N06 ⁰ 21'36"
		b	0.060	12.0	E0625'11"
	Katchuan	a	0.078	15.6	E06 ⁰ 14'41"
		b	0.050	13.4	N06 ⁰ 21'36"
	Wula	a	0.038	9.0	N062 ⁰ 5'34.6"
		b	0.068	11.3	E09 ⁰ 18'20.5"
	Bateriko	a	0.067	14.2	N06 ⁰ 23'31"
		b	0.078	9.1	E06 ⁰ 25'35"
	Kakun	a	0.070	8.5	N062 ⁰ 5'34.6"
		b	0.084	10.7	E09 ⁰ 18'20.5"
	Igwo	a	0.059	13.8	N0624'59.1"
		b	0.038	12.5	E0918'28.8"
	Ukwel Obudu	a	0.071	16.2	N06 ⁰ 19'21"
		b	0.051	9.3	E06 ⁰ 14'41"
	Utugwang	a	0.082	11.0	N06 ⁰ 23'31"
		b	0.073	7.2	E06 ⁰ 25'35"
	Ukpe	a	0.085	12.5	N0624'59.1"
		b	0.697	9.3	E0918'28.8"
	Grand Total:		4.364HA		

A = First home garden measured in the community, b= Second home garden measured in the community, M = Metre, GPS =Geographical position system
DHG = Distance from the house to the Garden in metres

Table 3: Variation in Sizes and geographical position system (GPS) of selected sacred forest in the study area

LGAs	Community	GPS Reading	Sacred forest dimension (Ha)
Akamkpa	Neghe	N04 ⁰ 31'15"	1.423
		E08 ⁰ 21'58"	2.597
	Ojor	N04 ⁰² 1'36"	1.174
		E08 ⁰ 23'34"	
Akpabuyo	Esuk Mbat	N04 ⁰ 21'39"	1.181
		E08 ⁰ 21'80"	2.279
	Ikot offiong Mbai	N04 ⁰ 21'08"	1.098
		E04 ⁰ 21'50"	
Obubra	Ohana	N06 ⁰ 22'27"	1.720
		E06 ⁰ 17'26"	2.579
	Edendon	N06 ⁰ 29'34"	1.859
		E06 ⁰ 35'18"	
Ikom	Etayip	N06 ⁰ 42'21"	1.056
		E06 ⁰ 30'47"	2.131
	Bokomo	N06 ⁰ 49'75"	1.075
		E06 ⁰ 37'40"	
Boki	Wula	N06 ⁰ 41'82"	1.170
		E06 ⁰ 30'27"	2.437
	Bunyin	N06 ⁰ 21'43"	1.267
		E06 ⁰ 32'48"	
Obudu	Kakum	N06 ⁰ 35'43"	0.945
		E06 ⁰ 47'13"	2.001
	Wure	N06 ⁰ 50'33"	1.056
		E06 ⁰ 28'40"	
Grand Total			13.967

M = Metres, GPS = Geographical position system, LGAs = Local Government Area

Correlation analysis

The correlation analysis showed that in the pooled data for the study areas, there were strong relationship between the dependent variables - availability of Important NTFPs (AIN) and the independent variables such as prevalence of illegal harvesters (PIH), contribution to annual income (CAI), high dependence on NTFPs (DIN), unsustainable harvesting of NTFPs (UHN), size of forest/gardens (SA), increase land use pressure (ILP), involvement of community in management (CIM), conflict between communities and harvesters (CCN) and lack of information on NTFPs, (r = 0.80, 0.80, 0.80, 0.80,

0.79,0.77,0.77,0.77 and 0.74 respectively Table 4.). And that livelihood of the people depends on the availability of important NTFPs in the study area.

Correlation analysis of NTFPs in the six local government areas

The correlation analysis in each of the LGAs depends on the relationship between AIN and other variables (Tables 5, 6 ,7, 8, 9 and,10). All the variables proved that availability of important NTFPs depends on practicing NTFPs against the negative factors that destroyed them while encouraging those that promote its sustainability.

Table 4: Correlation analysis of factors affecting the availability of important NTFPs in the six Local Government Areas

Variables	X ₁	X ₂	X ₃	X ₄	X ₅	X ₆	X ₇	X ₈	X ₉	AIN
X ₁ SA	1.00									
X ₂ PIH	0.83	1.00								
pX ₃ CAI	0.83	0.80	1.00							
X ₄ LIN	0.86	0.83	0.86	1.00						
X ₅ PFC	0.80	0.83	0.85	0.80	1.00					
X ₆ CIM	0.83	0.81	0.79	0.85	0.79	1.00				
X ₇ CPF	0.88	0.81	0.84	0.85	0.83	0.81	1.00			
X ₈ CCN	0.80	0.78	0.83	0.77	0.81	0.79	0.83	1.00		
X ₉ UHN	0.83	0.79	0.85	0.83	0.84	0.80	0.83	0.83	1.00	
AIN	0.79	0.80	0.80	0.80	0.74	0.77	0.77	0.77	0.80	1.00

PASW: Correlation matrix for the pooled data, **Basic Statistics:** Correlation are significant at p< 0.05, N = 1000 = Total number of respondents in all the studied LGA

Table 5: Correlation analysis of factors affecting the availability of important NTFPs in sacred forest and home garden in Akpabuyo

Variables	X ₁	X ₂	X ₃	X ₄	X ₅	X ₆	X ₇	X ₈	X ₉	AIN
X ₁	1.00									
X ₂	.87	1.00								
X ₃	0.88	0.85	1.00							
X ₄	.90	0.83	0.90	1.00						
X ₅	0.86	0.87	0.94	0.85	1.00					
X ₆	0.88	0.88	0.85	0.91	0.83	1.00				
X ₇	0.90	0.90	0.94	0.89	0.93	0.84	1.00			
X ₈	0.87	0.94	0.82	0.84	0.84	0.89	0.87	1.00		
X ₉	0.88	0.85	0.96	0.90	0.90	0.89	0.91	0.82	1.00	
AIN	0.85	0.78	0.78	0.84	0.80	0.86	0.77	0.82	0.78	1.00

PASW: Correlation matrix for Akpabuyo, **Basic Statistics:** Correlations are significant at p< 0.05

N = 169 = Total number of respondents in Akpabuyo LGA, *significant at p< 0.05

Where:

- AIN = Availability of important NTFPs (available = 1, not available = 0)
- X₁ = Size of the Forest/Garden (Large 1, small = 0)
- X₂ = Prevalence of Illegal Harvesters (Prevalence =1, not prevalence = 0)
- X₃ = Contribution to Annual Income (Contribute = 1, not contribute = 0)
- X₄ = High dependence on important NTFPs by rural communities (Depend = 1; not depend = 0)
- X₅ = Information on NTFPs (Available = 1; not available = 0)
- X₆ = Increase land use pressure and population density (Increase = 1, not increase = 0)
- X₇ = Involvement of community in forest management (Involvement = 1; not involvement =0)
- X₈ = Conflict between community and NTFPs havesters (Conflict =1, not conflict = 0)
- X₉ = Unsustainable harvesting of NTFPs (Sustainable = 1 unsustainable = 0).
- PASW = Predictive analytical software (ver 18.0)
- N = Number of respondents

Table 6: Correlation analysis of factors affecting the availability of important NTFPs in sacred forest and home garden in Akamkpa

Variables	X ₁	X ₂	X ₃	X ₄	X ₅	X ₆	X ₇	X ₈	X ₉	AIN
X ₁	1.00									
X ₂	0.87	1.00								
X ₃	0.92	0.81	1.00							
X ₄	.87	0.90	0.80	1.00						
X ₅	0.81	0.79	0.83	0.77	1.00					
X ₆	0.89	0.89	0.92	0.86	0.89	1.00				
X ₇	0.87	0.89	0.81	0.89	0.87	0.89	1.00			
X ₈	0.84	0.78	0.86	0.74	0.94	0.89	0.84	1.00		
X ₉	0.77	0.75	0.80	0.71	0.83	0.85	0.74	0.82	1.00	
AIN	0.86	0.78	0.81	0.76	0.71	0.79	0.78	0.73	0.82	1.00

PASW: Correlation matrix for Akamkpa, **Basic Statistics:** Correlations are significant at $p < 0.05$, N=167 = Total number of respondents in Akamkpa LGA

Table 7: Correlation analysis of factors affecting the availability of important NTFPs in Obubra

Variables	X ₁	X ₂	X ₃	X ₄	X ₅	X ₆	X ₇	X ₈	X ₉	AIN
X ₁	1.00									
X ₂	0.84	1.00								
X ₃	0.87	0.86	1.00							
X ₄	0.91	0.90	0.93	1.00						
X ₅	0.94	0.90	0.86	0.89	1.00					
X ₆	0.85	0.91	0.88	0.87	0.91	1.00				
X ₇	0.84	0.85	0.92	0.81	0.85	0.87	1.00			
X ₈	0.79	0.81	0.77	0.73	0.80	0.86	0.80	1.00		
X ₉	0.87	0.82	0.85	0.81	0.85	0.83	0.87	0.83	1.00	
AIN	0.81	0.83	0.83	0.79	0.83	0.84	0.85	0.74	0.85	1.00

PASW: Correlation matrix for Obubra, **Basic Statistics:** Correlations are significant at $p < 0.05$

N = 170 = Total number of respondents in Obubra LGA

Table 8: Correlation analysis of factors affecting the availability of important NTFPs in Ikom

Variables	X ₁	X ₂	X ₃	X ₄	X ₅	X ₆	X ₇	X ₈	X ₉	AIN
X ₁	1.00									
X ₂	0.86	1.00								
X ₃	0.77	0.83	1.00							
X ₄	0.86	0.86	0.988	1.00						
X ₅	0.76	0.82	0.72	0.75	1.00					
X ₆	0.90	0.88	0.77	0.80	0.72	1.00				
X ₇	0.96	0.82	0.92	0.82	0.76	0.90	1.00			
X ₈	0.80	0.83	0.91	0.74	0.88	0.76	0.80	1.00		
X ₉	0.8	0.85	0.82	0.85	0.89	0.81	0.86	0.88	1.00	
AIN	0.75	0.78	0.91	0.81	0.86	0.70	0.75	0.85	0.79	1.00

PASW: Correlation matrix for Ikom, **Basic Statistics:** Correlations are significant at $p < 0.05$
N = 165 = Total number of respondents in Ikom LGA

Table 9: Correlation analysis of factors affecting the availability of important NTFPs in Boki

Variables	X ₁	X ₂	X ₃	X ₄	X ₅	X ₆	X ₇	X ₈	X ₉	AIN
X ₁	1.00									
X ₂	0.87	1.00								
X ₃	0.92	0.81	1.00							
X ₄	0.87	0.90	0.80	1.00						
X ₅	0.81	0.79	0.83	0.77	1.00					
X ₆	0.89	0.89	0.92	0.86	0.89	1.00				
X ₇	0.87	0.89	0.81	0.89	0.87	0.89	1.00			
X ₈	0.84	0.78	0.86	0.74	0.94	0.89	0.84	1.00		
X ₉	0.77	0.75	0.80	0.71	0.83	0.85	0.74	0.82	1.00	
AIN	0.86	0.78	0.81	0.76	0.71	0.79	0.78	0.73	0.82	1.00

PASW: Correlation matrix for Boki, **Basic Statistics:** Correlations are significant at $p < 0.05$
N = 163 = Total number of respondents in Boki LG

Table 10: Correlation analysis of factors affecting the availability of important NTFPs in Obudu

Variables	X ₁	X ₂	X ₃	X ₄	X ₅	X ₆	X ₇	X ₈	X ₉	AIN
X ₁	1.00									
X ₂	0.81	1.00								
X ₃	0.84	0.79	1.00							
X ₄	0.73	0.86	0.82	1.00						
X ₅	0.89	0.83	0.92	0.77	1.00					
X ₆	0.74	0.81	0.83	0.92	0.75	1.00				
X ₇	0.90	0.86	0.78	0.79	0.82	0.81	1.00			
X ₈	0.89	0.77	0.83	0.72	0.91	0.73	0.88	1.00		
X ₉	0.84	0.89	0.81	0.85	0.88	0.81	0.85	0.82	1.00	
AIN	0.74	0.82	0.74	0.84	0.69	0.80	0.76	0.70	0.77	1.00

PASW: Correlation matrix for Obudu, **Basic Statistics:** Correlations are significant at $p < 0.05$
N = 166 = Total number of respondents in Obudu LGA

Quantitative and qualitative similarity of NTFPs: Tables 11 - 13 showed similarity indices of NTFPs in different home gardens with regards to their values

Table 11: Similarities indices: Sorenson (Quantitative) Index (Cn) of the NTFPs in the six locations

	HG _a	HG _o	HG _i	HG _m	HG _u	HG _A
HG _a	1.000	0.774	0.754	0.754	0.636	0.653
HG _o		1.000	0.750	0.704	0.658	0.706
HG _i			1.000	0.807	0.757	0.802
HG _m				1.000	0.810	0.758
HG _u					1.000	0.758
HG _A						1.000

Where: HG_a = Akamkpa LGA, HG_o = Akpabuyo LGA., HG_i = Boki LGA., HG_m = Ikom LGA., HG_u = Obudu LGA., HG_A = Obubra LGA.

Table 12: Similarity indices; Sorenson (Qualitative) Index (Cs)

	HG _a	HG _o	HG _i	HG _m	HG _u	HG _A
HG _a	7.000	0.949	1.00	1.00	0.901	0.853
HG _o		1.000	0.784	0.921	0.904	0.857
HG _i			1.000	0.857	0.955	0.875
HG _m				1.000	0.957	0.909
HG _u					1.000	0.952
HG _A						1.000

This is because both 94.99 (for C_s) and 0.90 or 90% (for C_j) are ≥ the critical value of 0.5 or 50%

Table 13: Significant values of the Sorensens quanlitative and quantitative results

	HG _a	HG _o	HG _i	HG _m	HG _u	HG _A
HG _a	1.00	0.90*	0.80	0.805	0.821	0.744
HG _o		1.00	0.85	0.854	0.825	0.75
HG _i			1.00	0.892	0.914*	0.882
HG _m				1.00	0.917*	0.833
HG _u					1.00	0.909*
HG _A						1.00

*Significant- Home gardens with higher values are similar.

Table 14: Summary of total number of NTFPs found in home gardens and Sacred forest in three ecotypes of the study area.

	Ecotype 1		Ecotype 2		Ecotype 3	
	freq	%	freq	%	freq	%
No. of sp in HG	1677	73.42	1262	75.75	1205	75.98
No. of sp in SF	607	26.58	404	24.25	381	24.02
Relative density	2284	100.00	1666	100.00	1586	100.00

* HG- Home Garden, * SF- Sacred Forest.

Discussion

Management practices of NTFPs in the study site

The management practices of these valuable NTFPs involved excessive harvesting to irreversible physical damaging of these species which are not harvested destructively. These patterns of exploitation have altered from extraction for subsistence and low volume sales to intensive commercial extraction and high-volume sales. These made most communities in the study area to imposed control over the exploitation of (NTFPs) Afang (*Gnetum africanum*) year in, year out. Collection of NTFPs is allowed by only villagers.

Defaulters are fine four bottle of gin or option of 100-200 naira per offence if caught disobeying the law of the land, as well as crime involving the exploitation of small quantity of Afang or other NTFPs. For larger quantities, the fine may involve the confiscation and sale of the Afang and the community keeps the proceeds.

For building equipments, plant species mainly trees and climbers are used e.g bamboo is highly multi-purpose species used in home and farm for building and making of a range of pools and tools. Other important NTFPs include *Eremospatha Macrocarpa*(*marantaceae*) and *Raphia vinifera* (Mohamed and Tesfaye, 2020).

On medicinal NTFPs, the shrubs are the most important sources of treatment substances, especially the *Aframomum* and *Ocimum gartissimum* L which form ingredients for a host of traditional

medicinal preparations and for the treatment of gastro intestinal disorders respectively. The tree products like *Elaeis guineensis*: palm kernel oil and black soap and *Pterocarpus osun*. campwood dye are used for various skin infections while *Massullai acamimata* and *Garcinia mannii* are used for hygiene, *Momordica augustisepale* as washing sponge (Uprety et al., 2016; Hido and Alemayehu, 2022; Delgado et al., 2023).

Tradition, culture and tourism of the people.

The survey recorded a great diversity of NTFPs used by households throughout the study area. There were some unique uses of the sacred forest depending on the ethnic, tribe, cultural or language (Masoodi and Sundriyal, 2020). For example, the stem of *Lasianthera africanum* is used as a musical instrument in Ikom LGA (Bendeghe Ekiem), chewing stick is carried and put in a bead bag for decoration in Akpabuyo LGA, Fern is used by masquerades in Akamkpa and Akpabuyo LGAs; the leaves of *Newbouldia* species are used by Ekpe masquerades.

The young leaves of *Elaeis guineensis* is used in sending errand and as a warning to prohibit people from entering certain places. The seeds of *Cola nitida* is used in Akpabuyo and Akamkpa LGAs for welcoming and entertaining visitors while seeds of *Garcinia kola* is commonly used for home purpose in Ikom, Obubra, Boki and Obudu LGAs. The *Gnetum africanum* is used as vegetable in cooking soup in Akpabuyo and Akamkpa LGAs, while it is mixed with little palm oil and eaten raw in Obubra, Ikom, Boki and Obudu LGAs.

Other cultural practices and rituals that were involved in societal control and regulation depended on the use of wide range of NTFPs (Derebe *et al.*, 2023). The respondents lamented that the original significance of these cultural values seems more or less lost in some cases but certain rituals are still relevant and these compel the use of skin dyes and markers, shakers and masks, drums and many of the other accoutrements of traditional practice. These cultural practices are associated with festivities, Easter and Christmas. A lot of these specialised instruments are art and craft cottage industry based and so have tourism outlet (Hadish, 2018; Delgado *et al.*, 2023; Dou *et al.*, 2023). For example, palm oil from *Elaeis guineensis* and mimosop oil from *Baillonela toxisperma* are substitutes for imported soya bean, groundnut or corn oils.

Marantaceae leaves provide substitutes for cellophane bags while cane rope from *Eremospatha macrocarpa* for tying as a substitutes for nylon fibre ropes.

The trees stand parameters obtained from the sacred forests in Ecotypes 1, 2 and 3, Akamkpa and Akpbuyo, Obubra and Ikom, Boki and Obudu respectively; showed that Ecotypes 1 and 2 had higher stand values than Ecotype 3. while stand density and stocking per hectare (17) were highest in Ecotype 2. These parameters apart from depending on the soil are also affected by the unsustainable harvesting (Shrestha *et al.*, 2020). This subsequently will affect the total volume production per hectare. Moreover, the high demands for NTFPs have traditionally encouraged collectors of NTFPs into destruction of NTFPs trees in an unhealthy competition for making the resource available on short term (Derebe *et al.*, 2023). In some cases, all the fruits of some trees are harvested completely from the natural forest leaving nothing for

natural regeneration. The contribution of NTFPs to household self-sufficiency, food security, income generation, accumulation of saving and risk minimization cannot be overemphasized (Shackleton *et al.*, 2015). Therefore, the rights of local people to their natural heritage should be acknowledged, recognized and guided based on mutual understanding of how the NTFPs should be sustainably managed for the current and future benefits of the rural people.

Summary

Non-timber forest products have the potentials for contributing to the local economy and improve natural resource management, leading to ecosystem and biodiversity conservation of an area. In Cross River State, NTFPs play significant role in subsistence farming as well as in marketing economy. The cultivation, collection and marketing of NTFPs have become a normal way of life for people in the study area to meet their daily needs. There is, however, great variation in the extent to which NTFPs are used between households in the area which reflects the extent to an integral part of rural livelihood. These NTFPs are often cultivated in some home gardens though not frequent in the study area. These gardens offer practical solutions to some challenges such as massive degradation and depletion of forest resources, apart from environmental improvement and landscape enhancement among others.

Home garden with their intensive and multiple land uses in these areas, provides safety net for households when food is scare, these gardens are not only important sources of food, medicines, spices, herbs and income generation, they are also important for the in-situ conservation of a

wide range of unique genetic resources. This system promotes family and community involvement in the process of providing food by incorporating it infield with other household tasks. Therefore, NTFPs play a significant role in rural livelihood and in home gardens. Sacred forests are age old traditional nature conservation practices adopted by the people in the sampled Local Government areas. This is regarded as the first democratic approach by the people to protect the nature from over exploitation long before the term “democracy” was coined. Also, these forests are protected in the study area because they harbour the gods or the spirit of the ancestors, they serve as sites for religious ritual and protect NTFPs of cultural and medicinal importance. Despite the pressure from changing social and political context, the religious beliefs that support the existence of sacred forest in the area have survived. Therefore, the need of the hour is to create awareness on the importance of sacred forest conservation, and also involve the local people in its conservation and management in order to enhance the people’s livelihood.

Conclusion

The cultivation and collection of NTFPs from the home gardens are major source of food and cash to the rural people particularly the poor as an alternative source of income and livelihood. The local communities in the study area have used NTFPs for a long time, which act as a safety net particularly when there is a short fall in agricultural production to minimize risk and fill the gap of food shortage. Generally, the major bottleneck affecting productivity of NTFPs in the study area is poor market access and infrastructure. Therefore,

improving the existing poor market infrastructure will simultaneously solve related problems that limit the development potential of the study area. Sacred forests have survived for many hundreds of years and today act as a treasure store of local biodiversity e.g., NTFPs. This is because the forest structure is also unique, representing the least disturbed lands of old age. They serve multiple functions: they contribute to the conservation of threatened forest ecosystems; they protect a large number of endemic or relict plants and animal species; they preserve the culture and traditional beliefs of the local communities.

It is worth trying the introduction of the eco-tourism approach in the sacred forests in order to provide opportunities for alternative incomes for the local communities living within and around them, and at the same time to conserve their biological resources, cultures and traditions. The important thing to note here is the education of the local community about eco-tourism. The tourists also should be educated about the local cultures and the traditional values of the local communities. It should be noted that emphasis must be placed upon the involvement of all stakeholders, such as local communities, NGOs, and government institutions (Tourism, Forestry, Land and Environment) in the planning of eco-tourism projects in sacred forests.

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