LIVELIHOOD DIVERSIFICATION AMONG ARABLE FARM HOUSEHOLDS IN THE FOREST ZONE OF OYO STATE, NIGERIA

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Abstract
The study assessed the livelihood diversification strategies among the arable farm households in the forest zone of Oyo State, Nigeria. A 3-stage random sampling technique was used to select a total of 160 arable farm households around some selected forest reserves for the study. A well-structured questionnaire was used for the collection of data. The analytical tools employed were descriptive statistics, livelihood index, and logistic regression model. The findings of the study revealed that majority of the respondents were male (57.5%), educated (81.2%), married (71.9%), and had a household size of about 7 members. Non timber forest products (NTFP) gathering (39.38%) was the most preferred livelihood diversification strategy followed by transportation business (16.88%), petty trading (13.75%), artisanal work (12.5%), firewood sales (6.25%), wage employed (4.38%), charcoal production (3.75%), timber sales (1.88%), and hunting (1.25%) in that order respectively. The forest-related livelihoods accounted for 52.5% of the predominant livelihood strategies, whereas, non-forest-related livelihoods accounted for 47.5%. The significant predictors of the probability of engaging in forest-related strategies include; primary education, and secondary education (10% each); tertiary education, and household size (1% each), and age of household head (5%). The study recommends the intensification of local capacities of the farmers such as access to education and training facilities to enable them access and process information, and credit to enhance their livelihood and minimize forest dependence.

Keywords: Livelihood, Diversification, Arable farmers, Forest reserve, Logistic regression

Introduction
Agriculture is primarily the source of livelihood in most rural areas in Nigeria, and it is constrained by some factors such as soil infertility, infrastructural inadequacy, risk and uncertainty and seasonality among others (Adepoju and Obayelu, 2013). Consequently, the majority of rural households are diversifying their livelihoods into off-farm and non-farm activities to achieve a sustainable source of income. According to the International Fund for African Development (IFAD, 2001), the farm sector employs about 75% of the country's total labour force and provides a livelihood for about 90% of its rural populace. Despite agriculture being the major source of livelihood, the off-farm and non-farm sector plays a significant role in the development of the rural sector. Forest ecosystems are parts of the Earth's greatest assets with habitats that are comprised of enormous flora and fauna species and soils as in indicated by International Union for the Conservation of Nature (IUCN, 2015). According to International Action for Primary Forest (IAPF, 2016), forest environs are home to about 80% of the world's land-dwelling biodiversity, and they also provide a livelihood for many households across the globe.

Millions of people all over the world depend on forests for income, food, raw materials, medicine, and fuel. The estimates by the Food and Agricultural Organization (FAO, 2001) showed that 500 million people live around the forests, and in some places; it is their primary source of food. In most developing countries, forest products serve as a safety net to farmers by reducing vulnerability to shocks when crops fail in terms of low yield or during times of droughts, floods or conflict. It also helps farmers to get by between harvest seasons and generally increase their wellbeing (Eric et al., 2014). In some areas, forests support the production of livestock through the provision of fodder, and in others, such as coastal mangrove swamps, they support local fisheries (Jonah et al., 2013). Many forest-dependent households utilize a combination of means to help meet their basic needs such as food and cash crop production, forest and

tree product gathering, and income-earning enterprises both on and off the farm. Often, the poorer the household, the more diverse the sources of their livelihood, as the needs for the year must be met from various off-farm and on-farm activities.

The significance of forest and forest resources to sustainable livelihoods cannot be overemphasized, as they remain substantial to many development efforts and are important to the reduction of poverty and hunger. However, very few studies have assessed the livelihood diversification activities of arable farm households around the forest zone. For this reason, this study investigated the livelihood diversification of arable farmers that are primarily deriving their livelihood from forest and forest resources. Therefore, this study aims to close this knowledge gap by providing new empirical evidence on the livelihood diversification of arable farm households in the study area. The specific objectives were to: describe the socio-economic characteristics; identify the predominant livelihood diversification strategies; determine the livelihood diversification status; and ascertain the determinants of livelihood diversification strategies among the arable farm households around the forest reserves in the study area. The study, therefore, could give rise to outcomes that would be essential to farmers, researchers, and policymakers by providing very important information to enhance policy formulation that would bring about

enhancing farmers livelihood without compromising sustainable forest resources utilization and management in Nigeria.

Methodology
Area of study
The study was conducted in Oyo State, located in the South-West part of Nigeria, occupying about 2,650,000ha (NBS, 2012). It is situated between latitudes $7^0 3'0.26''N$ and $9^0 11'6.10''N$ and longitudes $2^0 42'25'.14''E$ and $4^0 33'23.84''E$. The Climate is equatorial, with a distinct dry season from November to March and the wet season from April to October. The average annual rainfall is 1252.5mm, while the average daily temperature ranges between 23.2^0C and 31.9^0C, almost throughout the year (NBS, ibid). There are nine gazetted forest reserves in Oyo State covering about 342,461 hectares (ha) of land. These are Gambari, Igangan, Ijaiye, Lanlate, Okoo-Iro, Olasehinde, Olokomeji, Opara and Osho forest reserves. The Opara, Igangan, Ago Are I and II, Okoo-Iro forest reserves are situated in the Western part of the State, while, Olokemeji, Lanlate, Ijaiye, Osho and Gambari forest reserves are situated at the Southern part of the state (Figure 1). There is no forest reserve at both the Eastern and Northern parts of the State apart from the Old Oyo National Park at the North, which is a protected area for both flora and fauna (Alo, 2017).
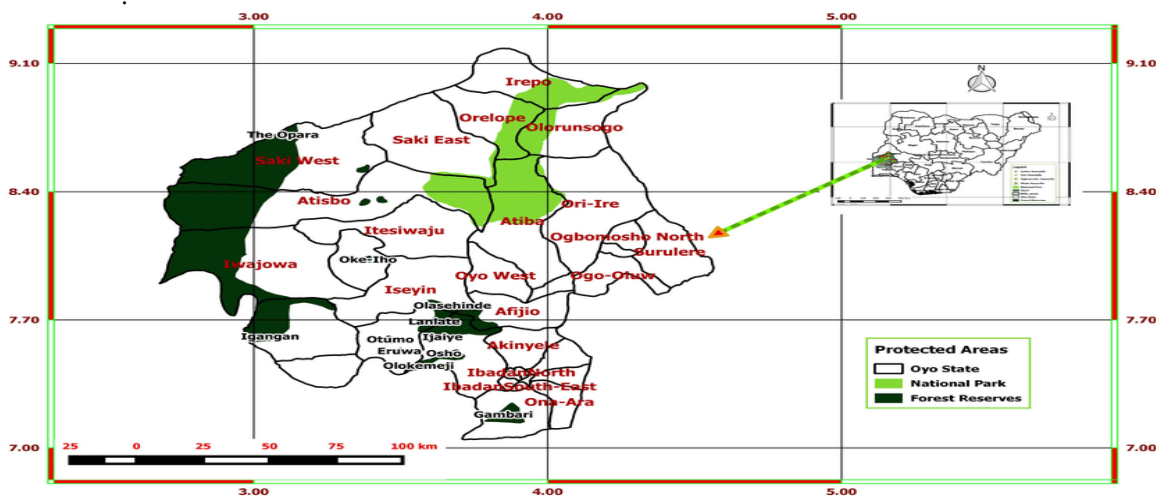

Figure 1: Map showing the spatial distribution of forest reserves in Oyo State, Nigeria
Source: Adapted from Alo (2017)

Sampling techniques
A 3-stage random sampling technique was used to select the representative arable farm households around the forest reserves for the study. In the first stage, four (4) forest reserves were randomly selected out of the nine (9) forest reserves. In the second stage, four (4) villages were randomly selected around each of the selected

forest reserves, giving a total of 16 villages. In the third stage, 10 arable farm households were randomly selected in each of the 16 villages, using a complete village housing list that was provided by the local authorities to give a total of 160 respondents for the study.

Table 1: Diagrammatic representation of the sampling procedure and sample size

S/No	Forest Reserves	Domiciled LGA	Selected Villages	No. of Selected Households
1	Gambari	Oluyole	Amosun, Oloya, Onipede, Abanla	40
2	Igangan	Ibarapa North	Akoya, Ayete, Owode, Ajegunle	40
3	Ijaiye	Akinyele	Alabata, Onilu, Ajeja, Idowu-Oko	40
4	Lanlate	Ibarapa East	Alapa, Panlati, Opoogede, Afayasoro	40

Method of data collection

The study employed the use of a structured questionnaire as a primary source of data collection to collect information on household socioeconomic status, livelihoods assets, and livelihood diversification strategies of the arable farmers. Both individual (age, gender, education, marital status, training participation) and household (income, household size, access to credit, and main energy sources) socio-economic characteristics were considered in the study. Based on the preliminary qualitative investigations, a range of key livelihood diversification strategies were identified to include artisan, employed (salaried/wage), timber sales, non-timber forest products (NTFP) gathering/domestication, firewood sales, charcoal production, petty trading, transportation, and hunting among others.

Analytical techniques and model specification

The analytical techniques that were used for the study include; descriptive statistics, livelihood diversification index, and logistic regression model. Descriptive statistics such as mean, frequency distribution tables, and percentages were used to describe the socio-economic characteristics of the respondents and the predominant livelihood diversification strategies of the respondents. A livelihood diversification index was created from the different livelihood diversification strategies adopted by the respondents to determine the livelihood diversification status, using the approach by Kimengsi *et al*. (2019) in calculating an index from the different livelihood diversification strategies.
The index is specified as:

$$\text{Index } A_i = \frac{A_i - A_{min}}{A_{max} - A_{min}}$$

A_i = the actual value of an indicator for the household *I*; and
A_{min} and A_{max} = the minimum and maximum values, respectively, of the indicator for the entire data set.
Logistic regression analysis was used to ascertain the determinants of livelihood diversification among the arable farm households in the study area.
The explicit form of the logit regression model is specified as:

$$Y = B_0 + B_1X_1 + B_2X_2 + B_3X_3 + B_4X_4 + B_5X_5 + B_6X_6 + B_7X_7 + U$$

Where:
Y = Livelihood strategies (Forest related = 1, 0 = Non-forest related)
The independent variables hypothesized as determinants of livelihood diversification following the approach of Kimengsi *et al*. (2019) with some

modifications are specified as:
X_1 = Age of the respondents (Years)
X_2 = Gender of household head (1 = Male, 0 = Female)
X_3 = Marital status (1 = Married, 0 = If otherwise)
X_4 = Education of household head (Years)
X_5 = Household size (Numbers)
X_6 = Training participation (1 = Yes, 0 = No)
X_7 = Access to credit (1 = Yes, 0 = No)
U = Error term

Results and Discussion

Socio-economic distribution of respondents

Table 2 reveals the socio-economic distribution of arable farm households in the study area. The result of gender distribution revealed that the majority of the respondents were male (57.5%), while females accounted for 42.5% of the respondents. This implies that there are more male-headed households in the study area. This is in line with the study of Aluko *et al*. (2019) who reported that most household heads are usually male because they are known to be the heads of the family except in cases where the male is dead leaving the headship position for the wife. The age distribution of the respondents shows that 10% of them were between the ages of 21-40 years, and 50% between 41-60 years, 35% between the ages of 61-80, and 5% above 80 years. The respondents had a mean age of 55years. This result indicates the low participation of youths in farming. The educational level of the household heads shows that majority (81.2%) of the respondents had formal education, while 18.8% were not educated. This implies that the respondents' level of awareness is high concerning the significance of the forest reserve and it may have a positive effect on their ability to access information, adopt new technological innovations and even access credits from formal financial institutions. Majority (83.1%) of the respondents had a household size of 6-10 members followed by those with 1-5 members (10%) and, those with over 11 members (6.9%) respectively. Mean household size of about 7 members was obtained. This was expected as the study was carried out in rural communities and it is typical of rural households to have a relatively large household size which is desirable in terms of supplying family labour instead of hired labour. However, it could become a burden in terms of the upkeep of the household. This large household size may have grave implications for the future existence of the reserve. This is because as the members of households increase and grow older, the demand for farmland may also increase and this may lead to agitation for the release of more portions of the reserves for farming activities. According to Kola-Oladiji *et al.* (2016), this means more mouths need to be fed and consequently an increased demand and harvest of NTFPs from the

reserves. Majority (59.4%) had a landholding of between 1 and 5 hectares, whereas, 31.3% had between 6 and 10, and 9.4% greater than 10 hectares of farmland. The mean farm size was 5.6 hectares in the study area. This implies that the respondents are medium-scale farmers. This could explain their increased use of the forest reserves to complement their farm earnings. Many (48.1%) of the respondents earned between ₦41,000 and ₦60,000 monthly, while, few (8.8%) earned above ₦80,000. The average total household income per month of the respondents in the study area was estimated at ₦53,481.25. The result of the marital status of the households presented shows that the majority (71.9%) of the respondents was married, single (1.3%), widowed (17.5%), and divorced/separated (9.4%). This implies that a greater percentage of the respondents had families indicating stability. According to Njoku and Offor (2016), stability creates a favourable environment for the development of personal integrity and for entrepreneurship which is important for efficient use of resources. The findings also revealed that majority (69.4%) of the arable farmers do not have access to credit or did not receive any credit for their farming activities at a time or the other. This corroborates with the study of Babatunde *et al.* (2015), that majority of farmers have no other means to access credit or purchased inputs in bulk which can reduce the total cost of their farm operation. The result further revealed that majority (63.8%) of the respondent had participated in formal training, while, 36.3% did not participate in any formal training. The high training participation could mean that the farmers are knowledgeable about their practices and the implications.

Also, it was revealed that the source of household energy of the farmers includes those that were using a combination of firewood and charcoal (50%), firewood only (36.3%), charcoal only (11.3%), and electric burner and/or liquefied gas (2.5%). This implies that 97.5% of the households were using unclean energy as the source of energy, most especially for cooking whereas; only 2.5% of them were using clean energy. However, the high dependence on fuelwood could have a serious implication on the sustainability of the forest reserves.

Table 2: Socio-economic distribution of respondents (n=160)

| Variables	Label	Frequency	Percentagee	Mean
Gender	Female	68	42.5	
	Male	92	57.5	
	21-40	16	10.0	
Age of household head	41-60	80	50.0	55
	61-80	56	35.0	
	Greater than 80	8	5.0	
	No Formal	30	18.8	
Education of household head	Primary	61	38.1	
	Secondary	44	27.5	
	Tertiary	25	15.6	
	1-5	16	10.0	
Household size	6-10	133	83.1	7
	11-15	11	6.9	
	1-5	95	59.4	
Farm size (Ha)	6-10	50	31.3	5.6
	Greater than 10	15	9.4	
	21,000-40,000	36	22.5	
Total household income/month (₦)	41,000-60,000	77	48.1	53481.25
	61,000-80,000	33	20.6	
	Greater than 80,000	14	8.8	
Marital status	Single	2	1.3	
	Married	115	71.9	
	Divorced/Separated	15	9.4	
	Widowed	28	17.5	
Access to credit	Did not receive	111	69.4	
	Received credit	49	30.6	
Training participation	Did not participate	58	36.3	
	Participated	102	63.8	
Source of household energy	Firewood and Charcoal	80	50.0	
	Firewood only	58	36.3	
	Charcoal only	18	11.3	
	Electric burner/Liquefied gas	4	2.5	

Source: Field survey, 2021

Preferred livelihood diversification strategies of respondents

Figure 2 shows the distribution of respondents according to their preferred livelihood diversification strategies. According to Babatunde *et al.* (2015), livelihood diversification strategies are the combination of activities that people choose to carry out and achieve their livelihood goals. In line with this, as shown in Figure 2, the entire respondents obtained income from a combination of farm and non-farm activities. The findings of the study revealed that 39.38% of the respondents were engaged in NTFP gathering as a source of livelihood besides farming in the study area, 16.88% were involved in the transportation business, 13.75% were engaged in petty trading, while 12.5% were engaged in artisanal work. The other livelihood activities were firewood sales (6.25%), wage/salary employed (4.38%), charcoal production (3.75%), timber sales (1.88%) and hunting (1.25%) respectively. The findings corroborate with Adepoju and Obayelu (2013), that single livelihood sources have proven over the years to be inadequate to liberate the rural poor from their poverty trap, requiring the adoption of multiple choices. The high engagement of the farmers in NTFP gathering can be explained on the basis that farmers in the study area usually seize the opportunity presented by the seasonal change in crop production to venture into gathering and marketing of non-timber forest products (such as edible fruits, wild animals, mushrooms, canes, honey, fish, and snails amongst others from the forests and water bodies) which is a more lucrative economic activity, because of its relatively low labour requirement and high-profit margin. The low engagement in livelihood activity such as firewood sales (6.25%), charcoal production (3.75%), timber sales (1.88%) and hunting (1.25%) could be attributed to the advocacy of the forest reserve officials and other stakeholders towards sustainable use of forest resources, while, that of employment (salaries/wages) (4.38%), could be attributed to the problem of unemployment in Nigeria. Therefore, the overall result is an indication that the arable farm households are relatively diversified in the study area.

Figure 2: Distribution of respondents according to their preferred livelihood diversification strategies (%)
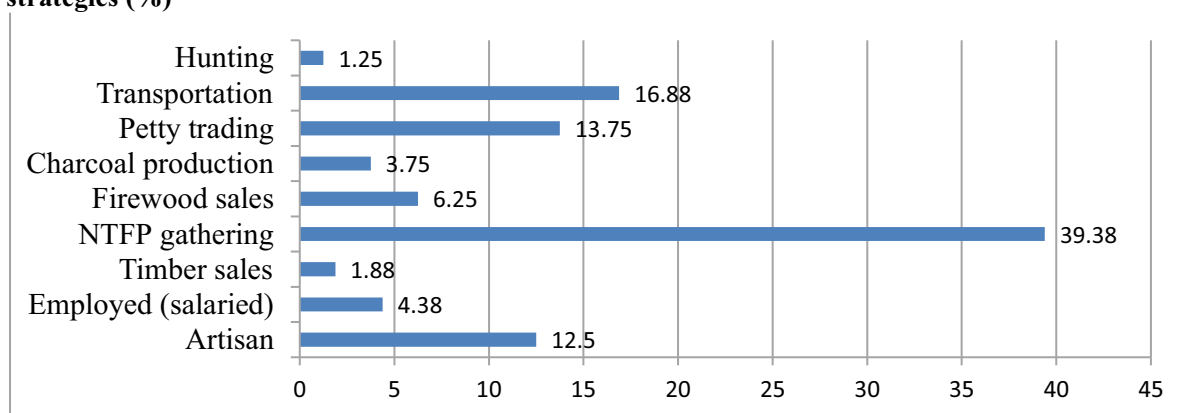
Source: Field survey, 2021

Livelihood diversification status of the respondents

Table 3 revealed the livelihood diversification status of the respondents in the study area. The arable farmers were requested to list their most preferred livelihood diversification strategy. The information that they provided was used to rank the diversification strategies. It was further grouped under forest and non-forest related livelihood strategies. The findings of the study show that forest-related livelihoods accounted for 52.5% of the predominant livelihood diversification strategies, whereas, non-forest related livelihoods accounted for 47.5% of the predominant livelihood strategies engaged by the arable farm households around the forest reserves. This implies that the arable farm households in the study area are forest-dependent. The finding conforms with the study by Kimengsi *et al.* (2019) and IUCN (2015) which points to the fact that forest resources form the basis of the livelihoods of forest fringe communities and the development of the fringe communities.

Table 3: Livelihood status of the respondents

Livelihood status	Frequency (n=160)	Percent (%=100)
Non-forest related	76	47.5
Forest related	84	52.5

Source: Field survey, 2021

Determinants of livelihood diversification strategies

The result of the logistic regression analysis of the determinants of livelihood diversification strategies adopted by the respondents in Oyo State is presented in Table 5. The chi-square value of 24.08 was significant at the 1% level shows that the model was good. The result reveals that primary education, and secondary education (10% each), tertiary education and household size (1% each) were positive and significant predictors of the probability of engaging in forest-related strategies,

while age of household head (5%) was negative and significant. Gender, marital status, training participation, and access to credit are non-significant predictors of the probability of engaging in forest-related strategies. Each odds ratio in this table indicates the multiplicative change in the odds (of a case falling into the target group, or Y=1) per unit increase on a given predictor, controlling for the others in the model. The odds ratio for the education category was 2.838, implying that the odds of a farmer engaging in forest-related strategies livelihood (Y=1) increased by a factor of 2.838 with every unit increase on the primary education category relative to those in the non-formal education category. Since we are multiplying odds by a 2.838 per unit increase on the predictor, it implies that our odds are increasing with each increase on the predictor. Similarly, the odds ratio for the secondary education category was 2.930, implying that the odds of a farmer engaging in forest-related livelihood (Y=1) increased by a factor of 2.930 with every unit increase on secondary education category relative to those in the non-formal education category. Since we are multiplying odds by 2.930 per unit increase on the

predictor, it implies that our odds are increasing with each increase on the predictor. The odds ratio for the tertiary education category was 6.139, implying that the odds of a farmer engaging in forest-related livelihood (Y=1) increased by a factor of 6.139 with every unit increase on tertiary education category relative to those in the non-formal education category. Since we are multiplying odds by a 6.139 per unit increase on the predictor, it implies that our odds are increasing with each increase on the predictor. The odds ratio for household size was 1.396, implying that the odds of a farmer engaging in forest-related livelihood (Y=1) increased by a factor of 1.396 with every unit increase in household size. Since we are multiplying odds by 1.396 per unit increase on the predictor, it implies that our odds are increasing with each increase on the predictor. The odds ratio for the age of household head was 0.968, implying that the odds of a farmer engaging in forest-related livelihood (Y=1) change by a factor of 0.968 with every unit increase on the age of household head. Since we are multiplying odds by 0.968 per unit increase on the predictor, it implies that our odds are decreasing with each increase on the predictor.

Table 5: Logistic regression estimates of determinants of livelihood diversification strategies

Variables	Coefficient	Std. Err.	Odds ratio	Std. Err	Z	P
Gender	0.351	0.396	1.421	0.563	0.89	0.375
Individual is married	0.590	0.460	1.805	0.831	1.28	0.199
Primary education	1.043*	0.568	2.838*	1.613	1.84	0.066
Secondary education	1.075*	0.616	2.930*	1.805	1.75	0.081
Tertiary education	1.815***	0.673	6.139***	4.134	2.69	0.007
Training participation	-0.739	0.452	0.478	0.216	-1.64	0.102
Access to credit	-0.0711	0.375	0.931	0.349	-0.19	0.850
Age of Household head	-0.0327**	0.0156	0.968**	0.0151	-2.10	0.036
Household size	0.333***	0.118	1.396***	0.164	2.83	0.005
Constant	-1.588	1.171	0.204	0.239	-1.36	0.175
LR chi2(9)	24.08					
Prob > chi2	0.0042					
Log-likelihood	-98.661692					
Pseudo R2	0.1088					
Observations	160					

Note: The base category for education is no formal, female for gender, non-married for marital status, did not receive for credit, and non-participation for formal training. *** =1%, ** =5%, * =10%

Conclusion

The arable farm households around the forest reserves in Oyo State are forest-dependent and relatively diversified. The predominant livelihood strategies are NTFP gathering, transportation business, petty trading, and artisanal work. NTFP gathering is the most preferred livelihood diversification strategy. The significant determinants of the probability of engaging in forest-related strategies by the respondents are primary, secondary, and tertiary education, household size and age of household head. Although farming remains the primary source of livelihood of the farmers, however, intensification of technical (education, training etc.) and financial capacity of the farmers is recommended to enhance their livelihood sustenance through conservation-friendly diversification approaches as an alternative strategy to minimize forest exploitation and dependence in the study area.

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