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*Original Paper*

# Effects of Forest Resource Exploitation on the Economic Income of Farming Households in Bida Local Government Area of Niger State

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***Abstract*—This study explored the effects of forest resource exploitation on the economic income of farming household in Bida LGA, Niger State. The socioeconomic characteristics, extent of forest resource exploitation, economic activities of farming household that dependent on forest resources, effect of forest resources exploitation and other socioeconomic characteristics on income, strategy adopted by the farming household to cope the effect of forest resources exploitation were the objectives of this study. A questionnaire was used to collect data from 160 respondents that were randomly selected in 4 villages. Data were analyzed using descriptive statistics and linear regression. The results revealed that majority were male and married, identified mahogany, shea nuts, and cashew nuts as the most exploited resources, while non-farm enterprises and small-scale ventures emerged as key economic activities among respondents. However, unsustainable exploitation practices such as clear-cutting and limited adoption of sustainable harvesting methods were prevalent, highlighting the ecological risks. Regression analysis revealed that gender, educational status, marital status and quantity of forest resources exploited significantly influenced income from forest-based activities. Strategies to mitigate the effects of exploitation included diversification of income sources and sustainable forest management, with respondents strongly supporting this approach.**

***Keywords*—Resource Exploitation, Forest Resource, Farming Households, Ordinary Least Square (OLS), Economic Income.***

## I. INTRODUCTION

Forest resources are natural materials in the forest that are of great utility to man as they serve as a source providing his wants and needs [16]. Ndo et al. [1] found that these resources are the root of majority of the natural materials utilized in any region or country. This is a commonality in Sub-Saharan Africa, where the majority of individuals both farmers and otherwise depend on natural forest resources for their income and survival [2, 25]. Ayinde [3] revealed that the urban households are not left out because though forest resources are a significant part of rural livelihood, proportion of urban households, though lower, also depend on these resources too. Gaya et al. [4] had similar findings, they revealed that significant percentage of households in Nigeria that consume solid fuels for their domestic needs was estimated to be about 70%, comprising 86% and 42% of rural and urban households respectively.

Other than meeting the basic socio-economic demands and requirements of rural people such as food, shelter and income, forest resources also serve as source for industrial raw materials. Fuel-wood and charcoal makeup 56% of global wood production and approximately 90% of this is produced in developing countries such as Nigeria. Fuel wood also known as firewood is the most important source of energy in Nigeria's rural communities [5].

Gould et al. [6] reported that forests are mediums of cultural and spiritual activities such as rituals, rites and ceremonies and as such they to the culture and religion of especially the rural people. Similarly, according to Simanihuruk [7] "Ecological behavior is deeply embedded in spiritual beliefs and ancestral identity." Chao [8] estimated that "between 1.095 billion and 1.745 billion people in the world depend on a wide range of forest products for their livelihoods and about 200 million indigenous rural communities are almost fully dependent on forests". Akemien et al. [9] revealed that a significant proportion of household economic activity is as a result of the annual value of products and materials collected from the forest.

## II. MATERIALS AND METHOD

### A. Description of the Study Area

Bida Local government area is located within Niger state, Nigeria. It has about 1.698 km2 area and a population of 266,008 [10] and a projected population of about 340,490.24 with a growth rate of 3.5% per annum [11]. Bida town lies on latitude 9°5'30"- 9°2'07"N and longitude 5°58'30"- 6°3'0"E.

Annual average rainfall is around 1200mm and the average temperature is 86F.

### B. Sampling procedure

Multistage sampling procedure was used for this study. A purposive selection of Bida constitute the first stage. The choice of Bida is premised on the forest nature of the LGA as compared to other part of the state. In the second stage, four communities were purposively selected and this include: Gbazhi, Esanta,Iffengi, Pichi. Subsequently, 40 households were randomly selected resulting to 160 farming households as the sample size. The purposive selection of communities means findings should be interpreted as indicative rather than representative of the whole LGA

### C. Method of data collection

This study employed primary data. A well-structured questionnaire was used to elicit relevant data on the socio-economic characteristics of the farming household, economic activities and forest resources being exploited.

### D. Data analysis

The analytical tools and models used in data analysis include descriptive statistics such as frequency and percentage, while, Ordinary least square (OLS) and the Likert scale were employed respectively.

### E. Ordinary least square (OLS)

This is a widely used statistical technique that measures the relationship between a dependent variable and one or more independent variables. This technique was used to examine the effects of forest resources exploitation and other socio-economic characteristics on the income of farming households. The model for this regression analysis is specified in the explicit form as:

$$\ln Y = \beta_o X_o + \beta_1 X_1 + \beta_2 X_2 + \beta_3 X_3 + \beta_4 X_4 + \beta_5 X_5 + \beta_6 X_6 + \beta_7 X_7 + e \quad (1)$$

Were

Y= the natural log of the income from forest products of respondent (naira)

$\beta_o$=intercept

$X_o$= slope

$X_1$ =household size(number)

$X_2$=Farmers level of education (primary=1, secondary=2, tertiary=3, Quranic education=4)

$X_3$=quantity of forest resources exploited(kg)

$X_4$=experience(years)

$X_5$=extension service (yes=1, no=0)

$X_6$=marital status (single=1, married=2, widowed=3, divorced=4)

$X_7$=gender (male=1, female=2)

$e$= error term

TABLE I. AGE DISTRIBUTION OF THE RESPONDENT

| Group | Frequency | Percentage |
|---|---|---|
| 24-31 | 54 | 33.8 |
| 32-39 | 39 | 24.4 |
| 40-47 | 36 | 22.5 |
| 48-55 | 20 | 12.5 |
| 56-63 | 11 | 6.9 |
| Total | 160 | 100.0 |

TABLE II. DISTRIBUTION OF THE RESPONDENTS ACCORDING TO SEX

| Sex | Frequency | Percentage |
|---|---|---|
| Male | 105 | 65.6 |
| Female | 55 | 34.4 |
| Total | 160 | 100.0 |

The dependent variable, income from forest products, was log-transformed (natural logarithm) prior to regression analysis to address skewness in the income distribution and to improve the normality of residuals. This transformation is a standard practice in econometric analysis [12]. There are other variables that economic theory and common sense suggest would strongly influence forest-based income particularly land ownership, market access and distance to the forest itself etc. They were not included because prior decision was made to focus on household-level socioeconomic characteristics as the aim was to explain internal household drivers of forest-based income.

### F. Sampling procedure

A Likert scale is a rating scale used to measure attitudes, opinions, or beliefs. It typically consists of a series of statements or questions, and respondents are asked to indicate their level of agreement or disagreement using a scale, such as:

- Strongly Disagree (1)
- Disagree (2)
- Neutral (3)
- Agree (4)
- Strongly Agree (5)

Likert scale was used to Identify the strategies adopted by farming households to cope with the effects of forest resources exploitation which was analyzed using descriptive statistics.

## III. RESULTS

### A. Socioeconomic Characteristics of the Respondents

Characteristics including age, sex, marital status, educational status, year of schooling, household head, house size, year of exploitation, extension service and income were all examined.

### B. Age of the respondents

Table I shows the age distribution. The results show the majority (33.8%) fall within the 24-31 years and (24.4%) of the respondents age fall within 32-39 years.

### C. Sex of the respondents

Table II shows the distribution based on sex which revealed that majority (65.6%), engaged in forest resources exploitation were male.

TABLE III. DISTRIBUTION OF THE RESPONDENTS ACCORDING TO MARITAL STATUS

| Marital status | Frequency | Percentage |
|---|---|---|
| Single | 41 | 25.6 |
| Married | 102 | 63.8 |
| Widowed | 9 | 5.6 |
| Divorced | 8 | 5.0 |
| Total | 160 | 100.0 |

TABLE IV. DISTRIBUTION OF THE RESPONDENT'S EDUCATIONAL STATUS

| Level of education | Frequency | Percentage |
|---|---|---|
| Primary | 32 | 20.0 |
| Secondary | 52 | 32.5 |
| Tertiary | 36 | 22.5 |
| Quranic | 40 | 25.0 |
| Total | 160 | 100.0 |

TABLE V. DISTRIBUTION OF HOUSEHOLD HEAD

| Response | Frequency | Percentage |
|---|---|---|
| Yes | 85 | 53.1 |
| No | 75 | 46.9 |
| Total | 160 | 100.0 |

TABLE VI. DISTRIBUTION OF RESPONDENT ON YEAR OF EXPLOITATION

| Group | Frequency | Percentage |
|---|---|---|
| 7-14 | 86 | 53.8 |
| 15-22 | 45 | 28.1 |
| 23-30 | 17 | 10.6 |
| >31 | 12 | 7.5 |
| Total | 160 | 100.0 |

### *D. Marital status*

Table III present the marital status of the respondents. The results shows that the majority (63.8%) of forest exploiters are married. This is not really surprising as married people tends to exhibit higher level of forest resource dependence due to their family responsibilities.

### *E. Level of Education*

Table IV Shows that secondary education is the most common (32.5%) amongst the respondent and tertiary education (22.5%). Respondents with secondary and tertiary education are more likely to engage in sustainable exploitation practices or seek alternative livelihoods.

### *F. Household head*

Table V shows that majority (53.1%) of respondents are identified as household heads while (46.9%) were not.

### *G. Year of exploitation*

Table VI indicates that the majority (53.8%) of respondents have been exploiting forest resources for 7–14 years, followed by 28.1% who reported 15–22 years of exploitation. A smaller proportion (10.6%) has engaged in exploitation for 23–30 years, while 7.5% have done so for more than 31 years.

### *H. Monthly household income of the respondent*

Table VII shows that the monthly household income distribution of respondents indicates that the majority fall within low-to-moderate income brackets. Approximately 36.9% of households earn less than ₦100,000, while 39.4% earn between ₦100,001 and ₦180,001. Meanwhile, 16.9% of respondents earn ₦180,002–₦260,002, reflecting households engaged in moderately lucrative activities, such as specialized farming or small-scale enterprises. Only 3.8% and 3.1% of respondents reported earnings of ₦260,003–₦340,003 and above ₦340,004, respectively, indicating a minority engaged in high-value economic activities, potentially linked to large-scale forest resource exploitation or well-established enterprises.

TABLE VII. DISTRIBUTION OF MONTHLY HOUSEHOLD INCOME

| Income(N) | Frequency | Percentage |
|---|---|---|
| <100000 | 59 | 36.9 |
| 100001-180001 | 63 | 39.4 |
| 180002-260002 | 27 | 16.9 |
| 260003-340003 | 6 | 3.8 |
| >3400044 | 5 | 3.1 |
| Total | 160 | 100.0 |

TABLE VIII. DISTRIBUTION OF FOREST RESOURCES EXPLOITED

| Forest Resources | Response | Frequency | Percentage |
|---|---|---|---|
| Mahogany | No | 86 | 53.8 |
| | Yes | 74 | 46.3 |
| Neem | No | 106 | 66.3 |
| | Yes | 54 | 33.8 |
| Baobab Fruit | No | 123 | 76.9 |
| | Yes | 37 | 23.1 |
| Iroko | No | 125 | 78.1 |
| | Yes | 35 | 21.9 |
| Moringa | No | 117 | 73.1 |
| | Yes | 43 | 26.9 |
| Cashew Nuts | No | 94 | 58.8 |
| | Yes | 66 | 41.3 |
| Shea Nuts | No | 84 | 52.5 |
| | Yes | 76 | 47.5 |
| Bush Meat | No | 149 | 93.1 |
| | Yes | 11 | 6.9 |
| Obeche | No | 143 | 89.4 |
| | Yes | 17 | 10.6 |
| Mango | No | 120 | 75.0 |
| | Yes | 40 | 25.0 |

TABLE IX. DISTRIBUTION OF FREQUENCY OF EXPLOITATION

| Frequency | Frequency | Percentage |
|---|---|---|
| Weekly | 30 | 18.8 |
| Monthly | 45 | 28.1 |
| Yearly | 85 | 53.1 |
| Total | 160 | 100.0 |

### *I. Forest resources exploited*

Table VII shows the diverse forest resources among the respondents in the study area where Shea nuts (47.5%) and mahogany (46.3%) while cashew nuts (41.3%) and neem (33.8). Moreover, baobab fruit was recorded to be 23.1%, moringa (26.9%), and mango (25%). In timber species, iroko recorded (21.9%) while obeche (10.6%). Bush meat exploitation (6.9%) was notably low.

### *J. Frequency of exploitation*

Table IX shows the frequency of forest resource exploitation among respondents varies, with the majority (53.1%) as yearly exploitation. However, approximately (28.1%) of respondents are engage in monthly exploitation of forest resources. A smaller group (18.8%) engages in weekly exploitation.

### *K. Quantity of forest resources exploited*

Table X shows the distribution of quantity forest resource exploitation among respondents which reveals notable differences in utilization patterns. A majority (56.3%)

TABLE X. DISTRIBUTION OF QUANTITY OF FOREST RESOURCES EXPLOITED

| Group(kg) | Frequency | Percentage |
|---|---|---|
| < 989 | 90 | 56.3 |
| 990-1889 | 35 | 21.9 |
| 1890-2789 | 20 | 12.5 |
| 2790-3689 | 15 | 9.4 |
| Total | 160 | 100.0 |

TABLE XI. DISTRIBUTION OF RESPONDENTS BY METHOD OF FOREST RESOURCE EXPLOITATION

| Method | Response | Frequency | Percentage |
|---|---|---|---|
| Sustainable Harvesting | No | 111 | 69.4 |
| | Yes | 49 | 30.6 |
| Selective Logging | No | 100 | 62.5 |
| | Yes | 60 | 37.5 |
| Clear-Cutting | No | 109 | 68.1 |
| | Yes | 51 | 31.9 |
| Hunting | No | 151 | 94.4 |
| | Yes | 9 | 5.6 |

TABLE XII. CHANGES IN THE FOREST RESOURCES AVAILABILITY

| Changes | Frequency | Percentage |
|---|---|---|
| Increase | 84 | 52.5 |
| Decrease | 39 | 24.4 |
| No change | 37 | 23.1 |
| Total | 160 | 100.0 |

exploited 90–989 kg. A smaller percentage engaged in higher extraction levels, with 12.5% exploiting 1890–2789 kg and 9.4% exceeding 2790 kg.

*L. Method of exploitation*

Table XI shows diverse methods of forest resource exploitation, highlighting varying degrees of environmental sustainability. A significant majority (69.4%) of respondents did not practice sustainable harvesting, while 30.6% reported its use. Selective logging, recorded 37.5%. Conversely, clear-cutting, reported by 31.9%. Hunting was the least utilized method, with only 5.6% of respondents engaging in it.

*M. Changes in the forest resources availability*

Table XII shows the result of changes in the forest resources availability where slightly majority (52.5%) of respondents reported an increase in forest resources, while 24.4% observed a decrease, and 23.1% stated no significant change.

*N. Primary and other economic activities*

The table XIII shows the primary and other economic activities engaged in by forest exploiters, highlighting a diversification of livelihood strategies. Among primary economic activities, non-farm enterprises were the most prominent, involving 48.8% of respondents. Mixed crop and livestock farming followed at 20.6%, with crop farming (16.9%) and livestock rearing (13.8%) representing smaller proportions. In terms of other economic activities, small-scale enterprises were the most common (48.1%), followed by wage labor (31.3%) and forest-based enterprises (20.6%).

*O. Ordinary least square analysis on effect of forest resources and other socioeconomic characteristics on income*

Table XIV shows the regression analysis results which indicate the relationship between selected independent

TABLE XIII. PRIMARY AND OTHER ECONOMIC ACTIVITIES

| Economic activities | Frequency | Percentage |
|---|---|---|
| Crop farming | 27 | 16.9 |
| Livestock | 22 | 13.8 |
| Mixed (crop & livestock) | 33 | 20.6 |
| Non-farm enterprise | 78 | 48.8 |
| Total | 160 | 100.0 |
| **Other Economic Activities** | | |
| **Others** | **Frequency** | **Percentage** |
| wage labor | 50 | 31.3 |
| Small scale aggregator | 77 | 48.1 |
| Forest based enterprise | 33 | 20.6 |
| Total | 160 | 100.0 |

TABLE XIV. ORDINARY LEAST SQUARE ANALYSIS ON EFFECT OF FOREST RESOURCES AND OTHER SOCIOECONOMIC CHARACTERISTICS ON INCOME

| Variables | Coefficient | Std. error | p-value |
|---|---|---|---|
| Constant | 11.014 | 0.144 | 0.000*** |
| Age | 0.004 | 0.006 | 0.549 |
| Gender | -0.240 | 0.071 | 0.001*** |
| Marital status | 0.137 | 0.058 | 0.020*** |
| Household size | 0.004 | 0.014 | 0.766 |
| Educational status | -0.091 | 0.029 | 0.002*** |
| Experience | 0.002 | 0.008 | 0.786 |
| Extension | -0.006 | 0.056 | 0.911 |
| Quantity of forest resources exploited (per 1000 kg) | 0.010 | 0.003 | 0.001*** |
| **Summary Statistics** | | | |
| Number of obs (n) | 160 | | |
| $R^2$ | 0.512 | | |
| F-statistic | 8.57 | | |
| Overall p-value | < 0.001 | | |

Notes:

*** $p \leq 0.01$; ** $p \leq 0.05$; * $p \leq 0.10$

variables and income from forest-based activities.

The model explained 51% of the variance in forest-based income ($R^2 = 0.512$), and was statistically significant overall ($F = 8.7$, $p < 0.001$). The regression analysis highlights key predictors influencing income from forest-based activities, revealing both significant and non-significant relationships. Gender emerged as a critical factor, with a coefficient of -0.240, indicating that male respondents tend to have higher incomes compared to their female counterparts. Additionally, marital status positively influences income, as indicated by a coefficient of 0.137 ($p = 0.020$). Conversely, the analysis revealed an unexpected negative relationship between education level and income ($B = -0.091$, $p = 0.002$). The quantity of forest resources exploited showed a coefficient of 0.010 per 1,000 kg, which is statistically significant and indicates a positive relationship with income generation. While the direct linear relationship is not evident, it suggests that other factors, such as market access and local governance, may mediate this relationship. Furthermore, the coefficients for age (0.004, $p = 0.549$), household size (0.004, $p = 0.766$), experience (0.002, $p = 0.786$), and extension services (-0.006, $p = 0.911$) were not statistically significant, indicating that these variables may have less direct influence on income in this context.

The dependent variable is log-transformed. As such, each coefficient represents the approximate proportional change in income associated with a one-unit increase in the corresponding explanatory 0variable, holding all other variables constant.

TABLE XV. LIKERT SCORES OF STRATEGIES ADOPTED BY THE RESPONDENTS TO COPE WITH THE EFFECT OF FOREST RESOURCES EXPLOITATION

| S/N | Strategy | Mean | SD | Rank |
|---|---|---|---|---|
| 1 | Diversification of income sources | 4.4 | 1.03 | 4 |
| 2 | Substitution strategy | 4 | 1.16 | 4 |
| 3 | Sustainable forest management | 3.92 | 1.07 | 4 |
| 4 | Conservation and resource management | 3.75 | 1.04 | 4 |
| 5 | Crop diversification strategy | 3.25 | 1.18 | 3 |
| 6 | Cooperative and collective action | 3.05 | 1.54 | 3 |

Quantity of forest resources exploited is expressed per 1,000 kg to give a numerically meaningful coefficient. A coefficient of 0.010 implies that each additional 1,000 kg exploited is associated with approximately a 1.0% increase in income from forest products, ceteris paribus.

### *P. Strategies adopted by the respondents to cope with the effect of forest resources exploitation*

Table XV shows the mean Likert scores, standard deviations, and rankings of the six coping strategies analyzed in this study. To determine whether each strategy was ”adopted” by respondents, a decision threshold of 3.50 was chosen. This threshold represents the midpoint between the ”Neutral” category (score = 3) and the ”Agree” category (score = 4) on the five-point scale. When calculated as (3 + 4) ÷ 2 = 3.50. Therefore, a mean score at this midpoint or above it indicates that the responses leaned toward agreement rather than neutrality i.e. the average respondent either agreed or strongly agreed with the strategy and as such, it is classified as adopted. A mean score below 3.50 indicates that the central tendency of responses does not reach the agreement threshold, and the strategy is classified as not adopted. This methodology has been employed in previous studies using five-point Likert scales such as [13]. Four of the six strategies were classified as adopted, whilst two, crop diversification strategy ($\bar{x}$ = 3.25) and cooperative and collective action ($\bar{x}$ = 3.05), below the 3.50 threshold were not adopted.

Scale: 1 = Strongly Disagree, 2 = Disagree, 3 = Neutral, 4 = Agree, 5 = Strongly Agree.

Decision based on mean score: ≥ 3.5 = Adopted strategy; < 3.5 = Not adopted.

## IV. DISCUSSION

The socioeconomic characteristics of the respondents suggest that younger individuals are more actively engaged in forest resource exploitation, which may be due to their higher physical capacity for labor-intensive activities. This is consistent with findings of Mushi et al. [14] and Chikuta et al. [15] who reported that forest-related activities are often dominated by the younger segment of the population due to the physical demands associated with resource extraction. The lower participation of older age groups may reflect their reduced physical strength or a shift toward less labor-intensive income-generating activities. According to Mahmoudi et al. [16], older individuals tend to transition to supervisory or advisory roles within household livelihoods, relying on younger family members for forest-based tasks. Furthermore, the dominance of younger exploiters could signal a lack of alternative employment opportunities, prompting youths to rely heavily on forest resources for subsistence and income, as noted by Andrews and Mulder [17]. However, males mostly dominate this sector and this can be attributed to various socio-cultural factors that often restrict women from accessing forest resources and exclusion from decision-making processes [18]. The higher percentage of married and single individuals resorting to forest resources as a means of livelihood may be attributed to needs for personal income generation and also lack of land ownership or not having alternatives for income generation [19, 20]. The level of education also determines the dependency on forest resources as the findings suggest that higher level of education reduced dependency on forest resources and as such its exploitation. One of the reasons would be because more educated individuals have access to better-paying formal and semi-formal employment opportunities such as in civil service, teaching, and skilled trade, as a result, they redirect productive time away from forest extraction, in so doing, their forest income is reduced even if overall household income is higher [21, 27]. Additionally, according to Tufail et al. [22] “the education of adults not only improves agricultural production techniques but also provides an understanding of forest existence for environmental sustainability”. Similarly, Bardsley et al. [23] reports that higher education is linked to more awareness regarding sustainable forest management. With such increased awareness, extraction of forest resources would be reduced. However, higher percentage of the respondents (53%) indicated to be the head of their household. This is important as the decision of the forest resources allocation depends on them therefore; they are integral in sustaining forest resources [24]. Most respondents (53.8%) had exploited forest resources for 7–14 years indicating that forest exploitation is a long-standing practice in the study area, with a significant proportion of the population relying on forest resources for over a decade. Wale et al. [25] reported that forest dependence often persists across generations due to limited alternative livelihood options and the accessibility of forest resources, therefore households with fewer alternative income opportunities tend to rely more on forest products for their livelihoods.

Monthly household income was concentrated in the lower brackets with 36.9% earning below ₦100,000 and 39.4% earning ₦100,001–₦180,001. This concentration in lower income categories suggests a dependence on subsistence-level activities and small-scale economic ventures, consistent with findings by Lubega et al. [26] and Zhang et al. [34] who observed similar patterns among forest-dependent households in rural areas. These findings align with Oldekop et al. [27], who noted that income levels in forest-dependent communities are often shaped by access to markets, diversification of livelihood activities, and regulatory constraints.

With regards to extent of forest resource exploitation, shea nuts (47.5%) and mahogany (46.3%) emerged as

the most exploited resources, which shows their economic significance and aligns with findings of Akureje and Oluwatosin [28]. Cashew nuts (41.3%) and neem (33.8%) also play important roles, the former supporting rural incomes and the latter valued for its medicinal and agricultural benefits. Resources like baobab fruit, moringa, and mango reflect their contributions to nutrition, medicine, and food security, consistent with studies by Salami et al. [29]. Timber species such as iroko and obeche highlight the demand for durable wood, though their exploitation raises conservation [30, 31]. Bush meat exploitation was notably low (6.9%), aligning with trends of reduced wildlife harvesting due to conservation measures. These findings collectively emphasize the importance of sustainable management to balance economic benefits with ecological conservation. The frequency of forest resource exploitation among respondents was varied but was predominately, yearly (53.1%), monthly (28.1%) and weekly (18.8%). This shows that forest exploitation is dependent on the intents as some occur yearly monthly and weekly [33, 32]. However, majority (56.3%) exploited between 90–989 kg, indicating subsistence-level reliance on forest resources, which is consistent with the findings of Wale et al. [25] and Zhang et al. [34] who observed low-intensity or household scale harvesting for basic and domestic needs, rather than large scale exploitation. Moderate-scale exploitation (990–1889 kg) reported by respondents is likely linked to small-scale commercial activities that provide supplemental income in rural communities, as forest resources account for substantial household earning [21].

In terms of method of exploitation, majority (69.4%) failed to practice sustainable harvesting, while clear-cutting was reported by 31.9% and selective logging by 37.5%; hunting was least common (5.6%). A notable inconsistency in the findings requires explicit attention. The results reports that 52.5% of respondents perceived an increase in forest resource availability, yet 69.4% do not practice sustainable harvesting, and clear-cutting was reported by 31.9% of respondents. Several explanations may account for this discrepancy Firstly, the perceived increase in forest resources despite unsustainable practices like clear-cutting, and persistent exploitation that has been going on for many years could be attributed to response bias. Respondents may have provided socially desirable responses by reporting that forest resources are increasing to match the interviewer's expectations most likely because forest conservation attitudes are generally viewed positively, as a result, they fell victims of response bias [35]. Additionally, the perspective of the respondents about environmental change may not always be in sync with objective ecological changes because their interpretations would stem from recent experiences and observable short-term changes rather than long-term trends [36].

Furthermore, conservation and reforestation efforts, natural regrowth, or a decline in the intensity of exploitation due to enforcement of conservation laws could account for the disparity. For instance, areas with active community-based forest management programs often experience resource replenishment due to sustainable practices and tree planting initiatives [37].

The results on economic activities of household's dependent on forest resources showed that, amongst primary economic activities, non-farm enterprises (48.8%) were the most prominent followed by mixed crop and livestock farming (20.6%), crop farming (16.9%), and livestock rearing (13.8%) representing smaller proportions. The prominence of non-farm enterprises as a primary activity is also consistent with evidence that off/non-farm activities improve productivity and income outcomes in rural farming communities [38]. In terms of other economic activities, small-scale enterprises were the most common (48.1%), followed by wage labor (31.3%) and forest-based enterprises (20.6%). These results are consistent with studies by [17, 25], which underscore the significance of small-scale businesses and wage labor as adaptive strategies for rural households.

The OLS regression ($R^2 = 0.512$; $F = 8.57$, $p < 0.001$) identified gender, marital status, level of education and quantity of forest resources exploited as the significant variables.

Gender was significant ($p= 0.001$), with a negative coefficient ($\beta= -0.240$), indicating that females respondents earned lower than their male counterparts from forest exploitation activities also reflecting the same male dominance as seen in the socioeconomic characteristics of the respondents. This dominance can be attributed to various socio-cultural factors that often restrict women from accessing forest resources and exclusion from decision-making processes [18].

Marital status was positively associated with income ($\beta = 0.137$, $p = 0.020$) suggesting that marital status is strongly correlated with increased income from forest extracting activities. It is mostly likely a numbers game as couples in addition to their children have more numbers, can extract more resources from the forest and generate more income through it compared to single individuals [19, 20].

Educational status had a negative and significant coefficient ($\beta = -0.091$, $p = 0.002$) indicating that higher levels of education was associated with reduced forest exploitation and by effect, reduced forest-based income. More educated respondents tend to redirect time toward formal or semi-formal employment, combined with the fact that, their overall awareness of sustainable practices may be higher, thus reducing the income they derive specifically from forest exploitation, [21, 27, 23]. The quantity of forest resources exploited was also positive and significant ($\beta = 0.010$ per 1,000 kg, $p = 0.001$), which means that for each additional 1,000 kg exploited, roughly a 1.0% increase in forest-based income was realized. This positive relationship is expected because forest resources have proven to be a substantial contributor to household income, particularly in areas where they are being exploited [21].

Different strategies employed by the respondents to cope with the effect of forest resources showed that income diversification, sustainable forest management, substituting forest product were strongly agreed upon. Income diversification recorded the highest mean score of 4.40, indicting a preference for alternate income sources as a strategy. Wale et al. [25] established that the number of income sources a household has, is a significant determinant of

their dependence on forest products. Mawa et al. [39], found income diversification as one of the main adaptive strategies employed to cushion the effects of forest exploitation. These findings indicate that income diversification would likely have a negative relationship with dependence on forest exploitation. Regardless, an opposing perspective was made by Nyamayevu et al. [40], who cautioned misinterpretation of income diversification with financial progress. According to them, poorer households, who are typically forest exploiters, diversify across multiple low return activities without meaningful improvements in their income and livelihood.

Substitution strategy was the second most adopted approach with a mean score of 4.00. this strategy typically involves the replacement of forest exploitation with other alternatives such as farming, market substitutes of forest products etc. this strategy is more conservative approach on forest exploitation as households realize the need to reduce the pressure, they inflict on the forest ecosystem without sacrificing their livelihood. Boyapati and Muthukumarappan [41], in a review of NTFP (non-timber forest products) literature from 2015 to 2025 across Sub-Saharan Africa, South Asia, and Latin America, observed that NTFPs can usually serve as substitutes for expenditures on food, medicine, fuel, and building materials. An argument was made by Olumba et al. [42], they found that even when farmers expressed awareness and showed intent to substitute forest products for other alternates, they are constrained by a number of factors such as inadequate market access, risk aversion to farming, lack of support etc.

Sustainable forest management with a mean score of 3.92 and conservation and resource management with a mean score of 3.75 came third and fourth respectively. This signifies that majority of the respondents are interested in maintaining long term forest productivity and they recognize the importance of sustainable forest management. Baddianaah and Baaweh [43], found that communities tend to be receptive to sustainable natural resource management programs from NGOs or governments especially if creatin benefits like infrastructural development, training and institutional support are made available. On another note, Yami and Mekuria [44] reported that without the attached benefits, willingness to engage in conservative activities may be impaired.

Crop diversification recorded a mean score of 3.25, it is therefore classified as not adopted because it fell below the adoption threshold of 3.5. This result is consistent with the findings of Olumba et al. [42] who identified a number of barriers to adoption of sustainable practices such as limited access to inputs and credit, fear of crop failure rising from land fragmentation, soil quality and poor extension services. Therefore, the respondents may recognize crop diversification as an option but do not find the conditions for its adoption, adequate.

Cooperative and collective action recorded the lowest mean score of 3.25, falling below the adoption threshold of 3.5 and thus it is classified as non-adopted. The lack of cooperation could be as a result of poor community governance hierarchy and support as identified by Yami and Mekuria [44] and Baddianaah and Baaweh [43].

## CONCLUSION

Forest resources remain a cornerstone of rural livelihoods in farming households in the studied communities of Bida LGA, contributing significantly to household income but also facing ecological threats due to unsustainable practices. The study revealed that with respect to socio economic characteristics, the respondents were mostly male (65%), married (63.8%) and between the age of 24 to 31 years (33.8%), whilst secondary education was the most common and majority of the respondents have been exploiting forest resources for the past 7-14 years, with monthly income earned below ₦180,001, categorizing them into low to medium income range.

The most exploited forest resources were identified to be shea nuts, mahogany and cashew nuts, the quantities extracted were generally below 989kg and yearly exploitation was the dominant pattern. The primary economic activity were non-farm activities whilst small scale enterprises and wages earned from labor constituted their supplementary income sources.

The OLS regression using a log transformed income as dependent variable revealed that gender, marital status, level of educational and quantity of forest resources exploited were significant in explaining forest-based income.

Amongst the coping mechanisms, income diversification had the highest mean score, indicating it was the most adopted, followed by substitution of forest products and sustainable forest management.

Different strategies employed by the respondents to cope with the effect of forest resources showed that income diversification, sustainable forest management, substituting forest product were strongly agreed upon with mean scores of 4.40, 4.00 and 3.93 respectively. While crop diversification and cooperative and collective action were not adopted as their mean score fell below the 3.5 mean threshold.

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