

SOCIOECONOMICS OF GENDER PARTICIPATION AND INSTITUTIONAL CONSTRAINTS TO NON-TIMBER FOREST PRODUCT COMMERCIALIZATION AMONG FOREST-DEPENDENT HOUSEHOLDS IN AKURE FOREST RESERVE, NIGERIA

Adebayo Samson Adeoye^{1*}, Oluwole Olalekan Oke²

¹ Department of Agricultural Extension and Management, Federal College of Forestry, Ibadan, Forestry Research Institute of Nigeria, PMB 5087, Jericho Hill, Ibadan, 200272, Nigeria

ORCID iD: <https://orcid.org/0000-0003-0909-5168>

² Department of Agricultural Extension and Management, Federal College of Forestry, Ibadan, Forestry Research Institute of Nigeria, PMB 5087, Jericho Hill, Ibadan, 200272, Nigeria.

ORCID iD: <https://orcid.org/0000-0003-3376-7702>

*Corresponding author: saadeoye06@gmail.com , adeoye.adebayo@fcfibadan.edu.ng

Received July 7, 2026	Revised September 9, 2026	Accepted September 24, 2026	Published September 30, 2026
DOI: https://doi.org/10.35219/jards.2026.3.09	Article type Research Article	Pages 130-144	

Abstract

Non-timber forest products (NTFP) are important for the livelihood and food and health security of forest-dependent households in Nigeria. Despite their importance, very little is known about the revenue generated from NTFP sales by different genders, especially in NTFP-rich regions. This study examined the socioeconomics of gender participation among NTFP collectors and the key constraints that impact the collection and commercialization of NTFP in the Akure Forest Reserve. Using purposive sampling, 98 participants were sampled. Data were analyzed using descriptive statistics and mean score ranking. Findings showed that NTFP collectors and traders were predominantly married, economically active, had low to moderate education, and had moderate household sizes. Gender differences were observed in complementary livelihoods. Men engaged in farming (the primary livelihood), while women were more engaged in trading. Most participants earned between ₦50,000 and ₦100,000 from NTFP sales, indicating the livelihood value of the sector. The poor quality of roads and lack of adequate storage facilities, coupled with forest guards, and impacts from climate change were noted as key constraints to NTFP commercialization. The findings indicate the potential value of NTFP to rural livelihoods, and gender and institutional constraints for the improvement of rural livelihoods, market infrastructure, and forest management. Socioeconomics of gender of NTFP collectors impacted income generation from NTFP sales and were linked to the attainment of SDG 2, 8, and 15.

Keywords: NTFP, Gender differences; Socioeconomic factors; Rural livelihoods; Income generation; Forest-dependent communities.

JEL classification: Q13, Q23

1. Introduction

In Nigeria, especially in some rural areas adjacent to forest reserves, non-timber forest products (NTFP) are important to household livelihood strategies. Women rely on NTFP for income, food, and health services. Rural women in such areas are said to have adequate skills and knowledge enhanced by food and health services associated with NTFP. Knowledge acquired from NTFP is said to enable them use resources to create economic opportunities for households and communities and to start enterprises (Jimoh et al., 2013). NTFP diminish income and livelihood risks in forest communities.

Among the many available poverty reduction strategies, NTFP are a good source of livelihood opportunities. Approximately 1.6 billion people use NTFP and over 80% of the population in developing countries rely on NTFP for food and medicine (Bwalya, 2011).

NTFP also provide food, income and medicine for a larger part of rural populations in Asia and Africa. Approximately 300 million people who inhabit tropical forests rely on NTFP for income (Endamana et al., 2016; Ojea et al., 2016).

Thus, non-timber forest products help to improve the socio-economic conditions of forest communities. Even though Sheil and Wunder (2002) argue that interest in NTFPs and sustainable rural development has increased globally, the lack of reliable and gender-disaggregated data continues to hinder developing countries, particularly Nigeria, in assessing the economic contribution of NTFPs. The national data systems in Nigeria are inadequate, especially in gender-related studies, and not much research has been done to assess the contribution of NTFPs to household income in the communities surrounding the Akure Forest Reserve.

There has been some work done to assess the economic value of NTFPs, however, there are no studies that have explored the gender aspects of the participation, profitability, and trade of NTFPs (Chidebere-Mark et al., 2016; Suleiman et al., 2017; Ominimini, 2017). To fill the existing research gap, the study examines the gender differentiated socioeconomic factors that influence income from the trade of NTFPs and the challenges that male and female NTFP harvesters experience in communities surrounding the Akure Forest Reserve.

This study has the following two objectives: (i) to gain an understanding of socioeconomics of male and female genders in NTFP collections, and (ii) to identify the primary constraints that male and female NTFP collectors experience in commercialization of NTFPs.

Operational definition of the Dependent variable

Non-Timber Forest Products (NTFP) sales revenue refers to households' monetary earnings from selling harvested, processed, or traded NTFPs in or around the Akure Forest Reserve in a specified reference period, in the study area. Forest products in this context exclude timber.

NTFPs include processed/unprocessed fuelwood, mushrooms, medicinal plants, honey, snails, fruits, nuts, leaves, bamboo, rattan, among others. The revenue is collected monthly, and at the household level is expressed in a continuous category.

2. Literature Review and Theoretical Framework

2.1. Conceptual Clarification of Non-Timber Forest Products

Non-timber forest products (NTFPs) are any biological resources that come from forests, as well as other lands outside of industrial timber, and include many different types of animal and plant forest products. Some of these products can be fruits, nuts, seeds, leaves, and even bark and resins.

They can be honey, bushmeat, and even fungi or medicinal plants. NTFPs have many roles when it comes to rural systems and daily life. They can help to provide food and can be used to sell and help with household income. Also, they can provide a rural community with medical treatment and even help provide material for cultural practices as well as cultural sustenance. NTFPs are a very multifunctional resource.

2.2. Global Perspective on Non-Timber Forest Products

On a global scale, recognition of Non-Timber Forest Products (NTFP) as part of sustainable forest management and conservation of biodiversity is of great importance (Shackleton & Pandey, 2014). Since NTFPs bring economic benefits without the need to clear a forest, they create a better incentive for the conservation of forest NTFPs rather than land-destructive NTFP practices. NTFP is a livelihood for at least 1.3 billion people, and the global trade is estimated to be over USD 88 billion annually (Food and Agriculture Organization of the United Nations [FAO], n.d.). Trade consists of traditional food and medicine, and modern trade items are essential oils and high-value forest items. NTFP is a vital item of subsistence economy trade in Africa and Asia and is important for the income of rural households and women, and for the marginalized (Bharucha & Pretty, 2010). For and the socio-economic stratification, NTFP are classified for the purpose of analysis by their life form (plant or animal), their use (food, medicine, culture), or their market orientation (subsistence, commercial). NTFPs have noticeable potential to fortify rural economy, mitigate poverty and provide climate change resilience and restoration.

2.3. Nigeria Perspective on Non-Timber Forest Products

Non-Timber Forest Products (NTFPs) offer residents of Southwest Nigeria and those in neighbouring communities of the Akure Forest Reserve (AFR) with significant supplemental income during the idle seasons of agriculture.

Kola, bitter kola (*Garcinia kola*), bush mango (*Irvingia gabonensis*), snails, honey, and medicinal plants and chewing sticks are examples of NTFPs found in the AFR (Olawuyi & Odeyale, 2019). These NTFPs are harvested and traded in the adjacent rural and urban centers and are a source of income generating activities for women. Research conducted in the forested areas of Nigeria has revealed that the trade of NTFPs is conducted through informal and localized systems, with scant connection to formal value chains (Meinhold et al., 2022). Women's participation in the informal-segmented system of service and production is critical for the export potential of shea butter, medicinal plants, and gums, among other products (Elnasikh & Khalil, 2018).

Nigeria's production, marketing, and trade of NTFPs is more likely to be informal and segmented due to the decaying trade-related infrastructures, scarcity of funds, poor trade information networks, and overexploitation of resources (Okpalaoka, 2021).

Gender is the principal organizing factor in NTFP systems, both at the local and international levels. Women dominate local food and craft harvesting and trading. Women are absent in more lucrative harvest segments such as trade and export of processed goods. This is due to structural inequalities in asset ownership, education, and decision-making (Adelesi, 2024; Bharucha & Pretty, 2010). This data requires gender-focused NTFP marketing in Nigeria, particularly in relation to marketing and integrated rural development.

3. Materials and Methods

3.1. Study design and context

This study was designed as a cross-sectional survey to evaluate how rural residents of the Akure Forest Reserve (AFR) depend on Non-timber Forest Products (NTFPs) for their livelihoods. It is located at Akure South Local Government Area (LGA) in the rainforest of southwestern Nigeria.

The reserve is located at longitudes of 5°09'11"-5°11'39"E and latitudes of 7°16'40"-7°18'38"N (Figure 1). AFR was established in 1936 and covers an area of 66 km². Osun State is located to the northeast of the reserve, and the neighbouring local governments include Oke-Igbo, Ifedore, Akure South, Ile-Oluji, Idanre, Ondo East, and Ondo West.

One of the natural borders is a river which makes the reserve ecologically and hydrologically important.

The community has a humid tropical climate, with an average daily temperature between 21°C and 29°C, and average daily humidity between 80 and 85%, ideal conditions for a thriving forest and an abundance of NTFPs. Forest biodiversity along with NTFPs is diverse. NTFPs offer nuts, berries, mushrooms, seeds, fruits, vegetables, medicinal plants, resins and essential oils. They are food and income sources.

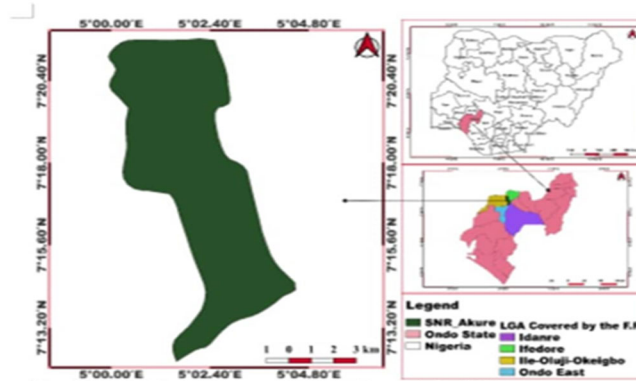


Figure 1. Map of the Study Area

Source: Akande (2020)

3.2. Data, variables, and sampling

Data were obtained from rural households around the Akure Forest Reserve using a structured questionnaire. The questionnaire focused on the rural households' socio-economic status and their reliance on Non-Timber Forest Products (NTFPs), their livelihood activities, and other factors that the study was interested in.

The rural residents engaged in the collection and utilization of forest based Non-Timber Forest Products (NTFPs) constituted the target population. A four-stage purposive sampling technique was used to derive the study sample. At the first stage, the communities that were relevant to the study and were proximal to the Forest Reserve were identified. At the second stage, the researcher selected the following four communities; Ipogun, Kajola/Aponmu, Ago Petesi, and Akika Camp, as they had the highest collection of NTFPs as a livelihood activity.

At the third stage, the sample frame was achieved by obtaining the population figures of the selected communities. Finally, to achieve sample population equity, and to reduce allocation bias, 10% of the communities' households were selected. 125 was the target sample size for the study and the number of respondents used to analyses the study.

Table 1. Population and Sample Size from the Selected Communities.

<i>Community</i>	Population	Proportionate sample size @10%
<i>Ipogun</i>	500	50
<i>Kajola/Aponmu</i>	200	20
<i>Ago petesi</i>	300	30
<i>Akika camp</i>	250	25
<i>Total</i>	1250	125

Note: Proportional allocation (10%) was selected to maintain representativeness across community sizes while meeting practical constraints on field resources. Also, 125 questionnaires were administered to respondents, but only 98 were retrieved from respondents around the reserve.

Source: Field survey (2025)

3.3. Analytical methods

3.4. Data Collection

Primary data were collected from household heads using a structured questionnaire complemented by face-to-face interviews to measure the accuracy of responses and to clarify some of the questions.

The questionnaire consisted of respondents' socio-economic characteristics, living activities, and challenges faced when collecting non-timber forest products (NTFP) in the communities adjacent to the Akure Forest Reserve. The questionnaire was reviewed for clarity and consistency. A community that was socio-economically like the target communities but was not included in the sampling frame served as a site for the pre-test. The suggestions from the pre-test were incorporated into the questionnaire and the other survey materials, prior to the main survey.

3.5. Analytical Procedures

IBM SPSS Statistics (Version 20.0) was the software of choice for coding, cleaning, and analysing the data. Respondents' socio-economic data and the key constraints to collecting NTFPs were summarized using descriptive statistics of frequencies, percentages, and means and ranked.

A three-point ordinal rating scale was used to assess the constraints with the following ratings: "Major constraint" (2); "Minor constraint" (1); and "Not a constraint" (0). The mean score (MS) was calculated for each constraint as follows:

The mean score (MS) for each constraint was calculated as the weighted sum of the response frequencies divided by the total number of respondents, as follows:

$$MS = \frac{2M_a + M_i + 0M_n}{N}$$

where M_a , M_i , and M_n represent the frequencies of respondents assigning scores of 2, 1, and 0, respectively, and N is the total number of respondents.

Where:

MS = Mean Score

M_a = Number of respondents who strongly/adequately identified the constraint as applicable (score = 2)

M_i = Number of respondents who identified the constraint as moderately applicable (score = 1)

$0(M_n)$ = Number of respondents for whom the constraint was not applicable (score = 0)

N = Total number of respondents.

The response weights' decision threshold was set at the average of the response weights:

$$\text{Decision Threshold} = \frac{2 + 1 + 0}{3} = 1.00$$

Thus, mean scores ≥ 1.00 may be interpreted as indicating the presence of major constraint, while mean scores < 1.00 indicate a minor constraint. Constraints with a $MS \geq 1.00$ were considered as high-severity (major) constraints. Constraints with a $MS < 1.00$ were considered as low-severity (minor) constraints. All constraints were then ranked in a descending order based on their mean rank, scores, and those with higher mean scores were considered to reflect the higher perceived severity. This was a descriptive study, so no inferential models were run, and significance levels with p values were not applicable.

3.6. Variable Definition and Measurement

Socio-economic theories of respondents were assessed as follows. Age (X_1) was assessed in years and in ranges. Gender (X_2) was coded as a nominal variable (male = 1, female = 2).

Marital status (X_3) was coded as married = 1, single = 2, and others. Educational attainment (X_4) was assessed as ordinal variable from adult education and higher educational qualifications.

Household size (X_5) was the count of persons within the household and grouped in household-size categories. Secondary occupation (X_6) was a nominal variable (e.g., farming, trading, artisan, and others).

Years of residence (X_7) was the count of years respondents had resided in the community and was classified in ordered groups. Access to extension services (X_8) was a binary variable (yes = 1, no = 0).

Income from the secondary occupation (X_9) was measured in Nigerian Naira (₦) and grouped in income classifications.

Access to credit (X_{10}) was the actual amount of credit received (₦).

Religion (X_{11}) was a nominal variable (e.g., Christianity, Islam, and others).

Response variable was the perceived severity of constraints to NTFP collection and was assessed in the three-point ordinal scale, and the scores were summarized in a weighted mean score.

3.7. Data Validation and Robustness

We examined finished questionnaires in the field for completeness and for internal consistency. During this time, the data was coded. To check for missing values and coding errors, records were verified against completed questionnaires using frequency distributions. I entered the data again to reduce transcription errors. A weighted mean score was assigned to the constraints to allow the respondents' constraints to be ranked and compared across participants.

3.8. Ethical Consideration

The study observed the ethical principles of the Federal College of Forestry, Ibadan's, Department of Agricultural Extension and Rural Development. The researchers sought the appropriate forest management and community leaders' permissions for the data collection. Participation in the study was voluntary. The study's nature and purpose were explained to obtain the respondents' informed consent. The respondents' identities were protected, and the respondents could withdraw their participation with no potential repercussions. The respondents' data, in the study, was stored securely, and the data was presented in the aggregate. The study was designed to be respectful and considerate of the target participants' genders.

4. Results

Socioeconomic Characteristics of Respondents

Table 2 describes the socioeconomic characteristics of residents in the forest-fringe communities of southwest Nigeria near the Akure Forest Reserve. Socioeconomic characteristics in the population of residents in terms of age and in terms of gender are summarized in the Table.1

The age group of 31–40 years is the most populous for both males (45.3%) and females (48.9%), and there is little variation in the economic structure of the community based on the gender of the population as they community members as they are both within the economically active age group.

Additionally, consistent with the trend on age, marital status also shows little variation. The group with the most males and females in the community was married (66.0% males, 64.4% females), and this shows that there are similar trends on formation of household units based on the gender of the population.

There is some age-related variation in educational level that is also gender related as males are more educated than females. The males mostly had secondary education (41.5%) and most of the females (44.4%) had primary education. Educational level also has an impact on one's socioeconomic status, as males having secondary education may impact their socioeconomic status positively.

There is little variation in household size as most males (51.0%) and females (53.3%) had household sizes of 4-6 members. Findings related to males' and females' monthly income had little variation, but most people had low incomes.

There was also variation in secondary occupation, but the variation was minimal as the most reported secondary occupation for both males and females was trade. However, a disparity was noted, and there was greater participation of females (80.0%) in trade compared to males (51.0%).

Finally, regarding income from secondary occupation, similarities were observed.

For secondary income, 60.4% of males and 53.3% of females fall into the category of earning less than ₦50,000. Like men, secondary income sources show limited contributions to aggregate earnings of women.

Table 2. Socioeconomic Characteristics of Respondents

Socioeconomic characteristics	Male (n=53)	%	Female (n=45)	%
Age				
20-30	10	18.9	8	17.8
31-40	24	45.3	22	48.9
41-50	16	30.1	9	20.0
>50	3	5.7	6	13.3
Marital Status				
Single	13	24.5	8	17.8
Married	35	66.0	29	64.4
Divorced	4	7.5	6	13.3
Widow	1	2.0	2	4.5
Religion				
Christianity	29	54.7	33	73.3
Islam	21	39.6	12	26.7
Traditional	3	5.7	-	-
Education				
No formal	14	26.4	11	24.4
Primary	15	28.3	20	44.4
Secondary	22	41.5	14	31.2
Tertiary	2	3.7	-	-

Household size				
<3	8	15.1	12	26.7
4-6	27	51.0	24	53.3
7-9	18	33.9	9	20.0
Monthly income				
<50000	4	7.5	1	2.3
50000-100000	40	75.5	37	82.2
101000-150000	5	9.4	5	11.1
151000-200000	3	5.6	2	4.4
>200000	1	2.0	-	-
Years of residency				
<5	3	5.7	5	11.1
5-10	16	30.2	19	42.2
11-15	21	39.6	17	37.8
16-20	11	20.8	4	8.9
>20	2	3.7	-	-
Access to credit				
Yes	38	71.7	34	75.6
No	15	28.3	11	24.4
Access to extension services				
Yes	39	73.6	31	68.9
No	14	26.4	14	31.1
Secondary occupation				
Trader	27	51.0	36	80.0
Civil servant	14	26.4	2	4.4
Artisan	12	22.6	7	15.6
Income from secondary occupation				
<50000	32	60.4	24	53.3
50000-100000	20	37.7	18	40.0

101000-150000	1	1.9	2	4.4
151000-200000	-	-	1	2.3
>200000				

Source: Field survey, 2025

Poor road ranking poor road networks was the top constraint for sales for both male and female NTFP sales collectors (mean = 1.6) as shown in Table 3.

Table 3. Constraints Encountered by Both Male and Female Collectors in Sales of NTFPs

Constraints	Major	Minor	Not a challenge	Mean score	Ranking
Poor road network	58 (59.2)	38 (38.8)	2 (2.0)	1.6	1st
Forest guards' interference	37 (37.8)	60 (61.2)	1 (1.0)	1.4	3rd
Access to credit	41 (41.8)	47 (48.0)	10 (10.2)	1.3	4th
Inadequate market infrastructure	44 (44.9)	47 (48.0)	7 (7.1)	1.4	3rd
Limited storage facilities	56 (57.1)	39 (39.8)	3 (3.1)	1.5	2nd
Unattractive pricing	40 (40.8)	47 (48.0)	11 (11.2)	1.3	4th
Climate change	41 (41.8)	43 (43.9)	14 (14.3)	1.3	4th
High transaction costs	44 (44.9)	45 (45.9)	9 (9.2)	1.4	3rd
Poor finance	37 (37.8)	54 (55.1)	7 (7.1)	1.3	4th
Difficulty sourcing products	40 (40.8)	49 (50.0)	9 (9.2)	1.3	4th
Price instability of products	30 (30.6)	59 (60.2)	9 (9.2)	1.2	5th
Locating NTFPs challenge	37 (37.8)	52 (53.1)	9 (9.2)	1.3	4th
Influence of middlemen	38 (38.8)	48 (49.0)	12 (12.2)	1.3	4th
Distance to market	37 (37.8)	48 (49.0)	13 (13.3)	1.2	5th
Limited access to marketing information	37 (37.8)	45 (45.9)	16 (16.3)	1.2	5th

Source: Field survey, 2025

Other results show that both male and female NTFP sales collectors have a similar ranking for inadequate storage facilities (mean = 1.5) and interference by forest guards, as well as inadequate market facilities and high transaction costs (3) (mean = 1.4).

The fourth ranking, while all the challenges were significant and pertinent, was access to credit (4), climate change, and the challenge of product availability (mean = 1.3). The fifth ranking was price instability, distance to market, and limited marketing information (mean = 1.2).

5. Discussion

The analysis indicates participants' socioeconomic traits largely shape their involvement in NTFP collection and trade around Akure Forest Reserve. This aids in the aim of the study to identify forest-dependent households and understand the obstacles they face in selling NTFPs. As most participants are aged between 31 and 40 years, the analysis indicates the collection and trade of NTFPs are largely carried out by participants who are economically active and able to perform the physically demanding nature of the work.

This finding is congruent with the sustainable livelihood theory, which argues the availability of labour and age as important components of human capital affect the extent to which people are attracted to livelihood activities based on the exploitation of natural resources (Okunlola et al., 2025; Olawuyi et al., 2019). This finding is consistent with Biland et al. (2021), which argues most of the NTFP-related activities in developing countries are conducted by people in their economically active years. The gender differentiation of livelihood activities shows that men and women perform complementary roles in various forest-based activities. In addition to farming, men also undertook the collection of NTFPs.

Trading and marketing activities were done by women. The activities done by men and women of the Akure Forest Reserve correlate to gender-based livelihood theories that in a particular context, and domestic work organization, correlate to the specialization of labour and the creation of livelihood activities. The findings of the study expand on the previous studies by showing that in the Akure Forest Reserve, despite the lower education of the women, they dominate the NTFP commercialization.

This contextual addition indicates a diversification of activities along the NTFP value chain and emphasizes the need for gender-sensitive strategies that increase the access of women to markets and financial services. The prevalence of married couples and families of four to six indicates that household structure is an important factor influencing the persistence of livelihoods reliant on NTFP. Larger households provide greater family labour for both the harvesting and the processing of NTFPs. Additionally, larger households tend to have larger consumption and thus greater dependence on forest resources.

According to Derebe and Alemu (2023) and Shitaye et al. (2024), there is a strong positive correlation between reliance on NTFPs for supplemental income and both household size and marital status. These findings also support the household livelihood diversification framework, which posits that households employ the available labor resources to as many livelihood activities as necessary to cope with income instability and enhance welfare. The respondents' educational levels were low, averaging only six years. Having a base formal education, while being low in comparison to other regions, may help households to engage with the market. However, the lack of education relative to other economic sectors may negatively influence access to modern productive methods and high-value markets. These findings agree with those of Adeoye et al. (2023), Dash et al. (2016), and Newton et al. (2016). They describe the forest-dependent households of the developing world as having low educational levels. The current findings suggest that the respondents of this study are heavily reliant on forest resources and have few other livelihood options, particularly low educational options, which contrasts with studies in regions with stricter institutional support. In the Akure Forest Reserve, the monthly earnings from selling Non-Timber Forest Products (NTFPs) ranged from ₦50,000 to ₦100,000. NTFPs are extremely important to the economy of the region. Rural households can sell enough forest products to sustain and enhance their welfare. These products are sold as cash crops. NTFPs have great income-generating potential for households, providing monthly sales that are important from an economic and welfare perspective. For households in forest-dependent communities, NTFPs have considerable economic significance, particularly in Nigeria. The community that uses forest-based resources remains dependent on them, despite overwhelming environmental and institutional challenges.

The inadequate state of the roads among the primary challenges to marketing Non-Timber Forest Products (NTFPs). NTFP sales are much less profitable due to the combined effect of increased costs of

transportation and the wastage of products that occurs after harvesting. According to Odeyale and Olawuyi (2018), the level of infrastructure in the rural areas is a major obstacle to the marketing of NTFPs in southwestern Nigeria. The absence of storage facilities also constrains logistics. The management of forest products is poor. The NTFP value chains of the rural communities that depend on the forest are highly reliant on the improvement of infrastructure to assist the management of the products after they are harvested. Respondents reported several issues stemming from institutional constraints, especially from interference by the forest guards. This shows that in addition to access restrictions, regulatory practices continue to affect NTFP commercialization in protected forest landscapes. The bulk of previous studies focused on the constraints of the market and infrastructure. This study attempts to fill the gaps by addressing the need to create more participatory and community-oriented governance mechanisms in the context of balancing forest conservation and livelihood security. Respondents mentioned climate change as another major challenge to NTFP collection and trade. This shows that respondents were concerned with the availability and the certainty of the resources and their production.

This corresponds with Abukari and Mumuni (2020) who explained that the climate negatively affects productivity and livelihoods of forest-dependent households. Particularly, climate change and the combination of inadequate infrastructure and institutional barriers emphasize that the trade of NTFPs is affected more by the combination of environmental and social challenges than a market challenge. It is evident that there are no climate resilience, infrastructure, and market challenges in the development of NTFPs in Akure Forest Reserve, but rather participatory and community-oriented governance of forests. Most findings impacted theory because they correspond with the Sustainable Livelihoods Framework and livelihood diversification theory.

They impacted theory because they described the latest evidence regarding the socio-economic and gender-based marketing constraints to Non-Timber Forest Products (NTFP) commercialization in the southwestern region of Nigeria. They impacted context because they identified the infrastructure gaps, institutional challenges, and climate change in a web of challenges to sustainable livelihood forestry in and around the Akure Forest Reserve.

6. Conclusions

The study found that non-timber forest products (NTFPs) were an important income source for households around Akure Forest Reserve. NTFPs provided important economic opportunities for both women and men, although participants focused on trading and women were involved in secondary income generating activities. As women were less involved in other income generating activities and were involved in household activities, their economic engagement was impacted by household size and education level, as observed in the study. Both men and women in the trading activities were likely to belong to economically active age groups. The collection and selling of products from Akure Forest Reserve was critical in providing livelihoods for participants. The study further found that poor roads, interference by forest guards, and lack of storage facilities limit the commercialization of NTFPs. The study found that NTFPs were an important resource to rural communities for household sustenance. There are major barriers in utilizing NTFPs, e.g., lack of infrastructure, poor governance, and socioeconomic challenges. Future safeguarding of forest resources and increasing rural income demands gender-based policies, better rural infrastructure and markets, and governance of forest resources.

6.1. Practical and policy implications

This research is beneficial to decision makers and forest managers and the rural communities they serve. This study helps rural communities develop sustainable value chains for non-timber forest products to better their livelihoods. The lack of adequate roads and storage facilities suggest to local authorities and government agencies that investments in rural areas are needed. Improvements in roads and the building of storage facilities would help community members lower the costs of transportation, post harvesting losses, and help NTFP enterprises make more money. The difference in the roles of men and women in this region indicates the need for policies that help women in the region gain more access to commerce of NTFPs. Development agencies, government bodies, and banks should increase the availability of loans to women, and more access to services that improve their skills, and more access to technology that helps them better their product. These policies would help women become more empowered and help families become more financially secure. This study exemplifies the need for more inclusive and participatory policies in the forest governance space. The forest management division should improve the ways that they partner and work with rural communities. Developing transparent guidelines to help resolve conflicts and communicate better with rural users of the forest would help people comply with the policies and lessen the barriers to legal commerce of NTFPs. The study shows that the impacts of climate change are becoming a major obstacle to the availability and marketing of NTFPs. Therefore, the climate adaptation strategies should be incorporated in the management of the forests and in rural development programs. Such strategies should focus on the application of the principles of climate smart harvesting, restoration of the degraded forest, domestication of the NTFP species of economic significance, and responsible climate-smart livelihood diversification to enhance the adaptability and resilience of the households that are dependent on forests. The results of the study also highlight the need to advance the producer cooperatives and the community associations. Strong cooperatives support the collective marketing of NTFPs, improve cooperatives' access to market and other crucial information, improve members' access to financing, and enhance members' access to government subsidized programs. These benefits would improve the efficiency and equity of NTFP Value Chains.

The study indicates that the respondents markedly low level of education implies a need for active capacity building. The forest extension workers, forestry, and other NGOs, should provide regular training on sustainable harvesting and enhanced post-harvest techniques, product quality, small scale entrepreneurship, business management and marketing. These actions will improve commercially the NTFP enterprises, ensure sustainable use of forest resources, and enhance various rural development initiatives.

6.2. Limitations and future research

This research includes some limitations. The first, is that the cross-sectional study only provided snapshot perceptions, limiting the ability to draw conclusions beyond the data provided. Second, there are limitations to the draw conclusions from the findings outside the surveyed communities. Lastly, despite efforts to validate data, fieldwork did not improve the study response issues, including incomplete questionnaires.

This likely introduced response biases. Missing longitudinal and comparative studies, the research lacks understanding of the multiple forest reserves and their function. The findings would have been

improved by the understanding gained from these studies. There are also a lack of econometric techniques and methods in the current research. With these tools, there is a greater opportunity to study the profitability of the NTFP business, the impacts on livelihoods, and evaluate policy and climate adaptation strategies and their effectiveness.

Acknowledgements

The authors sincerely appreciate the cooperation and support for this research during data collection from the forest-dependent households and the enumerators from Akure Forest Reserve surrounding communities. The authors are grateful to the community chiefs for permission and making the research possible. The authors appreciate the completely self-funded nature of this study.

References

- Abukari, A., & Mumuni, M. (2020). Contribution of non-timber forest products to livelihood of rural communities in Kumbungu District of Northern Ghana. *Asian Journal of Forestry*, 4(1), 10–14. <https://doi.org/10.13057/asianjfor/r040103>
- Adelesi, O. O. (2024). Understanding farmers diversity in non-timber forest products activities in Ogun State, Nigeria. *Scientific African*, 25, Article e02331. <https://doi.org/10.1016/j.sciaf.2024.e02331>
- Adeoye, A. S., Oke, O. S., Jatto, K. A., Oke, O. O., Adesina, Y. O., & Oyetoki, A. O. (2023). Perceived effects of climate change on the livelihood of non-timber forest products collectors in Ido Municipality, Ibadan, Nigeria. *Journal of Forestry Research and Management*, 20(1), 79–92.
- Akande, S. (2020). *Map of forest reserves in Nigeria* [Map]. ResearchGate. <https://doi.org/10.13140/RG.2.2.10692.58249>
- Bharucha, Z., & Pretty, J. (2010). The roles and values of wild foods in agricultural systems. *Philosophical Transactions of the Royal Society B: Biological Sciences*, 365(1554), 2913–2926. <https://doi.org/10.1098/rstb.2010.0123>
- Biland, M., Zeb, A., Ullah, A., & Kaechele, H. (2021). Why do households depend on the forest for income? Analysis of factors influencing households' decision-making behaviors. *Sustainability*, 13(16), Article 9419. <https://doi.org/10.3390/su13169419>
- Bwalya, S. M. (2011). Household dependence on forest income in rural Zambia. *Zambia Social Science Journal*, 2(1), 67–86. <https://scholarship.law.cornell.edu/zssj/vol2/iss1/6/>
- Chidebere-Mark, N. M., Ejike, R. D., & Akwiwu, U. N. (2016). Economics of non-timber forest products (NTFPs) marketing in Ikwuano Local Government Area, Abia State, Nigeria. *European Journal of Agriculture and Forestry Research*, 4(2), 1–8.
- Dash, M., Behera, B., & Rahut, D. B. (2016). Determinants of household collection of non-timber forest products (NTFPs) and alternative livelihood activities in Similipal Tiger Reserve, India. *Forest Policy and Economics*, 73, 215–228. <https://doi.org/10.1016/j.forpol.2016.09.012>
- Derebe, B., & Alemu, A. (2023). Non-timber forest product types and its income contribution to rural households in the Horn of Africa: A systematic review. *Forest Science and Technology*, 19(3), 210–220. <https://doi.org/10.1080/21580103.2023.2231963>
- Elnasikh, S. H., & Khalil, R. M.I. (2018). Sudan gum arabic exports composition: Changes, causes and implications. *SUST Journal of Agricultural and Veterinary Sciences*, 19(1), 77–89.
- Endamana, D., Angu, K. A., Akwah, G. N., Shepherd, G., & Ntumwel, B. C. (2016). Contribution of non-timber forest products to cash and non-cash income of remote forest communities in Central Africa. *International Forestry Review*, 18(3), 280–295. <https://doi.org/10.1505/146554816819501682>

- Food and Agriculture Organization of the United Nations. (n.d.). *Non-wood forest products*. <https://www.fao.org/forestry/nwfp/en/>
- Jimoh, S. O., Amusa, T. O., & Azeez, I. O. (2013). Population distribution and threats to sustainable management of selected non-timber forest products in tropical lowland rainforests of south western Nigeria. *Journal of Forestry Research*, 24(1), 75–82. <https://doi.org/10.1007/s11676-013-0327-z>
- Meinhold, K., Dumenu, W. K., & Darr, D. (2022). Connecting rural non-timber forest product collectors to global markets: The case of baobab (*Adansonia digitata* L.). *Forest Policy and Economics*, 134, Article 102628. <https://doi.org/10.1016/j.forpol.2021.102628>
- Newton, P., Miller, D. C., Byenkya, M. A. A., & Agrawal, A. (2016). Who are forest-dependent people? A taxonomy to aid livelihood and land-use decision-making in forested regions. *Land Use Policy*, 57, 388–395. <https://doi.org/10.1016/j.landusepol.2016.05.032>
- Odeyale, O. C., & Olawuyi, E. B. (2018). Socio-economic impact of non-timber forest products in income generation for sustainable forest management in Gambari Forest Reserve, Oyo State, Nigeria. *Scientific Research Journal*, 6(10), 35–43.
- Ojea, E., Loureiro, M. L., Alló, M., & Barrio, M. (2016). Ecosystem services and REDD: Estimating the benefits of non-carbon services in worldwide forests. *World Development*, 78, 246–261. <https://doi.org/10.1016/j.worlddev.2015.10.002>
- Okpalaoka, C. (2021). Infrastructural challenges in Nigeria and the effect on the Nigerians economy: A review of literature. *Environmental and Earth Sciences Research Journal*, 8(4), 159–162. <https://doi.org/10.18280/eesrj.080403>
- Okunlola, M. I., Onyekwelu, J. C., Oluwajuwon, T. V., Olasuyi, K. E., Ojo, D. O., & Israel, R. (2025). Marketing of non-timber forest products in Nigeria: A case of Akure metropolis. *Environment, Development and Sustainability*, 27(3), 7595–7614. <https://doi.org/10.1007/s10668-023-04208-7>
- Olawuyi, E. B., & Odeyale, O. C. (2019). Socio-economic analysis of agroforestry practices in Odeda Local Government Area, Ogun State. *Journal of Sustainable Environmental Management*, 11, 45–48.
- Olawuyi, E. B., Odeyale, O. C., & Agboola, F. O. (2019). Impact assessment of deforestation on rural households' livelihoods in Olokemeji Forest Reserve of Ogun State, Nigeria. *FUOYE Journal of Agriculture and Human Ecology*, 3(1), 20–29.
- Ominimini, S. E. (2017). Economic potentials of households and prioritization NTFPs in Yobe state, Nigeria. *Global Journal of Wood Science, Forestry and Wildlife*, 5(1), 157–165.
- Shackleton, C. M., & Pandey, A. K. (2014). Positioning non-timber forest products on the right development agenda. *Forest Policy and Economics*, 38, 1–7. <https://doi.org/10.1016/j.forpol.2013.04.004>
- Sheil, D., & Wunder, S. (2002). The value of tropical forest to local communities: Complications, caveats, and cautions. *Conservation Ecology*, 6(2), Article 9. <https://www.ecologyandsociety.org/vol6/iss2/art9/>
- Shitaye, Z., Tadesse, B., & Enkuahone, K. (2024). Sources and intensity of access to agricultural information technologies by smallholder farmers: Evidence from Northwest Ethiopia. *Frontiers in Sustainable Food Systems*, 8, Article 1455037. <https://doi.org/10.3389/fsufs.2024.1455037>
- Suleiman, M. S., Wasonga, V. O., Mbau, J. S., Suleiman, A., & Elhadi, Y. A. (2017). Non-timber forest products and their contribution to households income around Falgore Game Reserve in Kano, Nigeria. *Ecological Processes*, 6, Article 23. <https://doi.org/10.1186/s13717-017-0090-8>