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Perception of Locals on Multiple Contributions of NTFPs to the Livelihoods of Forest Fringe Communities in Ghana

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Abstract: Forest-dwelling residents frequently collect non-timber forest products (NTFPs) for various reasons, such as food, medicine, firewood, religious reasons, or handicrafts. This study examines the multiple benefits derived from NTFPs and how they contribute to the livelihoods of Ghanaian communities to alleviate poverty. Resources and services provided by NTFPs have an essential role in providing economic, nutritional, medicinal, cultural, and environmental benefits. This study examines the diverse range of NTFPs locals collect, such as chewing sticks, games, herbs, honey, leaves, mushrooms, pestles, raffia and palms, snails, and straws. In addition to serving different purposes, these NTFPs contribute to income generation, food security, health care, cultural practices, and the protection of the environment. A qualitative research approach was used in this study to collect data through semi-structured interviews and focus groups with members on multiple collections of NTFPs and their multiple benefits. We interviewed 732 residents regarding their multiple NTFPs and their potential to improve the livelihood of the locals. The data for the study were analysed using descriptive statistics. As a result of the survey, the frequency and percentages of responses were analysed for each indicator related to multiple values of NTFPs. Both males and females collected a list of NTFPs during the survey. Regarding NTFPs used for sale, 275 were reported, representing 37.57% of the total. In addition to emphasising the importance of sustainable management practices and equitable distribution of benefits, the study explores the multiple benefits of NTFPs for poverty alleviation in Ghanaian communities. It is essential to ensure the conservation of forest ecosystems and promote inclusive policies to harness the potential of NTFPs and maximise their positive impact on livelihoods. NTFPs provide multiple benefits for Ghanaian communities, including income, nutrition, healthcare, cultural preservation, and environmental sustainability. To promote sustainable development, it is imperative to understand the role of NTFPs and implement appropriate strategies.

Keywords: non-timber forest products; poverty alleviation; multiple values; Ghana

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1. Introduction

In developing countries, non-timber forest products (NTFPs) play a vital role in the livelihoods of communities, especially in the context of poverty alleviation [1–3]. Many products are derived from forests, excluding timber, such as medicinal plants, wild fruits, nuts, fibres, and honey [4,5]. Local communities in forest fringe in developing countries can generate income and gain economic empowerment through the utilisation and trade of

NTFPs [6–9]. NTFPs have become an essential source of income and sustenance in many rural communities in developing countries, for example, in Ghana, where a significant portion of the population relies on natural resources for their livelihoods [1,10–12]. They offer rural households the opportunity to diversify their economic activities, reduce their dependency on single sources of income, and increase their overall resilience to economic shocks and uncertainties [13–15]. There is more to NTFPs than their economic significance. As they provide a source of nutrition and dietary diversity, they also contribute to food security, particularly in rural areas where fresh produce may be limited [16–18]. In addition, NTFPs are often associated with cultural and traditional values, often forming an integral part of local customs, rituals, and traditional medicine. NTFPs are frequently used in traditional ceremonies, rituals, and medicinal practices, which preserve cultural heritage and strengthen community identity [19–21].

In addition to preserving traditional knowledge and practices, the sustainable management and utilisation of NTFPs can also contribute to their sustainability [22]. The use of NTFPs can be an effective means of incentivising sustainable forest management practices [23,24]. In the interest of local communities, NTFPs resources are preserved and utilised sustainably since they rely on them for their livelihoods. Consequently, conservation practices, such as the selective harvesting and protection of important NTFP-bearing species, can be adopted, contributing to the conservation of forest ecosystems [25,26].

NTFPs have been increasingly important in sustainable forest management since the early 1990s [24]. NTFPs play a significant role in the livelihoods of many rural communities in Ghana [27–29]. It is becoming increasingly clear that NTFPs play a crucial role in maintaining livelihoods in rural Africa, Asia, and elsewhere in developing nations [30–32]. Plants and animals other than timber are considered non-timber forest products, including fruits, nuts, vegetables, game, medicinal plants, resins, bark, fibres, palms, grasses, small wood products, and firewood [2,33,34]. In recent African case studies, NTFPs were identified as significant household incomes [35].

1.1. NTFPs and Their Contribution to the Ghana Economy

NTFPs are essential in the Ghanaian economy, contributing to livelihoods, employment, and income generation [36]. The contribution of NTFPs to the livelihoods of Ghanaian communities must be considered [37,38]. In Ghana, many rural communities depend on NTFPs for food, medicine, income, and cultural values [39]. For instance, wild fruits, game, roots, and leaves are important food sources for many households, especially during the lean season when other food sources are scarce. Medicinal plants are critical for treating various diseases and illnesses [40].

NTFPs serve a vital role in meeting the food, poverty alleviation, sustainable management of forest resources, and livelihood improvement needs of rural communities [37,41,42]. According to an FAO report, NTFPs contribute to the health and nutritional needs of 80% of developing nations [43]. In addition to providing income, food, medicine, and nutrition, forests are the primary source of income, food, and medicine for approximately 350 million people worldwide [44]. The industry provides sustenance and income to rural households across the globe; for example, it relies heavily on NTFPs, generating an annual income equivalent to USD 2.7 billion from NTFPs. Additionally, they account for 55% of all forestry employment. Furthermore, 50% of forest revenues and 70% of forest-based export income come from such resources [45,46]. NTFPs provide 50% of the household income for approximately one-third of India's rural population [6,47,48].

Despite NTFPs' multiple roles, Ghanaian policymakers must pay more attention to their potential contribution to food security, nutrition, health, and sustainable livelihoods [38,49]. A lack of awareness has been given to the perceptions of the locals on the multiple uses of NTFPs in development planning, poverty alleviation, and livelihood improvement programs in Ghana [36,50]. Research on the perception of locals on the multiple use of NTFPs in Ghana is relatively new and has received minimal formal investigation. More research needs to be conducted to assess the perception of the locals on the multiple

uses of NTFPs, social factors influencing the local's perceptions, and the contribution of NTFP's poverty alleviation to the nutrition, health, and food security of rural communities in Ghana [38]. Inventories of NTFPs by the Forestry Commission of Ghana focused only on rattans, climbers, and other minor tree species. Additionally, the Ghana Poverty Reduction Strategy Paper (GPRSP) should have considered the benefits of NTFPs [36]. Various attempts to value NTFPs have examined only these products' current local market value and have not attempted any in-depth evaluation of the benefits to rural communities of health and nutrition strategies [38].

1.2. Perception of Locals on the Multiple Uses of NTFPs

Examining local perceptions and other social factors like education, gender, and religion of the multiple uses of NTFPs is crucial for establishing sustainable policies for their utilisation [51]. Various social, cultural, and economic factors shape the perception of locals on the multiple uses of NTFPs [52,53]. Local communities may view NTFPs as essential resources for subsistence, income generation, and cultural practices, reflecting their intrinsic value in livelihood strategies [54,55]. Additionally, traditional ecological knowledge and customary practices influence how NTFPs are perceived and utilised, with indigenous knowledge systems guiding sustainable harvesting practices [56,57]. Economic considerations, such as market demand and income opportunities, also play a significant role in shaping perceptions of NTFPs, with communities prioritising certain products based on their economic value [58,59]. Understanding these diverse perceptions is crucial for developing sustainable management strategies that respect local values and promote the conservation of forest resources [60,61]. In Ghana, social factors such as education, religion, and gender significantly shape people's perceptions of multiple utilisation of NTFPs [62,63]. In Ghana, social factors like education, religion, and gender intricately influence how individuals perceive and utilise NTFPs [51,64,65]. Education levels play a crucial role in the multiple uses of NTFPs, as higher levels of education often correlate with increased awareness and understanding of sustainable NTFP management practices, fostering a greater sense of environmental stewardship [66–68]. Religious beliefs also shape perceptions, as certain NTFPs may hold spiritual or cultural significance, influencing their perceived value and appropriate use in traditional rituals and ceremonies [69]. Gender dynamics further impact NTFP utilisation, with women often playing a central role in gathering and processing NTFPs for household consumption and income generation, influencing their perceptions and priorities regarding these resources [70–72]. Additionally, societal norms and expectations surrounding gender roles can affect access to and control over NTFP resources, shaping decision-making processes related to their management and utilisation [73,74]. Understanding these complex social dynamics is essential for developing inclusive and equitable policies that effectively harness the multiple benefits of NTFPs while addressing the diverse needs and perspectives of local communities.

2. Conceptual Framework

The conceptual framework of the perception of locals on the multiple values of NTFPs can be useful as a basis for understanding the importance and multiple values of NTFPs in reducing poverty in Ghanaian communities. Again, considering the livelihood framework model provides a comprehensive framework for understanding the link between NTFPs and the livelihoods of local households within forest communities [75]. Given the cultural, ecological, economic, and nutritional value of many NTFPs collected from forests, local communities frequently gather and utilise these resources in diverse ways [76,77]. Communities in Ghana are heavily dependent on the natural resources found in forests for their livelihoods [78,79]. Rural communities rely heavily on NTFPs as a source of income, food security, and traditional knowledge [80,81].

The livelihood framework model (Figure 1) provides a comprehensive framework for understanding the link between the perceptions of locals on NTFPs and the livelihoods of local households within forest communities [82,83]. According to the conceptual frame-

work on locals' perceptions of NTFPs' multiple values, economic, social, cultural, and environmental values play a critical role in their sustainability [84,85]. NTFPs offer a direct economic contribution to households and communities through their sale in local markets or to external buyers [86–88]. This income generated from NTFPs serves as a crucial source of livelihood, contributing to household income stability and livelihood diversification. By engaging in the collection, processing, and sale of NTFPs, individuals can supplement their earnings and reduce dependency on single income sources [89–91]. Furthermore, the economic value derived from NTFPs supports various economic activities along their value chain, including transportation, marketing, and trade [92–94]. This, in turn, stimulates local economies, creates employment opportunities, and enhances economic resilience within communities. The income generated from NTFPs often serves as a buffer against income fluctuations, particularly in rural and forest-dependent communities, helping to alleviate poverty and improve overall well-being [95–97]. Additionally, the direct economic contribution of NTFPs fosters entrepreneurship and small-scale enterprises, empowering individuals to take control of their economic futures [98,99]. NTFPs play a vital role in enhancing economic prosperity and contributing to sustainable development in both rural and urban settings [100].

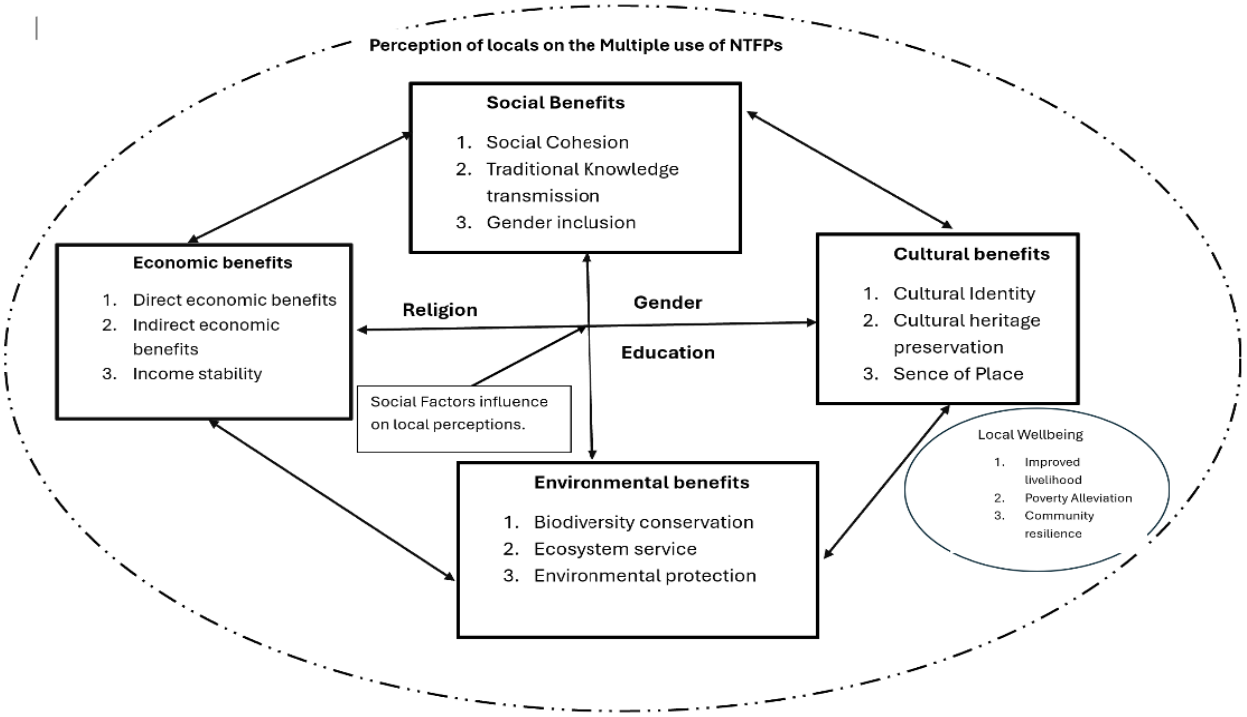

Figure 1. Conceptual framework of the perception of locals on the multiple uses of NTFPs and social factors influencing the perceptions of locals on multiple uses of NTFPs.

NTFP collection and processing activities foster community cohesion by encouraging communal efforts and cooperation among local residents [101,102]. Through shared responsibilities and collaborative endeavours, community members develop strong social bonds and a sense of solidarity [103,104]. This collective engagement not only strengthens interpersonal relationships but also promotes mutual support and reciprocity within the community [105,106]. Ultimately, the communal nature of NTFP activities enhances social cohesion, contributing to the overall well-being and resilience of local communities [107].

Traditional knowledge transmission involves passing down knowledge, practices, and skills within a community over generations [108,109]. It includes understanding how to use NTFPs for various purposes like medicine, food, and cultural significance. NTFPs are integral to local traditions, holding spiritual and social value and preserving cultural

heritage [110–112]. Interactions with NTFPs are part of everyday life for locals in forest fringe communities [113,114], offering opportunities for learning through rituals, stories, and hands-on experience. Parents, elders, and community leaders transmit traditional knowledge through practical demonstrations and involving young ones in gathering and processing NTFPs [115,116]. Younger generations learn practical skills and ecological understanding through observation and apprenticeship [117–119]. This transmission fosters a deep connection to the land, nurturing stewardship and community cohesion [120–122]. Traditional knowledge integrates ecological wisdom, promoting sustainable practices and conservation efforts. Traditional knowledge transmission preserves cultural heritage, promotes sustainability, and enhances community resilience [123–125].

Non-timber forest products (NTFPs) offer pathways for gender inclusion, empowering women economically and fostering their involvement in decision-making processes [126,127]. With decentralised harvesting, NTFPs provide equal access to resources, contrasting timber extraction, which often favours men [128,129]. Flexible work arrangements enable women to balance household duties with income generation, integrating NTFP collection into daily routines [55,130]. Engagement in NTFP activities enhances women's skills in forest management, processing techniques, and marketing, boosting confidence and community involvement [107,131]. Women's roles in value addition and market access amplify the commercial viability of NTFPs, bolstering economic autonomy. Participation in NTFP-related organisations cultivates leadership skills and amplifies women's voices in policy arenas [132]. Women's deep ecological knowledge contributes to sustainable NTFP management, fostering biodiversity conservation and ecosystem resilience [133]. In essence, NTFPs serve as catalysts for women's economic empowerment, leadership development, and environmental stewardship, promoting gender-inclusive and sustainable development pathways [134].

Through sustainable utilisation and conservation efforts, NTFPs play a vital role in preserving cultural heritage and biodiversity [22,135]. Indigenous communities have long relied on NTFPs for cultural practices, rituals, and traditional knowledge systems, thus perpetuating their cultural significance [136–138]. By sustainably managing NTFP resources, communities can ensure the continuation of these cultural traditions while simultaneously protecting biodiversity and ecological integrity [139,140]. Regarding sense of place, NTFPs imbue landscapes with cultural significance, fostering a sense of attachment and stewardship among local communities towards their natural environment [141,142].

NTFP harvesting practices incentivise the sustainable management of forest ecosystems, leading to biodiversity conservation and the protection of valuable habitats [111,143]. Many NTFPs also provide essential ecosystem services, including pollination, seed dispersal, and soil fertility enhancement, which contribute to ecosystem resilience and functioning [44,55]. Additionally, NTFP-rich forests play a crucial role in climate change mitigation by sequestering carbon, thereby helping to reduce greenhouse gas emissions and mitigate global warming. Moreover, these forests contribute to climate change adaptation efforts by providing resources resilient to climate variability, such as drought-resistant plants and medicinal herbs [144,145]. Overall, the conservation and sustainable management of NTFPs contribute significantly to biodiversity conservation, ecosystem resilience, and climate change mitigation and adaptation strategies [20,146].

Social factors such as gender, education, and religion exert a significant influence on the perceptions of local communities regarding the multiple uses of NTFPs [147,148]. Gender dynamics shape the roles and responsibilities of men and women in NTFP collection, processing, and utilisation, influencing their perspectives on the value and importance of these resources [149,150]. Gender dynamics dictate the division of tasks between men and women in NTFP activities, with women often responsible for collection and processing while men may focus on other tasks [151–153]. These dynamics impact individuals' perceptions of the value of NTFPs and their economic contributions, potentially affecting women's access to income and economic benefits derived from NTFPs. Addressing gender

inequalities and empowering women in decision-making can enhance their economic participation and ensure a more equitable distribution of benefits from NTFP utilisation.

Education levels impact individuals' awareness and understanding of the ecological, economic, and cultural significance of NTFPs, shaping their attitudes towards sustainable management practices [154,155]. Religious beliefs and cultural traditions may imbue certain NTFPs with spiritual or symbolic meaning, influencing their perceived value and appropriate use within local communities [156,157]. Overall, the interplay of these social factors shapes the diverse perceptions and priorities of locals regarding the utilisation and management of NTFPs.

Using the livelihood framework model (Figure 1), researchers and practitioners can analyse the relationship between NTFPs and household livelihoods in forest communities [158,159]. This approach aims to understand how different assets, strategies, and contextual factors influence the linkages and outcomes of NTFP-based livelihoods [160,161]. This information can be used to inform the design of interventions and policies that promote sustainable NTFP management, improve local livelihoods, and reduce poverty in Ghanaian forest communities.

Aim of the Study

NTFPs were marketed in the 1990s on their multiple uses and their potential to alleviate poverty and promote forest conservation, [162,163]. There have been several studies that have promoted the commercialisation [22,164–166], value addition [167,168], and multiple uses [169,170], but the perceptions of locals on multiple uses of NTFPs and the social factors that influence their perceptions have not been adequately explored. This study aimed to explore the locals' perceptions of multiple uses of NTFPs and social factors that can influence their perceptions.

3. Materials and Methods

3.1. Study Area

The study was conducted in five main Ghana regions where NTFPs dominate. These regions were selected because they contained relatively large tracts of tropical rainforest. Among the major economic activities in the study area are agriculture (farming), trade and commerce, and services (hotels, auto mechanics, sawmills, banks, etc.). Evergreen and deciduous trees make up the upper canopy, and evergreen species make up the lower canopy. The moist semi-deciduous forests contain the tallest trees, some of which can reach from 50 to 60 m in height. A wet semi-equatorial climate with a high annual rainfall of 1500–1800 mm characterises the study area. The regions fall within the tropical rainforest climatic zone, characterised by warm temperatures and heavy rain throughout the year. May–June and September–October are the peak months for rainfall. In the hottest month (February or March), the maximum temperature is 31–33 °C, while the lowest temperature is 19–21 °C in the coldest month (August). There are several species of trees found in the study area, including *Triplochiton scleroxylon* (Wawa), *Antaris Africana* (Kyenkyen), *clorophoraexcels* (Odum), *CeibaPentandra* (Onyina), and others.

3.2. Survey Methods

Using a team of interviewers, we conducted 732 interviews in rural communities in five (5) regions (Ahafo, Ashanti, Bono, Eastern, Western-North) of Ghana (Figure 2) to explore the perceptions of the locals on multiple uses of NTFPs to the forest adjacent communities and its potential to alleviate poverty. Following discussions with economists, market players, locals, and the Forestry Commission of Ghana, we developed a draft questionnaire in March 2022 (See Appendix A). Forest science researchers from the University of Eastern Finland, another from the University of Cape Coast Ghana, and the last from the Forest Research Institute of Ghana reviewed the survey after it was completed in Ghana. These faculty members contributed to formulating and revising wording to ensure language and conceptual clarity. A well-formulated timetable was devised to collect data from various

regions, districts, and communities. In June 2022, focus group discussions were conducted near the study areas to include NTFPs collectors, marketers, and farmers. This discussion was conducted to provide feedback on question phrasing and potential policy implications of the study. Interviews were conducted in the selected communities in Ghana from May to June 2022.

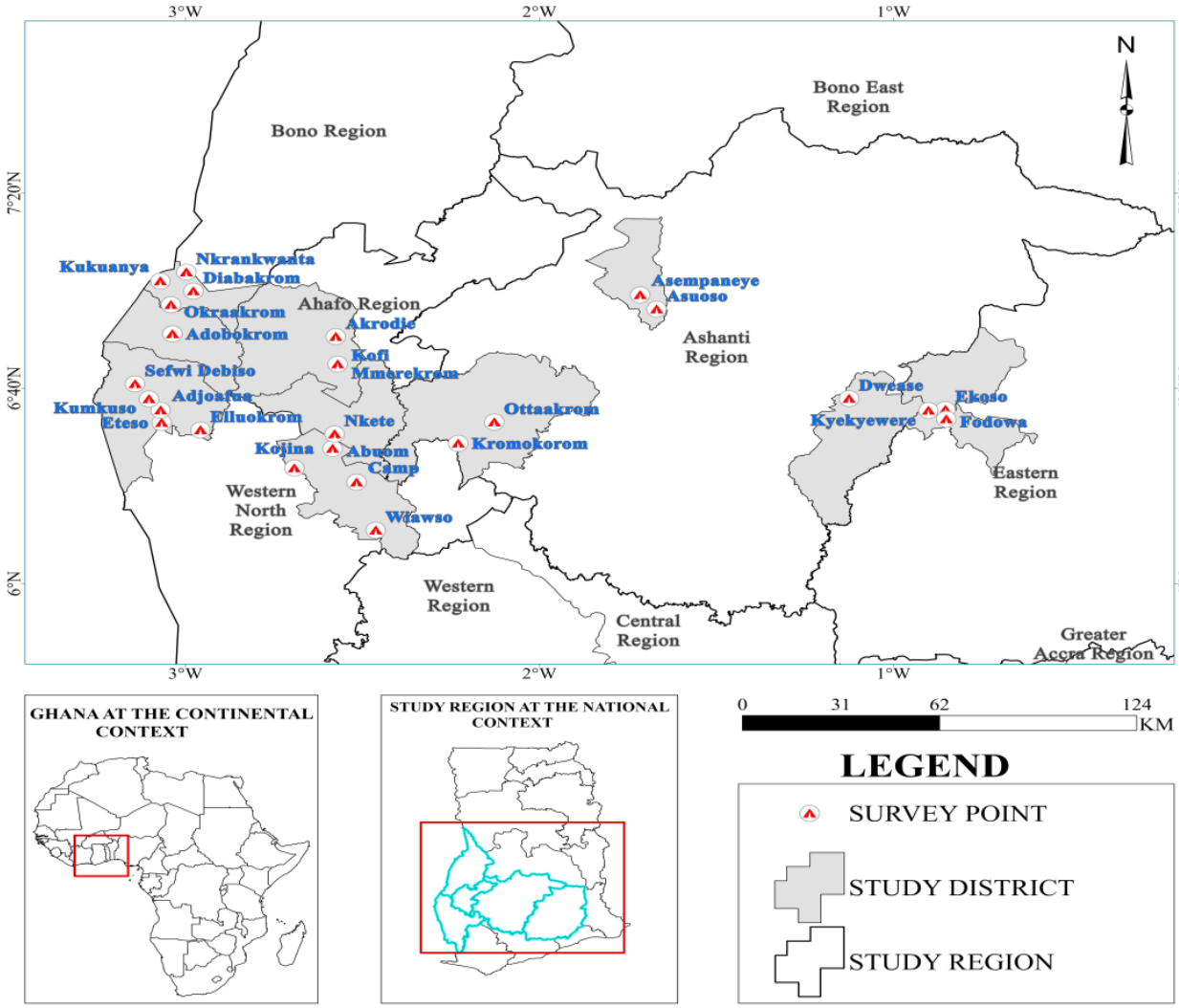

Figure 2. Map of Ghana showing the regions of the study area in Ghana. Source [31], 2023.

3.3. Sampling Collection

Purposive sampling was used to select regions, forest districts, and communities for the study. Five (5) regions (Ahafo, Ashanti, Bono, Eastern, Western-North) out of sixteen (16) regions in Ghana were selected. Ten (10) forest districts (Bia West, Bia East, Bibiani Bekwai Awhiaso, Asunafo North Municipal, Asunafo South, Antima Mponuaa, Doramma East, Dormaa West, Sefwi Wiawso, and Kwahu East) in the selected regions were also selected.

A total of 61 communities were selected within their respective forest districts and regions. These regions, districts, and communities were selected due to the substantial coverage of tropical forests, both off-reserve (off-reserve forests refer to forest areas located outside of officially designated forest reserves or protected areas) and reserved forests in the country. Again, the 61 communities were selected based on their proximity to the forest reserves within their respective forest districts. The purposive sampling method was applied to obtain detailed information from locals in the regions and districts directly involved in the collection, process, trade, and use of NTFPs. This method ensured that

every region, district, and community of the chosen population had detailed information related to NTFPs, thereby reducing the possibility of inconsistent information and ensuring that the sample was representative of the entire population in the region, district, and communities in Ghana.

In choosing the households of the respondents, we first visited all the 61 communities. Simple random sampling was used to randomly select 10 households each from the 61 communities. The simple random sampling method was applied to ensure that each member of the population had an equal chance of being selected, making the sample representative of the entire population. This helps to minimise bias and increases the likelihood that the sample accurately reflects the characteristics of the population. Each of the randomly selected households was numbered by writing the name of the region, the district, the community, and its respective number. In total, 610 households were numbered. A total of 300 of the numbered households were randomly selected, and these households were those visited, of which our interviews were administered. In each household, parents, family heads, and locals who were actively involved in the utilisation of NTFPs were contacted.

Among these selected households, the market centres of each of the selected communities were visited, and some of the key stakeholders in the trade of NTFPs and its process were also interviewed. Furthermore, individuals prominently engaged in NTFP collection were identified and interviewed, and a discussion was held with them. These key individuals were identified with the assistance of local residents, who helped pinpoint those actively involved in NTFP collection within the community.

The sample size of the study included 732 respondents, taking into account their age, gender, educational level, occupation, the number of years they have lived in the community, the kind of NTFPs they collect, their perception of the multiples used to the NTFPs, and social factors that are possible to influence their perception in the utilisation of NTPs. To calculate sample size, we used Cochran's formulas and procedures as described by [171]. Data were collected from respondents who relied on NTFPs as a source of livelihood and subsistence utilisation in the study area. Primary data were obtained through a structured questionnaire and key informant interviews where a series of questions, both closed and open-ended questions (See Appendix A), as well as discussion, on the local's perceptions of NTFPs and the multiple uses of NTFPs were administered to the relevant individuals or key stakeholders (traders, hunters, gatherers, and farmers) who are involved in NTFPs utilisation. In general, a mixed-method research approach was employed in the study. However, quantitative data were used to test the objective of the study. Qualitative research uses individual opinions, expressions, and subjective interpretations of the research problem, which was also applied during the key informant interviews and discussions. The study employed a logistic regression model to assess the influence of social factors on locals' perceptions of the multiple uses of NTFPs e.g., [172]. Logistic regression is used when the outcome or dependent variable is categorical. It is particularly useful when the outcome variable is binary, meaning it has only two possible outcomes which fall within the variables used in our studies. Additionally, logistic regression provides insights into the probability of different outcomes, making it valuable for decision-making and understanding relationships between variables.

With regard to demographics, locals who participated in the study were asked about their age, gender, education, occupation, and religious beliefs (See Table 1). With the response of age, we considered ages with the ranges of 18–20, 20–29, 30–39, 40–49, 50–59, and 60 or above. Education levels were classified into four categories: primary, high school, high school without a degree, and some graduate-level courses. Religion affiliations were grouped into Christian, Islam, and traditional categories.

Items to measure the household income of the focused locals, a range of household income, and an option for those who are not sure of their household income were given to locals. In order to obtain the item of the multiple NTFPs that were harvested, there was an open range of items that were to be mentioned by locals. Items common in the local

communities were streamlined, and the most common ones were presented and categorised on gender bases To ascertain the diverse uses of NTFPs, locals were invited to list various items associated with them. Common items prevalent in local communities were identified and prioritised for presentation. Local residents were queried regarding the alterations they have noticed due to climate change, impacting the productivity of NTFPs and altering their perceptions of NTFP sustainability. We conducted a comprehensive discussion with stakeholders on the social factors influencing their perceptions of NTFP utilisation. The insights shared by local community members were documented and summarised for further analysis.

Table 1. Overview of questionnaire items in relation to research questions.

ID	Topic of Research	Questionnaire Item	Response Format
1	Demographics	Age Gender Education Religion occupation	Open Closed Closed Closed Open
2	Household income	Can not Specify, Less than 5000, 10,000–19,999, 20,000–29,000. What is the range of your household income?	Closed
3	Multiple NTFPs Harvested	What are some of the NTFPs that are gathered, hunted or harvested from the forest?	Open
4	Multiple use of NTFPs	Sale, Constriction, artefact, livestock, religious leisure, and medicine. What are the harvested NTFPs used for?	Open and discussed
5	Perception of locals on climate change	Has the change in climate affected the production of NTFPs	Closed, Open and Discussion
6	Social Factors and their influence on Multiple use of NTFPs	Religion, Gender, occupation, and Education have affected the way you access and utilise NTFPs	Open and discussion

3.4. Data Analysis

We categorised interviewees into three classes based on their involvement with the value chain of NTFPs (collectors, buyers, and consumers) to investigate perceptions about climate change and its impact on NTFPs. Descriptive statistics were analysed using SPSS Statistics 20.0 (IBM, New York, NY, USA). Tables and graphs were created to display descriptive statistics related to sociodemographics, common NTFPs, and the locals' perceptions of multiple NTFP collection values. To evaluate the multiple values of the forest, we reviewed secondary data from government resources and published literature.

4. Results

Critical informant interviews, administration of questionnaires, participants' observations, and stakeholder consultations were used to solicit views on various facets of the NTFPs collections and multiple utilisation marketing of NTFPs in Ghana. The income levels of the locals were also assessed (Table 1). The study sample demographics were skewed a little to locals, females, males, low-income, and individuals who attained a lower-than-average level of education in Ghana. Of all the respondents contacted, 70.5 were males, and 29.5 were females (Table 2). This could result from the males being willing to respond and

be interviewed. This is expected due to the larger percentage of males being considered the head of the household and taking a major role in collecting and gathering NTFPs.

Table 2. Sociodemographic characteristics of participants (household income).

Variable	Number of Respondents (N)	Percentages (%)
Household Average Yearly Income (GHS)		
Can not Specify	167	22.8
Less than 5000	372	50.8
10,000–19,999	164	22.4
20,000–29,000	29	3.9

In light of the traditional gender roles assigning men as the heads of families and predominantly involved in gathering and hunting non-timber forest products (NTFPs), a greater number of male participants were engaged in this study, as indicated in Table 3. Furthermore, observations revealed that many women exhibited a reserved demeanour when responding to inquiries, frequently seeking approval from their husbands before actively engaging in the survey.

Table 3. Sample statistics of the explanatory variables (social factors) used in the econometric model and their hypothesised signs. Values in parentheses indicate frequencies or proportions.

Variable	Description	Frequencies	Categorical Variable (%)
Age	Age of the locals in years. Ages considered were		
	18–20	5	0.68
	20–29	115	15.8
	30–39	89	12.2
	40–49	95	12.98
	50–59	298	40.71
	60–older	130	17.75
Gender	Gender of the locals 1 = male, 0 = female	0 = 215 1 = 517	1 = 29.2 0 = 70.5
Education	Locals' level of education was category, High school = 1 Primary school only = 2, High school no degree = 3, Some Graduate Level Courses = 4	1 = 72 2 = 371 3 = 248 4= 41	1 = 9.8 2 = 50.7 3 = 33.9 4 = 5.6
Religion	Religion encompasses belief systems, values, and practices associated with sacred or spiritual matters, influencing how individuals interact with the natural environment. In Ghana, approximately 71% of the population adheres to Christianity, 18% to Islam, and a smaller percentage follows traditional beliefs [115]. For coding purposes, Christian affiliation is represented as 1, while Traditional affiliation is coded as 2 and Muslims.	1 = 438 2 = 259 3 = 35	1 = 59.8 2 = 35.4 3 = 4.8
Occupation	Describes the sector of the economy where locals are gainfully employed. For coding purposes, farmers were represented as 1, while Teachers were coded as 2, Nurses as 3 and Traders as 4.	1 = 620 2 = 1 3 = 2 4 = 109	1 = 88.4 2 = 0.1 3 = 0.3 4 = 11.2
Use of NTFPs by locals	This describes the multiple use of NTFPs by locals. This is where the utilisation of NTFPs was categorised and coded as follows. Artefacts = 1 Construction = 2 Food = 3, leisure = 4, Medicine = 5, Religion = 6 and sale = 7	1 = 112 2 = 95 3 = 180 4 = 15 5 = 115 6 = 45 7 = 170	1 = 15.3 2 = 13 3 = 24.6 4 = 2 5 = 15.7 6 = 6.1 7 = 23.2

A survey was conducted, encompassing a total of 215 female respondents (29.2%) and 517 male respondents (70.5%), as illustrated in Table 2. The majority of surveyed individuals fell within the age range from 50 to 59, comprising 298 respondents (40.7%). Conversely, the age group 18–20 had the lowest representation, with only five respondents (0.68%), likely due to the survey coinciding with school hours and many individuals in this age bracket being occupied with educational commitments. The educational levels among the local population varied, with a notable portion having completed primary education only. Among the respondents, 371 individuals (50.7%) had attained only primary education, while 41 (5.60%) held graduate degrees. The distribution of education might be influenced by financial constraints prevalent in the study area. Concerning religious affiliation, a significant majority identified as Christians, comprising 59.8% of the respondents, totalling 438 individuals, while 259 (35.4%) were traditionalists, and 35 (4.8%) were Muslims. Farming emerged as the predominant occupation among the respondents, accounting for 88.4% (620 individuals), while a smaller proportion worked as teachers (0.1%) and nurses (0.3%). Trading emerged as the second most common occupation, with 11.2%

of the total respondents, totalling 109 individuals. It was also observed that some women needed more time to be interviewed when they were with their husbands. Among the locals surveyed, 52.9% had only primary school education, with variation by male and female of education completed.

The locals' annual income ranged from GHC 5000 to 30,000 (Table 2), slightly higher than those mentioned [36]. Of the respondents, 372, representing 52.5%, had an annual income of approximately GHC 5000, equivalent to USD 500, and 22.8% could not specify their yearly income since their income is not documented. Overall, 164 of the respondents had their annual household income within the range of GHC 10,000–19,000, and 29 respondents (3.9%) reported their income between GHC 20,000 and 29,000. This lower income is likely due to the study area's rural nature and local households' dependence on agriculture and the forest. Of the respondents, 97.5% reported collecting NTFPs in the forest, meaning almost all the locals rely on the forest for their living.

From the response of the locals, chewing sticks, game leaves, and mushrooms are among the NTFPs (Figure 2) collected by the locals in the forest. From the survey on the number of NTFPs collected, processed, and sold, it was observed that a high number was recorded for the collections of snails and honey game, with few collecting chewing sticks, pestles, and raffia palms and leaves. It was observed that, for most of the NTFPs that are difficult to harvest, there was little interest in their collection. For example, chewing sticks, pestles, and leaves had fewer people participating in their collection, processing, and sales since it involves different processes and time to make it available for sale. It was also observed that these NTFPs were not directly used in the local household on a large scale but rather used more of the time for sale. The fact that the non-timber forest products (NTFPs) collected in the study area were primarily used for sale rather than for direct consumption indicates their economic value and potential as income-generating resources. Based on these findings, the local communities know the market demand for these NTFPs and have strategically invested in their commercialisation.

The following NTFPs presented in Figure 3 are collected by locals (males and females) in the forest communities. It was observed that some NTFPs, for example, leaves, snails, and mushrooms, were collected by women, and this confirms the work of [4] and is due to how accessible and not tedious their collections, processing, and sales are. On the side of the mushroom, it was observed that 50 women, representing 6.83%, participated in mushroom gathering, use, processing, and sales. With the NTFPs, for example, leaves are handled mainly by women to wrap food sold on the roadside and even in modern restaurants to reduce the pollution of plastics in our environment used to wrap food. Of the total respondents, 65, representing 8.88% of women, mentioned their involvement in collections, processing, and sales of leaves. Among the respondents, only 20 men, representing 2.87%, made their participation and sales of NTFPs clear. Snails were recorded to be the highest for women, with 120, representing 16.39% participating in their collection, processing and sales. Snails were seen as one of the most sold NTFPs in the study area. Most of the women spend much time gathering and processing snails. Snails gathered in the forest are sometimes sold without processing them. Processed snails increase the price, and most of the time, snails are used for household meals.

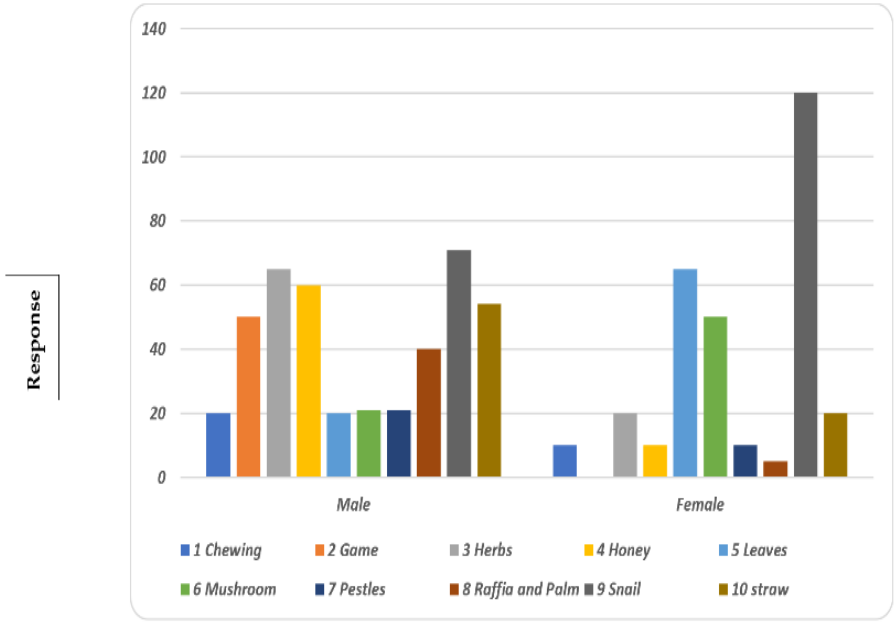

Figure 3. NTFPs collections in the study area by males and females.

On the other hand, NTFPs like game, herbs, raffia palm, straw, and pestles were handled mainly by men. For example, game had 50 respondents for men, representing 6.83%, while no women recorded for the game hunting, representing 0%. This may be because of how tedious the hunting of game is, and most of the hunting process does occur at night. With raffia palm, many men were recorded due to the preparation of the raffia palm for weaving baskets and mats for drying products like cocoa or other products. The preparation of raffia palm is heavy and involves several steps.

From the survey, a different response was given by the locals concerning the multiple uses of NTFPs (Figure 4). As part of the survey, both males and females collected the list of NTFPs. The number of NTFPs used for sale was reported as 275, representing 37.57%. As a result, these products are derived from forests and are intended for commercial use, such as trading or selling. The number 115 signifies the NTFPs utilised for medicinal purposes. These products may include various plants, herbs, or other natural resources found in forests that have medicinal properties and are used for healing or healthcare. Concerning medicine, 115 respondents mentioned that they are involved in collecting NTFPs for medicinal purposes. The products include plants, herbs, and other natural resources found in forests, which have medicinal properties and are used for healing or health care. Of the survey, 22 respondents, representing 3.01%, mentioned collecting NTFPs for leisure. For example, flowers, fruits, or other forest resources are sometimes used for decorative purposes, landscaping, or leisurely enjoyment during festivals [173]. Moreover, 30 respondents, representing 4.10%, mentioned that they collect some NTFPs for religious purposes. Some said they collect some products in the forest for rituals to pacify their gods. In rituals, ceremonies, and worship practices, some NTFPs include plant leaves, incense, and some animals like birds and other natural resources. The survey showed that 95 respondents, representing 12.98%, used NTFPs to feed their livestock. It was mentioned by the locals that they usually use leaves, fruits, and straws to feed their livestock. Fodder, grazing resources, or other forest-derived products consumed by or for the benefit animals can be considered among these products.

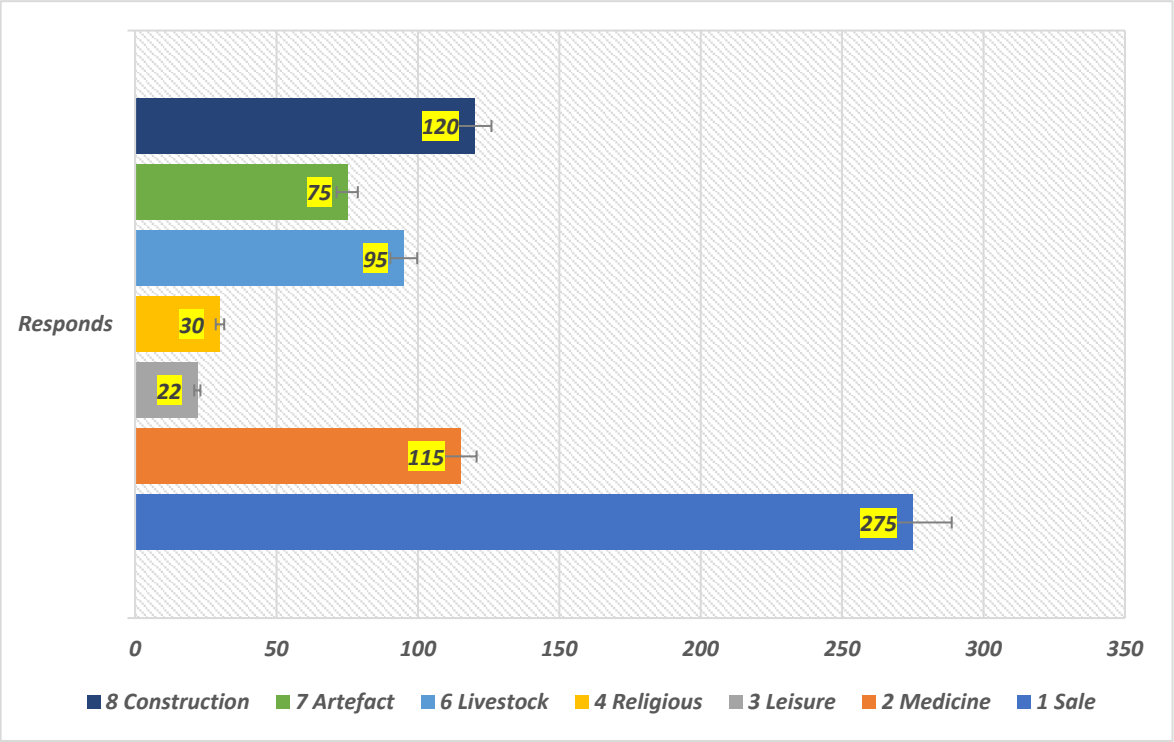

Figure 4. Multiple uses of NTFPS in the study area.

Overall, 75 respondents, representing 10.25%, mentioned that they collect NTFPs and process them into artefacts. These materials are wood, fibres, resins, or other forest resources transformed into art pieces, handicrafts, or traditional arts and crafts. From the survey, 120 respondents, representing 16.39%, collect NTFPs for construction. The products may include timber, bamboo, or other forest materials used in the construction industry for various purposes, such as structural elements, furniture, or decorative items.

4.1. Perception of the Locals on Multiple Values of NTFPs and Their Potential to Alleviate Poverty

Local perceptions regarding the utilisation of non-timber forest products (NTFPs) were categorised into various purposes, including artefacts, construction, food, leisure, medicine, religion, and sales. According to the responses gathered, 112 individuals, comprising 15.30%, mentioned collecting and harvesting NTFPs specifically for crafting artefacts, which are subsequently sold in the market. Additionally, 180 respondents, constituting 24.59%, perceived that the primary use of NTFPs lies in food consumption. It was noted that a smaller number of locals, 15 respondents (2.05%), viewed NTFPs as sources of leisure. Furthermore, a portion of the community regarded NTFPs as having religious significance. Moreover, a notable majority of locals expressed the perception that NTFPs are utilised for various medicinal purposes, with 115 respondents (15.71%) mentioning such use. Additionally, 170 respondents (23.22%) perceived NTFPs primarily as commodities for sale. Lastly, 95 respondents (12.98%) reported using NTFPs for construction purposes.

Examining the responses of local inhabitants concerning the multifaceted uses of non-timber forest products (NTFPs), logistic regression analyses were conducted to evaluate the effects of gender, education, religion, multiple uses of NTFPs, and household size on their perceptions. Gender, education, and religion were found to exert significant influence on how locals perceive and utilise NTFPs, as evidenced by the *p*-values of 0.00132 **, 0.00692 **, and 8.12×10^{-5} ***, respectively (refer to Table 4). The study suggests that gender, particularly in the context of harvesting, gathering, and selling NTFPs, may shape perceptions regarding their utilisation. However, household size and the various applications of NTFPs exhibited minimal impact on how locals comprehend the diverse

uses of NTFPs. Furthermore, the nature of work within local communities did not seem to affect their perception of NTFP utilisation within the community.

Table 4. Logistic regression model on peoples' perceptions of multiple uses of NTFPs.

Variable	Estimate	Std Error	Z Value	*p* Value
Intercept	22.85998	1078.87784	0.021	0.98310
Gender	−1.42808	0.44464	−3.212	0.00132 **
Education	−0.82063	0.30384	−2.701	0.00692 **
Religion	−1.25122	0.31750	−3.941	8.12×10^{-5} ***
Household size	0.07156	0.07007	1.021	0.30713
Occupation	−14.09820	1078.87703	−0.013	0.98957
Multiple uses of NTFPs	0.13597	0.12301	1.105	0.26900

Significance level: ** $p < 0.01$; *** $p < 0.001$.

4.2. Influence of Social, Cultural, and Environmental Values and Their Influence on Multiple Uses of NTFPs

During the discussions with key stakeholders, including harvesters, gatherers, and sellers, it became evident that social factors, environmental changes (such as climate change), and cultural beliefs significantly shape the locals' perceptions of the multiple uses of NTFPs. One respondent, who was a gatherer and trader, stated that "The changes in weather patterns, characterised by long dry seasons and short rainy periods, have negatively impacted the availability of snails and mushrooms for my NTFP business. Despite thorough searches in the forest, we find nothing, prompting me to cease this venture and seek alternative means of livelihood to sustain my family". A traditionalist who engages in gathering and hunting attributes the decline in NTFP production to the sinful behaviour of modern society. He said, "Sinful acts of modern people like abortion, homosexuality, and lesbianism have angered the gods, resulting in withheld rains, which has affected the production levels of NTFPS". These influences directly impact the potential of NTFPs to enhance local livelihoods. Social factors such as cohesion, gender roles, and socioeconomic status influence how locals perceive and utilise NTFPs. A noticeable absence of social cohesion between government officials, such as those from the Ghana Forestry Commission, and the local communities has led to tension between them. This tension arises from officials prohibiting locals from accessing NTFPs from the forest, with such actions being viewed as criminal. Consequently, individuals found gathering NTFPs for sustenance are reported to the police and paraded to the court. This has put them in fear of assessing NTFPs on their own land. One trader stated, "The officials from the Ghana Forestry Commission and forest guards consistently prevent us from accessing the forest to collect snails and mushrooms. Any attempt to enter the forest may lead to your arrest, prosecution, and potential imprisonment. Interestingly, they permit their wives, friends and girlfriends to gather and hunt for other NTFPs, creating a monopoly over the NTFP business in our village. We have been fighting and talking about this situation, but nothing has been done, and this is affecting our livelihood in the community".

It was also observed that cultural beliefs, traditions, and religion played crucial roles in the locals' perceptions of the multiple utilisation of NTFPs. It was found that gender differences influenced the gathering, processing, and marketing of NTFPs. It was revealed that certain types of NTFPs are designated exclusively for either women or men. It was also observed that some NTFPs like snails, rats and other games are not to be sold in some tribes in some of the communities because it is taboo to gather snails or hunt rats in the community. A man identifying as being from the Krobo tribe asserted that snails are deemed taboo and unclean within his cultural community. He adamantly stated that if someone were to prepare snails in his home, he would leave all utensils and take drastic action against that individual, as he refused to even touch snails. Additionally, it was noted that religious beliefs influenced the gathering, processing, and utilisation of certain NTFPs. Certain tribes abstain from handling particular NTFPs, such as snails and some games, due

to religious restrictions. Additionally, it was noted that certain NTFPs, like Frankincense, are carefully safeguarded owing to their significant religious significance.

5. Discussion

The data provided on the multiple non-timber forest products (NTFPs) and their contribution to the livelihoods of Ghanaian communities for poverty alleviation shed light on the varying levels of importance and utilisation of these products. The study mentioned several uses of NTFPs.

5.1. Multiple Collections of NTFPs from the Locals

NTFPs are collected by locals in forest communities for various purposes, contributing to their livelihoods and well-being. From the study, it was observed that there were different types of NTFPs that were collected from the forest. It was observed that NTFPs that are easy to gather and process are normally done by women, and heavy and difficult process ones are done by men (Figure 3). NTFPs can be collected and processed in a gendered manner in many cultures, with some tasks being assigned to women and others to men. It is important to note that the division of labour depends on the NTFPs' characteristics and the associated activities.

Generally, women handle NTFPs that are relatively easy to collect and process, such as herbs, leaves, fruits, and certain types of mushrooms. The activities involved in these tasks may include gathering, sorting, cleaning, and processing the products. The knowledge of local flora and women's expertise in harvesting these resources is valued for contributing to household nutrition, traditional medicine, and income generation. On the other hand, it is generally the responsibility of men to collect and process NTFPs that require a high level of physical strength or specialised skills. Some tasks may be assigned to men, such as hunting game, climbing trees to gather certain fruits or nuts, or cutting down larger plants or trees to harvest specific products. Physical endurance and specialised knowledge may be required to perform these activities, which can be labour-intensive and potentially dangerous.

5.2. Commercialisation of NTFPs to Improve Local Livelihood

A significant improvement in the livelihoods of forest communities could be achieved through the commercialisation of NTFPs [22,174]. From the study, it was observed that many of the locals gather different forms of NFPs for sales. Several advantages and opportunities are associated with the commercialisation of NTFPs when it is appropriately managed. From the study, the 275 respondents, representing 37.5%, mentioned that the NTFPs gathered are mostly sold. The commercialisation of NTFPs allows local communities to generate income [59]. Community members can earn a sustainable income by selling forest products in local markets or to larger buyers. As a result of this income diversification, poverty levels are reduced, and households are provided with more excellent financial stability. The commercialisation of NTFPs has been recognised as a direct contributor to poverty reduction efforts [175,176]. Forest communities often need economic opportunity, and NTFPs offer an avenue for generating income without relying solely on traditional agriculture or wage labour. Locals can improve their living standards, access necessities, and invest in education and health care by generating market value for NTFPs.

Creating employment opportunities within forest communities is possible by commercialising NTFPs [177,178]. With the growing demand for NTFPs, various roles in the value chain are required, such as harvesting, processing, packaging, transportation, and marketing [179,180]. Jobs can be created as a result, especially for community members with skills or knowledge related to the management and trade of NTFPs. It is possible to encourage sustainable resource management practices through commercialisation [181,182]. Communities are more likely to manage their forest resources responsibly when the economic value of NTFPs is recognised [183]. As part of this effort, sustainable harvesting techniques must be adopted, reforestation and regeneration efforts must be promoted, and measures must be taken to prevent overexploitation. This helps in the sustainable

management of forest resources. By giving local communities greater control over their resources and decision-making processes, the commercialisation of NTFPs can enhance their empowerment [184,185]. It allows communities to determine their development pathways, fostering a sense of ownership and autonomy. Through empowerment, community cohesion, self-reliance, and the strengthening of local institutions can be enhanced [186,187].

5.3. NTFPs Providing Religious and Leisure to People

Forest communities benefit significantly from non-timber forest products (NTFPs) by providing opportunities for religious and leisure activities. These products have a cultural, spiritual, and recreational value, contributing to individuals' overall well-being and quality of life. This study observed that 22 respondents, representing 3.01%, and 30, representing 4.1%, used NTFPs for leisure and religious purposes, respectively. In forest communities, NTFPs are often used in religious rituals and ceremonies [158,188]. Certain plants, leaves, or extracts may have sacred or symbolic significance and be incorporated into various traditional practices [189,190]. From the study, some locals mentioned that "As a tradition, we go to the forest during the Christmas season to collect banana stems for use as Christmas trees. Also, we use palm leaves as shade during funeral activities". The rituals are deeply rooted in cultural and spiritual beliefs, giving people a sense of belonging and connection to their heritage.

NTFPs preserve cultural practices and traditional knowledge [191,192]. The use of these products in religious ceremonies, storytelling, dances, and other cultural events contributes to the transmission of cultural values, wisdom, and traditions from one generation to the next. In addition to contributing to the preservation of cultural heritage, NTFPs are deeply woven into the fabric of cultural identities. NTFPs can serve aesthetic and recreational purposes. Forests rich in NTFPs provide natural leisure, relaxation, and recreation [193–195].

Visitors and locals enjoy nature walks, bird watching, wildlife observation, and picnics in forested areas. Diverse plant species, aromatic herbs, and beautiful landscapes enhance the aesthetic experience and provide a tranquil environment for leisure and recreation. NTFPs provide crafts and artistic expression to the locals. The NTFPs are used in various artistic and craft forms as raw materials. The traditional handicrafts, artwork, and decorative items of forest communities are made from bark, leaves, fibres, seeds, and other natural materials. In addition to showcasing individual artists' creativity and artistic skills, these works represent cultural heritage and traditions. NTFPs play a crucial role in preserving cultural practices and traditional knowledge. The use of these products in religious ceremonies, storytelling, dances, and other cultural events contributes to the transmission of cultural values, wisdom, and traditions from one generation to the next. In addition to contributing to the preservation of cultural heritage, NTFPs are deeply woven into the fabric of cultural identities.

5.4. NTFPs for Artefacts, Construction, and Its Benefits to Improve Local Livelihood

NTFPs are essential in providing materials for artefacts and construction, thus improving local livelihoods. NTFPs, such as various creeping plants, leaves, and ropes, provide valuable materials for construction purposes. Local communities can harvest and process timber from sustainable sources to build houses, furniture, tools, and other structures [196–198]. This utilisation of NTFPs supports local livelihoods by providing employment opportunities in weaving, carpentry, and related industries. Several tree species, including cork oak, can produce cork from their bark, which is used for various applications, including flooring, insulation, and artisanal crafts. In addition, NTFP fibres such as rattan, bamboo, and palm can be woven into baskets, mats, furniture, and other products used for sale and generate income for the locals. Those with skills in traditional crafts can earn an income from collecting and processing bark and fibres. NTFPs produce resins and latex used in various applications, including artefacts and construction. Tree resins such as dammar and copal are used in varnishes, adhesives, and traditional art

materials. Rubber-based products, such as tyres, footwear, and other rubber products, are produced with latex obtained from rubber trees. Local communities can benefit from the tapping and processing of resin and latex to generate income and employment.

Bamboo and rattan are versatile in constructing and creating various artefacts. Bamboo and rattan are versatile NTFPs [199,200]. Bamboo is known for its strength, flexibility, and rapid growth, making it suitable for building materials, furniture, handicrafts, and even musical instruments [201,202]. In furniture production, baskets, and decorative items, rattan is commonly used for its pliability and durability. Managing and utilising bamboo and rattan resources sustainably can provide sustainable income streams to local communities.

5.5. NTFPs Provide Feeding for Livestock That Helps to Improve Life

Non-timber forest products (NTFPs) provide livestock feed resources in forest communities. NTFPs also contribute to the improvement of local livelihoods. In forest ecosystems, some tree and shrub species provide valuable fodder for livestock. Cattle, goats, sheep, and other livestock can benefit from the leaves, twigs, and other parts of these plants that are rich in nutrients. Fodder made from NTFPs is a sustainable and cost-effective alternative to commercial feed, especially in areas without easy access to conventional feed sources [203,204]. There are a variety of browse plants in forest areas, including shrubs and woody plants, which are highly palatable and nutritious for grazing animals. This helps locals improve their animal feed, enhancing animal husbandry and potentially improving livestock sales. Livestock, including goats and sheep, can consume other trees' foliage, twigs, and bark [201,205,206]. By reducing dependence on cultivated fodder crops and improving livestock resilience during periods of forage shortage, browse plants support local livelihoods in forested areas. Some NTFPs are used for medicinal purposes that may also benefit livestock health [4,207]. Plants with natural antimicrobial, antiparasitic, and immune-boosting properties can benefit livestock's overall health and productivity. Traditionally, local communities have used medicinal plants for livestock care, providing a sustainable and cost-effective method of animal health care.

5.6. NTFPs Are Improving the Health of Local People

In forest areas, non-timber forest products (NTFPs) are important in providing traditional medicine to the local communities [208]. Indigenous and local populations have used these medicinal NTFPs for centuries to address various health issues and maintain their well-being. Many forest communities have their traditional healing systems that rely heavily on the knowledge and use of medicinal plants [207,209]. Plants collected from the forest prepare remedies and treatments for various health conditions. To identify and utilise NTFPs for medicinal purposes, local healers possess traditional knowledge. Again, a vast array of plant species with medicinal properties can be found in forest ecosystems, which are rich in biodiversity. Traditionally, these plants have been used to treat ailments such as fever; digestive, respiratory, and skin conditions; and more. NTFPs used in medicine include herbs, roots, leaves, bark, fruits, and seeds that are processed or prepared in various ways. NTFPs provide sustainable and accessible health care to locals in the forest communities. As a result of limited access to modern healthcare facilities, NTFPs serve as a primary source of health care for many forest communities. Locals have access to affordable and culturally appropriate remedies due to the availability of medicinal NTFPs in their surroundings. This is particularly important, particularly in remote areas with limited access to conventional healthcare services.

5.7. Local Perception of Multiple Use of NTFPs

The local perception of non-timber forest products (NTFPs) encompasses their diverse uses, economic significance, and potential to enhance livelihoods. Studies indicate that communities are knowledgeable about the various NTFPs available and recognize their versatility, including applications in medicine, food, leisure, religion, sale, construction, and handicrafts. Locals also understand the economic value of NTFPs, acknowledging their

potential to generate income and support household livelihoods. Furthermore, NTFPs are seen as contributing to poverty alleviation by providing sustainable income opportunities and improving community well-being. Specifically, NTFPs play essential roles in religious practices, traditional medicine, and local cuisine, reflecting their cultural significance and historical use. While some perceive NTFPs as highly effective medicinal remedies, others may exhibit scepticism influenced by factors such as cultural beliefs and the availability of alternative treatments. Similarly, NTFPs are valued for their nutritional benefits and cultural heritage in local cuisines, contributing to food security and preserving traditional cooking techniques. Despite varying perceptions, NTFPs are considered valuable resources with economic, cultural, and environmental implications. Gender, religion, and education significantly influence locals' perceptions of NTFPs, highlighting the importance of understanding these social factors in promoting sustainable resource management and poverty alleviation initiatives.

6. Conclusions

Undoubtedly, NTFPs contribute significantly to Ghanaian communities' livelihoods and poverty alleviation. In addition to providing income generation opportunities, food security, health care, and the preservation of cultural practices, NTFPs provide economic, nutritional, medicinal, cultural, and environmental benefits. In addition to chewing sticks, game, herbs, honey, leaves, mushrooms, pestles, raffia and palm, snails, and straw, locals collect a wide range of non-timber forest products for various purposes. Despite the myriad benefits of NTFPs to local communities, their perception of NTFPs is significantly influenced by social, cultural, and environmental values concerning their sustainable utilisation. The research revealed that locals gather NTFPs for diverse purposes, including construction, crafting, livestock feed, religious rituals, leisure, medicinal use, and sale, as commonly reported by participants. Interestingly, a small number of locals mentioned leisure as a reason for collecting NTFPs, possibly due to time constraints from their daily commitments. In terms of age groups, the study revealed that individuals aged 50–59 were most actively involved in the research, whereas those aged 18–20 were the least represented. This trend may be attributed to the younger age group being predominantly students, likely occupied with schooling during the study period. The study showed that social factors like education, gender, and religion influence how locals perceive the multiple uses of NTFPs, with occupation and home size having little or no influence. It was shown that the collection and sale of NTFPs have empowered local communities, who are often involved in the processing and marketing of NTFPs. The study showed that multiple benefits derived from NTFPs contribute to poverty alleviation in Ghanaian communities by diversifying income sources, improving food security, preserving cultural practices, and improving access to health care.

It is essential for both the locals and the government to ensure sustainable management practices, equitable distribution of benefits, and the conservation of forest ecosystems to continue reaping the benefits of NTFPs in the long run. Again, the government of Ghana can promote community-based forest management to involve locals in the sustainable harvesting and use of NTFPs, ensuring both livelihood improvement and environmental protection. Through capacity-building initiatives and training programs, the government can equip forest fringe communities with sustainable NTFP collection, processing, and marketing skills, enhancing their economic contributions. Additionally, policies recognising the significance of indigenous knowledge and traditional practices in NTFP utilisation, aiming to protect cultural heritage and customary rights associated with these resources, should be encouraged. Such measures foster an environment conducive to preserving and transmitting traditional knowledge within forest fringe communities.

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Conflicts of Interest: The authors declare no conflict of interest.

Appendix A

This survey is designed to assess the sustainable utilisation of Non-Timber forest Products to alleviate poverty in Ghana. This is for a Doctoral thesis in the school of Forest Sciences at the University of Eastern Finland Joensuu.

(Any information provided will be treated Anonymously)

1. What is your name (Optional)

2. Age
   - ☐ 17 or younger
   - ☐ 18–20
   - ☐ 21–29
   - ☐ 30–39
   - ☐ 40–49
   - ☐ 50–59
   - ☐ 60 or older
3. Gender
   - ○ Male
   - ○ Female
4. Level of Education
   - ○ Primary school only
   - ○ High School, no degree
   - ○ High School degree
   - ○ Vocational School
   - ○ Some University Courses
   - ○ University Degree
   - ○ Some Graduate Level Courses
5. What is your occupation?
   - ○ Farming
   - ◉ Trading
   - ○ Other (please specify):
6. What is your religious believe
   - ○ Christian
   - ○ Muslim
   - ○ Traditionalist
7. Which region are you located in?

- ◉ Western-North
- ○ Ashanti
- ○ Bono-East
- ○ Ahafo
- ○ Eastern

8. What is the name of the District you are located

9. What is the Name of the community where you live?

10. How long have you lived in this community?
    - ○ 1–2 years
    - ○ 4–10 years
    - ○ 10–20 years
    - ○ 20-Above
11. Do you depend on the forest?
    - ◉ Yes
    - ○ No
12. Do you hunt for NTFPs in the forest?
    - ○ Yes
    - ○ No
13. Do you hunt for the NTFPs in large quantities?
    - ○ Yes
    - ○ No
    - ○ Other (please specify):

14. If yes, What product do you normally hunt for in the forest?
    - ○ Snails
    - ○ Mushrooms
    - ○ Honey
    - ○ Game
    - ○ leaves
    - ○ Chewing stick.
    - ○ Other (please specify):

15. What do you use them for? (Mention)

16. What is your household income (Amount quoted in Ghc)
    - ○ Less than 5000
    - ○ 10,000 to 19,999
    - ○ 20,000 to 29,999
    - ○ Can not Specify
17. Can you quantify the total amount you obtained from the products you hunt from the forest in a year when you sell the product?
    - ○ Yes
    - ○ No
    - ○ Other (please specify):

18. If Yes does it fall within this range? (Ghc)
    - ○ Less than 1000
    - ○ 3000 to 4000
    - ○ 5000 to 5999
    - ○ 6000 to 6999
    - ○ 7000 or more
19. Do you face problems in gathering and hunting of NTPs
    - ○ Yes
    - ○ No

20. If yes, What problem do you face when hunting NTFPs from the forest?

21. Do social factors like gender, religion and education affect how you perceive the importance of NTFPs?
    - ○ Yes
    - ○ No
22. Has gender affected how NTFPs and their importance are perceived?
    - ○ Yes
    - ○ No
23. Describe how gender has changed how you perceive the importance of NTFPs

24. Has Religion affected how NTFPs and their importance are perceived?
    - ○ Yes
    - ○ No

25. Describe how Religion has influenced your perception of the importance of NTFPs and how you use NTFPs

26. Has your occupation affected how NTFPs and their importance are perceived and how you use?
    - Yes
    - No
27. Describe how Occupation has influenced your perception of the importance of NTFPs and how you use NTFPs
28. Do you obtain a permit to access the forest NTFPs harvest from the forest?
    - Yes
    - No
29. Is it easy to obtain a permit from the Forestry Commission?
    - Yes
    - No
30. Do you know what Climate change is?
    - Yes
    - No
31. What are some of the causes of climate change?
32. Do you think the climate has affected the production levels of NTFPs?
    - Yes
    - No
33. What are some of the changes you have observed in terms of the weather conditions in your area?

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