Review

A Review of the Potential of Non-timber Forest Products to Alleviate Poverty

Obed Asamoah *, Jones Abrefa Danquah, Dastan Bamwesigye *, Nahanga Verter, Ebo Tawiah Quartey, Charles Mario Boateng, Suvi Kuittinen, Emmanuel A. Boakye, Mark Appiah, Ari Pappinen

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Review

The Potential of Non-timber Forest Products to Alleviate Poverty: A Systematic Review

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Abstract: Non-timber forest Products (NTFPs) are a broad category of natural resources harvested from forests that do not involve cutting down trees for their wood or timber. NTFPs play a vital role in the livelihoods and economies of many rural communities, particularly in forest-dependent regions. Despite the benefits obtained from NTFPS, little is known about its potential to alleviate poverty in the local communities. The objective of this review is to comprehensively assess the potential of NTFP's contribution to poverty reduction within forest fringe communities. The study employed the systematic review method to delve into the multifaceted relationship between NTFPs and poverty alleviation. We followed the preferred reporting items for systematic reviews and meta-analyses protocol (PRISM-P). In all, 58 research articles were reviewed. The results indicated that NTFPs hold significant promise as a tool for poverty alleviation. Globally, NTFPs have the potential to alleviate poverty and increase household incomes between 19% and 78% within forest fringe rural communities. In addition, the review indicated that countries in Africa and Asia depend highly on NTFPs and provide substantial amounts of income to the locals. However, the potential for NTFPs to reduce poverty is not uniform. It is highly contingent upon local ecological conditions, market accessibility, community involvement, and supporting policies and interventions. In conclusion, this systematic review demonstrates that NTFPs have a substantial role in poverty alleviation. This study underscores the need for continued research and targeted development initiatives to unlock the vast potential of NTFPs in addressing poverty challenges.

Keywords: non-timber forest products; potential; poverty; livelihood; alleviation; locals

1. Introduction

Non-timber forest Products (NTFPs) are various resources or products obtained from forests that are distinct from timber or wood products (Pandey et al., 2016; Shrestha et al., 2020). This includes plant- and tree-based products and products derived from animals and fungi that are not wood-based (Shackleton & Pandey, 2014; Shackleton & Pullanikkatil, 2019). Community livelihoods

and well-being are significantly impacted by NTFPs, which play a significant role in sustainable forest management and conservation (Harbi et al., 2018; Melese, 2016; Uprety et al., 2016). Many NTFPs are edible and provide essential nutrients. In rural areas where access to food is limited, they contribute to the diversification of diets (Dwivedi et al., 2017; Mango et al., 2018). Fruits, nuts, mushrooms, and wild vegetables are NTFPs that enhance nutrition and food security (Sardeshpande & Shackleton, 2019; Tata Ngome et al., 2017). Several NTFPs have medicinal properties and are integral to traditional healthcare systems (Masoodi & Sundriyal, 2020; Mipun et al., 2019; Shrestha et al., 2020). They are derived from plants and herbs found in forests and have been used for generations to treat a wide range of health problems. Traditional medicine utilises NTFPs to improve the accessibility and affordability of healthcare, particularly for local communities (Asamoah et al., 2023; Lindberg et al. 2023, 2023; Mipun et al., 2019). In these communities, natural remedies play a crucial role in promoting health, providing remedies for ailments, and contributing to the well-being of those in the community. Additionally, the knowledge and practices associated with using NTFPs for medicinal purposes are often passed down through cultural and traditional teachings, further enriching the heritage of healthcare practices within these communities (Mohd Salim et al., 2023).

By diversifying the economic base of communities, NTFPs reduce the dependency on a single source of income (Leßmeister et al., 2018; Verma & Paul, 2016). This diversification plays a crucial role in enhancing economic resilience, especially when faced with changes in other sectors or fluctuations in the market (De Roest et al., 2018; Sedita et al., 2017). Individuals and communities can generate multiple streams of revenue by collecting, processing, and trading NTFPs. The multifaceted income-generation approach provides a buffer against economic instability caused by changes in demand, prices, or other unforeseen circumstances in traditional markets (Ahenkan & Boo, 2011; Suleiman et al., 2017). In addition, economic diversification through NTFPs can provide a safety net during challenging economic times (David et al., 2019; Wahlén, 2017). For example, if a primary source of income, such as agriculture or a specific industry, experiences a downturn, revenue from NTFPs can be used to offset financial losses and maintain a certain standard of living. Individuals and communities can have a more resilient financial structure, which reduces their vulnerability to economic shocks. In addition to bolstering financial stability, economic diversification through NTFPs encourages sustainable practices. Communities are trying to sustainably manage and harvest these forest resources to ensure long-term availability and economic viability. As a result, responsible stewardship of the environment and conservation efforts are encouraged, aligning economic activities with environmental sustainability.

1.2. Poverty and poverty alleviation in Ghana

Poverty is a multifaceted and complex societal issue that can be defined in various ways (Olsson et al., 2014; Spicker, 2020). Poverty measurement can be approached in two distinct ways: the absolute approach and the relative approach (Decerf, 2021). **Absolute Poverty** sets a fixed standard below which individuals or families are living in poverty (Decerf, 2021; O'Boyle, 1990). Absolute poverty can also be explained as the state in which individuals or households lack the financial resources to meet the minimum living requirements needed over an extended period (Hulme & Shepherd, 2003; Mensah & Gordon, 2020). Poverty is characterised by the inability to meet basic needs such as food, shelter, safe drinking water, education, and healthcare. The World Bank, for example, defines extreme poverty as living on less than $1.90 per day (Manuel et al., 2018; Newhouse et al., 2016). On the contrary, relative poverty is a concept that considers poverty in relation to the broader society (Mellish, 2016; Müller & Neuhäuser, 2011). It is based on a comparison to other people's standing in the economy, and it looks at individuals or families whose resources are so insufficient that they are excluded from the lifestyle and activities considered normal in that society. Relative poverty can be observed by looking at relative societal or international standings. It is a phenomenon most relevant in societies in which there is no acute problem with absolute poverty, thus being an ethically less severe problem (Bhalla & Lapeyre, 2016; Spicker, 2020).

Studies have provided varying estimates of the poverty rate in Ghana, reflecting the complexity of measuring poverty and the different methodologies used (Carvalho & White, 1997; Coudouel et

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al., 2002; Sahn & Stifel, 2000). According to the World Bank, Ghana's "international poverty" rate was estimated at 27% in 2022, representing an increase of 2.2% since 2021. This indicates a concerning trend of worsening poverty in the country. Additionally, the World Bank projects that poverty is expected to increase to nearly 34% by 2025, based on the international poverty line (World Bank in Ghana, 2023). Oxfam International offers insights into Ghana's poverty situation, reporting that approximately 24.2% of the nation's population resides below the poverty line (OXFAM International, 2023). The organisation underscores pronounced inequalities, notably between the southern and northern regions, where a substantial portion of the populace survives on less than $1 per day. Again, the World Bank's Poverty & Equity Brief for Ghana provides detailed statistics on poverty rates and economic growth in the country. It indicates that Ghana has made significant progress in reducing poverty, with the poverty rate at the 2011 PPP of $1.90 per person per day decreasing from 47.4% in 1991 to 13.3% in 2016 (World Bank Group (Poverty&Equity), 2022). However, the report also notes that poverty reduction has slowed since 1998, and the growth elasticity of poverty has decreased remarkably. Poverty alleviation in Ghana involves endeavours to minimise the prevalence of poverty and mitigate the adverse impact it imposes on those affected by it. Ghana has substantially improved poverty reduction (Selase & Lu, 2018). Notably, from 2001 to 2010, the country implemented structural reforms in response to the increasing poverty rates, as outlined in its Poverty Reduction and Growth Strategies (Ampofo, 2017).

1.3. Role of Non-Timber Forest Products in Poverty Alleviation

Non-timber forest products (NTFPs) have emerged as a crucial component in poverty alleviation efforts in forest communities (Issaka, 2018). With their significant potential to generate income and improve livelihoods, these products have gained recognition and attention from policymakers, researchers, and development practitioners (Jaffee et al., 2018; Mukul et al., 2016; Scoones, 2015). Studies have shown that one of the critical benefits of NTFPs is their ability to provide income-generating opportunities for rural communities, especially those living in or near forest areas (Rahman et al., 2021; Verma & Paul, 2016). Many of these communities heavily rely on forest resources for their livelihoods. The collection, processing, and sale of NTFPs offer them a means to generate income and improve their living conditions. Additionally, NTFPs have a relatively low entry barrier compared to other income-generating activities (Chakravarty et al., 2015; Meinhold & Darr, 2019). This makes them particularly suitable for marginalised groups, such as women, youth, and indigenous communities, who may face limited access to resources and opportunities. By engaging in NTFP activities, these groups can enhance their economic empowerment and reduce their vulnerability to poverty (Djoudi et al., 2015; Kassa & Yigezu, 2015). NTFPs-related activities significantly generate employment opportunities, especially in rural and forest fringe areas (Lepcha et al., 2022; Talukdar et al., 2021). This impact is particularly pronounced in regions with scarce or limited formal job opportunities. NTFP-related activities encompass a range of tasks from harvesting, processing, packaging, and transportation to marketing and sales. These activities demand a diverse range of skills and labour (Chakravarty et al., 2015; Vega et al., 2023). Local community members often engage in these activities, providing them with direct employment opportunities within their vicinity.

NTFP harvesting and processing often align with seasonal patterns of resource availability. This leads to predictable employment patterns, providing stability and consistent income during specific times of the year when these resources are abundant (Saxena & Güneralp, 2022; Vaughan et al., 2023). Engaging with NTFPs can foster entrepreneurship and the development of small enterprises. Individuals or small groups may start businesses related to value addition, such as processing NTFPs into marketable products like herbal medicines, handicrafts, or food items (Bannor et al., 2021; Harbi et al., 2023). This entrepreneurial spirit contributes to local economic development. The nature of NTFPs activities often promotes community collaboration. Communities may come together to harvest, process, or market these products collectively, encouraging a sense of unity and shared responsibility while distributing the benefits of the enterprise (Dentoni et al., 2018; Paudel, 2016). Engaging with NTFPs can serve as an additional income source for farmers in rural and forest fringe

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areas. This supplementary income helps buffer against the fluctuating returns from agricultural activities and provides a safety net during challenging times. For farmers residing in rural and forest fringe areas, involvement in NTFP-related activities can function as an extra source of income. This added revenue helps mitigate the unpredictable earnings from agricultural endeavours and offers a safety net during challenging periods.

1.4. Importance of poverty alleviation in forest communities

Poverty alleviation holds immense significance for locals in forest communities, impacting various aspects of society, the economy, and the overall well-being of its people to fulfil the goal one (1) of the sustainable development goal. Combatting poverty is intrinsically linked to enhancing human capital. Through poverty alleviation measures, access to education, healthcare, and skill development opportunities can be broadened, nurturing a skilled and healthy workforce essential for national progress (Council, 2015; World Bank, 2019). Poverty alleviation is directly linked to economic growth (Boukhatem, 2016). By raising individuals and communities out of poverty, locals can harness a more productive workforce. As people have increased access to resources and opportunities, they contribute to the nation's economy, fostering entrepreneurship, innovation, and overall economic progress. Poverty alleviation necessitates investing in human capital. When lifted from poverty, individuals can access education, healthcare, and skill development (Hoque et al., 2015).

This investment in human potential enhances the skills and capabilities of the workforce, paving the way for a more knowledgeable and skilled society. Poverty alleviation efforts work towards reducing income inequality (Adekoya, 2018; Hassanain, 2015). The income gap narrows as individuals move out of poverty, creating a more equitable society. This reduction in income disparity enhances social harmony and inclusiveness, critical components of sustainable socioeconomic development(van Niekerk, 2020; Zauro et al., 2020). Poverty alleviation ensures that individuals can access necessities such as food, clean water, housing, and healthcare. When people's basic needs are met, they can focus on self-improvement, education, and economic activities, ultimately contributing to the nation's development (Hizi, 2019). Poverty alleviation is instrumental in ensuring social and political stability. When communities experience improved living standards and economic well-being, they are more likely to engage positively in the democratic process and contribute to a stable and peaceful society (Gilchrist & Taylor, 2016; Werhane et al., 2020). Poverty alleviation is at the core of the United Nations' Sustainable Development Goals. By addressing poverty, Ghana aligns itself with international development objectives, fostering a sustainable and inclusive society that prioritises the well-being of its citizens (Gore, 2015; Werhane et al., 2020). Poverty alleviation entails investment in infrastructure and public services. Building roads, schools, hospitals, and other essential facilities creates jobs and enhances access to vital services, stimulating economic growth and overall societal development. A nation making strides in poverty alleviation enhances its global competitiveness and reputation. Ghana's commitment to reducing poverty showcases its dedication to social development, attracting investments, aid, and partnerships on the international stage (Mensah & Gordon, 2020; Osei-Kyei, 2017).

1.5. Aim of the Review

There have been several initiatives and projects aimed at poverty alleviation in Ghana, which various organisations and institutions have implemented. For example, Oxfam International has been working in Ghana since 1985, aiming to reduce poverty in Ghana. The organisation supports farmers who are into Agriculture to improve the livelihood of the locals. Agricultural growth since ages is considered a significant driver of poverty reduction, especially in forest fringe communities in Ghana (Hirons et al., 2018; Mohammed, 2014). Strategic investments in agriculture could significantly impact poverty reduction and bring growth to forest and local communities in Ghana (Aryeetey & McKay, 2007; Breisinger et al., 2008)0. In seasons with crop failure due to adverse weather conditions, NTFPs serve as the safety net that cushions the locals by providing cash income (Mulungu & Manning, 2023). Considering the potential of NTFPs for poverty alleviation could permit a more

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quantitative assessment and provide more insight into the sustainable utilisation of NTFPs and their management in the forest fringe communities in Ghana, Africa and other parts of the world (Fasona et al., 2019). Understanding how NTFPs can alleviate poverty is paramount and can provide a holistic view of the benefits they can contribute to locals in the forest fringe communities. Incorporating the potential of NTFPs in poverty alleviation strategies will provide a comprehensive, quantitative, and targeted approach to poverty reduction in Ghana's forest fringe communities.

This synthesis aims to comprehensively review existing studies, consolidating valuable insights and knowledge to assist a diverse audience, including researchers, local communities, and forest managers. The primary focus of this review is on NTFPs and their potential to serve as a catalyst for poverty alleviation and enhancement of livelihoods within the forest fringe communities in Africa and other parts of the world. The synthesis involves systematically collecting and compiling existing research studies related to NTFPs worldwide. This compilation creates a centralised knowledge repository, making it more accessible and convenient for stakeholders to access pertinent information on NTFPs.

2. Methodology

2.1. Searches terms and languages

Our searches were conducted in English, primarily because the review team members were proficient in this language. This approach also served as a practical means of narrowing the scope of the review. Due to our goal of exploring the multifaceted relationship between NTFPs and poverty, we developed an extensive set of search terms. As a result, these terms were designed to encompass a variety of aspects of NTFPs as well as various dimensions of poverty alleviation.

2.2. Searches

We followed the Preferred reporting items for systematic review and meta-analysis protocols (PRISM-P) (Moher, 2009; Page et al., 2021) to systematically retrieve and categorise the relevant literature on NTFPs and their potential to alleviate poverty. Our research inquiries are wide-ranging, making our review fall under the category of a systematic map (Roe et al., 2014). PRISMA can serve as a robust framework for performing systematic reviews on a wide range of subjects, as noted in the review report (Moher, 2009). (Sierra-Correa & Cantera Kintz, 2015) have emphasised that PRISMA is adept at formulating research questions for systematic reviews and can effectively establish the criteria for including or excluding studies in the analysis.

2.3. Database and Search Strategy

In the current study, we identified four major journal databases for our review: Scopus, ScienceDirect, Google Scholar, and Web of Science (WOS). Studies by (Fanchini et al., 2020 Mohd Salim et al., 2023 Roberts et al., 2019) have shown that there is a plethora of databases available, including SCOPUS, Google Scholar, EMBASE, MEDLINE (via PubMed), Web of Science, CINAHL, and Cochrane Controlled Trials. However, our study focused on Scopus, Google Scholar, ScienceDirect, and Web of Science over other databases due to their well-established indexing of journal articles. These databases are renowned for their reliability, providing access to empirical data and encompassing various multidisciplinary study fields, such as environmental sciences, agricultural sciences, biological sciences, and social sciences. Additionally, as emphasised by (Martín-Martín et al., 2018), Scopus, Google Scholar, Web of Science, and ScienceDirect are recognised as some of the world's top and most competitive citation databases. As per the methodology outlined by (Cheng et al., 2017; Shaffril et al., 2020), a systematic approach was undertaken involving identification, screening, and eligibility procedures to curate appropriate articles for the study. These meticulously devised processes facilitated the comprehensive retrieval of articles and the synthesis of various studies, ensuring the review's transparency and organisational coherence. In this study, a set of keywords was carefully chosen, including "non-timber forest products (NTFPs)," "poverty," "livelihood," "alleviation," "forest,", "communities," "locals," To enhance the search's efficacy,

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synonyms and related terms that had been employed in prior research were incorporated. These keywords were then amalgamated in the search string, utilising techniques such as truncation, Boolean operators (AND and OR), quotation marks, and asterisks (see Table 1).

Table 1. The keywords searched in the search string.

Databases	Keywords
Web of Science	Non-timber forest products" OR "NTFPs*" AND "Potential" AND "poverty" OR "livelihood" OR "Improvement" OR "Alleviation" AND "forest communities" OR "Locals" OR "Fringe" OR "Adjacent"
Scopus	Non-timber forest products" OR "NTFPs*" AND "Potential" AND "poverty" OR "livelihood" OR "Improvement" OR "Alleviation" AND "forest communities" OR "Locals" OR "Fringe" OR "Adjacent"
ScienceDirect	Non-timber forest products" OR "NTFPs*" AND "Potential" AND "poverty" OR "livelihood" OR "Improvement" OR "Alleviation" AND "forest communities" OR "Locals" OR "Fringe" OR "Adjacent"
Google Scholar	Non-timber forest products" OR "NTFPs*" AND "Potential" AND "poverty" OR "livelihood" OR "Improvement" OR "Alleviation" AND "forest communities" OR "Locals" OR "Fringe" OR "Adjacent"

2.4. Data Abstraction and Analysis

In the current study, an integrated review approach was employed. The integrative review method is a comprehensive approach that analyses and synthesises a wide range of study designs, including qualitative, quantitative, or a blend of both, by transforming one type into another (Whittemore & Knafl, 2005). In this study, qualitative methodologies were employed, thoroughly examining the titles, abstracts, and contents of the selected papers. Data abstraction was conducted in alignment with the research questions to ensure that the findings from the investigations could effectively address the specified research queries (Badini et al., 2018; Gutiérrez Rodríguez et al., 2016; Shaffril et al., 2020). Subsequently, thematic analysis was performed to identify relevant themes and sub-themes derived from the results. As per the approach outlined by (Braun & Clarke, 2017), thematic analysis is a method for describing, interpreting, and documenting patterns within the abstracted data. There are several advantages to using this methodology over other qualitative methods, including ease of learning and implementation, accessibility and flexibility for researchers with less experience, as well as the ability to summarise, highlight critical points, and interpret data. Furthermore, as highlighted by (Boyatzis, 1998), thematic analysis allows researchers to draw connections between information from various facets of a research issue within their own research.

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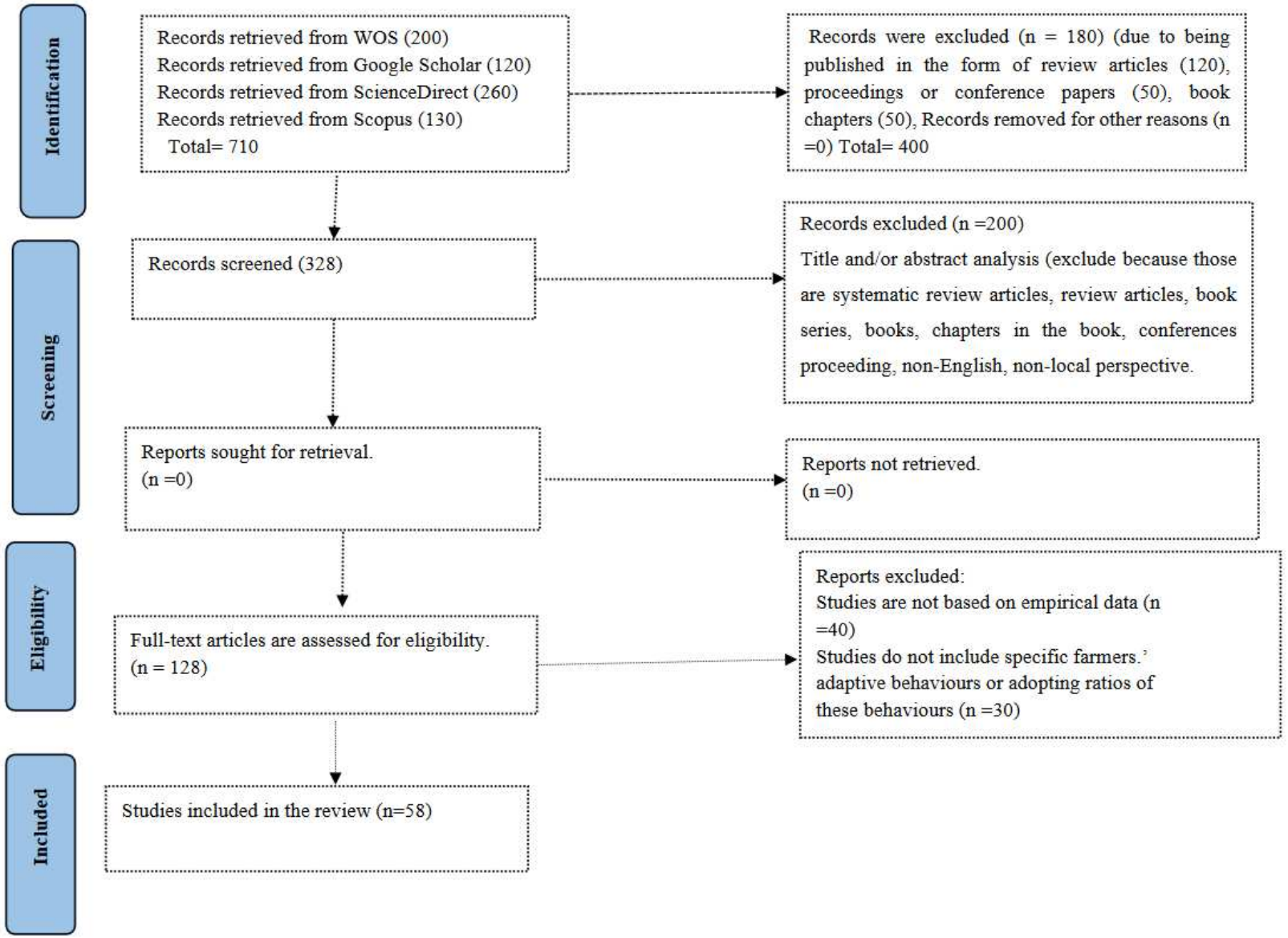

Figure 1. Flow of information through the different phases of a systematic review using the PRISMA method.

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2.5. Analytical framework, of which the literature is analysed to NTFPs potential to alleviate poverty

In this section, we explored a wide-ranging evolution of ideas derived from diverse studies that have extensively detailed the contributions and multifaceted utilisation of NTFPs, which generate income for local communities and the countries involved in the harvesting and processing these resources. We examined studies that have delineated various types of Non-Timber Forest Products (NTFPs) and have also documented their commercialisation and income generation. We also looked into how NTFPs contribute to poverty alleviation through their sale, local household use, and export for foreign exchange.

The analysed studies were divided into two primary sections: (1) Studies focusing on the collection of NTFPs for household use and (2) Studies examining NTFPs for commercial purposes. The analysed studies were based on regions such as Africa, Asia, South America, and Europe see Figure 2. The studies have also examined the potential of NTFP-based bioeconomy in livelihood security and income inequality mitigation among locals. Studies that have sought to understand the role of NTFPs in household subsistence and income generation, as well as the impact of the local and national economy on the bioeconomy. Additionally, we analysed studies conducted to assess the development of the NTFP industry and its achievement in poverty alleviation, particularly in lower-income forest areas in the selected regions.

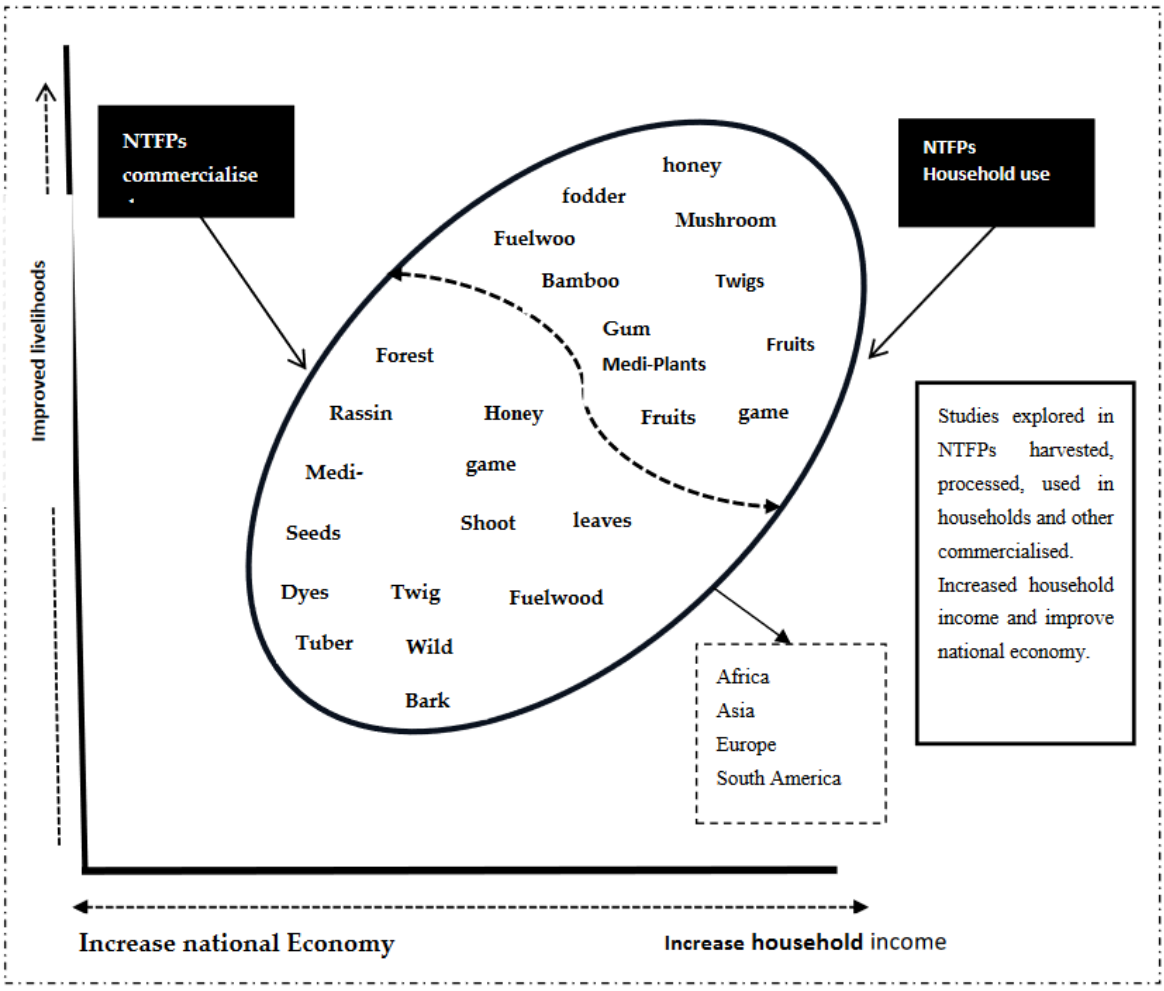

Figure 2. Analytical framework on the selection of studies based on the analysis of the Potentials of NTFPs and their potential to alleviate poverty.

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3. Results

The outcomes obtained from Scopus, WOS, Google Scholar and ScienceDirect underwent a manual filtration process utilising the predefined keywords. Each article's bibliographic and citation details were entered individually into an Excel worksheet. This bibliographic information encompassed the author(s) names, publication title, publication year, document type, and country of origin. Several steps were undertaken before making the final selection (Table 1). Initially, the article titles were evaluated, adhering to the established inclusion and exclusion criteria. Subsequently, the abstracts of the papers were scrutinised, and any publications unrelated to the current subject matter were excluded. Lastly, a comprehensive manual assessment was carried out on the chosen full-text publications. As presented in Table 2, 58 articles remained following the screening process. The WOS database contributed 200 articles corresponding to the keywords. Of the remaining 60 articles, the selection was based on their titles. Further screening based on the abstracts yielded 40 articles. Ultimately, 15 publications were retained for data interpretation. In the case of Scopus, 130 articles were initially selected based on keywords, and 50 were chosen through a title-based filtering approach. However, after evaluating the abstracts of 60 publications, they were eliminated from consideration, and 15 were retained. This resulted in a final selection of four articles for data interpretation. These same steps were applied to the other database, and in total, 58 studies were retained.

Table 3. Screening from various search engines.

Database	Total Result According to Stated Keywords	First Phase of Selection Filtered by Title	Second Phase Selection Filtered by Abstract	Result
Web of Science	200	60	40	15
Scopus	130	50	20	10
ScienceDirect	260	35	25	19
Google Scholar	120	14	14	14
Total				58

3.1. Distribution across regions and the study's timeframe

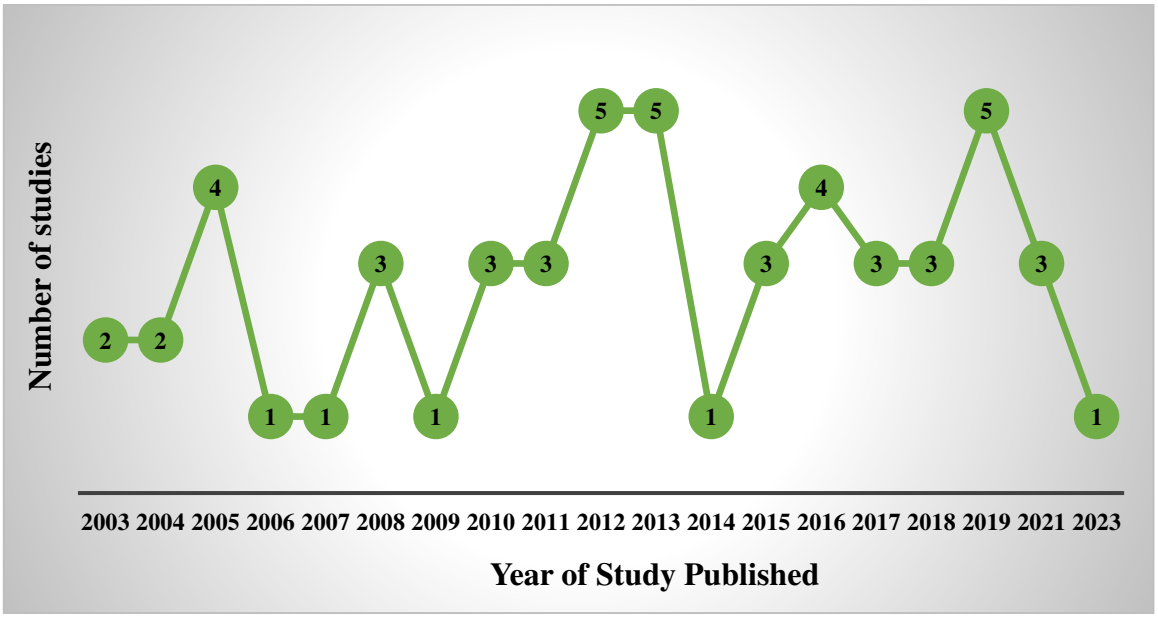

Figure 3. A number of studies with the year studies were published.

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We evaluated a series of studies and their respective publication years. The study considered 20 years' time frame from 2003 to 2023 Figure 2. The screening process revealed that the years 2012, 2013, and 2019 had the highest number of studies focused on assessing or evaluating NTFPs and their capacity to enhance the quality of life for local communities and alleviate poverty. Conversely, the years 2006, 2007, 2009, 2014, and 2023 had the lowest publication frequency, each featuring only one study related to NTFPs and their potential to mitigate poverty, while the remaining years saw the publication of three or four such studies.

We examined various studies and the countries where these studies were conducted. Notably, Nigeria stood out as the country with the most extensive body of research on NTFPs (Figure 2) and their role in poverty alleviation in rural areas, making a significant contribution to the Nigerian economy. India closely followed, ranking as the second-highest contributor to studies focused on the potential of NTFPs to enhance livelihoods. In contrast, countries such as Ghana, Burkina Faso, Nepal, Tunisia, and the combined region of Ukraine and Sweden had just one study each identified through the search criteria.

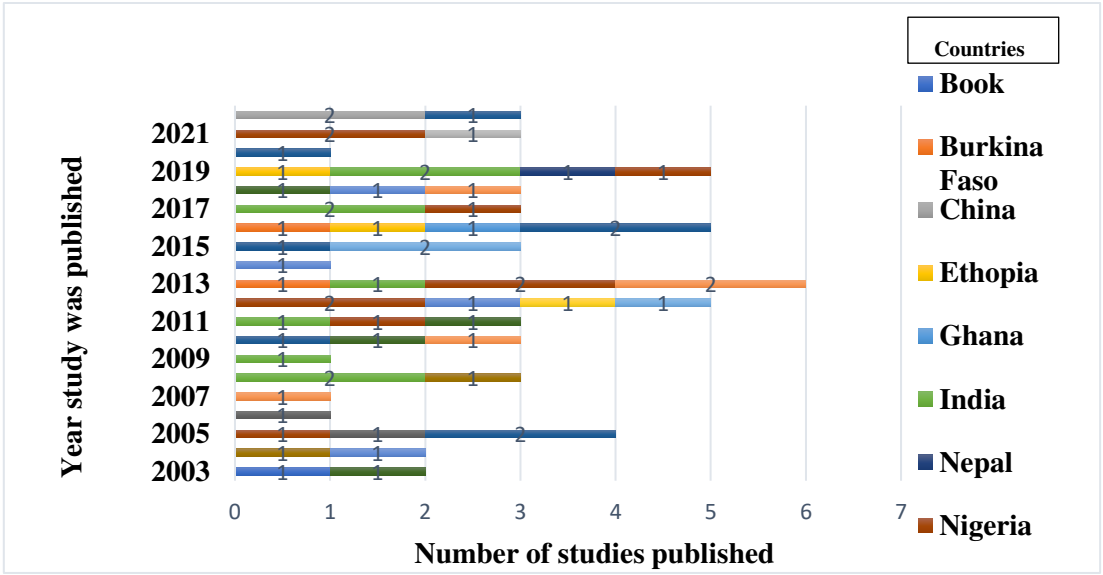

Figure 3. Countries and the year where these studies were conducted.

Based on the applied search criteria, in 2003, the research focused on NTFPs and their capacity to alleviate poverty. It was predominantly conducted in Sudan and South Africa. The most extensive research output was observed in 2013, with significant studies carried out in India, Nigeria, and Tanzania. In contrast, the year 2023 had the lowest number of studies, possibly attributable to the likelihood that many studies conducted in that year were in the review stage, awaiting publication. Notably, both 2005 and 2016 saw the highest number of studies, but they predominantly consisted of review works assessing the potential of NTFPs to enhance local livelihoods.

The search results clearly indicate a predominance of studies in Africa and Asia, with South America having a relatively smaller representation. Europe being the least represented (see Figure 4). In 2013, five papers were published in Africa and one in Asia, and the year 2019 witnessed the highest number of studies in Asia, with three papers. Only one study was conducted in Europe, specifically in 2012. South America saw two papers, both published in 2005 and 2006.

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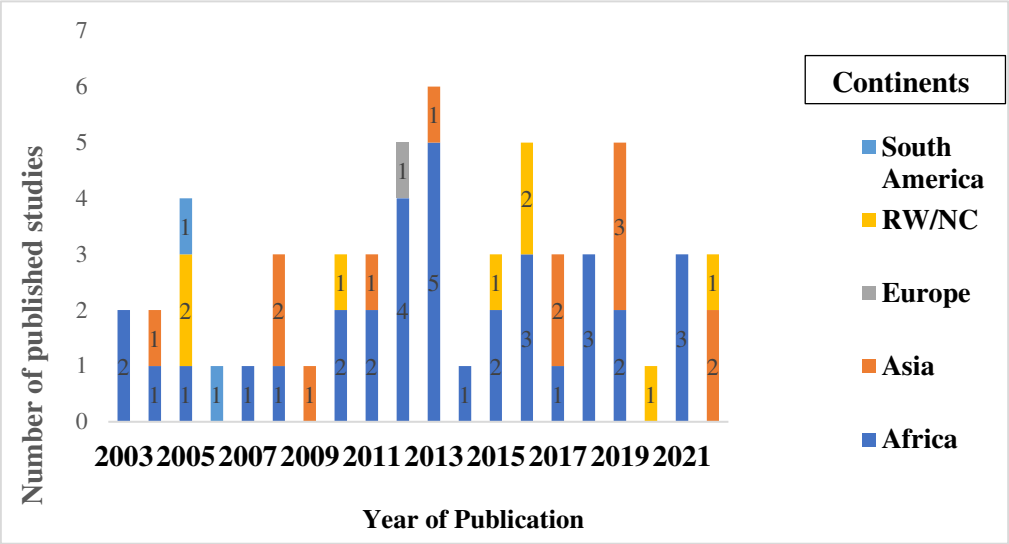

Figure 4. Continental and year of publication with a review paper.

Table 4. Studies on NTFPs and their contribution to Poverty alleviation.

Region Studied	Specific NTFPs collected	% Contribution of NTFPs to Household income	Citation
Tanzania	Firewood, fodder, honey.	**40**	(Giliba et al., 2010)
Myanmar	bamboo shoot, charcoal, firewood, broom grass	**43.7**	(Moe & Liu, 2016)
Ethiopia	Forest coffee, honey, spices (Ethiopian cardamom and long paper), fuelwood, medicinal and edible plants, bamboo	**47**	(Melaku et al., 2014)
Nepal	Fruits, leaves, seeds, shoots, bark, roots	**44–78**	(Rijal et al., 2011)
India	Medicinal plants, Mushrooms, Wild vegetables, Fuel wood, Gum resin and tannin, Millets, and seeds	**19–32**	(Saha & Sundriyal, 2012)
Uganda	Fuel wood, wild vegetables, Mushrooms, medicinal plants.	**26**	(Jagger, 2012)
Benin	Fodder, twigs, wild fruits, fuelwood, medicinal plants.	**39**	(Heubach et al., 2011)
Myanmar	Fuel, Fodder, Food, Medicinal plant, Wildlife	**50-55**	(Aung et al., 2015)
Cameroon	Fodder, medicinal plants, roots, tubers leave flowers, games dyes, etc.	**31**	(Ngwatung & Roger, 2013)

The search yielded information from studies that have quantified the specific contributions of NTFPs to households in local communities situated within forest areas. It also provided studies provide valuable insights into the contribution of non-timber forest products (NTFPs) to household income and poverty alleviation.

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Table 5. Overview of the Income Contribution of NTFPs in Various Arid Forest Nations.

Contribution	Region	Products	Citation
4- 60% total income	Tanzania, Ethiopia Nigeria, India, Zambia	Honey, mushrooms, wood fuel fruits, leaves etc.	(Mulenga et al., 2012),(Nambiar, 2019; Nandi & Sarkar, 2021)
40–60% of women's income, and 15–20% of overall household income.	Burkina Faso	NTFP	(Tincani, 2012)
10–50% of harvester's income in Sudan	Sudan	Gums, resins, and wax	(Elmqvist & Olsson, 2006)
This income contributes to 32.6% of annual household subsistence	Ethiopia	Gums, resins, Bamboo off farm crops and other NTFPs	(Mekonnen et al., 2013, 2014)
Between 19% and 95% of local income	South Africa	Honey, mushroom and other NTFPs	(S. Shackleton & Gumbo, 2010)
70% of the cash income of rural household	Tanzania	NTFPs	(Makonda & Gillah, 2007)

The review showed that income generated from NTFPs varies depending on the specific type of NTFPs being harvested, gathered, and used. In both Asia and Africa, food resources hold significant value as they can either contribute to income when sold or reduce household expenses when consumed.

4. Discussions

4.1. Regions where NTFPs' potentials to alleviate poverty has been carefully studied

Globally, the significance of NTFPs has been recognised for their contributions to conservation, income generation, improvements in livelihoods, and rural development (Peerzada et al., 2022). However, the potential of NTFPs to alleviate poverty has been a subject of extensive study, particularly in developing countries (Adam, 2019). (Menelisi, 2014) highlighted that Zambia and Tanzania's woodlands are the leading honey producers in the Sub-Saharan region. According to the institution's data, in 2005, Zambia harvested 219 tonnes of honey, valued at US$491,000 in the market, while Tanzania exported 466 tonnes with a total value of US$674,000 (S. Shackleton & Gumbo, 2010). Since the implementation of the Honey Market Tracking System (HMTS), both countries have experienced a significant increase in their export volumes, with growth rates ranging from 20% to 30% since 2001, which has had a positive impact and improved local livelihoods. In Nigeria, studies conducted by (Muhammad, 2017) in the Kano state revealed that 45% of the surveyed households received a portion of their total incomes, ranging from 20.5% to 40.5%, from Non-Timber Forest Products (NTFPs). About 22% of these households derived a higher share, ranging from 41% to 60.5% of their total household incomes from NTFP sales. On the other hand, only 2% of all the households interviewed reported that a significant portion, exceeding 80.5% of their incomes, was generated through NTFP-based enterprises in the study area.

Economic estimates of around USD 90 billion per year have been projected for NTFPs globally, with approximately one-third of this value being consumed within local economies, bypassing market transactions (Mahapatra & Tewari, 2005). Crucially, the role of Non-Timber Forest Products (NTFPs) in bolstering the income of rural households holds substantial significance in numerous countries worldwide. For instance, (C. M. Shackleton et al., 2007) found that in Central and West

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Africa, the income shares derived from NTFPs can, at times, equal or even surpass the minimum wages of school teachers and other professional workers. Their study also revealed that NTFP traders in the Democratic Republic of Congo earned weekly incomes ranging from USD 16 to 160, while the producers earned approximately 50-75% of that weekly amount. Prior studies have noted that rural households in Nigeria obtained a substantial portion of their incomes, as high as 80%, from the sale of NTFPs (Jimoh et al., 2013). Again, (Zaku et al., 2013) documented that more than 70% of households in Nigeria rely directly on fuelwood as their primary energy source, with a daily consumption estimate of 27.5 million kg/day. This has saved people from depending on expensive other source of energy. There are many regions throughout the country where the extraction and processing of NTFPs has evolved from subsistence use and local market sales to include international cross-border trade. One example of this transformation can be seen in the high forest regions of Eastern and Western Nigeria, where the collection and sale of game meat and snails have become significant income-generating activities for locals (Onuche, 2011). Again, In the Central and Northern regions of Nigeria, specifically within the Savannah zone, rural households derive substantial income from various activities, including honey production, fuelwood gathering, locust bean seed collection, gum arabic harvesting, and charcoal production(Jimoh et al., 2013) which monies are used to resolve other family issues for example payments of fees and hospital bills. Comparable roles of NTFPs in enhancing the welfare of rural communities were also documented in other African nations, such as Kenya and Tanzania (Mbuvi & Boon, 2009; Schaafsma et al., 2014).

The global trade in wild mushrooms is valued at over $2 billion annually, as reported by (Hall et al., 2003). A substantial portion of this trade is driven by four genera commonly consumed in temperate regions: boletes (*Boletus* spp.), chanterelles (*Cantharellus* spp.), matsutakes (*Tricholoma* spp.), and truffles (*Tuber* spp) (Hall et al., 2003). Despite receiving less attention from researchers compared to temperate fungi, wild mushrooms from tropical forests play a crucial role in providing sustenance and income. In a survey that involved querying rural women in Ghana to prioritise 16 Non-Timber Forest Products (NTFPs) based on their significance as sources of food and income, the majority, accounting for 76%, considered mushrooms to be a "most important" resource, as indicated by (Ahenkan & Boo, 2011). Studies have shown that numerous species of ungulates, primates, birds, rodents, reptiles, and amphibians found in tropical regions are targeted for their meat, commonly referred to as bushmeat (Shanley et al., 2015). (Brashares et al., 2004) reported that bushmeat trade is believed to have a value in the billions of U.S. dollars. It has been estimated by (Fargeot et al., 2017) that the yearly consumption value of bushmeat in Bangui, the capital of the Central African Republic, amounts to $16 million, which is more than 1% of the country's GDP.

4.2. NTFPs, income generation and Poverty alleviation

Besides fuel and timber resources, the forests offer diverse products that can enhance local livelihoods and help reduce poverty reduction (Djoudi et al., 2015; Shackleton & Pandey, 2014). Nevertheless, in numerous areas, accurately documenting the role of NTFPs remains challenging, mainly because a substantial portion of the trade takes place in informal markets. Consequently, the true contribution of NTFPs has yet to be formally integrated into the national economy (Djoudi et al., 2015). Nonetheless, there is empirical support for certain noteworthy NTFPs; for example, Shea butter in Burkina Faso is the country's third most crucial export (Schreckenberg 2004). In Tanzania, Ethiopia, Nigeria, India, and Zambia, honey, mushrooms, wood fuel fruits, leaves, etc, are provided between 4-60% of income to locals in these countries (Mulenga et al., 2012; Nandi & Sarkar, 2021; Tincani, 2012). In Ethiopia, gums and resins rank second only to livestock in their impact on household livelihoods (Mekonnen et al., 2013). Studies have shown that, in Sudan, between 10-50% of rural households in come are obtained from NTFPs like Gums, resins and wax (Elmqvist & Olsson, 2006).

Forest products, such as medicinal herbs, honey, mushrooms, and fruits, hold significant importance as marketable commodities. Extensive research has focused on assessing the role of these (NTFPs) in bolstering local incomes, primarily within the Miombo in India (Djoudi et al., 2015). Studies by (Shackleton et al., 2007) provide an estimate that South Africa alone has more than 300,000 traditional healers, with a significant portion believed to rely on forest products for treating different

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ailments and helping those who have no financial strength to visit the hospitals. Nevertheless, the nature and significance of such trade exhibit regional variations. Research spanning both Asian and African regions suggests that dry forest foods frequently serve as substantial supplements to purchased food, with the value of foods collected and consumed by households potentially depending entirely on dry forest products during specific seasons in which locals save money on food(Hegde & Bull, 2008). In Mozambique, the forestry sector, which provides NTFPs, plays an important role in the national economy by contributing about 4% of the country's GDP and about 80% of energy needs (Hegde & Bull, 2008).

Among the various Non-Timber Forest Products (NTFPs) originating from tropical forests, medicinal plants are recognised as one of the most extensively researched categories (Shanley et al., 2015). Research findings indicate that traditional medicine serves as the primary source of healthcare in numerous regions, with figures such as 80% in Africa, as reported by the World Health Organization (Shanley et al., 2015). The worldwide botanicals market is experiencing an annual growth rate of over 7%, amounting to approximately $85 billion in annual sales. The natural personal care and cosmetics sector generates about $31 billion in annual sales, expected to reach $46 billion by 2018 (Laird & Wynberg, 2016). In 2003, the collective export of shea nuts from Ghana, Burkina Faso, Togo, Mali, Cote d'Ivoire, and Benin amounted to over 140 million kilograms, with an approximate value of $24 million, as reported by UN Comtrade. One of the most famous tropical nuts is the Brazil nut, scientifically known as Bertholletia excelsa. This nut is primarily harvested from the wild in the Amazon Basin, adding to its allure and exotic nature (Shanley et al., 2015). Its unique flavour and nutritional benefits have made it a popular choice among consumers worldwide. The significant export figures from Bolivia, Brazil, and Peru in 2012, amounting to over 35 million kilograms and valued at $190 million, highlight the global demand for this remarkable nut (Shanley et al., 2015).

Throughout the course of human civilisation, people have harnessed various forest fibres and construction materials for purposes such as constructing homes, thatching roofs, crafting tools, and weaving cordage, baskets, and mats. Bamboo and rattan stand out among the critical tropical forest fibres involved in international trade. Both woody and herbaceous bamboos are part of the grass family and are distributed across tropical and temperate regions. Renowned for their exceptional tensile strength, woody bamboos have a rich history of utilisation in Asia, where they have been employed in creating residences, tools, paper, and musical instruments. The global trade in bamboo and rattan products has expanded considerably, surpassing $3.417 billion USD in 2019 (Zhao et al., 2022). Asia, notably China, serves as the principal origin of these products and holds a substantial portion of the worldwide market (Sigit, 2020). Bamboo and rattan are used for various products, including construction materials, furniture, papermaking, musical instruments, toys, and food markets, at various processing levels (Huang et al., 2019). China, for example, earns $130 million USD annually from exports of edible bamboo shoots and $117 million USD from woven bamboo products (Kumar & Sastry, 1999). India's incense stick industry, estimated to be worth $400 million USD, relies on bamboo as a raw material. Previous old studies by (Kumar & Sastry, 1999) revealed that in many Asian countries, rattan is second only to timber in economic importance, with a global trade and subsistence value estimated at $6,500 million USD. Furniture is the most popular rattan product, with the Philippines alone exporting rattan furniture worth $123 million USD in 1994. Rattan products accounted for 89 per cent of Indonesia's foreign exchange earnings of $238 million USD in 1987

Studies conducted by (Nataliya, 2012) in Ukraine in Europe revealed that locals reported earning more than 3,000 UAH (Ukrainian Hryvnia) per season from selling berries, which roughly translates to 300 EUR and equates to two monthly rural salaries. The average price for one litre of blueberries was approximately 10-15 UAH, implying that people collected and sold around 200 litres of berries. Wild strawberries fetched around 50 UAH per litre (approximately 5 EUR), and a kilogram of penny bun mushrooms sold for 60 UAH (about 6 EUR). While interviewees were somewhat reserved about disclosing their earnings from mushroom and berry sales, they emphasised that such income could sustain them for several months. Local residents marketed their berries and mushrooms in nearby cities, towns, and along the main roads within the region. Interviewees noted that one could earn 100 UAH (approximately 10 EUR) daily, exceeding the average daily wage in rural areas. The distance to

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these markets ranged from 2 to 60 kilometres. In villages situated near the Polish border, locals sold berries, primarily blueberries, to foreign companies, which then transported the berries to Poland for value-added production. Respondents mentioned the ease of selling to Polish companies as they purchased all the collected berries. The average price for one litre of blueberries in these transactions was 10 UAH (approximately 1 EUR). Additionally, residents gathered Non-Wood Forest Products (NWFPs) for personal use.

4.3. Critiques

While the majority of the analysed studies consistently indicated that Non-Timber Forest Products (NTFPs) have the potential to alleviate poverty, a slight discrepancy emerged among studies regarding the extent to which NTFPs can fully address poverty. The search results provide a comprehensive view of the potential of non-timber forest products (NTFPs) to alleviate poverty. At the same time, some studies acknowledge the importance of NTFPs as a significant source of cash income for remote communities and a safety net for diversifying income (María Castro et al., 2023; Shackleton & Gumbo, 2010). However, others highlight the complexity of the relationship between NTFPs and poverty, with income shares from NTFPs being highest among poor communities and households, leading to discussions of NTFPs as potential poverty traps (Shackleton et al., 2024). Additionally, a structured analytical framework has been formulated to evaluate the impact of income derived from NTFPs on poverty alleviation, signifying a deliberate attempt to comprehend and quantify this association (Adam et al., 2023). Nevertheless, it has been observed that the capacity of NTFPs to influence rural development positively depends on their role within a comprehensive livelihood strategy, implying that their contribution to poverty alleviation is not assured (Adam et al., 2013). Many NTFPs have been harvested in an unsustainable manner, leading to the degradation of resources and scarcity of resources (Peters & Mundial, 1996). In an extensive examination of NTFPs trade, (Neumann & Hirsch, 2000) emphasised that the trade of NTFPs frequently results in a meagre income for the most economically disadvantaged communities rather than serving as a catalyst for socioeconomic development. Again, according to (Shackleton et al., 2024), several authors (Angelsen & Wunder, 2003; FAO, 2003) have presented various reasons why the utilisation of Non-Timber Forest Products (NTFPs) or dependence on NTFP income is likely to lead to poverty traps. Most of these reasons are connected to what is commonly referred to as "low returns" in the NTFP trade.

5. Conclusions

The systematic review of non-timber forest products' potential to alleviate poverty reveals a complex and multifaceted relationship. While NTFPs hold promise as a sustainable source of income and livelihood diversification for forest-dependent communities, their potential impact on poverty alleviation depends on factors such as local ecological conditions, market access, value addition, commercialisation, and community involvement. Based on the results of the review, it is evident that NTFPs can play an important role in reducing poverty when they are effectively managed and incorporated into comprehensive development plans. By utilising these products sustainably, impoverished communities and the environment can benefit from a mutually beneficial situation that aligns income generation with conservation efforts. From the study, it was observed that most of the local communities in Africa and India depend fully on NTFPs. NTFPs, in their sustainable utilisation, represent a win-win scenario. Allowing local communities to derive income from these forest resources it lessens the pressure on timber and other potentially destructive activities, which can lead to deforestation and habitat destruction. Consequently, this sustainable approach helps preserve ecosystems and the biodiversity they harbour. Nevertheless, unlocking the full potential of NTFPs as a tool for poverty alleviation necessitates a concerted effort. Tailored policies and well-planned interventions are imperative in ensuring that NTFP management is sustainable and that the benefits are widely distributed. This includes promoting responsible harvesting practices, investing in value-addition processes to increase the market value of NTFPs, and facilitating easier market access for local communities.

Furthermore, the success of NTFP-based poverty alleviation initiatives hinges on local communities' active involvement and empowerment. Strengthening their capacity to engage in NTFP activities, access markets, and negotiate fair prices is essential for ensuring that the benefits of NTFPs reach those most in need. Again, the success of NTFPs in addressing poverty hinges on creating an enabling environment that supports their sustainable utilisation while ensuring that local communities have the knowledge, resources, and opportunities needed to maximise their benefits. With the right policies and interventions in place, NTFPs can serve as a powerful force for improving both the economic well-being of forest-dependent communities and the health of our ecosystems. In light of these findings, it is clear that NTFPs can be a valuable tool in the fight against poverty, but their potential can only be fully harnessed through targeted interventions, local empowerment, and a holistic approach that considers the unique dynamics of each community and ecosystem. Further research and sustainable development initiatives are needed to maximise the impact of NTFPs on poverty alleviation.

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