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Socio-economic factors and traditional communities development: a meta-analysis in the context of non-timber forest product

Fatores socioeconômicos e desenvolvimento de comunidades tradicionais: uma meta-análise no contexto de produtos florestais não madeireiros

Factores socioeconómicos y desarrollo de comunidades tradicionales: un metaanálisis en el contexto de los productos forestales no maderables

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ABSTRACT
Non-timber forest products (NTFPs) are essential for rural livelihoods in temperate and tropical regions. This study investigates the socio-economic factors influencing communities managing these resources through a systematic review of 3442 articles, selecting 21 with relevant data for meta-analysis. Using binary logistic regression, the study examines the relationship between NTFP dependence and variables such as gender, age, family size, education, forest conservation, public policies, social organization, marketing channels, and income. The findings highlight the significant influence of gender, age, public policies, social organization, income, and forest conservation. Notably, socio-economic improvement occurs regardless of NTFP dependence. To ensure sustainable development, strategies should focus on increasing social awareness, mechanizing resource extraction, providing financial incentives for research and training, ensuring stable market conditions, and implementing conservation-focused public policies. These measures will support traditional communities

Keywords: economic development, forests, public policy, systematic review, sustainable.

RESUMO
Produtos florestais não madeireiros (PFNMs) são essenciais para a subsistência rural em regiões temperadas e tropicais. Este estudo investiga os fatores socioeconômicos que influenciam as comunidades que administram esses recursos por meio de uma revisão sistemática de 3.442 artigos, selecionando 21 com dados relevantes para meta-análise. Usando regressão logística binária, o estudo examina a relação entre a dependência de PFNMs e variáveis como gênero, idade, tamanho da família, educação, conservação florestal, políticas públicas, organização social, canais de marketing e renda. As descobertas destacam a influência significativa de gênero, idade, políticas públicas, organização social, renda e conservação florestal. Notavelmente, a melhoria socioeconômica ocorre independentemente da dependência de PFNMs. Para garantir o desenvolvimento sustentável, as estratégias devem se concentrar em aumentar a conscientização social, mecanizar a extração de recursos, fornecer incentivos financeiros para pesquisa e treinamento, garantir condições de mercado estáveis e implementar políticas públicas focadas na conservação. Essas medidas apoiarão as comunidades tradicionais).

Palavras-chave: desenvolvimento econômico, florestas, política pública, revisão sistemática, sustentável.

RESUMEN
Los productos forestales no madereros (PFNM) son esenciales para los medios de vida rurales en las regiones templadas y tropicales. Este estudio investiga los factores socioeconómicos que influyen en las comunidades que gestionan estos recursos a través de una revisión sistemática de 3442 artículos, seleccionando 21 con datos relevantes para el metanálisis. Utilizando la regresión logística binaria, el estudio examina la relación entre la dependencia de los PFNM y variables

como el género, la edad, el tamaño de la familia, la educación, la conservación forestal, las políticas públicas, la organización social, los canales de comercialización y los ingresos. Los hallazgos destacan la influencia significativa del género, la edad, las políticas públicas, la organización social, los ingresos y la conservación forestal. Cabe destacar que la mejora socioeconómica ocurre independientemente de la dependencia de los PFNM. Para garantizar el desarrollo sostenible, las estrategias deben centrarse en aumentar la conciencia social, mecanizar la extracción de recursos, proporcionar incentivos financieros para la investigación y la capacitación, garantizar condiciones de mercado estables e implementar políticas públicas centradas en la conservación. Estas medidas apoyarán a las comunidades tradicionales.

Palabras clave: desarrollo económico, bosques, políticas públicas, revisión sistemática, sostenible.

1 INTRODUCTION

Forest resources play a fundamental role in the world in many ways, from biodiversity conservation to global climate regulation. Forests are complex ecosystems that provide a wide range of ecosystem services that are essential for human survival and well-being.

While timber is traditionally considered the most important forest resource, non-timber forest products (NTFPs) include a wide variety of products derived from plants, such as leaves fruits, seeds, oils, resins, fibers, medicinal plants and honey. It is estimated that there are between 4000 and 6000 NTFPs with commercial value (Scbd, 2001).

Non-timber forest products are part of the life of traditional communities that derive part of their livelihood from the forest. The term “traditional communities” has several meanings. They are communities that generally engage in forest management as part of a subsistence strategy (Newton *et al*., 2016).

These communities are primarily and directly dependent on the forest for their livelihoods and trade, such as fishing, hunting, shifting cultivation and gathering non-timber forest products, with the forest being an important symbol for the maintenance of their traditions and culture (Kandzior, 2016).

Or they are self-identified groups that maintain a close connection to their area of origin and the natural resources available there to preserve their social, cultural and economic structures; these include indigenous peoples, quilombolas, extractivists, riverside dwellers and artisanal fishermen. (Brazil, 2007).

These local communities face numerous challenges, such as land use change and the intrusion of illegal loggers, miners and farmers. Despite these obstacles, these communities play a crucial role in the conservation and preservation of forests (Un, 2019).

Several studies (Dash; Behera; Rahut, 2016; Shackleton; De Vos, 2022; Tonini *Et Al*, 2017; Wale; Nkoana; Mkuna, 2022; Walle; Nayak, 2022; Yletyinen, Kuhmonen, Stahlmann-Brown, 2024) attempt to understand the relationship between these families and their dependence on forest resources. However, this dependence is a multifaceted phenomenon, and therefore there is some divergence between research on the factors that may influence these communities to achieve socio-economic development, even if they live in these areas.

Therefore, the aim of this article was to investigate to what extent a greater or lesser reliance on non-timber forest products can influence the development of these communities and what factors are responsible for this.

By developing this study, we aimed to contribute to the literature by identifying common socioeconomic characteristics of communities that manage non-timber forest products. The use of meta-analyses is justified because they fill theoretical gaps in the field of non-timber forest products and, above all, because it is a topic with many publications. In this way, countries with different cultural aspects but with similar difficulties in collecting and marketing their products have been studied. It is therefore expected that this meta-analysis will guide strategic decisions and understanding of the needs of traditional communities that manage non-timber forest products.

2 METHODOLOGY

2.1 SEARCH STRATEGY

This systematic review was conducted according to the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) guidelines (Moher et al., 2009). The PICo strategy followed the PRESS guidelines (Mcgowan *et al.*, 2016) and defined the problem: non-timber forest products; interest: socioeconomic development of populations managing non-timber forest products; context: dependency, commercialization of non-timber forest products, and forest sustainability.

The PICo strategy was used to answer the research question on socio-economic development of communities managing non-timber forest products and forest sustainability. The search strategy was conducted by two authors who searched for studies on the socioeconomic and demographic aspects of communities managing non-timber forest products (NTFPs) and the conservation of these areas.

The official search bases used were Science Direct, Google Scholar, Scopus, Web of Science, Pubmed, Scielo and Periódico Capes. The search was customized with the keywords and the addition of the respective Boolean operators used in each database. The search terms "Non-timber forest products OR NTFP" were used in combination with the terms "Community NTFP collectors OR Rural communities"/ "Socioeconomic OR extractivist livelihood"/ "Sustainable development OR sustainability"/ "Development OR conservation"/ "Commercialization". Only peer-reviewed publications in English, Spanish and Portuguese were considered.

2.2 SELECTION CRITERIA AND INCLUSION CRITERIA FOR STUDIES

In the selection criteria for publications to be included in the study, only complete articles that presented demographic and socio-economic data of communities managing non-timber forest products were considered.

Assessments were considered that included the location of these communities, average income, age, predominant gender in NTFP management, family size, education, type of marketing chain, type of NTFP extraction or cultivation, social organization, participation in public policies, economic dependence on NTFP, and forest conservation.

The study excluded gray literature works such as dissertations, theses, books, reviews and opinion articles to select only studies with greater scientific evidence, as they were peer-reviewed and belong to recognized indexers in the scientific world.

2.3 STUDY SELECTION AND DATA EXTRACTION

The selected articles were identified through an electronic search of each database and the results were compiled using the Zotero 6.0 reference manager. Briefly, duplicate studies were eliminated, as were those assessed by title and abstract, excluding any studies that did not meet the inclusion criteria. The included studies were assessed, and data collected and then tabulated.

2.4 STATISTICAL ANALYSIS

The data was compiled and analyzed using RStudio software. Descriptive statistics such as absolute and relative frequency were used to characterize the communities studied. The binary logistic regression model was used to assess the socio-economic development factors of the communities managing non-timber forest products.

The absence of multicollinearity and outliers was previously tested. Odds ratios (95% confidence interval) were calculated. In all analyzes performed, a p-value below 0.05 was considered significant.

The study examined the main effects of the relationship between the dependent variable (economic dependence on non-timber forest products) and the explanatory variables gender, age group, education, family size, presence of public policies, social organization and marketing channel, income and conservation of forest land.

3 RESULTS AND DISCUSSION

3.1 SYSTEMATIC REVIEW

A total of 3442 publications were found in the 6 databases searched and the results were analyzed with the help of a reference manager. The number of duplicate publications amounted to 1502 studies. After their removal, the total number of publications amounted to 1940.

In this next phase, which included an evaluation by title and reading of the abstract, 1645 articles were eliminated, leaving a total of 295 for the subsequent content evaluation. 210 review articles, summaries of national and international events, opinion articles, book chapters,

dissertations and theses were discarded, leaving 85 articles for full reading, of which 64 publications were discarded as they did not meet the inclusion criteria set during the search.

In this phase of the research, 21 articles were considered for the study, which met all the criteria set for the research, thus finalizing the search. The data was then collected and extracted to obtain the results. A flowchart of the individual steps and the number of studies selected are shown in Figure 1, which corresponds to the PRISMA (Figure 1) guidelines (Haddaway; Page; Pritchard; Mcguinness, 2022). The articles used to perform the meta-analysis are listed in Table 1.

Table 1. Articles used for the meta-analysis.

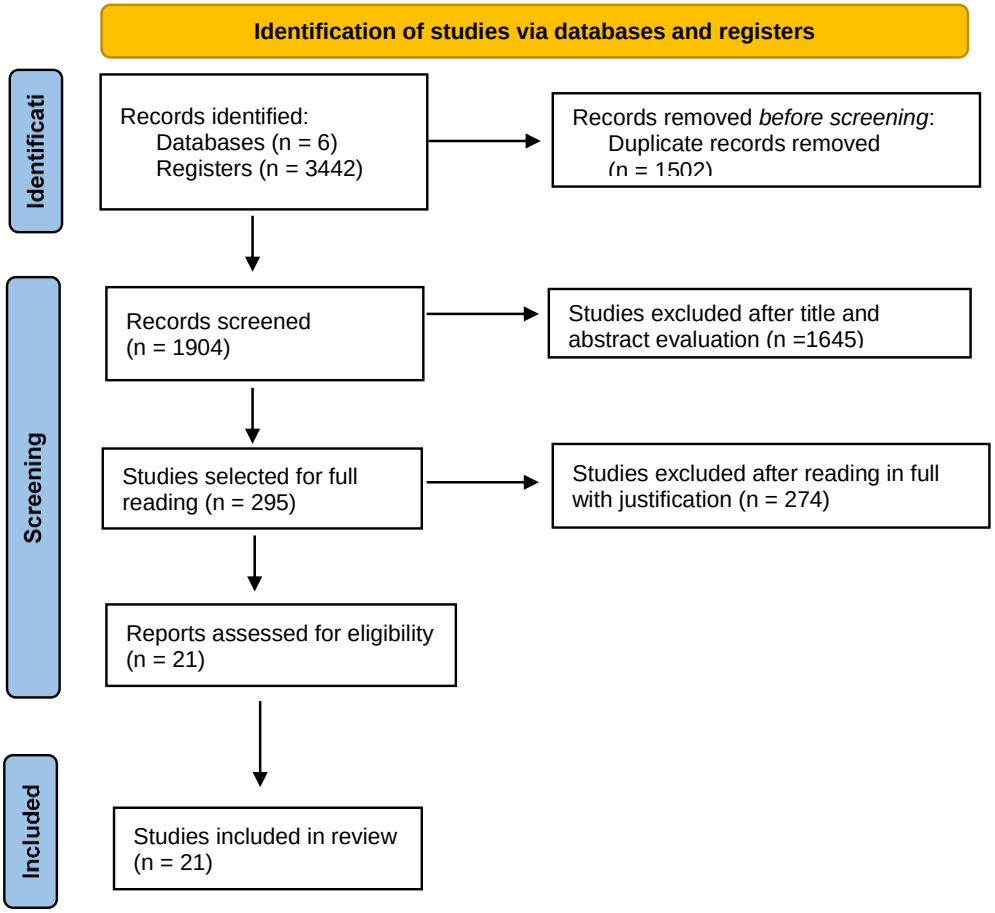
Authors (year)	Journal	Manuscript	Country of Study	Goals
Marques, Dos Reis, Denardin (2019)	Environment and Society	Yerba mate landscapes: forest use and socio-environmental conservation	Brasil	Discusses the possibilities and limitations of yerba mate management and the relationship of farmers with sustainability
Santos *et al.* (2021)	Forest	Characterization of the organizational instruments of the pine nut productive chain in RS: a comparison with brazilian chestnuts in Acre	Brasil	Analyze the Brazil nut production chain to identify existing potential that can be used to promote the pine nut chain in the social, economic and environmental spheres.
Fandohan *et al.* (2019)	Journal Espinhaço	Economic value and socio-cultural determinants of non-timber forest products harvesting in the W Transboundary Biosphere Reserve, Benin – África	África	Examine the economic value of non-timber forest products and their contribution to the income of people living around the Transbundary Bioreserve in Benin.
Rahman *et al.* (2021)	Regional Sustainability	Contribution of non-timber forest products to the livelihoods of the forest-dependent communities around the Khadimnagar National Park in northeastern Bangladesh	Bangladesh	It assesses the influence of occupational category (firewood collectors, farmers, small entrepreneurs, daily wage earners and tea plantation workers) on NTFP dependence and the role of NTFPs in household income in northeastern Bangladesh.
Tonini *et al.* (2017)	Native	Caracterização e rentabilidade do sistema extrativista da castanha-do-brasil praticado em Itaúba (MT)	Brasil	Characterize, generate technical indexes and analyze economic aspects of the Brazil nut extraction system practiced in Itaúba (MT).
Escobal e Aldana (2003)	World Development	Are nontimber forest products the antidote to rainforest degradation? Brazil nut extraction in Madre De Dios, Peru	Peru	Exploring the relationship between poverty and the Amazon rainforest under management by Brazil nut collectors in southeastern Peru.

da Silva e dos Reis (2009)	Forest Science	Produção de pinhão na região de caçador, SC: aspectos da obtenção e sua importância para comunidades locais	Brasil	Characterize aspects of obtaining pine nuts and their importance as a source of income for local communities.
Rodrigues *et al*. (2017)	Green Journal of Agroecology and Sustainable Development	Dinâmica socioeconômica e organizacional em comunidade remanescente do quilombo Rio Gurupá, Marajó, Pará	Brasil	Analyze the socioeconomic dynamics and organization in agroextractive family units of the remaining community of the Rio Gurupá quilombo, Pará.
Lopes *et al*. (2019)	Landscape and Urban Planning	Mapping the socio-ecology of Non Timber Forest Products (NTFP) extraction in the Brazilian Amazon: The case of açaí (*Euterpe precatoria* Mart) in Acre	Brasil	Mapping socioecological aspects of açaí extractive systems in Western Amazonia, Brazil.
Suleiman *et al*. (2017)	Ecological Processes	Non-timber forest products and their contribution to households income around Falgore Game Reserve in Kano, Nigeria	Nigéria	Assess the relationship of forest peoples in terms of NTFP contributions to household livelihoods and income.
Morsello *et al*. (2012)	PlosOne	The effects of processing non-timber forest products and trade partnerships on people's well-being and forest conservation in amazonian societies	Brasil	To assess whether the processing of non-timber forest products and the establishment of commercial partnerships between communities and forestry companies improve marketing results.
Sousa *et al*. (2018)	Global Ecology and Conservation	The (in)visible market of miriti (*Mauritia flexuosa* L.f.) fruits, the "winter acai", in Amazonian riverine communities of Abaetetuba, Northern Brazil	Brasil	This article discusses a production and commercialization chain of NTFPs in the municipality of Abaetetuba, Northern Brazil.
Venter e Witkowski (2012)	Agroforestry Systems	Fruits of our labour: contribution of commercial baobab (*Adansonia digitata* L.) fruit harvesting to the livelihoods of marginalized people in northern Venda, South Africa	África do Sul	To assess the direct use (subsistence) and income (cash) value of baobab fruit on the livelihoods of baobab pickers in South Africa.
Pouliot (2013)	Economic Botany	Contribution of "Women's Gold" to West African livelihoods: The case of shea (*Vitellaria paradoxa*) in Burkina Faso	Burquina Faso	Quantify the contribution that shea makes to the total income of rural families, quantify the involvement of women in the collection of shea nuts and fruits and their marketing.
Duchelle *et al*. (2014)	World Development	Smallholder specialization strategies along the forest transition curve in Southwestern Amazonia	Brasil e Bolívia	Verify the relationship between forest transition and household assets and evaluate land use under political conditions that determine family specialization strategies with a mediating effect on the sustainable use of protected areas.

Martinot *et al*. (2017)	Journal of Rural Economics and Sociology	Coletar ou Cultivar: as escolhas dos produtores de açaí-da-mata (*Euterpe precatoria*) do Amazonas	Brasil	Identify the determining factors that lead traditional family farmers from the lower Manacapuru River to engage in the extractive activity or cultivation of açaí-da-mata (Euterpe precatoria), a species native to the state of Amazonas.
Laube (2015)	UDS International Journal of Development	Global shea nut commodity chains and poverty eradication in northern Ghana: myth or reality?	Gana	It analyzes the current socioeconomic and institutional dynamics triggered by the successive commercialization of shea nuts in four communities in Ghana.
Conceição *et al*. (2017)	Native	Cadeia produtiva do piquiá no município de Santarém, Estado do Pará, Brasil	Brasil	Describes the piquiá production chain in the municipality of Santarém, Pará.
Silva Junior *et al*. (2019)	Journal of Agricultural Science	Socio-economics of acai production in rural communities in the Brazilian Amazon: A case study in the municipality of Igarapé-Miri, state of Pará	Brasil	It analyzes the production system and the socioeconomic changes that have occurred in rural communities whose economic support comes from the management of açaí.
Udeagha *et al*. (2016)	Forestry Ideas	Socio-economics and status of two non-timber forest products *(Irvingia* fruit and kernel) in a changing environment in cross river state, Nigeria	Nigéria	Analyzes socioeconomic factors affecting the abundance and status of Irvingia fruits and stones and anthropogenic environmental change.
Antunes *et al*. (2021)	Land	Non-timber forest products and the cosmetic industry: an econometric assessment of contributions to income in the Brazilian Amazon	Brasil	Analyzes the production of non-timber forest products through partnerships between communities and multinational cosmetics companies.

Source: Prepared by the authors themselves.

Figure 1. "Flow diagram following the PRISMA guidelines, showing the total number of records identified and filtered at each stage of the selection process from the systematic review."



Source: Prepared by the authors themselves.

3.2 NON-TIMBER FOREST PRODUCTS COVERED IN THE STUDY

The great diversity of non-timber forest products was emphasized in this study. The definition of NTFP according to the FAO (FAO, 1995) includes resin, vines, oil, seeds, ornamental and medicinal plants, and social and environmental services, among others.

Açaí fruits were collected in most of the publications surveyed (26%), as were Brazil nuts. Shea fruits (13%), typical of African regions, are also a product that is strongly represented in scientific research.

Açaí (*Euterpe oleracea* and *Euterpe precatoria*) is the fruit of a palm tree native to the Amazon region, of which two species are of commercial value. Its trade has become known mainly for its antioxidant and nutritional properties (Silveira et al., 2023).

Yerba mate (*Ilex paraguariensis*) is a species native to the southern region of South America that has great socio-economic and cultural value. It is mainly consumed in the form of an infusion known as "chimarrão". The global demand for this drink is increasing due to its health benefits, as it has a balanced stimulating effect, contains more natural antioxidants than coffee and fewer artificial chemicals than energy drinks (Croge, Cuquel, Pintro, 2020).

The Brazil nut (*Bertholletia excelsa*) is an oilseed that grows on around 325 million hectares in the Amazon basin. Consumption is growing by around 8% annually, with preference given to the dried nuts without shells. In terms of exports, Brazil is not the largest exporter in the world, as it has difficulties in meeting the demand of the international market, especially in the production process, where aflatoxins have been detected (Fonseca *et al.*, 2021).

Andiroba (*Carapa guianensis*) has a spherical fruit that easily releases an oil when dried, which is of great economic value due to its cosmetic and medicinal properties (Fonseca, 2021). Miriti or buriti (*Mauritia flexuosa*) is the fruit of a palm tree that has several uses for Amazonian riverside communities, from food to the production of handicrafts (Sousa; Vieira-Da-Silva; Barros, 2018). Piquiá (*Caryocar villosum*) is a tree species native to the Amazon rainforest. The oil from these fruits has great medicinal value and is traditionally used for body aches (Conceição et al., 2017). Pine nuts, a seed of the Araucaria angustifolia species, are native to southern Brazil. Usually, the collection of pine nuts is a way to increase the income of families living near the remaining Araucaria forests, of which there are few left due to deforestation in the last century (Da Silva; Dos Reis, 2009).

According to Endamana et al. (2016), the importance of NTFPs varies depending on the economic and cultural context of each location. In industrialized countries, these products are generally used for biodiversity conservation and cultural or recreational purposes. In developing countries, particularly in Africa and Asia, NTFPs are essential for livelihoods and income generation, especially in times of low agricultural production.

In Africa, for example, it is estimated that more than two thirds of the continent's inhabitants rely on these products. The great biodiversity found in this region includes products such as fruits, seeds, medicinal plants, honey, gums and resins (UN, 2021).

The fruit of the shea tree (*Vitellaria paradoxa*), especially its nut, is considered one of the most economically and ecologically important plants in the dry regions of Africa. Its export in

the form of shea butter is valued in the pharmaceutical, food and, above all, cosmetics industries. It is important for the local economy as the most used edible oil (Laube, 2015).

Irvinia species, especially the African mango (*Irvinia gabonensis*) and its seeds, originate from African tropical forests and provide income and food for rural families due to their multifunctionality. Their culinary properties are emphasized on the international market, especially because of their high content of ascorbic acid. However, the forest area covered by this species is severely affected by climate change (Udeagha; Udo; Olajide, 2016).

The baobab tree (*Adansonia digitata*) is a large tree found mainly in southern and western Africa. All parts of the plant are used, and more than 300 products are registered. The nutritional value, especially of the fruits and seeds, makes it an important plant for the livelihood of the population in these areas and for commercial use. However, the massive commercialization on the world market can have serious consequences for its use for livelihoods in areas where there is a high dependence on daily nutrition (Venter; Witkowski, 2012).

3.3 SOCIODEMOGRAPHIC PROFILE

The surveyed articles involved 2883 people distributed across communities dependent on non-timber forest products. According to the data, the frequency by gender responsible for management was evenly distributed between men and women (both = 54.2%). Table 2 summarizes the descriptive statistics of the communities studied.

Table 2. Characteristics of the communities studied

Varible	Items	Absolute frequency (n)	Relative frequency (%)	Mean (SD)
Gender	Male	7	29.2	
	Female	4	16.7	
	Both	13	54.2	
Age group	14 - 30 years	4	16.7	
	31 - 45 years	13	54.2	
	> 45 years	7	29.2	
				42 (5.5)
Education	Illiterate	7	29.2	
	Incomplete elementary	15	62.5	
	Complete elementary	2	8.3	
Family size	2 - 4	11	45.8	
	> 5	13	54.2	

Total number of community members	2883

Source: Prepared by the authors themselves.

Açaí is a crop where the harvest is carried out by men, as this activity requires strength because the trees are tall. The same goes for storage and marketing. Women thresh the fruit, which requires greater care to avoid contaminating the açaí with the soil, removing insects and selecting the best fruit. There is also the preparation of açaí wine, a typically female activity intended for family consumption and sale at local fairs (Rodrigues *et al.*, 2017).

Regarding the age group of the head of the family, most were between 31 and 45 years old (54.2%), with an average age of 42 years. Typically, younger family heads are more reliant on forest resources, as older people receive a pension or some kind of retirement or, as it is an activity that requires great physical effort, are unable to perform it. However, the age factor may vary.

According to Lepetu, Alavalapati and Nair (2009), younger people can utilize the forest resources multiple times and thus earn more income. The same relationship was found by Birben (2022). An inversely proportional relationship between age and dependence on non-timber forest products was confirmed by Jain and Sajjad (2015), who cite the migration of young people from villages in search of better paying jobs.

The level of education of the most important family members reveals an alarming fact. About 91% are illiterate or have an incomplete minimum education. Education is directly related to better employment opportunities, income and living conditions such as housing, food and leisure.

These families with almost no education are more dependent on activities related to livelihood and exploitation of forest resources and consequently have lower socio-economic development. It is assumed that a higher level of education contributes to a better awareness of the conservation and sustainability of environmental resources and provides government incentives.

This result is confirmed by studies in Africa such as Baiyegunhi and Oppong (2016), India with Jain and Sajjad (2016) and Nepal with Bhandari and Jianhua (2017).

Regarding the number of family members, there was a higher frequency of more than 5 members (54.2%). In general, larger families can extract more products from the forests, in addition to providing labor for other activities or providing work in other communities.

However, smaller families can also be highly dependent on non-timber forest products. This is a factor that generally does not play a role in determining the socio-economic development of communities living near forests. There are authors who have found a positive relationship (FIKIR; TADESSE; GURE, 2016; HUSSAIN *et al*., 2019), suggesting that the likelihood of increasing resource dependency is doubled with increasing family size as they have greater daily needs. Birben (2022) and Garekae; Thakadu and Lepetu (2017) studied families with an average of 3 members who were equally dependent. These differences can be explained by different socio-demographic profiles.

Rodrigues et al. (2017) find that the average number of children in rural communities is decreasing, reflecting a new social dynamic. Nevertheless, they are larger than families in urban areas when factors such as geographical and cultural differentiation are considered.

3.4 SOCIO-ECONOMIC FACTORS

The degree of income dependency was considered as a dependent variable in the regression model. Communities in which the income earned from NTFP was ≤50% of total income were categorized as “non-dependent” and coded with a value of 0. Above this threshold, these families were considered dependent on forest resources and coded with a value of 1. This cut-off point was used as a strategy to build the model, as recommended by other authors (BIRBEN, 2022; JAIN; SAJJAD, 2016).

Table 3 shows the logistic regression coefficients, standard error, Wald test, significance and odds ratio for each predictor. The tolerance and VIF values were less than 0.10 and greater than 10, respectively, indicating that there was no multicollinearity and that the criteria for performing logistic regression were met. In addition, no outliers were detected. The likelihood ratio test showed that the model was significant between the dependent and independent variables, with [χ^2 (11) = 30.553; p< 0.001; R^2 Negelkerke = 0.398] and the data were correctly classified in 86% of cases.

As shown in Table 3, the predictors education, family size and marketing channel were not significant for the model presented, which may be due to the demographic and cultural differences in the individual articles.

Table 3. Predictive factors and outcomes of the logistic regression model.

Predictor	B	SE	Wald	Sig	Exp(B)
Gender	0.205	0.025	1.325	0.041	1.178
Age group	-0.097	0.128	2.596	0.036	0.794
Education	0.129	0.049	1.634	0.653	1.116
Family size	0.470	0.761	0.573	0.754	1.379
Public policy	1.487	0.012	3.210	0.003	0.908
Social organization	0.799	0.104	1.345	0.004	0.899
Marketing channel	0.188	0.034	1.877	0.322	2.031
Income	-0.009	0.001	1.104	<0.000	2.205
Preservation	-0.103	1.203	0.647	0.0129	1.003

Source: Prepared by the authors themselves.

3.5 GENDER

The gender factor had a coefficient (B) of 0.205 and an odds ratio of 1.178. In the studies used in this research on gender, it was found that the work of managing non-timber forest products, in the specific case of fruits and/or seeds, is carried out by men and women in the family, each with their own activities. Morsello et al. (2012) mention that the processing of Brazil nuts takes place in several steps up to the extraction of oil and that this activity is carried out by both sexes and by children.

Marques, Reis and Denardin (2019) mention that the harvesting of yerba mate is a family activity in which everyone participates, as it is considered a pleasant activity by the farmers.

Gender aspects are widely addressed in several studies (BIRBEN, 2022; MOHAMMED; BOATENG; AL-HASSAN, 2013; SUNDERLAND *et al*., 2014) and in some works they have a positive impact on dependence on forest resources, which is consistent with the present study.

The female gender tends to be more dependent on NTFPs as there is evidence that they are more involved in gathering to generate additional income to feed their children and for the welfare of the household (MUSHI; YANDA; KLEYER, 2020; NDANGALASI; BITARIHO; DOVIE, 2007).

3.6 AGE GROUP

Table 3 shows that the age group has a negative coefficient (B) of -0.097 and an odds ratio of 0.794. This shows that the probability of dependence on forest resources decreases with increasing age of the family heads.

Hussain et al. (2019) observed a positive dependency relationship with increasing age of the family head. However, Gunnar and Peter (2001) observed the same opposite relationship. The age range is a parameter that can vary greatly. In general, older people are not highly dependent on forest resources because they receive retirement benefits or have income from livestock or agriculture, or because it is an activity that requires physical resilience and that younger members of the community end up managing.

Within this age range, it is necessary to take a closer look at the problem of child labor in the extraction of non-timber forest products. National and foreign consumers ignore the importance of children in fruit harvesting.

The complaints of the United States Department of Labor (Usdol, 2022) refer to the harvesting of açaí and Brazil nuts by child labor. The authors Ferreira; Koury and Jacob (2020) report a high rate of child labor and consequently illiteracy among children working in the açaí harvest in the Brazilian state of Pará. The children learn this trade from an early age and from the age of 10-11 are destined to climb trees higher than 15 meters to harvest, which is why it is considered one of the most dangerous professions in Brazil. This work leads to inadequate school performance and, in most cases, complete absenteeism from school, making it difficult for low-income families to access state benefits, which require proof of school attendance (Almeida et al., 2021).

3.7 SOCIAL ORGANIZATION

In the present study, the explanatory variable ‘social organization’ had a significant effect on the influence of dependence on non-timber forest products (Table 4). The regression coefficient was positive, and the odds ratio was 0.899.

The social organizations observed included mainly community associations, cooperatives and industry associations. Bilateral partnerships between extractive producers and industry are

promising when it comes to conserving forest areas, reducing bureaucracy because the relationship is more direct, and alleviating poverty. However, income from the commercialization of non-timber forest products is not always sufficient to compete with other, more profitable activities such as agriculture and livestock. In addition, a large proportion of communities are not affiliated with any organization and sell directly at fairs or to middlemen.

Although the income generated with these organizations is better, as the price paid is higher than the market price, the study by Morsello et al. (2012) shows that this is not enough to ensure the continuous economic development of these communities and the preservation of the environment.

Another issue raised by several authors (Vosti et al., 2003; Duchelle et al., 2014; Morsello et al., 2014) is that the greater supply of money when buying NTFPs increases the pressure on the forests. The benefiting families tend to cut down more forest to invest in agriculture and livestock farming.

Regarding the influence of the factor 'social organization' on the development and dependence of communities that cultivate non-timber forest products such as fruits or nuts, there is no consensus on the advantages and disadvantages.

Families with greater labor capacity that receive technical support and financial investment throughout processing tend to benefit from the cooperative model and can generate a higher income, about 25% more (Antunes; Simmons; Veiga, 2021).

Communities that are not able to distribute income equally in the cooperative because of gender, job and payment inequality for the processed product rather than the harvested product led to disagreements and families dropping out (Rizek; Morsello, 2012).

There is also a group of people who do not participate in any form of association and sell NTFP at local fairs or directly to middlemen, as is the case of pinhão (SANTOS et al., 2002) and miriti (DE SOUSA et al., 2018). In these two cases, the income generated follows the seasonality of the product and contributes significantly to the development of these communities.

However, the lack of commitment of families in the creation of cooperatives has a negative impact on the sale of baobab (Klauberg et al., 2014) and shea, since individual marketing in local markets generates very little income and cannot contribute to the eradication of poverty in the region, as they are unable to produce adequate quality and quantity to meet industry

demand. The participation of small local producer families in the global shea commodity chain is minimally profitable (about 40 to 230 US dollars annually) (Pouliot, 2012).

3.8 PUBLIC POLICY

According to Table 3, this factor was significant and had a positive coefficient and an odds ratio of 0.908. This indicates that the dependence of families on forests is greater where there are public policies.

Public policies affecting forest areas can directly benefit these biomes, such as banning deforestation, but they can also help to reduce community dependence. Effective and comprehensive policy interventions are needed to reduce dependence on forests.

The authors Rahman; Roy and Islam (2021) mention that co-management projects, such as those implemented in Bangladesh in partnership with the United States from 2003 to 2018, generated revenue through payments for environmental services and regulation of forest use. These projects, funded by the United States Agency for International Development, have improved people's lives, reduced illegal logging and hunting, and increased forest conservation and protection initiatives.

In Brazil, a policy has been created that guarantees minimum prices for commodity producers. The PGPM-Bio (Minimum Price Guarantee Policy for Sociobiodiversity Products) pays the difference between the cost and the value that should be sold for products of socio-economic diversity. In this way, the producer can use the resources sustainably and maintain his activity. The Minimum Price Guarantee Policy for Socio-Biodiversity Products (PGPM-Bio) guarantees a minimum price for 17 commodity products that contribute to the conservation of Brazil's biomes: açaí, andiroba, babaçu, baru, rubber, buriti, cocoa extract, Brazil nut, juçara, macaúba, mangaba, murumuru, pequi, piaçava, pine nut, pirarucu and umbu (CONAB, 2017).

However, public policies do not always solve the problem of dependence on forest resources, especially non-timber forest products. The socio-economic development of families is directly linked to other factors, as mentioned earlier.

Guariguata et al. (2017) state that while public policies have important benefits for forest sustainability and income generation for communities dependent on extractive activities, it is

imperative that the government allocates resources to control and monitor resources, as the system does not always function correctly.

This policy must be implemented in an integrated manner and adapted to local circumstances, considering the different social, economic and environmental contexts. Furthermore, it is crucial to involve relevant stakeholders such as local communities, indigenous peoples, the private sector and civil society organizations to ensure the success and sustainability of these policies.

3.9 INCOME

Income showed a statistically significant and negative correlation with dependence on NTFP. The negative income coefficient indicates that families with higher income from other economic activities are less dependent on these forest resources. The odds ratio of 2.205 indicates that for an increase in income of about two units, families are about twice as likely to be dependent on the fruits/seeds they have harvested from the forests.

In the selected articles, the communities were found to be engaged in other profitable activities, such as cattle rearing, timber sales, agriculture and small-scale fishing, in addition to gathering fruits such as açaí, shea, pine nuts and harvesting yerba mate. most of them are engaged in paid employment, in addition to some kind of financial support from the government, such as Bolsa Família in Brazil (government income transfer for vulnerable families). Depending on the level of participation in these activities, the contribution to the annual family income from the collection and sale of NTFP was lower.

The harvest of yerba mate, for example, generates a considerable income for 33% of the families surveyed. And 72% consider it an important reserve, be it to save money or to pay off debts (Marques, Dos Reis, Denardin, 2019).

The income determined varied greatly depending on the country and the NTPF collected, the level of processing and the marketing channel. On average, the annual values (converted into dollars) ranged between 32 and 3392 US dollars. About 20% was sold directly to the consumer, the rest to middlemen.

Irregular income is also a factor affecting these communities, as the harvests are seasonal and without adequate processing, year-round marketing is not possible. In addition, the quantity collected must be sufficient to make it economically viable.

Morsello et al. (2012), when studying social welfare and income in Amazonian communities, reported that partnerships with companies were not able to minimize fluctuations in income levels and that the profit from selling the raw product to market commodities was greater than if they had processed it. According to the authors, caution is needed in developing strategies for better financial returns as many aspects need to be considered, such as the labor involved, the product, the distance from trading centers, and cultural and local aspects.

Garekae; Thakadu and Lepetu (2017) attribute less dependence on forest resources to families where their members are employed in other activities. The income of these families tends to be higher, which enables them to buy alternative products in the markets. The collection of NTFPs only takes place during rest periods or as an additional source of income.

Obtaining a satisfactory income from the fruits/seeds collected from the forests is constrained by obstacles related to technology, marketing channels, infrastructure, the level of development of the communities that manage them and bureaucratic aspects, as Belcher and Schreckenberg (2007) have noted. In the case of shea, for example, collectors are paid according to the quality of the raw material, which is specific to each sector (cosmetics or food), and there are also specific requirements for extraction.

Açaí, which is sold in the municipality of Igarapé in the Brazilian state of Pará, is responsible for the total income of more than 70% of the people interviewed in the study by Silva Junior et al (2019). As the trading center and navigable port are far away, these collectors end up selling the fruit to middlemen. Although the financial return is lower than what they would likely obtain if they sold directly without intermediaries, these families have nevertheless experienced an improvement in their economic development. They have been able to buy more durable goods and food.

Income generation from NTFP plays a fundamental role for people in remote areas and for women, for whom it is the only way to earn money, and is expected to alleviate poverty and food insecurity, especially in times of food shortages. However, as we have seen, the income from non-timber forest products, in the case of fruits/seeds, is not able to meet all the needs of the families that depend on them.

In some cases, the profits from this commercialization do not fully reach the intended beneficiaries. While the additional income contributes to the family's livelihood, when this income is highly dependent on these resources, the difficulties observed in this sector inevitably have socio-environmental consequences.

3.10 CONSERVATION OF FOREST AREAS

The conservation of forest areas responsible for the supply of NTFP is an extremely important factor in understanding the relationship between communities and the environment.

As shown in Table 4, the factor ‘conservation of forest areas’ was significant with a negative coefficient of -0.103 and an odds ratio of 1.003, indicating that the greater the dependence on these resources, the less likely it is that these areas will be conserved.

The conservation of forests is crucial to ensure the continued availability of non-timber forest products. Unsustainable exploitation and degradation of forests can lead to the depletion of these resources and ultimately the loss of valuable ecosystem services. The destruction of natural habitats can also lead to the extinction of plant and animal species, which has a negative impact on biodiversity and the health of ecosystems.

Globally, there are several papers (Birben, 2022; Fikir; Tadesse; Gure, 2016; Hussain *et al*., 2019) that emphasize the dependence of families on forest resources, addressing social issues but not discussing the extent to which this dependence can affect the conservation of forest areas and whether the impacts of extraction will have consequences for these biomes.

The over- extraction of non-timber forest products can have a negative impact on the population dynamics of exploited plants and lead to changes in the structure and organization of these areas.

In the study by Santos et al. (2021), 75% of respondents do not worry about planting araucaria trees, as the sale of pine nuts supplements their income. And in the case of Brazil nuts in the Brazilian state of Acre, extractivists do not plant new nut trees because the cycle is very long and because they have no knowledge about the germination and cultivation of these trees.

In Bangladesh (RAHMAN; ROY; ISLAM, 2021), the continued dependence of residents on Khadimnagar National Park has led to severe pressure on available resources, resulting in a significant decline in sources of non-timber forest products. From 2003 to 2018, the Bangladesh

Forest Department, with support from US development agencies, developed projects on joint management, alternative livelihoods, payment for ecosystem services and regulation of forest use. This initiative improved the socio-economic conditions of families, reduced dependence on forest resources as well as logging and illegal hunting and, most importantly, led to community engagement in resource conservation and protection.

This study has clearly shown that government and societal action can make a positive difference in the lives of families to ensure sustainable management of forest resources and conserve forest biodiversity. Effective government policies and regulations are needed to protect forests and promote the sustainable use of non-timber forest products. This includes the establishment of protected areas and the creation of laws.

In this context, Brazil nuts have become a product that requires the commitment of three countries - Brazil, Bolivia and Peru. The constant land conflicts, illegal mining and the expansion of cattle ranching and soybean cultivation in these areas contribute to deforestation and consequently to a decline in nut tree populations (Guariguata et al., 2017).

Yerba mate, on the other hand, is mainly produced in the indigenous form (68%) and to a lesser extent of 13% in indigenous and planted systems (Marques, Dos Reis, Denardin, 2019). These systems are of great importance as they also contribute to the conservation of araucaria forests (*Araucaria angustifolia*) in the region. Nevertheless, farmers believe that part of the area has been replaced by agricultural plantations, livestock farming and firewood production. However, they emphasize that there is a sense of conservation of the forests, as the yerba mate is part of the culture and tradition of the communities and generates a significant income in times of economic crisis.

Morsello et al. (2012) report that the relationship between deforestation and the collection and trade of NTFPs is highly variable. Depending on the level of partnership with other companies that require environmentally sustainable management, there is a tendency to conserve forests. However, there are also cases where families who earn a higher income are more likely to turn to agricultural activities and, consequently, deforestation becomes a reality.

Furthermore, according to Parra (2018), a careful construction of the NTFP trade is necessary so that this market does not become a source of unrestrained exploitation of biomes. Commercialization has significant impacts on five forms of subsistence capital: human, social,

financial, natural and physical capital. The study of these impacts is complex and requires ongoing research to find solutions that help communities dependent on these resources.

The literature highlights some fundamental aspects to improve this commercialization, as outlined by Vedeld et al. (2007) and Leakey et al. (2005). These aspects include domesticating and disseminating germplasm, improving post-harvest technology to increase efficiency, investing in marketing campaigns, promoting supply contracts that meet local and international culinary demands, and building partnerships with local companies that have sustainability plans. These measures are considered essential to improve the commercialization of NTFP and secure the livelihoods of the affected communities.

It was thus established that the factor 'conservation of forest areas' is an indicator that is directly related to the other factors. The conservation of biomes and forest areas that produce non-timber products requires a multi-stakeholder approach. It is extremely important to apply selective harvesting methods, constantly monitor the natural regeneration of forest areas, set extraction quotas and, above all, involve traditional communities in decision-making on the use of forest resources. It is expected that by incorporating this knowledge, effective and balanced management of NTFPs aimed at conserving these resources can be promoted.

4 CONCLUSION

Non-timber forest products play an extremely important role for the traditional communities that manage these resources. The systematic review of 21 articles and the meta-analytical study identified key factors influencing the socio-economic development of these families and the sustainability of the forest areas.

The logistic regression performed showed the statistical significance of the factors of gender, age group, presence of public policies, social organization, income and conservation of forest areas. This indicates that these are factors that can influence the socio-economic development of communities as they lead to greater or lesser dependence on forest resources. Some important conclusions can be drawn from the above results.

It has been noted that the role of gender is important because when women are involved in the marketing of products and not just the collection, they improve the living conditions of the

family. The age range of workers also needs to be discussed in detail, as many children are involved in the extraction of raw materials.

As far as public policies are concerned, it was noted that they exist but are not effective, as many communities do not have access to them due to bureaucratic problems. Social organization in the form of cooperatives or associations with the industry must monitor the entire production chain and provide training for workers and processing and conservation technologies to ensure the permanence of family income and the sustainability of the forests.

We conclude that the socio-economic development of these communities is possible, despite their dependence on forest resources, if government and society understand and act to create better economic conditions and prosperity for these communities and ensure commercialization in a sustainable manner. fair income, with guarantees for the conservation of forests.

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REFERENCES

ALMEIDA, HP; HOMMA, AKO.; MENEZES, AJEA de.; FILGUEIRAS, GC; FARIAS NETO, JT de . Perfil socioeconômico da produção de açaí manejada em comunidades rurais do Município de Igarapé-Miri, Pará. **Pesquisa, Sociedade e Desenvolvimento** , [S. l.] , v. 11, p. e592101120084, 2021. DOI: 10.33448/rsd-v10i11.20084.

ANTUNES, A., SIMMONS, C. S., VEIGA, J. P. Non-timber forest products and the cosmetic industry: An econometric assessment of contributions to income in the Brazilian Amazon**.** **Land** v. 10, n. 6, p. 1-16, 2021. DOI: 10.3390/land10060588.

BAIYEGUNHI, L. J. S., OPPONG, B. B. Commercialisation of mopane worm (*Imbrasia belina*) in rural households in Limpopo Province, South Africa. **Forest Policy and Economics** v. 62, p. 141-148, 2016. DOI: 10.1016/j.forpol.2015.08.012.

BELCHER, B., SCHRECKENBERG, K. Commercialisation of Non-timber Forest products: A reality check. **Development Policy Review** v. 25, n. 3, p. 355-377, 2007. DOI: 10.1111/j.1467-7679.2007.00374.x.

BHANDARI, D., JIANHUA, Z. Household dependency on Buffer Zone community forest and its implication for management of Chitwan National Park, **Nepal**. International Journal of Sciences 3 v. 3, p. 68-80, 2017. DOI: 10.18483/ijSci.1214.

BIRBEN, Ü. Socio-economic factors influencing household dependency on forests: an empirical evidence from Turkey**. CERNE** v. 28, p. e-103043, 2022. DOI: 10.1590/01047760202228013043.

BRASIL. Decreto nº 6.040, de 7 de fevereiro de 2007. **Dispõe sobre a instituição de uma Política Nacional de Desenvolvimento Sustentável dos Povos e Comunidades Tradicionais.** Diário Oficial da União, Brasília, DF. Available: http://www.planalto.gov.br/ccivil_03/_ato2007-2010/2007/decreto/d6040.htm.

CONAB. **Mercado e comercialização do açaí**. 2019. Available: https://www.conab.gov.br/info-agro/analises-do-mercado-agropecuario-e-extrativista/analises-do-mercado/historico-mensal-de-acai/.

CONCEIÇÃO, S. P. C. P., GAMA, J. R. V., MONTEIRO, R. N., FERREIRA, R. J. S., SOUSA, P. S. DE. 2017. Cadeia produtiva do piquiá no municípiode Santarém, Estado do Pará, Brasil. **Native** v. 5, n. 1, p. 31-36, 2017. DOI: 10.31413/nativa.v5i1.4165

CROGE, C.P., CUQUEL, F.L., PINTRO, P.T.M. Yerba mate: cultivation systems, processing and chemical composition. **A review. Scientia agricola,** v. 78, n. 5, p. e20190259, 2021. DOI: 10.1590/1678-992X-2019-0259.

DA SILVA, C. V.; DOS REIS, M. S.Produção de pinhão na região de caçador, SC: aspectos da obtenção e sua importância para comunidades locais. **Forest Science,** v. 19, n. 4, p. 363-374, 2009. DOI: 10.5902/19805098892.

DASH, M.; BEHERA, B.; RAHUT, D. B. Determinants of household collection of non-timber forest products (NTFPs) and alternative livelihood activities in Similipal Tiger Reserve, India. **Forest Policy and Economics** , v. 73, p. 215-228, 2016. DOI: 10.1016/j.forpol.2016.09.012.

DE SOUSA, F. F., VIEIRA-DA-SILVA, C., BARROS, F. B.The (in)visible market of miriti (Mauritia flexuosa L.f.) fruits, the "winter acai", in Amazonian riverine communities of Abaetetuba, Northern Brazil. **Global Ecology and Conservation** v. 14, p. e00393, 2018. DOI: 10.1016/j.gecco.2018.e00393.

DUCHELLE, A. E., ALMEYDA ZAMBRANO, A. M., WUNDER, S., BÖRNER, J., KAINER, K. A. Smallholder Specialization Strategies along the Forest Transition Curve in Southwestern Amazonia. **World Development** , v. 64, p. S149-S158, 2014. DOI: 10.1016/j.worlddev.2014.03.00.

ENDAMANA, D., ANGU, K. A., AKWAH, G. N., SHEPHERD, G., NTUMWEL, B.C. Contribution of Non-Timber Forest Products to Cash and Non-Cash Income of Remote Forest Communities in Central Africa. **International Forestry Review** , v. 18, p. 280-295, 2016. DOI: 10.1505/146554816819501682.

ESCOBAL, J., ALDANA, U. Are Nontimber Forest Products the Antidote to Rainforest Degradation? Brazil Nut Extraction in Madre De Dios, Peru. **World Development** , v. 31, n. 11, p. 1873-1887, 2003. DOI: 10.1016/j.worlddev.2003.08.00.

FANDOHAN, A. B. Economic value and socio-cultural determinants of non-timber forest products harvesting in the W Transboundary Biosphere Reserve, Benin. **Journal Espinhaço** , v. 8, n. 1, p. 13-23, 2019. DOI: 10.5281/zenodo.3345131.

FAO. Non-wood Forest Products 7, Non-wood Forest Products for rural Income & Sustainable Forestry, 1995. Rome. Available in: https://www.fao.org/4/v9480e/v9480e.pdf

FERREIRA, O. B. D. S., KOURY, S. E. C., JACOB, V. A atividade de extração do fruto açaí e o necessário enquadramento como uma das piores formas de trabalho infantil: visibilidade e conscientização. **Revista de Estudos Jurídicos** , v. 40, p. 253-277, 2020. DOI: 10.22171/rej.v24i40.3423.

FIKIR, D., TADESSE, W., GURE, A. 2016. Economic Contribution to Local Livelihoods and Households Dependency on Dry Land Forest Products in Hammer District, Southeastern Ethiopia. **International Journal of Forestry Research** , v. 2016, p. 1-12, 2016. DOI: 10.1155/2016/5474680.

Fonseca, F. L. d. 2021. **Andiroba**. Manejo Florestal, Acre, Embrapa. Available: https://www.embrapa.br/en/agencia-de-informacao-tecnologica/tematicas/manejo-florestal/manejo-florestal-nao-madeireiro/andiroba.

FONSECA, F. L. D., ROVER, O. J., WADT, L. H. D. O., CARTAXO, C. B. D. C. Sustainability indicators of the Brazil nut tree management. **Revista Brasileira de Ciências Ambientais**, V. 5, n 4, p 1-13, 2021.DOI: 10.5327/Z21769478889

GAREKAE, H., THAKADU, O. T., LEPETU, J. Socio-economic factors influencing household forest dependency in Chobe enclave, Botswana. **Ecological Processes**, V. 6, n 1, p 40-48, 2017. DOI: 10.1186/s13717-017-0107-3

Guariguata, M. R., Cronkleton, P., Duchelle, A. E., Zuidema, P. A. Revisiting the 'cornerstone of Amazonian conservation': a socioecological assessment of Brazil nut exploitation. **Biodiversity and Conservation**, V. 26, n 9, p 2007-2027, 2017. DOI: 10.1007/s10531-017-1355-3

GUNNAR, K., PETER, J. P. Spatial variability and disincentives to harvest: Deforestation and fuelwood collection in South Asia. **Land Economics**, V. 77, n 2, p 206-216, 2001.DOI: 10.2307/3147090.

HADDAWAY, N. R., PAGE, M. J., PRITCHARD, C. C., MCGUINNESS, L. A. PRISMA2020: An R package and Shiny app for producing PRISMA 2020-compliant flow diagrams, with interactivity for optimised digital transparency and Open Synthesis. **Campbell Systematic Reviews, V.** 18, n 2, p e1230, 2022. DOI: 10.1002/cl2.1230

HUSSAIN, J., ZHOU, K., AKBAR, M., KHAN, M. Z. *et al.* Dependence of rural livelihoods on forest resources in Naltar Valley, a dry temperate mountainous region, Pakistan. **Global Ecology and Conservation**, V. 20, n.2, p e00765, 2019. DOI: 10.1016/j.gecco.2019.e00765

JAIN, P., SAJJAD, H. Household dependency on forest resources in the Sariska Tiger Reserve (STR), India: Implications for management. **Journal of Sustainable Forestry, V.** 35, n 1, p 1-15, 2015. DOI: 10.1080/10549811.2015.1099108

JAIN, P., SAJJAD, H. Household dependency on forest resources in the Sariska Tiger Reserve (STR), India: Implications for management. **Journal of Sustainable Forestry**, V. 35, n.1, p 60-74, 2016. DOI: 10.1080/10549811.2015.1099108

Kandzior, A. Indigenous People and Forests. 2016. *In*: Pancel, L., Köhl, M. (Ed.). **Tropical Forestry Handbook**. Berlin, Heidelberg: Springer Berlin Heidelberg. p. 3311-3343.

KLAUBERG, C., VIDAL, E., RODRIGUEZ, L. C. E., DIAZ-BALTEIRO, L. Determining the optimal harvest cycle for copaíba (*Copaifera* spp.) oleoresin production. **Agricultural Systems**, v. 131, p. 116-122, 2014. DOI: 10.1016/j.agsy.2014.07.007

LAUBE, W. Global shea nut commodity chains and poverty eradication in northern Ghana: myth or reality? **UDS International Journal of Development**, v. 2, n. 1, p. 128-148, 2015. DOI: 10.47740/32.UDSIJD6i.

LEAKEY, R. R. B., TCHOUNDJEU, Z., SCHRECKENBERG, K., SHACKLETON, S. E., SHACKLETON, C. M. Agroforestry Tree Products (AFTPs): Targeting Poverty Reduction and Enhanced Livelihoods. **International Journal of Agricultural Sustainability**, v. 3, n. 1, p. 1-23, 2005. DOI: 10.1080/14735903.2005.9684741

LEPETU, J., ALAVALAPATI, J., NAIR, P. Forest dependency and its implication for protected areas management: a case study from Kasane Forest Reserve, Botswana. 2009.

LOPES, E., SOARES-FILHO, B., SOUZA, F., RAJÃO, R., MERRY, F., CARVALHO RIBEIRO, S. Mapping the socio-ecology of Non Timber Forest Products (NTFP) extraction in the Brazilian Amazon: The case of acai (*Euterpe precatoria* Mart) in Acre. **Landscape and Urban Planning**, v. 188, p. 110-117, 2019. DOI: 10.1016/j.landurbplan.2018.08.025

MARQUES, A. D. C., REIS, M. S.D, DENARDIN, V. F. As paisagens da erva-mate: uso das florestas e conservação socioambiental. **Ambiente & Sociedade**, v. 22, p. e02822, 2019. doi: 10.1590/1809-4422asoc201702822vu2019l3ao

MARTINOT, J. F., PEREIRA, H. DOS S., SILVA, S. C. P. DA. Coletar ou Cultivar: as escolhas dos produtores de açaí-da-mata (*Euterpe precatoria*) do Amazonas. **Journal of Rural Economics and Sociology** , v. 55, p. 751-766, 2017. DOI: 10.1590/1234-56781806-94790550408

MCGOWAN, J., SAMPSON, M., SALZWEDEL, D. M., COGO, E., FOERSTER, V., LEFEBVRE, C. Press Peer Review of Electronic Search Strategies: 2015 Guideline Statement. **Journal of Clinical Epidemiology** v. 75, p. 40-46, 2016. DOI:10.1016/j.jclinepi.2016.01.021

MOHAMMED, F., BOATENG, S., AL-HASSAN, S. Effects of Adoption of Improved Sheabutter Processing Technology on Women's Livelihoods and their Microenterprise Growth. **American Journal of Humanities and Social Sciences** , v. 1, n. 4, p. 244-250, 2013. DOI: 10.11634/232907811604419.

MORSELLO, C., DELGADO, J. A. D. S., FONSECA-MORELLO, T., BRITES, A. D. Does trading non-timber forest products drive specialisation in products gathered for consumption? Evidence from the Brazilian Amazon. **Ecological Economics** v. 100, p. 140-149, 2014.DOI: 10.1016/j.ecolecon.2014.01.021

MORSELLO, C., RUIZ-MALLEN, I., DIAZ, M. D., REYES-GARCIA, V. The effects of processing non-timber forest products and trade partnerships on people's well-being and forest conservation in Amazonian societies. **PLoS One**, V.7, n. 8, p e43055, 2012. DOI: 10.1371/journal.pone.0043055

MUSHI, H., YANDA, P. Z., KLEYER, M. Socioeconomic factors determining extraction of non-timber forest products on the Slopes of Mt. Kilimanjaro, Tanzania. **Human Ecology** v. 48, n. 6, p. 695-707, 2020. DOI: 10.1007/s10745-020-00187-9.

NDANGALASI, H. J., BITARIHO, R., DOVIE, D. B. K. Harvesting of non-timber forest products and implications for conservation in two montane forests of East Africa. **Biological Conservation,** v. 134, n. 2, p. 242-250, 2007. DOI: 10.1016/j.biocon.2006.06.020.

NEWTON, P., MILLER, D. C., BYENKYA, M. A. A., AGRAWAL, A. Who are forest-dependent people? A taxo nomy to aid livelihood and land use decision-making in forested regions. **Land Use Policy** v. 57, p. 388-395, 2016. Doi:10.1016/j.landusepol.2016.05.032

Parra, C. What can culture in and for sustainable development learn from protected areas? *In*: Birkeland, I. J. (Ed.). **Cultural Sustainability and the Nature-Culture Interface: Livelihoods, Policies, and Methodologies, Routledge Studies in Culture and Sustainable Development**. New York: Routledge, cp. 49-65, 2018.

POULIOT, M. Contribution of "Women's Gold" to West African Livelihoods: The Case of Shea (*Vitellaria paradoxa*) in Burkina Faso. **Economic Botany** , v. 66, p. 237-248, 2012. DOI: 10.1007/s12231-012-9203-6

RAHMAN, M. H., ROY, B., ISLAM, M. S. Contribution of non-timber forest products to the livelihoods of the forest-dependent communities around the Khadimnagar National Park in northeastern Bangladesh. **Regional Sustainability** v. 2, n. 3, p. 280-295, 2021. DOI: 10.1016/j.regsus.2021.11.001

RIZEK, M. B., MORSELLO, C. Impacts of Trade in Non-timber Forest Products on Cooperation among Caboclo Households of the Brazilian Amazon. **Human Ecology** v. 40, p. 707-719, 2012. DOI:10.1007/s10745-012-9506-3

RODRIGUES, P. L., GUIMARÃES, J. B., MARTINS, C. M., SANTOS, M. A. S. DOS, REBELLO, F. K. Dinâmica socioeconômica e organizacional em comunidade remanescente do quilombo Rio Gurupá, Marajó, Pará. **Green Journal of Agroecology and Susainable Development** v. 12, n. 1, p. 105-116, 2017.DOI: 10.18378/rvads.v12i1.4344.

SANTOS, A. J., CORSO, N. M., MARTINS, G., BITTENCOURT, E. Aspectos produtivos e comerciais do pinhão no Estado do Paraná. **Revista Floresta** v. 32, n. 2, p. 163-169, 2002. DOI: 10.5380/rf.v32i2.2281

SANTOS, E. L., DE FARIAS, J. A., DE CAMPOS DE JESUS, L., PASA, D. L. Characterization of the organizational instruments of the pine nut productive chain in rs: a comparison with brazilian chestnuts in Acre. **Florest** v. 51, n. 2, 2021. DOI: 10.5380/rf.v51i2.69864

SCBD. Sustainable management of non-timber forest resources. . **CBD Technical Series v. 6**.Montreal: Quebec: Secretariat of the Convention on Biological Diversity, 2001. 30p.

SHACKLETON, C. M., DE VOS, A. How many people globally actually use non-timber forest products? **Forest Policy and Economics** v. 135, p. 102659, 2022. DOI: 10.1016/j.forpol.2021.102659.

SILVA JUNIOR, J. I. D. S., REBELLO, F. K., LIMA, H. V., SANTOS, M. A. S., SANTOS, P.C. DOS; LOPES, M. L. B. Socio-economics of acai production in rural communities in the Brazilian Amazon: A case study in the Municipality of Igarapé-Miri, State of Pará. **Journal of Agricultural Science** v. 11, n. 5, p. 215-224, 2019. DOI: 10.5539/jas.v11n5p215.

SILVEIRA, J. T. D., ROSA, A. P. C. D., MORAIS, M. G., VICTORIA, F. N., COSTA, J. A. V. An integrative review of Açaí (*Euterpe oleracea* and *Euterpe precatoria)*: Traditional uses, phytochemical composition, market trends, and emerging applications. **Food Research International,** p. 113304, 2023. DOI: 10.1016/j.foodres.2023.113304

SOUSA, F. F. D., VIEIRA-DA-SILVA, C., BARROS, F. B. The (in)visible market of miriti (*Mauritia flexuosa* L.f.) fruits, the "winter acai", in Amazonian riverine communities of Abaetetuba, Northern Brazil. **Global Ecology and Conservation**, v. 14, p. e00393, 2018. DOI: 10.1016/j.gecco.2018.e00393

SULEIMAN, M.S., WASONGA, V.O., MBAU, J.S. *et al*. Non-timber forest products and their contribution to households income around Falgore Game Reserve in Kano, Nigeria. **Ecological Processes** v. 6, p. 1-14, 2017. DOI: 10.1186/s13717-017-0090-8

SUNDERLAND, T., ACHDIAWAN, R., ANGELSEN, A., BABIGUMIRA, R. *et al.* Challenging Perceptions about Men, Women, and Forest Product Use: A Global Comparative Study. **World Development** , v. 64, p. S56-S66, 2014. DOI:10.1016/j.worlddev.2014.03.003

TONINI, H., BALDONI, A., SOLER, E., HOOGERHEIDE, S. *et al.* Caracterização e rentabilidade do sistema extrativista da castanha-do-brasil praticado em Itaúba (MT). **Nativa,** v. 5, n. 3, p. 175-181, 2017.DOI: 10.31413/nativa.v5i3.4418

UDEAGHA, A. U., UDO, E. S., OLAJIDE, O. Socio-economics and status of two non-timber forest products (*Irvingia fruit* and kernel) in a changing environment in cross river state, Nigeria. **Forestry Ideas** 2016. p. 171-187. Available: https://forestry-ideas.info/issues/issues_Index.php?journalFilter=56.

UN. United Nations. **Forests play vital role in empowering people, promoting economic growth and combating climate change**. 2019. Available: https://www.un.org/development/desa/en/news/forest/forum-on-forests-14th-session.html.

UN. United Nations.**The Global Forest Goals Report 2021**. New York USA: United Nations Forum on Forests Secretariat, 2021. 9789211304282. 114 p. Available: https://www.un.org/esa/forests/wp-content/uploads/2021/08/Global-Forest-Goals-Report2021.pdf.

USDOL. 2022 List of goods produced by child labor or forced labor. Washington US: U.S. Department of Labor, 2022. 116 p. Available: dol.gov/BetterTradeTool.

VEDELD, P., ANGELSEN, A.; SJAASTAD, E., KOBUGABEBERG, G. Counting on the environment: forest incomes and the rural poor. *In*: Vedeld, P. (Ed.). **Environmental Economics,** 98,Washington DC: World Bank. p. 95.

VENTER, S. M., WITKOWSKI, E. T. F. Fruits of our labour: contribution of commercial baobab (*Adansonia digitata* L.) fruit harvesting to the livelihoods of marginalized people in northern Venda, South Africa. **Agroforestry Systems** v. 87, p. 159-172, 2013 DOI: 10.1007/s10457-012-9532-6.

WALE, E., NKOANA, M. A., MKUNA, E. Determinants of rural household livelihood dependence on non-timber forest products: A case study from Inanda Community, KwaZulu-Natal, South Africa. **Frontiers in Forest and Global Change** v. 5, p. 788815, 2022. DOI: 10.3389/ffgc.2022.788815.

WALLE, Y., NAYAK, D. Factors determining the participation of natural resource cooperative members in forest management: A study of dry forest area in Ethiopia. **Trees, Forests and People** v. 8, p. 100241, 2022. DOI: 10.1016/j.tfp.2022.100241.

YLETYINEN, J., KUHMONEN, I., STAHLMANN-BROWN, P. Resilient and sustainable natural resource production: how are farmers and foresters coping?. **Ecology and Society**, v. 29, n. 1, 2024. DOI: 10.5751/ES-14752-290106.