American Journal of Plant Sciences, 2026, 17(1), 68-79
https://www.scirp.org/journal/ajps
ISSN Online: 2158-2750
ISSN Print: 2158-2742

Economic Importance of Non-Timber Forest Products Favored by the Local Populations of the Ziama Biosphere Reserve

Agnès Sangare[1*], Zaou Soropogui[1], Gbadieu Prosper Soumaoro[1], Pépé Monemou[1,2], Demba Magassouba[3], Aïssata Camara[3], Haziz Sina[4], Adolphe Adjanohoun[5], Lamine Baba-Moussa[4]

[1]Department of Biology, University of N'Zérékoré, N'Zérékoré, Republic of Guinea
[2]Faculty of Environmental Sciences, University of N'Zérékoré, N'Zérékoré, Republic of Guinea
[3]Department of Biology, Gamal Abdel Nasser University of Conakry (UGANC), Conakry, Republic of Guinea
[4]Faculty of Science and Technics, University of Abomey-Calavi, Abomey-Calavi, Republic of Benin
[5]National Agronomic Research Institute of Benin, Cotonou, Benin
Email: *agnesangare@gmail.com

How to cite this paper: Sangare, A., Soropogui, Z., Soumaoro, G.P., Monemou, P., Magassouba, D., Camara, A., Sina, H., Adjanohoun, A. and Baba-Moussa, L. (2026) Economic Importance of Non-Timber Forest Products Favored by the Local Populations of the Ziama Biosphere Reserve. *American Journal of Plant Sciences*, **17**, 68-79.
https://doi.org/10.4236/ajps.2026.171005

Received: October 29, 2025
Accepted: January 18, 2026
Published: January 21, 2026

Abstract

Non-timber forest products (NTFPs) of plant origin play a critical role in sustaining rural livelihoods in tropical forest regions. This study aimed to assess the economic value of priority plant-based NTFPs exploited by local populations living around the Ziama Biosphere Reserve (ZBR), southeastern Guinea. An ethnobotanical survey using structured and semi-structured interviews was conducted with 110 household heads. Results showed that NTFP exploitation is predominantly undertaken by men (63.64%). Among the identified species, *Laccosperma secundiflorum* (P. Beauv.) Kuntze, *Eremospatha macrocarpa* (G. Mann & H. Wendl.), and the fruits of *Piper guineense* Schumach. & Thonn. were the most economically important due to their high market demand and profitability. These products are generally sold in bundles or by weight, providing a significant source of household income. Annual income derived from these priority NTFPs ranged from 3,000,000 to 10,000,000 GNF (approximately 200,000 - 606,500 FCFA). Income generated from NTFP exploitation was primarily allocated to food, children's education, healthcare, and clothing. The findings highlight the strong economic dependence of local communities on a limited number of plant-based NTFPs and underscore the need for sustainable management strategies, including regulated harvesting and domestication, to ensure the long-term availability of these resources.

Keywords

Ziama Biosphere Reserve, Non-Timber Forest Product, Socio-Economic Importance, Local Population, Harvester

1. Introduction

Tropical forests are major reservoirs of non-timber forest products (NTFPs), which contribute significantly to the livelihoods of rural and urban populations worldwide [1]. These products provide essential goods for food, medicine, income generation, and cultural practices, thereby supporting both subsistence and local economies [2]-[4]. In many developing regions, more than 80% of indigenous and rural populations depend directly on NTFPs, particularly during periods of food shortage [5] [6]. In addition to their subsistence role, NTFPs underpin important commercial activities and represent a substantial source of income for rural households [7]-[9]. In Africa alone, approximately 150 NTFPs are actively traded in local and regional markets due to their economic value [10] [11].

However, the growing demand for certain high-value NTFPs in urban centers has led to increased harvesting pressure in rural landscapes, often exceeding sustainable extraction levels [12]. This intensified exploitation contributes to forest degradation, biodiversity loss, and, in some cases, the transformation of natural forests into agroforestry systems [13] [14]. Such trends pose serious risks to food security, public health, and ecosystem resilience. Despite their importance, the economic value of plant-based NTFPs and their contribution to household livelihoods remain insufficiently quantified and poorly documented in the scientific literature, particularly at the local scale [15]. Quantitative assessments of community dependence on NTFPs are therefore essential for informing sustainable forest management and conservation strategies.

In the Republic of Guinea, communities living in and around forest ecosystems rely heavily on plant-based NTFPs to satisfy basic needs related to food, healthcare, education, and income generation [16]. Several species are prioritized by rural populations because of their high economic profitability and market demand [17] [18]. The Ziama Biosphere Reserve (ZBR), located in southeastern Guinea, constitutes a key ecological and socioeconomic area, providing a wide range of plant resources such as fruits, seeds, leaves, shoots, roots, and bark that are used for both subsistence and trade [19]. Consequently, certain plant-based NTFPs from the ZBR are preferentially harvested by local populations for their economic value [20] [21]. Nevertheless, empirical data on the economic importance and exploitation intensity of these priority NTFPs within the ZBR remain scarce.

Therefore, the objective of this study is to assess the economic value of priority non-timber forest products of plant origin used by local communities surrounding the Ziama Biosphere Reserve, in order to provide a scientific basis for sustain-

able resource management and conservation planning.

2. Materials and Methods

2.1. Study Area

The study was conducted in the Ziama Biosphere Reserve (ZBR), located in south-eastern Guinea between 8˚03'N and 8˚32'N latitude and 9˚08'W and 9˚32'W longitude. The reserve covers an area of approximately 119,019 ha and is surrounded by five Rural Communes comprising a total of 35 villages [22]. According to the General Population and Housing Census (RGPH, 2014), the area has a population of 73,175 inhabitants, corresponding to a population density of 18.9 inhabitants/km^2.

The climate of the ZBR is humid tropical, characterized by high annual rainfall averaging approximately 2700 mm and mean annual temperatures ranging from 17.7˚C to 30.4˚C (**Figure 1**). The vegetation is stratified into two main layers: a lower layer dominated by plant communities characterized by *Parinari excelsa* Sabine [23], and an upper montane layer dominated by *Triplochiton scleroxylon* K. Schum [24].

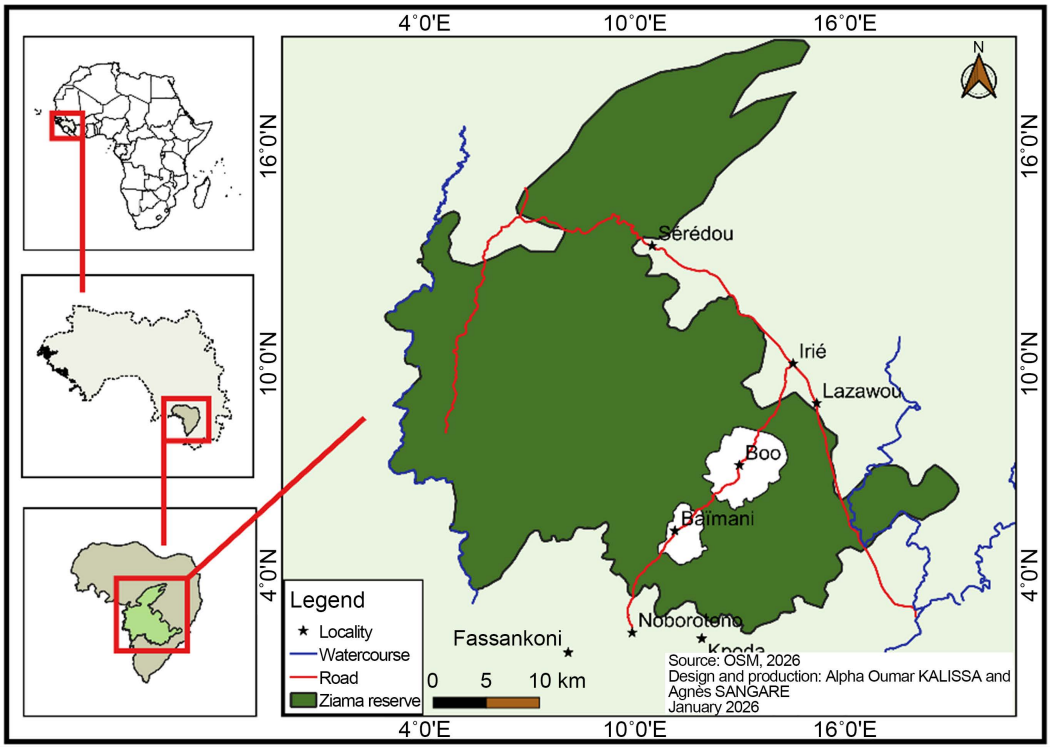

Figure 1. Location map of the Ziama Biosphere Reserve.

2.2. Data Collection

Data were collected through a socioeconomic survey conducted among populations aged 20 years and above in three villages located around the reserve: Bôo, Baimani, and Lazawou. Structured and semi-structured interviews were used to

gather information from respondents. Before data collection, meetings were held with local authorities in each village to explain the objectives of the study and obtain community consent. Subsequently, households recognized as being involved in the exploitation of non-timber forest products (NTFPs) were identified [25].

Structured and semi-structured questionnaires were then administered to heads of households identified as users of plant-based NTFPs within the ZBR [26]. In total, 110 household heads, primarily farmers, were interviewed. The questionnaire covered respondents' sociodemographic characteristics (sex, age, level of education, and number of dependents) as well as information on priority NTFPs exploited, including local product names, selling prices, and the allocation of income generated from these products [27]. All plant-based NTFPs mentioned in local languages were recorded and subsequently translated into French to facilitate identification and analysis [28].

2.3. Data Processing and Analysis

Survey data were compiled, coded, and analyzed using Microsoft Word and Excel 2013. Scientific identification of plant species was carried out using reference floras of tropical Africa [29], relevant botanical literature [30], and herbarium collections from the University of N'Zérékoré and the Institute of Agronomic Research of Guinea (IRAG) in Sérédou.

The production value is equal to the price of NTFPs (P) multiplied by the quantity of products collected (xf). That is: VP = Pxf

The total production cost consists of the labor cost (Lf) for collecting forest products [31] [32], that is: CT = Lfw with w = unit labor cost.

$$Lf = \beta xf$$

where β is the time required to collect one unit of NTFP xf, hence

$$CT = \beta xfw.$$

The income from NTFPs is written as: Revpfnl = Pxf – βxfw.

Spatial data processing and cartographic representation of the study area were performed using QGIS version 2.10 (Pisa).

3. Results

3.1. Socioeconomic Profile of Respondents

3.1.1. Gender Distribution

A total of 110 respondents from villages surrounding the Ziama Biosphere Reserve were surveyed. Men accounted for 63.64% of respondents, while women represented 36.36% (**Figure 2**).

The predominance of men among respondents reflects their greater involvement in the harvesting of plant-based non-timber forest products (NTFPs), an activity that often requires long-distance travel and physical effort for transporting harvested materials. In addition, men are generally household heads and bear primary responsibility for household subsistence. Women, who were less repre-

sented, mainly collect NTFPs located closer to villages and that are more easily accessible.

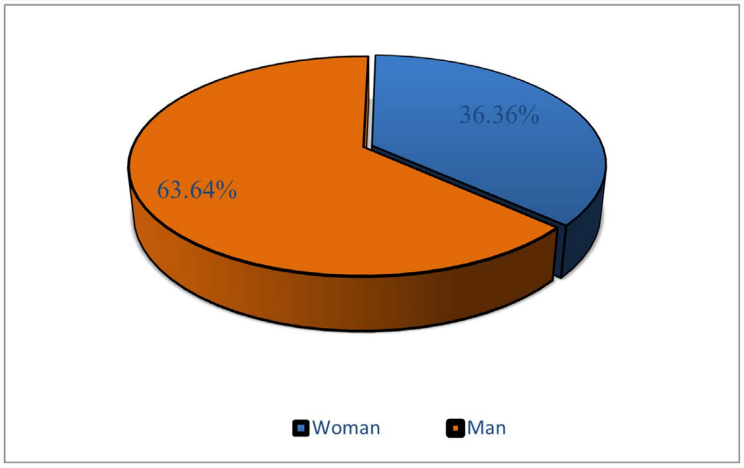

Figure 2. Distribution of respondents by gender.

3.1.2. Age Structure of Respondents

Respondents ranged in age from 20 to 70 years. The most represented age group was 40 - 50 years (44%), followed by 30 - 40 years (33%). Individuals aged 60 - 70 years were the least represented, accounting for only 4% of respondents (**Figure 3**).

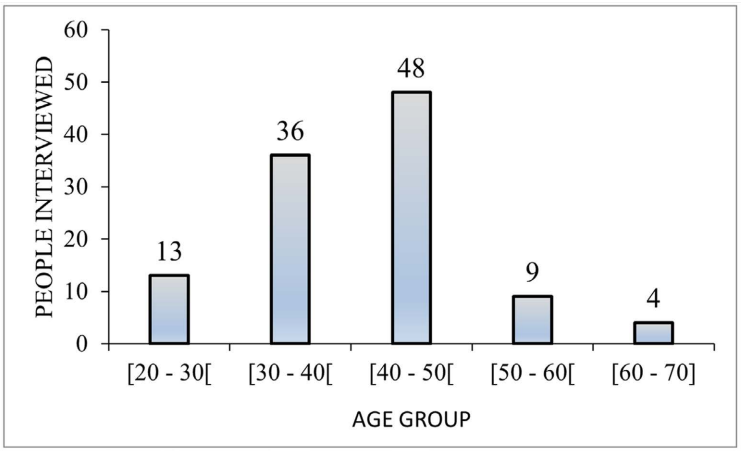

Figure 3. Distribution of respondents by age group.

The predominance of respondents aged 30 - 50 years indicates that economically active adults are the main actors involved in the exploitation of plant-based NTFPs. This age group generally possesses extensive knowledge of forest resources and their locations within the reserve.

3.1.3. Educational Level of Respondents

The educational level of respondents was generally low. Half of the respondents (50%) had no formal education, while the remaining 50% had attended school to varying degrees. Among those with formal education, 27.27% had completed pri-

mary education, 10.91% secondary education, and 11.82% university education (Figure 4).

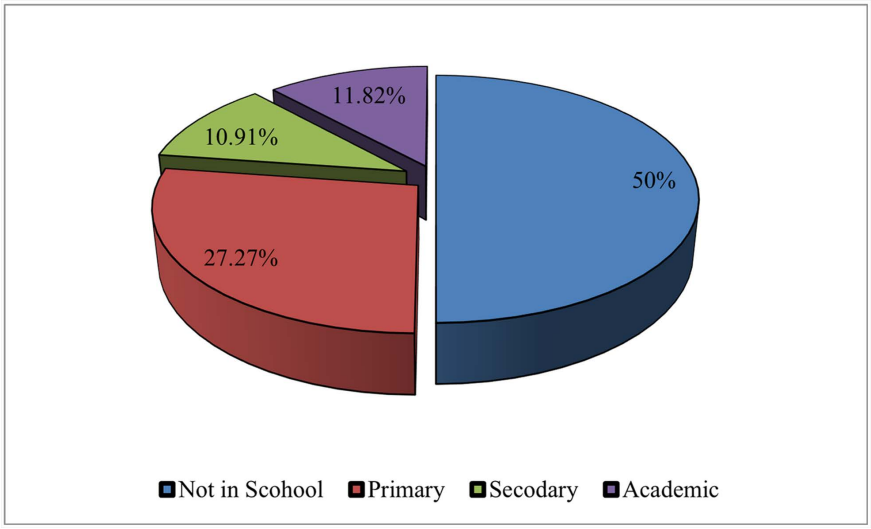

Figure 4. Distribution of respondents by educational level.

The high proportion of respondents without formal education reflects the predominance of farming and hunting activities in the area, as well as school dropout rates linked to socioeconomic constraints. Respondents with secondary and university education were mainly students who engaged in NTFP exploitation seasonally to meet financial needs.

3.1.4. Household Dependency Burden

Most respondents (43.64%) reported being responsible for households of 5 - 10 dependents. This was followed by 26.36% of respondents with 10 - 15 dependents, while 11.82% supported between 15 and 20 individuals (Figure 5).

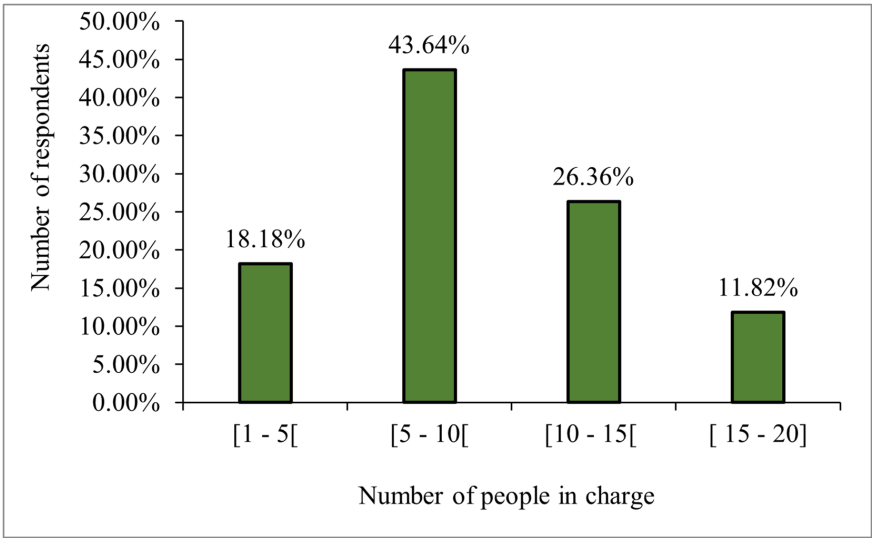

Figure 5. Household dependency burden of respondents.

These results indicate that most respondents support large households, which increases reliance on forest resources as a primary means of subsistence and income generation.

3.2. Priority Uses of Plant-Based NTFPs

The survey identified a total of eight plant-based NTFP species exploited across the studied villages. *Eremospatha macrocarpa* (G. Mann & H. Wendl.) was the most frequently cited species (35%), followed by *Laccosperma secundiflorum* (P. Beauv.) Kuntze (22%) and *Piper guineense* Schumach. & Thonn. (16%). *Beilschmiedia mannii* (Meisn.) Benth. & Hook. f. was the least cited species (5%). All respondents (100%) acknowledged the economic importance of these plant-based NTFPs (Table 1).

Table 1. Uses of priority plant-based NTFPs identified by local populations.

Species name	Person under investigation	Importance for the population		
		Food	Therapeutic	Economic
Eremospatha macrocarpa (G.Mann & H.Wendl.)	38	0	0	+
Laccosperma scundiflorum (P.Beauv.) Kuntze	24	0	0	+
Ricinodendron heudelotii (Baill.) Pierre ex Heckel.	10	+	+	+
Beilschmiedia manii (Meisn.) Benth. &Hook.f.	05	+	+	+
Garcinia kola Hechel	08	+	+	+
Piper guineense Schumach. & Thome.	18	+	+	+
Xylopia aethiopica (Dunal) A. Rich	07	+	+	+
Total	110	48 (44%)	48 (44%)	110 (100%)

Overall, plant-based NTFPs play a critical role in local livelihoods. Six species (44%) were reported to be used for both food and medicinal purposes, while all eight species were used for economic purposes and income generation.

3.2.1. Economic Value of Priority Plant-Based NTFPs

Plant-based NTFPs constitute an important source of income for local communities. The plant parts commercialized include stems, fruits, and seeds, which are sold either in bundles or by weight. Among the identified species, *Eremospatha macrocarpa* exhibited the highest annual economic value, ranging from 5,000,000 to 10,000,000 GNF (approximately 303,250 - 606,500 FCFA). *Laccosperma secundiflorum* generated an estimated annual income of 4,000,000 - 8,000,000 GNF (252,500 - 505,000 FCFA), while *Piper guineense* generated 3,000,000 - 7,000,000 GNF (200,000 - 451,500 FCFA). In contrast, *Beilschmiedia mannii* showed a lower economic value, with annual income ranging from 200,000 to 500,000 GNF (13,000 - 33,250 FCFA) (Table 2).

Table 2. Estimated annual economic value of priority plant-based NTFPs.

Name of priority species	Person under investigation	Used part	Sales method	P U (GNF)	Annual revenue in GNF
Eremospatha macrocarpa (G.Mann & H.Wendl.)	36	Tige	Botte	[100,000 – 250,000[	[5,000,000 - 10,000,000[
Laccosperma scundiflorum (P.Beauv.) Kuntze	27	Tige	Botte	[150,000 – 200,000[	[4,000,000 - 8,000,000[
Ricinodendron heudelotii (Baill.) Pierre ex Heckel.	11	Graine	Kilogram	[35,000 - 45,000[	[500,000 - 1,000,000[
Beilschmiedia manii (Meisn.) Benth. &Hook.f.	02	Graine	Kilogram	[15,000 - 25,000[	[200,000 - 500,000[
Garcinia kola Hechel	08	Graine	Kilogram	[40,000 - 80,000[	[2,000,000 - 5,000,000[
Piper guineense Schumach. & Thome.	23	Graine	Kilogram	[50,000 - 150,000[	[3,000,000 - 7,000,000[
Xylopia aethiopica (Dunal) A. Rich	03	Fruit	Kilogram	[10,000 - 20,000[	[200,000 - 600,000]
Total	110			**[10,000 - 250,000]**	**[200,000 - 10,000,000]**

Three species—*Eremospatha macrocarpa*, *Laccosperma scandensflorum* (P. Beauv.) Kuntze, and *Piper guineense*—were identified as the most economically significant for local communities, largely due to their high demand in urban markets.

3.2.2. Allocation of Income from Plant-Based NTFPs

Income derived from the exploitation of plant-based NTFPs was allocated to several household needs (Figure 6). Food accounted for the largest share (40.00%), followed by children's education (26.36%), healthcare (18.18%), and clothing (15.45%).

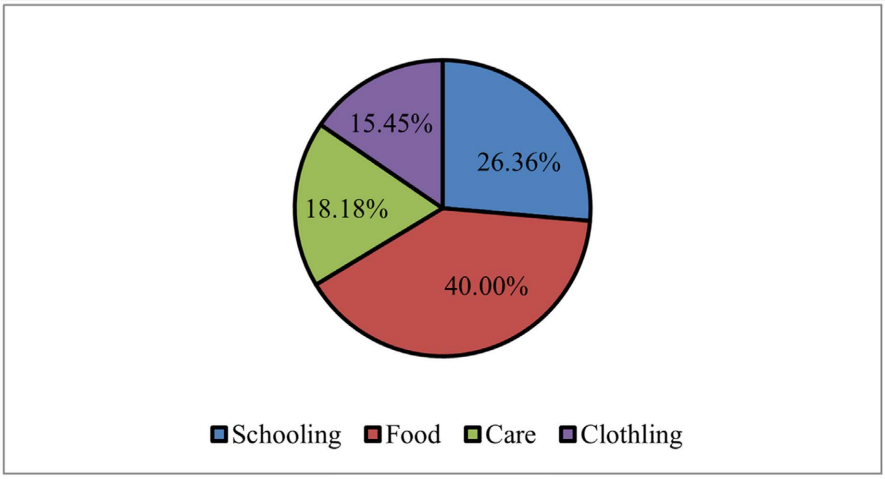

Figure 6. Allocation of income derived from plant-based NTFPs.

These findings demonstrate that income generated from NTFPs plays a central role in ensuring household food security, access to education, healthcare, and basic living requirements.

4. Discussion

Guinean forests in general, and the Ziama Biosphere Reserve (ZBR), have seen few studies on the socio-economic importance of non-timber forest products (NTFPs). Nevertheless, we referred to the results of similar research conducted by other researchers to discuss our own findings.

Gender of respondents:

The surveys were conducted among 110 people in remote villages in the Ziama Biosphere Reserve. Men accounted for the majority of respondents (63.64%), while women were in the minority, representing 36.36% of those surveyed (**Figure 2**).

This study is comparable to that of [16] conducted in the Republic of Guinea on the incidence of non-timber forest product exploitation by the population living near the Diécké Classified Forest, where the number of men surveyed was higher, at 73.44% compared to 26.56% of women. This reality can be explained by the fact that the Ziama Biosphere Reserve is a high mountain and very dense forest inhabited by wild animals. This often does not give women the courage to enter it frequently.

The survey made it possible to list 8 forest plant species identified in the ZBR, the most important of which are: *Eremospatha macrocarpa* (G. Mann & H. Wendl.), *Laccosperma secundiflorum* (P. Beauv.) Kuntze, *Piper guineense* Schumach. & Thome, and *Beilschmiedia manii* (Meisn.) Benth. & Hook.f.

These results are contrary to those of [13] in the classified forest of Haut-Sassandra in the central-west of Côte d'Ivoire. They recorded 137 plant species collected by locals, used in food and traditional medicine. This large difference is also explained by their much larger number of respondents compared to our study, 499 versus 110.

Economic values of plant-based non-timber forest products are prioritized by local communities

Plant-based non-timber forest products (NTFPs) represent a very significant commercial value for the economy of local populations. Indeed, the parts used for sale include stems, seeds, and fruits. These products are often sold in bundles and by the kilogram, allowing them to generate money to meet certain basic family needs. These results are consistent with those of [9], who mentioned that non-timber forest products are key subsistence resources for households and provide income for local populations. From a usage perspective, our study revealed that NTFPs are used in food, therapy, and the economy. These results differ from those of [13], who reported that, after food and traditional medicine, NTFPs are used in construction and handicrafts.

Among these products, *Eremospatha macrocarpa* (G. Mann & H. Wendl.) has

a higher economic value ranging from 5,000,000 to 10,000,000 GNF, or 303,250 to 606,500 FCFA per year. This is followed by *Laccosperma secundiflorum* (P. Beauv.) Kuntze, with an annual economic value ranging from 4,000,000 to 8,000,000 GNF, or 252,500 to 505,000 FCFA. *Piper guineense* Schumach. & Thome, highly valued economically by the population, has an economic value ranging from 3,000,000 to 7,000,000 GNF, or 200,000 to 451,500 FCFA per year. The species *Beilschmiedia manii* (Meisn.) Benth. & Hook.f, less appreciated by the population, has an annual economic value of 200,000 to 500,000 GNF, or 13,000 to 33,250 FCFA, and is the most appreciated by the respondents (Table 2).

Indeed, NTFPs, being one of the main sources of income for the populations living near the ZBR, often enter this reserve in search of NTFPs, which can lead to the degradation of this forest ecosystem.

5. Conclusion

This study highlights the importance of non-timber forest products (NTFPs) of plant origin to communities surrounding the Ziama Biosphere Reserve (ZBR). Eight plant species were identified as being predominantly harvested to meet local food, medicinal, and economic needs. Among these, *Eremospatha macrocarpa*, *Laccosperma scandensflorum*, and *Piper guineense* were identified as priority species due to their significant economic value for local populations. Income generated from the exploitation of these species contributes directly to household livelihoods, including food security, children's education, healthcare, and clothing. However, increasing demand from urban markets has intensified harvesting pressure on these priority species, raising concerns about their sustainability. These findings underscore the need for appropriate management and conservation strategies to ensure the sustainable use of economically important NTFPs while maintaining the livelihoods of local communities surrounding the ZBR.

Conflicts of Interest

The authors declare no conflicts of interest regarding the publication of this paper.

References

[1] Kapemba, A.M., Nkashama Mukenge, J.C., Kabongo Bafue, M. and Etshindo Aseke, A. (2023) Déterminants de la consommation des produits forestiers non ligneux dans la Ville de Kananga: Cas du Gnetum Africanum (MFumbwa). *International Journal of Accounting, Finance, Auditing, Management and Economics*, **4**, 237-258.

[2] Correia, M., Diabaté, M., Beavogui, P., Guilavogui, K., Lamanda, N. and de Foresta, H. (2010) Conserving Forest Tree Diversity in Guinée Forestière (Guinea, West Africa): The Role of Coffee-Based Agroforests. *Biodiversity and Conservation*, **19**, 1725-1747. https://doi.org/10.1007/s10531-010-9800-6

[3] Nyengayenge, D., Kanyange, A. and Rufuruguta, E. (2002) L'utilisation des produits forestiers non ligneux dans le cadre de la gestion durable au Burundi. *Le Flamboyant*, **55**, 25-29.

[4] Alex, W., Ulrich, G.A.H. and Sylvain, V.A. (2017) Importance Socioculturelle Des

Produits Forestiers Non Ligneux Du Massif Forestier d'Agoua Au Benin. *European Scientific Journal, ESJ*, **13**, 123-139. https://doi.org/10.19044/esj.2017.v13n14p123

[5] Ingram, V., Awono, A.A. and Schure, J. (2014) Les PFNL participent à la création des revenus des ménages pauvre. *Chapitre*, **7**, 49.

[6] Tollens, E. (2004) Sécurité alimentaire à Kinshasa: Un face-à-face quotidien avec l'adversité. In: *Ordre et désordre à Kinshasa, Réponses populaires à la faillite de l'État*, l'Harmattan, 61-79.

[7] Aznar, O. and Perrier-Cornet, P. (2003) Les services environnementaux dans les espaces ruraux Une approche par l'économie des services. *Économie rurale*, **273**, 153-168. https://doi.org/10.3406/ecoru.2003.5396

[8] Thiombiano, D.N.E., Lamien, N., Dibong, S.D. and Boussim, I.J. (2010) Etat des peuplements des espèces ligneuses de soudure des communes rurales de Pobé-Mengao et de Nobéré (Burkina Faso). *Journal of Animal & Plant Sciences*, **9**, 1104-1116.

[9] Priso, R.J., Nanga, J.F., Etame, J., Din, N. and Amougou, A. (2011) Les produits forestiers non ligneux d'origine végétale: Valeur et importance dans quelques marchés de la région du Littoral-Cameroun. *Journal of Applied Biosciences*, **40**, 2715-2726.

[10] (2001) Les produits forestiers non ligneux comestibles utilisés dans les pays africains francophones. Non Wood News, FAO, 5-13.

[11] Tchatat, M. and N'Doye, O. (2006) Etude des produits forestiers non-ligneux d'Afrique Centrale: Réalités et perspectives. *Bois et Forets des Tropiques*, **289**, 27-39.

[12] Freddy, M.B.G. (2020) Caractéristiques socio-économiques du commerce des bourgeons de rotin (*Laccosperma secundiflorum* et *Eremospatha macrocarpa*) à Brazzaville, République du Congo. *European Scientific Journal ESJ*, **16**, 102-116. https://doi.org/10.19044/esj.2020.v16n7p102

[13] Zanh, G.G., Koua, K.A.N., Kouakou, K.A. and Barima, Y.S.S. (2018) Saturation foncière à la périphérie de la forêt classée du Haut-Sassandra (Centre-Ouest de la Côte d'Ivoire) durant la période de 1990 à 2016. *Tropicultura*, **36**, 171-182.

[14] Kouakou, K.A., Barima, Y.S.S., Kpangui, K.B. and Godron, M. (2018) Analyse des profils écologiques des produits forestiers non ligneux dans la région du Haut-Sassandra (Centre-Ouest de la Côte d'Ivoire). *Tropicultura*, **36**, 435-446.

[15] Loubelo, E. (2012) Impact des produits forestiers non ligneux (PFNL) sur l'économie des ménages et la sécurité alimentaire: Cas de la République du Congo. Thèse de doctorat, Université de Renne 2, 261 p.

[16] Monemou, P., Soropogui, Z. and Soumaoro, G.P. (2022) Importance socioéconomique des rotins dans la vie des populations vivant à la périphérie de la forêt classée de Diécké, République de Guinée. *Revue Ivoirienne des Sciences et Technologie*, **40**, 265-278.

[17] Kouakou, K.A. (2019) Disponibilité et vulnérabilité des espèces sources de produits forestiers non ligneux d'origine végétale de la forêt classée du Haut-Sassandra et sa périphérie après la décennie de crise au Centre-Ouest de la Côte d'Ivoire. Thèse de doctorat. Université Jean Lorougnon Guede, 11-13.

[18] Tabuna, H. (2000) Le marché Européen des Produits Forestiers Non Ligneux en provenance d'Afrique Centrale. In: Sunderland, T.C.H., Clark, L.E. and Vantomme, P., Eds., *Les Produits Forestiers non ligneux. Recherches actuelles et perspectives pour la conservation et le développement. Réunion Internationale sur les Produits Forestiers non Ligneux*, FAO, 267-280.

[19] Diawara, D. (2001) Situation des Ressources Génétiques Forestières de la Guinée.

Atelier sous-regional FAO/IPGRI/ICRAF sur la conservation, la gestion, l'utilisation durable et la mise en valeur des ressources génétiques forestières de la zone sahélienne, Ouagadougou, 8-9.

[20] Ouédraogo, M., Ouédraogo, D., Thiombiano, T., Hien, M. and Lykke, A.M. (2013) Dépendance économique aux produits forestiers non ligneux: Cas des ménages riverains des forêts de Boulon et de Koflandé, au Sud-Ouest du Burkina Faso. *Journal of Agriculture and Environment for International Development*, **107**, 45-72.

[21] Eke Balla, S.M (2011) La valorisation des produits forestiers non ligneux au Cameroun. La valorisation des produits forestiers non-ligneux dans l'arrondissement de Yokadouma. Éditions universitaires européennes, 88-110.

[22] CFZ (2020) Centre Forestier de N'Zérékoré. Plan d'Aménagement et de Gestion de la Reserve de Biosphère de Ziama. République de Guinée. N'Zérékoré, 19-29.

[23] Lisowski, S. (1991) Rapport de mission d'appuis dans le cadre du progerfor de la DNFC en Rep. De Guinée, 49 p.

[24] Schnell, R. (1952) Végétation et flore de la region montagneuse du mont (Afrique occidentale française). Mémoires de l'institut Français d'Afrique noire No 22, 598 p.

[25] Diabaté, M., Diabaté, M., Koné, F., Haba, O.O., Foresta, H.D. and Labouisse, J. (2022) Chapitre 3. Diversité floristique et usages des plantes forestières en zones rurales de Guinée forestière. In: Profizi, J.P., *et al.*, Eds., *Biodiversité des écosystèmes intertropicaux*, IRD Éditions, 57-71. https://doi.org/10.4000/books.irdeditions.40894

[26] Ghiglione, R. and Matalon, B. (2004) Les enquêtes sociologiques: Théories et pratique. Armand Collin, 103 p.

[27] Lawrence, A., Phillips, O.L., Ismodes, A.R., Lopez, M., Rose, S., Wood, D., *et al.* (2005) Local Values for Harvested Forest Plants in Madre De Dios, Peru: Towards a More Contextualised Interpretation of Quantitative Ethnobotanical Data. *Biodiversity and Conservation*, **14**, 45-79. https://doi.org/10.1007/s10531-005-4050-8

[28] Hama, O., Tinni, I. and Barage, M. (2019) Contribution des produits forestiers non ligneux a la securite alimentaire desmenages dans la commune rurale de tamou, au sud-ouest du niger (Afrique de louest). *International Journal of Advanced Research*, **7**, 210-227. https://doi.org/10.21474/ijar01/9824

[29] Bosch, C.H., Siemonsma, J.S., Lemmens, R.H.M.J. and Oyen, L.P.A. (2002) Plant Resources of Tropical Africa/Ressources Végétales de l'Afrique Tropicale. Basic list of species and commodity grouping/Liste de base des espèces et de leurs groupes d'usage. PROTA Programme, 341 p.

[30] Hawthorne, W. and Woody, J.C. (2006) Plants of Western African Forests: A Guide to the Forest Threes, Shrubs and Lianes from Senegal to Ghana. Kew Publishing, 1023 p.

[31] Pearce, D.W. and Atkinson, G.D. (1993) Capital Theory and the Measurement of Sustainable Development: An Indicator of "Weak" Sustainability. *Ecological Economics*, **8**, 103-108. https://doi.org/10.1016/0921-8009(93)90039-9

[32] Gopalakrishnan, P. and Banerji, A.K. (2004) Maintenance and Spare Parts Management. Prentice Hall.