

Inventory and Characterisation of Non-Timber Forest Products Used by the Local Population Living Near the Diécké Protected Forest, South-East Guinea

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Abstract

The aim of this study was to inventory and characterize the non-timber forest products (NTFPs) exploited by local populations in the Diécké classified forest. An inventory of NTFPs was conducted, complemented by ethnobotanical surveys involving 447 farmers, including 346 men (77.40%) and 101 women (22.6%). The farmers' ages ranged from 20 to 61. A total of 111 plant species belonging to 99 genera and 47 families were identified, as being used by local populations. These species are used for various purposes, including traditional medicine, food, handicrafts, construction, packaging and sacred practices. The floristic surveys also identified four morphological types: trees (59%), grasses (19%), shrubs (16%) and lianas (6%). The harvesting methods varied according to the morphological type of the species, and the plant organ or part collected. Leaves were the most frequently harvested plant parts (55%), followed by bark (11.70%), roots (16.20%), fruits (8.10%), branches (6.30%) and others (2.70%). To ensure the sustainable use of NTFPs, it is important to regulate and to rationalize their exploitation in order to maintain their long-term availability.

Keywords

Inventory, Characterisation, Non-Timber Forest Products, Riparian Population, Diécké Classified Forest

1. Introduction

Forests and trees make vital contributions to both people and the planet, by strengthening livelihoods, improving air and water quality, preserving biodiversity and providing solutions to climate change [1]. The ecosystem functions provided by biological diversity are wide-ranging and irreplaceable [2]. In rural areas, thousands of people depend directly on this biodiversity for their food, income and various other subsistence activities [3]. Forests are complex ecosystems which, in addition to timber production, provide numerous other resources known as Non-Timber Forest Products (NTFPs) [4]. They also provide a wide range of social and environmental services, harbor a high level of biodiversity, and constitute an invaluable genetic resource [5]. Tropical rainforests contain are particularly rich in non-timber forest products (NTFPs) and ecosystem services that contribute significantly to people's well-being [6] [7]. Communities living on the fringes of these forests are therefore dependent on non-timber forest products for their livelihoods and income [8]. These NTFPs have thus sparked a considerable resurgence of interest in recent years due to their contribution to household economies and the conservation of biological diversity [9]. They constitute an essential food source for the survival of rural populations during the lean season and in years of drought, as well as a source of food during periods of heavy rainfall [10]. Today, NTFPs play an increasingly important role in socioeconomic, ecological, cultural, and even political terms in many tropical countries [11]. The United Nations Conference on Environment and Development held in Rio in 1992 recognized their ecological and socioeconomic importance in the sustainable management of forest ecosystems [12].

NTFPs are among the natural resources which local communities most frequently rely on to diversify their productive activities and improve their incomes [13]. They include, in particular, food products (nuts, mushrooms, wild fruits, herbs, etc.), plant products (fibers, vines, flowers, roots, bark, etc.), plant extracts (bamboo, rattan, raffia, etc.), and game and other animal products (bush meat, bees, honey, silk, caterpillars, etc.) [14] [15]. For local communities, NTFPs often represent the most tangible manifestation of the forest's value as natural capital [16]. Furthermore, the NTFP sector largely operates within the informal economy; and often lacks an appropriate organizational, institutional, and legal framework and is not sufficiently valued [17].

This situation affects the availability of plant-based NTFPs, sometimes altering their distribution around villages [18] [19]. Consequently, the extent of degradation and the availability of the NTFP species on which rural populations depend have become a cause for concern [20]. Furthermore, when human activities carried out within a protected area or a classified forest become intensive, they can contribute to the impoverishment of the local communities that depend on them. This is the case in the Diécké classified forest, situated in south-eastern Guinea. Furthermore, when human activities within a protected area or a classified forest become intensive, they can contribute to the impoverishment of the local com-

munities that depend on them. This is the case in the Diécké classified forest, situated in south-eastern Guinea.

This natural region is the most forested area in the country and is home to extensive tracts of humid rainforests, notably in the Ziama and Nimba Mountains biosphere reserves, as well as the classified forests of Diécké, Béro and Pic de Fon [21]. However, the dense rainforests have been extensively cleared (after having been relatively little exploited for timber), to the extent that only a few tens of thousands of hectares remain, concentrated mainly in two large protected forest areas: the Ziama Forest, covering 112,300 ha, and the Diécké Forest, 64,000 ha, as well as in a few small forests that are difficult to access or protected by local customs [22]. With regard to the Diécké Protected Forest, several studies have already been carried out, notably the 'Study of the rattan industry around and within the Ziama, Diécké and Mont Béro Protected Forests' [23], the socio-economic importance of rattan in the lives of communities living on the periphery of the Diécké Protected Forest [24], on the effects of rattan harvesting on associated species on the periphery of the Diécké Protected Forest, [21] as well as on the economic value of non-timber forest products in the lives of communities living on the fringes of the Diécké Protected Forest [25]. However, no study has been carried out focusing on the inventory and characterisation of non-timber forest products harvested by communities living on the periphery of the Diécké Protected Forest, hence the necessity and relevance of conducting this study.

2. Materials and Methods

2.1. Description of the Study Area

The Diécké Protected Forest is situated in south-eastern Guinea between 7°22' and 7°39' north latitude and 8°47' and 9°06' west longitude, covering an area of 64,000 hectares. The climate is sub-equatorial, with a long rainy season. Average annual rainfall is 1840 mm. Wet rainforests, secondary forests and mesophilic forests make up the bulk of the forested area [21]. The Diécké Classified Forest and the villages in its vicinity are influenced by river backwaters such as Gbin, Nié and Gbinbé. The surrounding area has been shaped by various waves of migration involving indigenous people, non-indigenous people and foreigners. The indigenous populations living on the outskirts belong to the two major groups, the Kpèlè and the Manons, which are the main ethnic groups in the area [24]. Migrants and foreigners seeking a livelihood come from all the country's ethnic groups, as well as some from Liberia, and are exerting various pressures on the entire Diécké Protected Forest. The aim of this migration has been to find agricultural land and to engage in cross-border trade, given the area's proximity to Liberia and Côte d'Ivoire [26]. The outskirts of the Classified Forest have experienced, and continue to experience, waves of migration due to the launch of the agro-industrial programme for modern rubber and palm oil production chains, established in 1987 and led by the Guinean Palm Oil and Rubber Company (SOGUIPAH), a public limited company under Guinean law, wholly owned by the State but managed on a private-

sector basis. The communities living on the fringes of this classified forest are engaged in agriculture, livestock farming, sport hunting and the harvesting of non-timber forest products [24] (**Figure 1**).

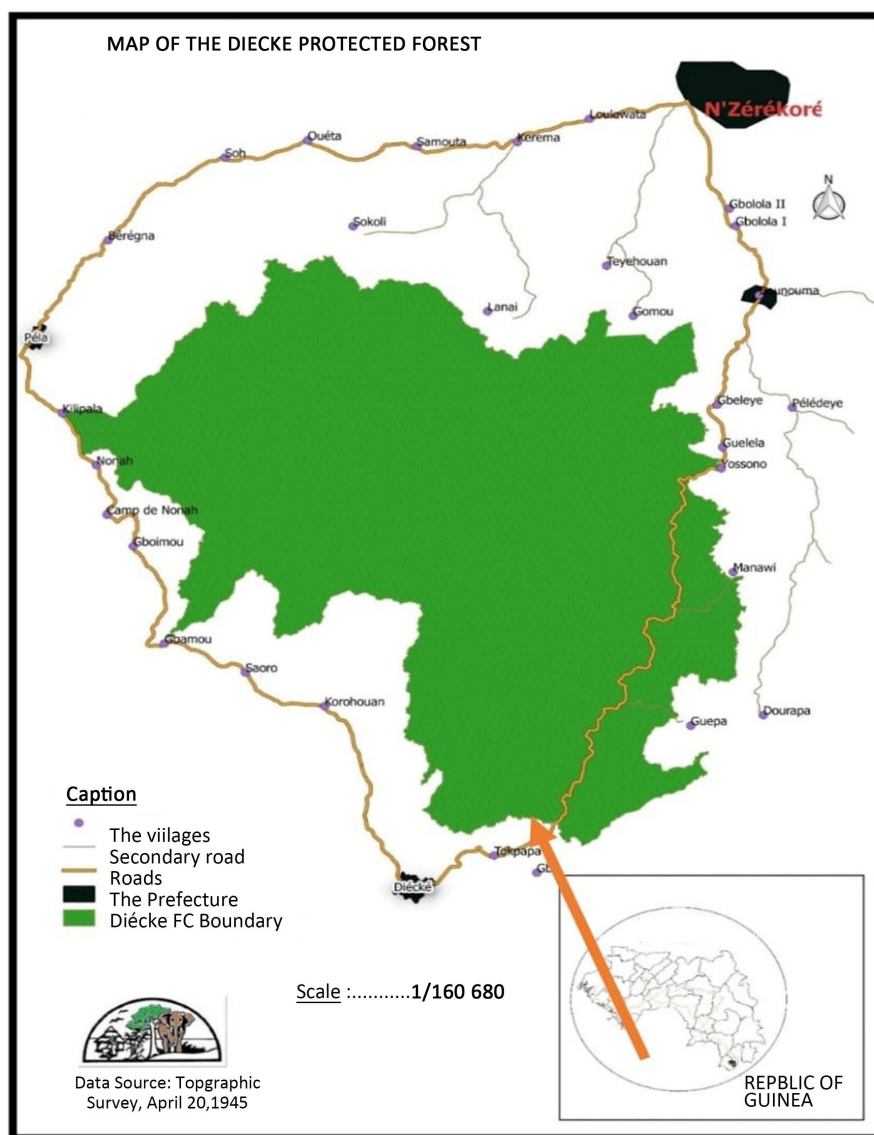


Figure 1. Overview of the Diécké classified forest.

2.2. Data Collection

Data collection was carried out in all villages and areas situated around the Diécké Classified Forest (FCD) using the survey forms shown in **Figure 1**. Data collection for this activity took place between 5 February and 15 May inclusive. 20 villages (Yosonon, Bounouma, Gboimou, Samouta, Kéréma, Nonah, Péla, Bérégnia, Korohouon, Saoro, Gbamou, Kilikpala, Ouéta, Tèyéouon, Gbèlèye, Pèlèdeye, Gomou, Tokpapa, Dourapa, Diécké) and 8 sectors (Manawi, Lanai, Gbin, Soo, Sokoli, Gborola I, Gborola II, Nonah Camp). Respondents were selected using random sampling. The sample size n was determined using the normal approximation of the

binomial distribution (Cochran, 1977, cited by Halidou, 2016). The formula for determining n is given by:

$$n = \frac{t^2 * p(1-p)}{e^2}$$

- n : Minimum sample size to be obtained (the number of households or individuals to be surveyed).
- t : Critical value derived from the reduced centered normal distribution, determined by the chosen confidence level. The standard in academia is a 95% confidence level, which yields a fixed value of $t = 1.96$.
- p : Estimated or expected proportion of the characteristic under study in the population (for example, the percentage of households harvesting NTFPs). In the absence of prior data, p is conventionally set to 0.5 (50%), which maximizes the variance and ensures the largest and most conservative sample possible.
- e : Acceptable margin of error (or desired precision). The scientific standard is set at 5%, or $e = 0.05$.

There were 56 focus groups in total, comprising 2 groups (1 for women and 1 for men). During this session, men and women were separated to avoid one group influencing the other (Thiombiano *et al.*, 2012).

A letter was sent to the forestry authority and the local authorities explaining the aim of the study. Subsequently, before the questionnaire was administered, consent was obtained from the local authorities by explaining the aim of the study to them, in accordance with the method used by (Uprety *et al.*, 2012; Kébenzikato *et al.*, 2015). Next a qualitative method involving semi-structured face-to-face interviews with the local population was employed to facilitate the collection of data and experiences through dialogue [19]. The questions focused on the demographic profile of each stakeholder, their experience in the sector, details of the NTFPs harvested (name of the plant, source of supply), harvesting techniques, categories of use (food, medicinal, construction, handicrafts, sacred, ceremonial, packaging), the extent to which each species is used, and their economic value. The interviews were therefore conducted in French and in the local language with people who had extensive knowledge of NTFPs and were aged 20 or over. A total of 447 people were interviewed; the focus group discussions involved between six and twelve participants and a facilitator discussing the issue at hand [27]. During these sessions, men and women were separated to avoid one group influencing the other [28].

2.3. Flora Surveys

The choice of sites for the survey plots was based on the tracks used by loggers searching for plant-based non-timber forest products (NTFPs). The surface survey method described in [29] was adopted. This method involves describing the vegetation by listing and classifying species within areas measuring approximately 20 m on each side, oriented according to the four cardinal points, with precise spacing. In this study, square plots measuring 20 m by 20 m were estab-

lished in various habitats within the Diécké Protected Forest (FCD). Each plot covered a total area of 400 m² (**Figure 2**). In practical terms, linear transects 20 m in length were established from the forest edge inwards. A 10-metre-wide strip on either side of the transect line was defined for the floristic survey. A total of 49 plots were established for floristic surveys, covering a total sampled area of 22,400 m². For the establishment of the plots, sites were selected based on the trails used by loggers searching for plant-based non-timber forest products (Monemou *et al.*, 2025). All NTFP species encountered were recorded across the entire square area.

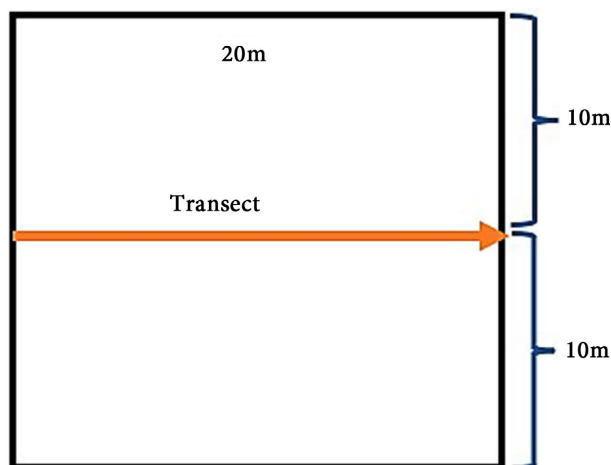


Figure 2. Diagram of a grid survey for collecting floristic data.

The plants collected were identified in the field using *Woody Plants*; those that could not be identified were taken to the Sérédou herbarium for identification.

2.4. Data Analysis

2.4.1. Profile of Stakeholders in the Non-Timber Forest Products Sector

The data from the socio-economic survey were entered into a database using Microsoft Excel 2013. They were organised to highlight the age groups of artisans and operators involved in Non-Timber Forest Products sourced from the Diécké classified forest.

2.4.2. Frequency of Use

The frequency of use is determined using the citation-based approach. This approach is based on the principle that the most widely used NTFP source species are those cited by several people [30]. It is calculated using the following equation:

$$Fu = \frac{S}{N} \times 100 \quad (1)$$

where: S = number of people using the product in question; N = total number of people interviewed. When Fu approaches 0, the species is used to a limited extent, and when Fu approaches 100, the species is used extensively.

3. Results

3.1. Profile of Non-Timber Forest Product Harvesters

Surveys carried out amongst local residents identified 447 harvesters, of whom 346 were men (77.40%) and 101 were women (22.6%). The ages of these harvesters ranged from 20 to 61 years. Producers aged between 31 and 40 were the most numerous, accounting for 35% of those interviewed. They were followed by those aged between 20 and 30 (30%); 41 and 50 (23%); and 51 and 60 (8%). Farmers aged 61 and over are in the minority and account for 4% of respondents (**Figure 3**).

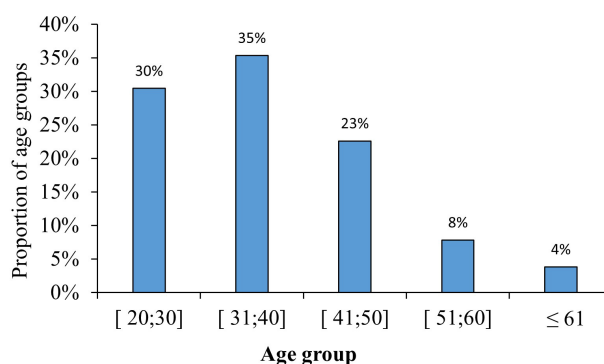


Figure 3. Histograms showing the distribution of NTFP users.

3.2. Inventory and Characterisation of Non-Timber Forest Products

The results of the survey, combined with those of the inventory, enabled the identification of 111 plant species used by the local population in the Diécké Protected Forest. These species are divided into 99 genera and 47 families. These species are used in traditional medicine, food, crafts, construction, packaging and for sacred purposes (**Table 1**).

3.3. Biomorphological Types of Non-Timber Forest Products Inventoried in the Diécké Classified Forest

Floristic surveys in the Diécké Classified Forest have enabled us to identify four morphological types of species that are sources of Non-Timber Forest Products. In terms of these types, trees are the most numerous (59%) followed by herbs (19%); shrubs account for 16%; and vines bring up the rear at 6% (**Figure 4**).

3.4. Use of Non-Timber Forest Products

The local population living near the Diécké Classified Forest uses NTFPs for medicinal, food, craft, construction, packaging and sacred purposes. **Figure 5** shows the proportion of different plant species used for each purpose. The medicinal category ranks first at 71%, followed by the food category 14%; crafts account for 7%, construction 5%, sacred uses 2%, and packaging comes last at 2%.

Table 1. List of plant species used as sources of non-timber forest products inventoried in the Diécké Protected Forest.

N°	Scientific name	Family	Primary use	Frequency of use (%)
1	<i>Adenia lobata</i> (Jacq.) Engl.	Passifloraceae	Medicinal	9.17
2	<i>Afraegle paniculata</i> (Schumach. & Thonn.) Engl.	Rutaceae	Medicinal	5.14
3	<i>Aframomum alboviolaceum</i> (Ridley) K. Schum.	Zingiberaceae	Medicinal	8.27
4	<i>Aframomum exscapum</i> (Sims) Hepper	Zingiberaceae	Medicinal	10.06
5	<i>Aframomum melegueta</i> K. Schum.	Zingiberaceae	Medicinal	35.57
6	<i>Ageratum conyzoides</i> Linn.	Asteraceae	Medicinal	41.38
7	<i>Aidia genipiflora</i> (DC.) Dandy	Rubiaceae	Construction	3.57
8	<i>Albizia adianthifolia</i> (Schumach.) W.F. Wright	Mimosaceae	Handcrafted	33.78
9	<i>Albizia ferruginea</i> (Guill. & Perr.) Benth.	Mimosaceae	Handcrafted	32.21
10	<i>Alchornea cordifolia</i> (Schum. & Thonn.) Müll.Arg.	Euphorbiaceae	Medicinal	27.96
11	<i>Alstonia boonei</i> De Wild.	Apocynaceae	Medicinal	50.11
12	<i>Anchomanes difformis</i> (Blume) Engl	Araceae	Medicinal	7.82
13	<i>Anthocleista djalensis</i> A. Chev.	Loganiaceae	Medicinal	5.14
14	<i>Antiaris toxicaria</i> var. <i>africana</i> (Engl.) C.C. Berg	Moraceae	Construction	10.73
15	<i>Aspilia africana</i> var. <i>ambigua</i> C.D. Adams	Asteraceae	Medicinal	4.02
16	<i>Baissea leonensis</i> Benth.	Apocynaceae	Medicinal	10.06
17	<i>Baphia bancoensis</i> Aubrév.	Fabaceae	Medicinal	8.94
18	<i>Baphia nitida</i> Lodd.	Fabaceae	Medicinal	7.15
19	<i>Bombax buenopozense</i> P. Beauv.	Bombacaceae	Medicinal	3.57
20	<i>Bussea occidentalis</i> (Hutch)	Fabaceae	Food	7.82
21	<i>Bridelia ferruginea</i> Benth.	Euphorbiaceae	Handcrafted	6.71
22	<i>Bryophyllum pinnatum</i> (Lam) Oké	Crassulaceae	Medicinal	3.8
23	<i>Calamus deërratus</i> L.	Arecaceae	Handcrafted	67.56
24	<i>Calotropis procera</i> (Ait.) Ait.f.	Asclepiadaceae	Medicinal	6.71
25	<i>Carapa procera</i> DC. De Wilde	Meliaceae	Medicinal	22.14
26	<i>Cassia occidentalis</i> Linn.	Caesalpinaceae	Medicinal	16.77
27	<i>Ceiba pentandra</i> (Linn.) Gaerth.	Bombacaceae	Food	47.87
28	<i>Celtis zenkeri</i> Engl.	Ulmaceae	Medicinal	23.71
29	<i>Cercestis afzalii</i> (Cchott)	Araceae	Handcrafted	28.85
30	<i>Chrysophyllum albidum</i> G.Don	Sapotaceae	Medicinal	7.38
31	<i>Cola nitida</i> (Vent.) Schott & Endl.	Sterculiaceae	Food	10.29
32	<i>Combretum molle</i> R. Br. ex G. Don	Combretaceae	Medicinal	13.19
33	<i>Cordia platythyrsa</i> Bak.	Boraginaceae	Medicinal	11.85
34	<i>Cynometra megalophylla</i> Harms	Caesalpinaceae	Medicinal	5.59
35	<i>Deinbollia pinnata</i> (Poir.) Schumach. & Thonn.	Sapindaceae	Food	15.88
36	<i>Detarium senegalense</i> J.F. Gmel.	Caesalpinaceae	Medicinal	27.29

Continued

37	<i>Diospyros mespiliformis</i> Hochst. ex A. DC.	Ebenaceae	Medicinal	27.74
38	<i>Diospyros vignei</i> F. White	Ebenaceae	Medicinal	30.20
39	<i>Distemonanthus benthamianus</i> Baill	Caesalpiniaceae	Sacred	35.12
40	<i>Elaeis guineensis</i> Jacq.	Arecaceae	Food	95.52
41	<i>Entandrophragma angolense</i> (Welw.) C. DC.	Meliaceae	Medicinal	69.79
42	<i>Entandrophragma candollei</i> Harms	Meliaceae	Medicinal	31.54
43	<i>Entandrophragma cylindricum</i> (Sprague)	Meliaceae	Medicinal	48.76
44	<i>Entandrophragma utile</i> (Dawe & Sprague)	Meliaceae	Medicinal	50.11
45	<i>Eremospatha macrocarpa</i> (G. Mann & H. Wendl.)	Arecaceae	Handcrafted	90.1
46	<i>Erythrophleum ivorense</i> A. Chev.	Caesalpiniaceae	Sacred	89.48
47	<i>Ficus exasperata</i> Vahl	Moraceae	Medicinal	12.75
48	<i>Ficus sur</i> Forsk.	Moraceae	Medicinal	9.39
49	<i>Ficus umbellata</i> Vahl	Moraceae	Medicinal	16.77
50	<i>Funtumia africana</i> (Benth.) Stapf	Apocynaceae	Handcrafted	34.67
51	<i>Garcinia kola</i> Heckel	Clusiaceae	Medicinal	67.11
52	<i>Griffonia simplicifolia</i> (Vahl ex DC.) Baill .	Caesalpiniaceae	Medicinal	39.59
53	<i>Harungana madagascariensis</i> Lam. ex Poir.	Hypericaceae	Medicinal	41.16
54	<i>Heliotropium indicum</i> Linn.	Boraginaceae	Medicinal	16.10
55	<i>Holarrhena floribunda</i> (G. Don) Dur. & S.	Apocynaceae	Medicinal	43.17
56	<i>Irvingia gabonensis</i> (Aubry-Lecomte ex O'Rorke)	Irvingiaceae	Food	50.78
57	<i>Kalanchoë crenata</i> (Andrews) Haw	Crassulaceae	Medicinal	9.39
58	<i>Kigelia africana</i> (Lam.) Benth.	Bignoniaceae	Construction	16.10
59	<i>Laccosperma secundiflorum</i> (P. Beauv.)	Arecaceae	Handcrafted	89.70
60	<i>Lecaniodiscus cupanioides</i> Planch.	Sapindaceae	Medicinal	23.26
61	<i>Leea guineensis</i> G. Don	Leeaceae	Medicinal	19.01
62	<i>Macaranga barteri</i> Müll. Arg.	Euphorbiaceae	Medicinal	16.77
63	<i>Manniophyton fulvum</i> Müll. Arg.	Euphorbiaceae	Medicinal	40.26
64	<i>Mansonia altissima</i> (A. Chev.) A. Chev.	Sterculiaceae	Medicinal	47.20
65	<i>Marantochloa leucantha</i> (K. Schum.) M.	Marantaceae	Packaging	53.46
66	<i>Margaritaria dicoidea</i> (Stem.bark)	Euphorbiaceae	Medicinal	10.29
67	<i>Mareya micrantha</i> (Benth.) Müll. Arg.	Euphorbiaceae	Medicinal	12.08
68	<i>Microglossa pyrifolia</i> (Lam.) Kuntze	Asteraceae	Medicinal	34.89
69	<i>Milicia excelsa</i> (Welw.) Benth.	Moraceae	Medicinal	54.36
70	<i>Millettia zechiana</i> Harms	Fabaceae	Medicinal	18.89
71	<i>Morinda lucida</i> Benth.	Rubiaceae	Medicinal	35.79
72	<i>Morus mesozygia</i> Stapf ex A. Chev.	Moraceae	Medicinal	20.58
73	<i>Motandra guineensis</i> A. DC.	Apocynaceae	Medicinal	9.17

Continued

74	<i>Myrianthus arboreus</i> P. Beauv.	Cecropiaceae	Medicinal	12.52
75	<i>Napoleonaea vogelii</i> (Hook.f.) Planch.	Napoleonaeaceae	Medicinal	17.67
76	<i>Nauclea latifolia</i> Sm.	Rubiaceae	Medicinal	36.01
77	<i>Nesogordonia papaverifera</i> (A. Chev.) R.	Sterculiaceae	Construction	19.23
78	<i>Newbouldia laevis</i> (P. Beauv.) Seemann ex.	Bignoniaceae	Medicinal	32.43
79	<i>Ocimum gratissimum</i> Linn.	Lamiaceae	Food	17.89
80	<i>Olex subscorpioidea</i> Oliv.	Olacaceae	Medicinal	38.92
81	<i>Palisota hirsuta</i> (Thunb.) Schum. ex Engl.	Commelinaceae	Medicinal	23.26
82	<i>Paullinia pinnata</i> L.	Sapindaceae	Medicinal	12.08
83	<i>Pentacletra macrophylla</i> (Benth)	Fabaceae	Medicinal	7.82
84	<i>Phyllanthus muellerianus</i> (O. Ktze.) Exell	Euphorbiaceae	Medicinal	15.21
85	<i>Picralima nitida</i> (Stapf) T. Durand & H.	Apocynaceae	Medicinal	17.44
86	<i>Piliostigma thonningii</i> (Schum.) M.	Caesalpiniaceae	Medicinal	25.27
87	<i>Piper guineense</i> Schum. & Thonn.	Piperaceae	Food	92.61
88	<i>Piptadeniastrum africanum</i> (Hook.f.) B.	Mimosaceae	Medicinal	15.43
89	<i>Pouteria aningeri</i> Baehni	Sapotaceae	Construction	17.44
90	<i>Pycnanthus angolensis</i> (Welw.) Warb	Myristicaceae	Medicinal	33.10
91	<i>Raphia hookeri</i> G. Mann & H. Wendl.	Arecaceae	Food	68.68
92	<i>Rauvolfia vomitoria</i> Afzel.	Apocynaceae	Medicinal	51.67
93	<i>Ricinodendron heudelotii</i> (Baill.) Pierre.	Euphorbiaceae	Food	82.10
94	<i>Sacolglotus gabonensis</i> (Bail.) Urb.	Humiricaceae	Food	39.59
95	<i>Salacia nitida</i> (Benth.) N. E. Br.	Hippocrateaceae	Food	17.89
96	<i>Salacia owabiensis</i> Hoyle	Hippocrateaceae	Food	13.19
97	<i>Solanum nigrum</i> Linn.	Solanaceae	Medicinal	8.27
98	<i>Spathodea campanulata</i> P. Beauv.	Bignoniaceae	Medicinal	4.25
99	<i>Spondias mombin</i> Linn.	Anacardiaceae	Food	3.13
100	<i>Sterculia tragacantha</i> Lindl.	Sterculiaceae	Medicinal	2.01
101	<i>Streblus usambarensis</i> Engl.	Moraceae	Medicinal	6.71
102	<i>Terminalia ivorensis</i> A. Chev.	Combretaceae	Medicinal	28.85
103	<i>Terminalia superba</i> Engl. & Diels	Combretaceae	Medicinal	32.21
104	<i>Thaumatococcus daniellii</i> (Benn.) Benth.	Marantaceae	Packaging	54.36
105	<i>Tiliacora dinklagei</i> Engl.	Mennispermaceae	Medicinal	6.04
106	<i>Trema guineensis</i> (Schum. & Thonn.) Ficalho	Ulmaceae	Medicinal	19.23
107	<i>Triplochiton scleroxylon</i> K. Schum.	Sterculiaceae	Medicinal	40.49
108	<i>Vernonia amygdalina</i> Delile	Asteraceae	Medicinal	21.02
109	<i>Vernonia colorata</i> (Willd.) Drake	Asteraceae	Medicinal	19.01
110	<i>Xylopia aethiopica</i> (Dunal) A. Rich.	Annonaceae	Medicinal	57.49
111	<i>Zanthoxylum Zanthoxyloides</i> (Lam.) Zepern.	Rutaceae	Medicinal	35.79

Biomorphological type of non-timber forest products

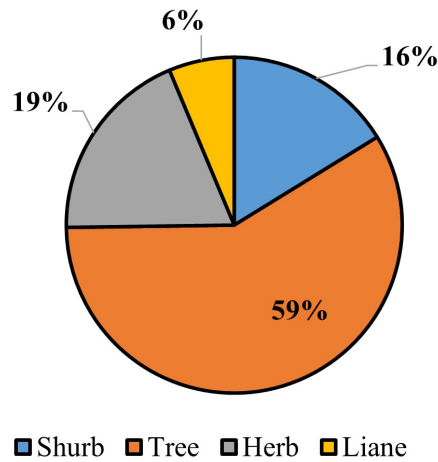


Figure 4. Biomorphological types of the inventoried species.

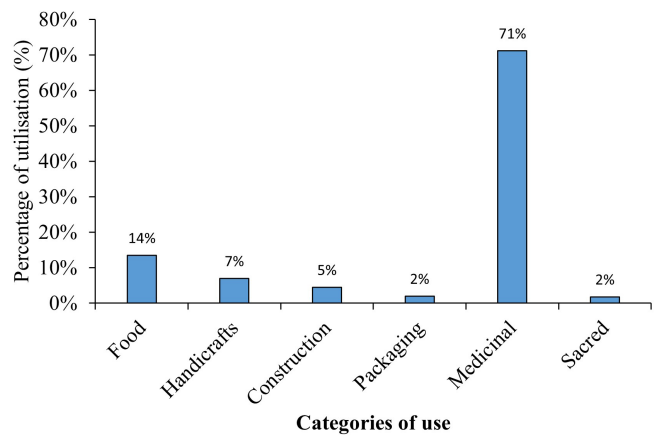


Figure 5. Proportion of NTFPs used by the local population.

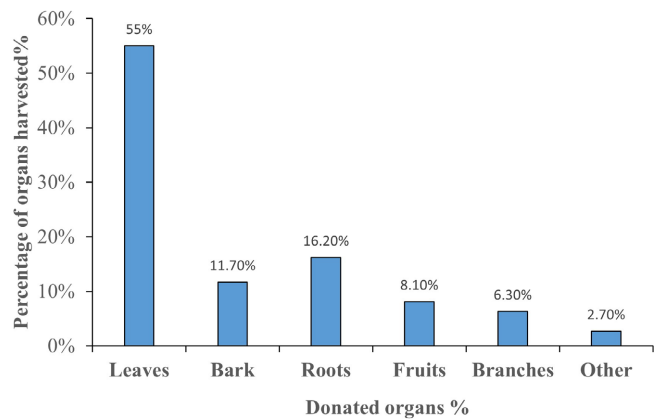


Figure 6. Proportion of organ types harvested by local communities.

3.5. Types of NTFP Parts Harvested by the Local Population

Within the framework of this study, it was observed that in the Diécké Classified Forest, local people harvest various parts to meet dietary, economic and therapeutic

tic needs, as well as for other purposes, with accessibility being a major factor (**Figure 6**). Generally speaking, local communities have unrestricted access to NTFPs, which are often harvested in a haphazard and unregulated manner. The methods used by local residents of the Diécké Protected Forest to collect or harvest parts of NTFPs vary according to the morphological type of the species, as well as the specific part sought. Among these harvesting methods, the collection of leaves ranks first at 55%, followed by bark (16.20%), roots (11.70%), fruits (8.10%), branches (6.30%) and other plant parts (2.70%).

4. Discussion

With regard to the inventory and characterisation of non-timber forest products (NTFPs), the results of the surveys, combined with those of the floristic surveys, enabled us to catalogue 111 plant species across 99 genera and 47 families in the Diécké Protected Forest. These species were classified into four biomorphological types, which trees being the most abundant (59%), followed by herbs (19%); shrubs account for 16% and lianas bring up the rear at 6%. These findings differ from those reported by [13], who recorded 105 plant species harvested in the Agoua mountain range in the commune of Bantè, in the Collines department of Benin belonging to 48 families. According to biomorphological type, herbaceous species were the most frequently harvested by local communities (66.67%). Trees account for 19.04% of the harvested species, whilst shrubs account for 14.28% of the harvested NTFPs.

With regard to the use of non-timber forest products (NTFPs), it should be noted that food, medicine, crafts, construction, sacred purposes and packaging are the various categories of use of NTFPs by the communities living on the fringes of the Diécké Classified Forest. Analysis of these uses has enabled us to identify six (6) categories, including traditional medicine, food, crafts, construction, sacred purposes and packaging. This finding differs from those reported by [16], who identified seven categories of NTFP use in the vicinity of the Haut-Sassandra Classified Forest in Côte d'Ivoire and by [9], who identified eight categories of NTFP use in the Donga watershed in northwestern Benin. This difference can be explained by the fact that the uses of NTFPs vary from one area to another, taking into account the customs, traditions, and socioeconomic practices of the communities living around the classified forests.

With regard to the uses of non-timber forest products (NTFPs) parts harvested by the local population, it should be noted that in the Diécké Protected Forest, the collection or harvesting of NTFP parts by local residents of the Diécké Protected Forest is divided into five methods. Among these methods, the harvesting of leaves ranks first at 55%, followed by bark (16.20%), roots (11.70%), fruits (8.10%), branches (6.30%) and others (2.70%). These results contrast with those of [17], which identified six methods of harvesting plant parts in the rural commune of Tamou, in south-western Niger (fruits, leaves, bark, stems, seeds and roots).

5. Conclusion

This study, based on an ethnobotanical survey combined with a floristic inventory, provided a comprehensive overview of the non-timber forest products (NTFPs) available in the Diécké Classified Forest. In the surrounding villages where the investigations were carried out, a total of 447 harvesters were recorded, comprising 346 men (77.40%) and 101 women (22.60%). The ages of the harvesters ranged from 20 to 61 years. The 31 - 40 age group is the most common, accounting for 35% of those interviewed. In total, 111 species belonging to 99 genera and 47 families were recorded. These species include trees, herbs, shrubs and vines.

The use of these plant species, which provide non-timber forest products, contributes to the well-being of communities living on the fringes of the Diécké Protected Forest through food, medicine, crafts, construction, religious practices and packaging. The plant parts harvested included leaves, bark, roots, fruit, branches and others plant parts.

This study does not focus primarily on the intensification of harvesting, the abundance or the regeneration of NTFPs harvested by local communities. It places considerable emphasis on identifying the key NTFP species harvested by local communities, as well as the harvesting practices that are leading to the decline of these species.

The conservation and sustainable management of NTFPs are essential to ensure the long-term sustainability of local cultural uses and practices, as well as the transmission of traditional knowledge about plants from one generation to the next.

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Author Contributions

PM designed the study. PM, SZ, and BD performed the statistical analysis and wrote the protocol. PM, ZS and NAA wrote the first draft of the manuscript. PM, ZS, and BD managed the analyses of the study. PM, ZS, NAA, BD, and YSSB managed the literature searches. All authors read and approved the final manuscript.

Conflicts of Interest

The authors declare that there are no conflicts of interest related to this work.

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