Floristic characteristics, social and ecosystem importance of coffee-based agroecosystems in the mountainous West of Côte d'Ivoire

Piba Serge Cherry, Karidioula Tinnin Patricia, Ta Bi Irié Honoré, Tra Bi Fezan Honora

Correspondence

Piba Serge Cherry[1*], Karidioula Tinnin Patricia[1], Ta Bi Irié Honoré[1], Tra Bi Fezan Honora[2]

[1]UFR Agronomic, Forestry and Environment Engineering (IAFE), University of Man, PO. Box 20 Man, Côte d'Ivoire.
[2]Laborartory of Botany and Valorization of plant Diversity, UFR Natural Sciences, Nangui Abrogoua University, PO. Box 801 Abidjan 02, Côte d'Ivoire.

*Corresponding Author: serge.piba@univ-man.edu.ci; *https://orcid.org/0009-0000-7993-9990*

Ethnobotany Research and Applications 31:54 (2025) - http://dx.doi.org/10.32859/era.31.54.1-11
Manuscript received: 24/02/2025 – Revised manuscript received: 05/08/2025 - Published: 07/08/2025

Research

Abstract

Background: In response to the reduction of forests in favor of monoculture cash crops in Côte d'Ivoire, agroecosystems have become an important resource for the daily lives of local populations and for biodiversity conservation in the Montagnes District an area overexploited by shifting agriculture. This study aims to contribute to the understanding and valorization of coffee ecosystems in the mountainous west.

Methods: An ethnobotanical survey and floristic inventories were conducted from February to March 2024 in the Montagnes District, covering three departments (Man, Facobly, and Biankouma), within the coffee plantations of 27 reference farmers associated with the National Agronomic Research Center of Côte d'Ivoire. Floristic surveys documented the identity and abundance of each tree species associated with coffee plants, while semi-structured interviews identified their uses by coffee farmers.

Results: In agrosystems, 431 trees associated with coffee plants were counted. These trees are distributed among 67 species, belonging to 54 genera and 22 botanical families. The predominant species, with lowest Rarefaction index (Ri), regardless of the department, were *Albizia adiantifolia* (Schum.) W.F.Wright (Ri: 22.22%) and *Albizia zygia* (DC.) J.F.Macbr. (Ri: 40.70%), both used for shade and soil fertilization. Some associated species were used for food (13 species), medicine (17), and timber (seven). *Elaeis guineensis* Jacq. (Ri: 22.22%), *Morinda lucida* Benth. (Ri: 55.56%), and *Milicia excelsa* (Welw.) Berg. (Ri: 51.85%) were the most associated species for food, medicine, and timber, respectively.

Conclusions: These results highlight the importance of coffee-based agroecosystems in conserving the flora of the mountainous region of Côte d'Ivoire.

Keywords: Coffee, Agrosystems, Montagnes District, Côte d'Ivoire.

Background

Forests serve as biodiversity refuges (Yaokokoré-Béibro *et al*. 2015, N'Guessan *et al*. 2025) and an invaluable genetic reservoir (Lefèvre 2017). They have always been a source of forest products, both animal and plant-based, essential for rural and urban populations (Tabuna 1999). Forests harbor the majority of terrestrial biodiversity (FAO 2020) and play a role in soil protection, water quality, rainfall regulation, and climate change mitigation (Altieri & Pengue 2006). However, according to the FAO (2020), since 1990, 420 million hectares of forests have been lost due to conversion to other uses.

In Côte d'Ivoire, 84% of the forest area has disappeared (Koné 2015). According to national forest and wildlife inventory reports, the forest area was estimated at 2.97 million hectares in 2020 (Cuny *et al*. 2023), compared to 16 million hectares at the end of the 19th century (Chevalier 1909). Several hectares of forest are destroyed each year due to human activities, exacerbated by certain agricultural practices. Some researchers, for example, Adou *et al*. (2016), have suggested agroforestry as a socially acceptable, economically viable, and environmentally sustainable substitute for traditional agriculture. According to Di Roberto *et al*. (2023), it has become an essential concept following massive deforestation for plantation crops. This practice represents one of the best solutions to reconcile agricultural production and environmental protection sustainably (Vroh *et al*. 2017, Bamenga *et al*. 2024). The biodiversity harbored by these agroecosystems is increasingly recognized as vital because it not only helps maintain the biological, economic, social, and spiritual functions of cultivated landscapes but also serves as an essential substitute habitat for wildlife displaced by habitat loss (Vandermeer *et al*. 1998). Agroforestry systems contribute to income diversification (Koné *et al*. 2021), sustainable ecosystem management, and the relative preservation of biodiversity (Atangana *et al*. 2014).

Coffee cultivation, one of the pillars of the Ivorian economy, is typically practiced under shade cover in over half of all orchards. This shade system primarily consists of a mix of forest trees preserved during land clearing and planted fruit trees (Tricart 1957, Eponon *et al*. 2017). According to Eponon *et al*. (2017), orchards are established on former forest land in 62% of cases, compared to 38% on fallow or former coffee plantations. Full-sun cultivation is implemented in 42% of cases. In the Montagnes District of Côte d'Ivoire, primary and secondary forests, like in other regions, have almost disappeared in favor of perennial crop plantations such as rubber, cocoa, and especially coffee, particularly in the Department of Man and its surroundings. The Abidjan-Daloa-Man was formerly called Route du Café (Tricart 1957). In this little-studied mountainous area, coffee cultivation under permanent shade integrates the presence of other plant species and thus harbors a relative biodiversity. Coffee produced under such conditions can easily be protected, valorized, and recognized with a label.

The objective of this study is to determine the floristic richness of coffee plantations, the social and ecological importance of species associated with coffee trees and to contribute to the valorization of coffee produced in the Montagnes District.

Materials and Methods

Study design and data collection

Study area

The study were carried out in the mountainous west of Côte d'Ivoire, between 8°00 W and 7°30 W longitude and 8°10 W and 7°30 N latitude, in three departments: Man, Biankouma, and Facobly (Fig. 1). Data collection were carried out in 27 coffee plantations for as many coffee farmers interviewed. The selected coffee farmers were referred by he National Center for Agronomic Research (CNRA) in Côte d'Ivoire, in particular by the Coffee-Cocoa program of the regional station in the Montagnes District. In total, ten coffee plantations were studied in the Department of Man, nine in Facobly, and eight in Biankouma.

Floristic inventory and ethnobotanical surveys

Data collection were conducted through floristic inventories and semi-structured interviews within coffee plantations. The flora was described, and its importance defined. In all plantations, woody or tree species associated with coffee trees were identified using the itinerant methodology (Aké-Assi 1984). A pre-designed, semi-structured questionnaire administered to plantation owners helped define the different uses, parts used, and importance of assoiated species. This ethnobotanical approach was used by many authors such as Vermeulen *et al*. (2009) and Kouamé *et al*. (2024). All ethnobotanical and floristic investigations were conducted in French in the plantations from February to March 2024.

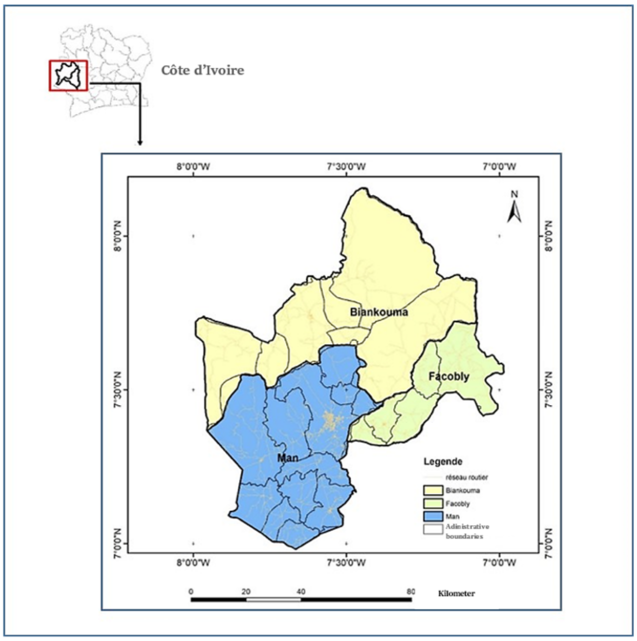

Figure 1. Geographical location of the study area

Botanical identification

The plant species recorded were identified by comparison with the herbarium specimens from the National Floristic Centre (CNF) of Félix Houphouët-Boigny University. The identified specimens were preserved at the University of Man. The Global Biodiversity Information Facility (GBIF, https://www.gbif.org/) online database was also used for the botanical identification of plant species. The family nomenclature was updated according to the APG IV system (APG 2016).

Data processing and analysis

Floristic richness, similarity, and importance of species associated with coffee trees

Floristic richness was used to determine the quality of the preserved flora, functional richness (number of species in different use domains), and to quantify the floristic similarity of plots in different departments. The Sørensen similarity index (1948) was calculated based on the floristic resemblance of inventoried stations using a "species-relevés" table. For two stations considered, the mathematical expression of the Sørensen coefficient is:

$$Ks = (2c/a+b)x100$$

where: Ks = Sørensen similarity coefficient; a = number of species in list a (statement A); b = number of species in list b (statement B); and c = number of species common to relevés A and B being compared. This index highlighted the floristic similarity between plots in the three visited departments.

The processing of ethnobotanical data refers to the different uses of these plant species by the population in the domains of ecology, food, medicine, and construction.

Species Rarefaction index (Ri)

The Rarefaction index (Ri) or species rarity-weight richness determines the abundance and rarity of a plant species. This ethnobotanical index is regularly used and is calculated using the following formula (Géhu & Géhu 1980):

$$Ri = [1 - (ni/N)] \times 100$$

ni: number of relevés in which species i is present; N: total number of relevés.

Species with a rarity index greater than 80% are considered rare in the environment, between 50 and 80% as preferential or abundant, and a rarity index less than or equal to 50% characterizes a very frequent or very preferential species.

Data Analysis

The collected data were processed using EXCEL software and transferred to SPSS 20.0 for database setup. Statistical analyses were then performed using XlStat software version 2018.2 (XlStat by Addinsoft 2018). One-way analysis of variance (ANOVA1) followed by the Tukey comparison test and the Student's t-test were used to identify differences between cities. Differences were considered significant for $p < 0.05$.

Results

Socio-demographic characteristics of Farmers

Data analysis showed that the average age of plantation owners is 47 years, with a majority being men. Only one woman owned a plantation. The dominant ethnicity was Yacouba, accounting for 73%, compared to 20% Wobé and 7% allochthonous Mossi. The majority of coffee farmers had a primary (80%) and secondary (19%) education level.

Floristic richness and conservation potential

A total of 67 species associated with coffee trees were inventoried in the orchards. They are distributed among 54 genera and 22 families (Table 1). The most represented genera were *Citrus*, and *Trichilia*, each with three species. The most represented families were Fabaceae (nine species), Malvaceae, and Moraceae, with seven species each (Fig. 2). The most abundant species were *Elaeis guineensis* Jacq. with 55 individuals, *Albizia adianthifolia* (Schum.) W.F.Wright (45 individuals), and *Albizia zygya* (DC.) J.F.Macbr (40 individuals). These species were distributed among microphanerophytes (52%), mesophanerophytes (33%), and megaphanerophytes (15%) (Fig. 3). The average number of associated species in the plantations was 7 ± 4 species. There is no significant difference in the average number of associated species in the plantations of the different departments ($P > 0.05$). The Department's agrosystems are places for biodiversity conservation (Fig. 4).

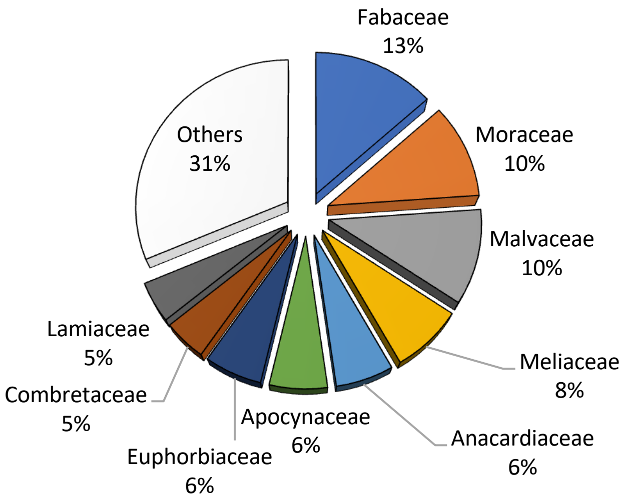

Figure 2. Diversity of plant families inventoried in coffee plots in the Montagnes District

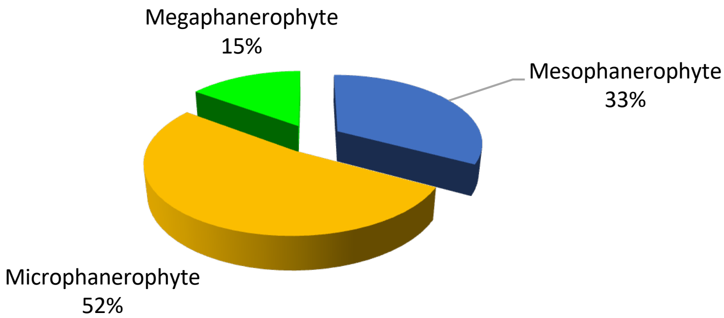

Figure 3. Diversity of biological types of plants inventoried in coffee plots in the Montagnes District

Table 1. Status of species according to their Rarefaction index

Families	Species	Bio.Typ.	Presence	Rarefaction index (Ri)	Status
Fabaceae	*Albizia adianthifolia* (Schum.) W.F.Wright	amP	21	22.22	TP
Arecaceae	*Elaeis guineensis* Jacq.	amP	21	22.22	TP
Fabaceae	*Albizia zygia* (DC.) J.F.Macbr	amP	16	40.74	TP
Moraceae	*Milicia excelsa* (Welw.) Berg.	aMP	13	51.85	P
Rubiaceae	*Morinda lucida* Benth.	amp	12	55.56	P
Anacardiaceae	*Mangifera indica* L.	amP	10	62.96	P
Myristicaceae	*Pycnanthus angolensis* (Welw.) Warb.	amP	10	62.96	P
Lauraceae	*Persea americana* Miller	amP	9	66.67	P
Malvaceae	*Cola nitida* (Vent.) Schott & Endl	amP	9	66.67	P
Combretaceae	*Terminalia ivorensis* A.Chev.	aMP	8	70.37	P
Malvaceae	*Ceiba pentandra* (L.) Gaertn.	aMP	7	74.07	P
Anacardiaceae	*Spondias mombin* L.	amP	7	74.07	P
Rutaceae	*Citrus sinensis* L.	amp	6	77.78	P
Moraceae	*Antiaris toxicaria* (Pers.) Lesch.	amP	4	85.19	R
Rutaceae	*Citrus reticulata* Blanco.	amp	4	85.19	R
Fabaceae	*Piptadeniastrum africanum* (Hook.f.) Brenan	aMP	4	85.19	R
Fabaceae	*Millettia zechiana* Harms	amp	4	85.19	R
Meliaceae	*Entandrophragma angolense* (Welw.) C.DC.	aMP	3	88.89	R
Musaceae	*Musa paradisiaca* L.	hmp	3	88.89	R
Cecropiaceae	*Myrianthus arboreus* P.Beauv.	amp	3	88.89	R
Myrtaceae	*Psidium guajava* L.	amp	3	88.89	R
Apocynaceae	*Rauvolfia vomitoria* Afzel.	amp	3	88.89	R
Fabaceae	*Senna siamea* (Lam.) HS.Irvin & Barneby	amp	3	88.89	R
Malvaceae	*Triplochiton scleroxylon* K.Schum.	aMP	3	88.89	R
Fabaceae	*Baphia nitida* lodd.	amp	2	92.60	R
Malvaceae	*Cola cordifolia* (Cav.) R.Br.	amP	2	92.60	R
Combretaceae	*Combretum dolichopetalum* Engl. & Diels	amp	2	92.60	R
Cecropiaceae	*Myrianthus libericus* Rendle	amp	2	92.60	R
Meliaceae	*Trichilia tessmannii* Harms	amP	2	92.60	R
Rubiaceae	*Aidia genipiflora* (DC.) Dandy	amp	1	96.30	R
Euphorbiaceae	*Alchornea cordifolia* (Schum. & Thonn.)	almp	1	96.30	R
Apocynaceae	*Alstonia boonei* De Wild.	aMP	1	96.30	R
Annonaceae	*Annona muricata* L.	amp	1	96.30	R
Fabaceae	*Anthonotha macrophylla* P.Beauv.	amp	1	96.30	R
Sapindaceae	*Blighia sapida* Koenig	amP	1	96.30	R
Malvaceae	*Bombax buonopozense* P.Beauv.	aMP	1	96.30	R
Meliaceae	*Cedrela odorata* L.	amP	1	96.30	R
Lamiaceae	*Clerodendrm splendens* G.Don	amp	1	96.30	R
Sapindaceae	*Deinbollia pinnata* (Poir.) Schumach. & Thonn.	amp	1	96.30	R
Myrtaceae	*Eugenia malaccensis* Lour.	amp	1	96.30	R
Moraceae	*Ficus exasperata* M.Vahl	amp	1	96.30	R
Apocynaceae	*Funtumia elastica* (Preuss) Stapf	amP	1	96.30	R
Clusiaceae	*Garcinia kola* Heckel	amp	1	96.30	R
Malvaceae	*Glyphaea brevis* (Spreng.) Monachino	amp	1	96.30	R
Anacardiaceae	*Lannea nigritana* (Scott Elliot) Keay	amp	1	96.30	R
Euphorbiaceae	*Macaranga barteri* Müll.Arg.	amp	1	96.30	R
Euphorbiaceae	*Mareya micrantha* (Benth.) Mull.Arg.	amp	1	96.30	R
Fabaceae	*Millettia lane-poolei* Dunn	amp	1	96.30	R
Moraceae	*Morus mesozygia* A.Chev.	amP	1	96.30	R
Rubiaceae	*Nauclea latifolia* Blanco	amp	1	96.30	R
Bignoniaceae	*Newbouldia laevis* (P. Beauv.) Seem. ex Bureau	amp	1	96.30	R

Apocynaceae	*Pleioceras barteri* Baill.	amp	1	96.30	R
Anacardiaceae	*Pseudospondias microcarpa* (A.Rich.) Engl.	amP	1	96.30	R
Bignoniaceae	*Spathodea campanulata* Beauverd	amP	1	96.30	R
Euphorbiaceae	*Tetrorchidium didymostemon* (Baill.) Pax & K. Hoffm.	amp	1	96.30	R
Ulmaceae	*Trema orientalis* (L.) Blume	amp	1	96.30	R
Meliaceae	*Trichilia martineaui* Aubrév. & Pellegr.	amP	1	96.30	R
Moraceae	*Trilepisium madagascariense* D.C.	amP	1	96.30	R
Lamiaceae	*Vitex doniana* Sweet	amp	1	96.30	R
Annonaceae	*Xylopia aethiopica* (Dumal) A.Rich.	amP	1	96.30	R
Fabaceae	*Baphia pubescens* Hook.f.	amp	1	96.30	R
Rutaceae	*Citrus aurantifolia* Christm.	amp	1	96.30	R
Moraceae	*Ficus sur* Forssk.	amP	1	96.30	R
Moraceae	*Milicia regia* (A.Chev) C.C.Berg	aMP	1	96.30	R
Combretaceae	*Terminalia superba* Engl & Diels	aMP	1	96.30	R
Meliaceae	*Trichilia prieuriana* A.Juss.	amP	1	96.30	R
Lamiaceae	*Vitex grandifolia* Gürke	amp	1	96.30	R

Legend:
Bio.Typ. : Biomorphological type ; **amP** : mesophanerophyte tree; **aMP** : megaphanerophyte tree; **amp**: microphanerophye tree ; **hmp** : microphanerophyte grass ; **TP** : very preferential; **P** : preferential ; **R** : Rare.

Figure 4. View of a coffee agroecosystem in the Montagnes District

The evaluation of the Sørensen similarity index indicates an average similarity of less than 50% in the floristic richness of coffee plantations in the three departments. This index is 45.28% between the Department of Man and Facobly, representing the highest similarity index between two departments. It is 43.48% between the departments of Facobly and Biankouma and 32.79% between the Department of Man and Biankouma. These values reflect a floristic difference among all plots in the three departments, even though some common species exist. Only tree species (Table 1) were present and preferred across all departments with a rarity index of less than 41%, representing 7% of the species. These were *A. adianthifolia*, *A. zygia* (Fig. 5), and *E. guineensis.* Across the three departments, ten species, or 23%, were preferred. These include, among others, *Milicia excelsa* (Welw.) Berg. (Fig. 6), *Terminalia ivorensis* A.Chev., *Ceiba pentandra* (L.) Gaertn., *Morinda lucida* Benth., *Mangifera indica* L., *Persea americana* Miller, and *Cola nitida* (Vent.) Schott & Endl.

Species utilities and availability

The results of surveys conducted among farmers indicated that the woody vegetation associated with coffee plants primarily served to provide shade and create a humid microclimate. *A. adianthifolia* and *A. zygia* were the most predominant species, cited as improving soil fertility through the decomposition of their fallen leaves. Thirty-one species were recognized for their social importance in the daily lives of local communities (Table 2). These species played a role in food (13 species), traditional medicine (17 species), and construction (seven species).

Food plants accounted for 19.4% of the inventoried species. These included among others, *E. guineensis, C. nitida*, *M. indica*, *P. americana,* and *Musa paradisiaca L.* Medicinal plants included species such as *Alstonia boneii* De Wild., *Antiaris toxicaria*

(Pers.) Lesch., *Entandrophragma angolense* (Welw.) C.D.C., *M. lucida*, *Piptadeniastrum africanum* (Hook.f.) Brenan, and *Garcinia kola* Heckel, representing 25.3% of the species. Seven species, or 10.44%, were used in craftsmanship for building homes and as commercial timber.

The most frequently used plant parts for food were the fruits (84.6%). For medicinal purposes, bark (58.9%) and leaves (17.7%) are the primary components. Stems were used exclusively (100%) in construction and timber. These species, which represent valuable phytogenetic resources, hold significant social importance in the daily lives of the local populations.

Figure 5. Individuals of *Albizia zygia* and *A. adianthifolia* in a coffee plantation

Figure 6. *Milicia excelsa* in a coffee plantation

Table 2. Social use of preserved plants in coffee agrosystems of the Montagnes District

Families	Species	Rarefaction index (Ri)	Pharmacopoeia	Eating	Lumber
Euphorbiaceae	*Alchornea floribunda* Müll. Arg.	96.30	Leaves		
Apocynaceae	*Alstonia boonei* De Wild.	96.30	Barks		
Annonaceae	*Annona muricata* L.	96.30	Leaves and barks	Fruits	
Moraceae	*Antiaris toxicaria* (Pers.) Lesch.	85.19	Barks		
Malvaceae	*Bombax buonopozense* P.Beauv.	96.30		Flowers	
Meliaceae	*Cedrela odorata* L.	96.30	Barks		
Malvaceae	*Ceiba pentandra* (L.) Gaertn.	74.07			Stem
Rutaceae	*Citrus reticulata* Blanco.	85.19		Fruits	
Rutaceae	*Citrus sinensis* L.	77.78		Fruits	
Malvaceae	*Cola nitida* (Vent.) Schott & Endl	66.67	Barks	Fruits	
Arecaceae	*Elaeis guineensis* Jacq.	22.22		Fruits	
Meliaceae	*Entandrophragma angolense* (Welw.) C.DC.	88.89	Barks		Stem
Clusiaceae	*Garcinia kola* Heckel	96.30	Barks and fruits	Fruits	
Malvaceae	*Glyphaea brevis* (Spreng.) Monachino	96.30	Leaves		
Anacardiaceae	*Mangifera indica* L.	62.96	Barks	Fruits	
Euphorbiaceae	*Mareya micrantha* (Benth.) Mull.Arg.	96.30	Leaves		
Moraceae	*Milicia excelsa* (Welw.) Berg.	51.85			Stem
Rubiaceae	*Morinda lucida* Benth.	55.56	Barks		
Musaceae	*Musa paradisiaca* L.	88.89		Fruits	
Cecropiaceae	*Myrianthus arboreus* P.Beauv.	88.89		Fruits and leaves	
Bignoniaceae	*Newbouldia laevis* (P. Beauv.) Seem. ex Bureau	96.30	Barks and leaves		
Lauraceae	*Persea americana* Miller	66.67		Fruits	
Fabaceae	*Piptadeniastrum africanum* (Hook.f.) Brenan	85.19	Barks		Stem

Myrtaceae	*Psidium guajava* L.	88.89		Fruits	
Myristicaceae	*Pycnanthus angolensis* (Welw.) Warb.	62.96	Barks		
Apocynaceae	*Rauvolfia vomitoria* Afzel.	88.89	Leaves		
Anacardiaceae	*Spondias mombin* L.	74.07	Fruits		
Combretaceae	*Terminalia ivorensis* A.Chev.	70.37			Stem
Combretaceae	*Terminalia superba* Engl & Diels	96.30			Stem
Malvaceae	*Triplochiton scleroxylon* K.Schum.	88.89			Stem
Lamiaceae	*Vitex doniana* Sweet	96.30	Barks		

Discussion

The floristic inventory in the three departments identified 67 woody species in the coffee agrosystems. This number represents a significant potential for the conservation of floristic diversity compared to monoculture plantations such as rubber and oil palm. Ballo *et al*. (2022) identified 91 associated plant species in the cocoa agrosystems of southeastern Côte d'Ivoire. The difference could be explained by the difference in cultivated species and the size of the sampled plots. But also by the floristic richness of the forest precedents. The study area was located in a rainforest sector (Guillaumet & Adjanohoun 1971). It was dominated by dense evergreen humid forest while the Mountain District was covered with dense semi-deciduous forests (Mangenot 1955). This area of the Southeast was characterized by a very rich floristic diversity (Konan 2016). Furthermore, Ollinaho & Kröger (2021) highlight the relationship between the nature of agroforestry practices and their socio-economic contexts, in particular the challenges faced by farming communities. According to Piba *et al*. (2010), the species conserved in agrosystems, their quality and their diversity are generally a function of the social habits of the populations which vary from one ethnic group to another.

The studied plantations are rich in microphanerophytes, mesophanerophytes, and adult megaphanerophytes, representing a phytogenetic potential due to the presence of seed trees. The most represented families are Fabaceae, Malvaceae, and Moraceae, which are characteristic of the Ivorian forest landscape (Bakayoko 2005, Adou *et al.* 2006). The present species are generally fruit trees, medicinal plants, and food plants that serve the daily needs of the population.

The most abundant species identified are similar to those identified by Amoa *et al.* (2021), whose study was conducted simultaneously in the Tonkpi and Guémon regions. The results of that study identified *E. guineensis*, *C. nitida*, *A. adianthifolia*, *M. paradisiaca* and *M. excelsa* as the most common species associated with coffee plants. The minor difference in results could be explained by the difference in size between the two study areas. Also, the choice of associated species and agroforestry approaches can be distinct, and sometimes divergent, depending on the techniques promoted, the actors involved, and previous cultivation (Ollinaho & Kröger 2021).

The average floristic similarity observed between coffee agroecosystems in these Departments can be explained by their location within the same phytogeographic zone - specifically, the mountainous sector of the Guinean domain as described by Guillaumet & Adjanohoun (1971). The observed differences are likely due to varying local practices that may differ from one locality to another or between Departments. Several species are preserved due to their importance for local communities. The availability of food plants could ensure food security through their sale or use, particularly by women and children (Sonwa *et al*. 2001). The sale of these products also helps cover certain expenses, including children's education. The preservation of medicinal species demonstrates a good knowledge of their importance by farmers. *M. lucida*, for example, is a medicinal plant whose medicinal properties are recognized (Adebayo *et al*. 2020). Their importance in the plantations is justified by the fact that, faced with difficult living conditions, producers turn to traditional medicine to meet their health needs, as health centers remain relatively expensive and scarce (Koulibaly *et al*. 2016). Coffee plantations also represent refuges for certain plant species. For example, *M. excelsa* and *T. ivorensis*, species present and protected within certain orchards, are commercial species threatened by overexploitation of forests in Côte d'Ivoire. These species could constitute seed sources and represent a phylogenetic resource. The most associated species, *A. zygia* and *A. adiantifolia*, are preserved for their shade but also for their quality as leguminous plants promoting soil fertility (Vroh *et al*. 2019). The large number of shade trees in the different departments could also be explained by the common farming practices of the Tonkpi region, where plantations are established on previous forest lands. According to Amoa *et al*. (2021), most coffee plantations are under medium (37%) to dense (38%) shade. The trees left in the plantations are mostly forest trees spared during the establishment of the orchard. Most of the species found in coffee-based agroecosystems are rare and may have a special status. These species are often vulnerable, endangered, or threatened with extinction. Thus, these agroecosystems serve as refuges due to the presence of these species and confirm the importance of supporting their preservation.

Conclusion

This study aimed to contribute to the valorization of coffee from the Montagnes region by characterizing plant diversity, ethnobotanical potential, and ecosystem importance. Floristic inventories identified 67 species in coffee plantations in the Departments of Man, Biankouma, and Facobly, distributed among 54 genera and 22 families.

The identified species primarily serve as shade but also have other ecosystem functions, including food, traditional medicine, and timber. The most predominant species in the plantations are *E. guineensis*, used for food, and *A. adianthifolia* and *A. zygia*, used for shade and soil fertilization. The association of woody vegetation with perennial or annual crops is a sustainale alternative to forest destruction and the mitigation of floristic richness.

Declarations

List of abbreviations: Bio.Typ. Biomorphological type; amP: mesophanerophyte tree; aMP: megaphanerophyte tree; amp; microphanérophye tree; hmp: microphanérophyte grass; TP: very preferential; P: preferential; R: Rare.

Ethics approval and consent to participate: Data were collected with respect for confidentiality and consent. All respondents were informed of the purpose of this study.

Consent for publication: not applicable.

Availability of data and materials: Supplementary data available in the article and data generated are available upon request.

Competing interests: The authors declare that they have no conflict of interest regarding this manuscript.

Author contributions: Initiation of the study: Piba Serge Cherry. Development of the protocol: Karidioula Tinnin Patricia, Piba Serge Cherry. Data collection: Piba Serge Cherry, Karidioula Tinnin Patricia. Plant identification: TA Bi Irié Honoré, Tra Bi Fézan Honora. Data processing and statistical analyses: Piba Serge Cherry, Karidioula Tinnin Patricia.

Acknowledgements

The authors of the study thank the National Center for Agronomic Research of Côte d'Ivoire and the farmers of the mountain region for their contribution to the study.

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