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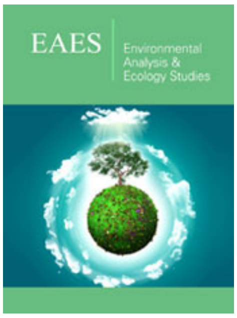

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Biodiversity and Conservation Status of *Gilbertiodendron dewevrei* Monodominant Forests and Adjacent Mixed Forests in the Congo Basin

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Abstract

Tropical rainforests are home to a high level of biodiversity and are of global importance in the development of conservation strategies. To make effective and accurate modelling of the composition of forest ecosystems, it is necessary to study the composition, diversity and structure of these ecosystems. The aim of this study is to make an inventory, investigate the biodiversity and conservation status of woody species between mixed forests (F.mx) and *Gilbertiodendron dewevrei* monodominant forests (F. mono). The methodological approach adopted was inventories of woody species with diameters ≥10cm in 8 permanent plots (5 of F. mono and 3 of F. mono) in the Dja Biosphere Reserve. The diversity indices between the two types of forest, the chorology and the IUCN status of the species were determined from the inventory data. Overall, 196±6 species from 43 families and 144 genera were identified in the F.mx, compared with 84±7 species in 32 families and 72 genera in the F. mono. Total species richness, Shannon Simpson diversity index and Piélou equitability were significantly higher in the F.mx than in the F. mono. The average stem density was higher in F.mx than in F. mono. In the F.mx, the family value index shows that the *Annonaceae* family (FIV=10.54%) was the most represented, whereas in the F. mono, it was the Fabaceae family (FIV=71.61%). *Tabernaemontana crassa* (13.63%) and *Gilbertiodendron dewevrei* (127.71%) were the most important species in terms of importance value index in F.mx and F.mono respectively. According to the IUCN classification, 5% and 2% of species in F.mx and F.mono respectively were vulnerable. *Dialium guineense*, endemic to south-west Cameroon, was identified in F.mx. In both types of forest, around 58% belong to the Guinean-Congolese region.

Keywords: Conservation status; Congo basin; Diversity; Species richness; Tropical rainforest

Introduction

Tropical Forests (TF) are home to the greatest biological diversity in the world [1,2]. As a result, they provide numerous ecosystem services [3], including ecological, social and economic services, which are essential for maintaining biogeochemical balances and the daily well-being of the people living along their margin. Despite the many services they provide, these forests are currently being affected by overexploitation of their flora and fauna resources, leading to their degradation [4], fragmentation [5,6] and a reduction in the ecosystem services they provide [7]. It is estimated that around 3.94 million ha of forest was lost each year between 2010 and 2020 in the TF [8]. However, for more than a decade, the need to preserve TF for the survival of mankind has been at the heart of national FAO [9] and international. Nations Unies [10] debates. Countries have therefore based their conservation strategies on the creation and extension of the network of protected areas, with mixed results. Contrary to the idea that TF are uniquely associated with high biodiversity, some patches of these forests have low diversity and are commonly referred to as monodominant forests [11]. It is therefore vital to better estimate the floristic richness of the different types of tropical forest [3]. So, to better define effective conservation mechanisms, it is necessary to understand in greater detail whether there are floristic and structural differences between the different types of forest that make up TF if the aim of conservation is to mitigate climate change and/or species extinction.

In the different types of forest in tropical zones, floristic diversity can affect ecosystem functions and modify vegetation structure and species distribution [12-15]. Some authors have shown that the floristic composition and structure of different types of forest in tropical zones is influenced by temperature [16], edaphic factors [17-19], climate [20], and by human activity [1,21]. Other authors have shown that biotic factors such as intra-specific interactions also play a fundamental role in the maintenance and stability of ecological communities [22,23]. According to [24], in African and Neotropical monodominant forests, the dominant species belong mainly to the *Caesalpiniaceae*, whereas in Asia they belong to the *Dipterocarpaceae* and *Lauraceae*.

Despite the importance and richness of the flora of the Congo Basin, these forests continue to deteriorate. This is the case of the Dja Biosphere Reserve (DBR), which was created to conserve its rich biodiversity and study the dynamics of its forests. The DBR is home to different types of forest, such as rock forests, forests on hydromorphic soils (Raphia, mytragyna, Uapaca) and terra firma forests, including mixed and monodominant forests. [2] showed that for monodominance to occur, more than 80% of the trees in the ecosystem must belong to the same species. However, this model has been reframed and the common definition of monodominant forests such as those with *Gilbertiodendron dewevrei* (De Wild.) J. Leonard (*Fabaceae-Caesalpinioideae*) (F.mono) is that at least 60% of the trees present in the ecosystem belong to a single species [25], and the diameter of the trees is generally ≥70cm [26]. In contrast, mixed forests (F.mx) are those in which around 5% of the trees belong to the same species [27]. In the DBR, a great deal of work has been done on the floristic and structural study of ecosystems [28], the aboveground biomass of vegetation types [29], the mechanisms governing monodominance [24], the influence of soil on the composition and structure of different types of forest [17] and fungal diversity [30].

Though the floristic composition and structure of different forest types in the tropics have been studied for species with a diameter at breast height of ≥30cm [31]. In the DBR, there are still biases in our understanding of the mechanisms involved in the conservation and chorology of species with a diameter at breast height ≥10cm. Nevertheless, knowledge of the floristic composition and structure of the forests adjacent to the Dja remains a tool for managing the biodiversity of this area with a view to conserving and maintaining the many ecosystem services provided by tropical forests. This study analyses diversity in F.mono and adjacent F.mx in the DBR in Cameroon and critically focuses on individuals with diameters ≥10cm. Specifically, it aims to (1) investigate the floristic composition, structural attributes and chorological and conservation status of woody species between monodominant *G. dewevrei* forests and adjacent mixed forests.

Material and Methods

Study site

This study took place in the Dja Biosphere Reserve (DBR), which covers an area of approximately 526,000 ha and extends across the southern and eastern regions of Cameroon (Figure 1). It is geographically located at 2°50 and 3°30 N and 12°20 and 13°40 E. The average altitude of the DBR varies between 500 and 700m. Phytogeographically, this DBR belongs to the humid evergreen forests made up of forests on firm land (75%), forests on hydromorphic soils (20%) and forests on rock (5%) and comprising a heterogeneous system of vast areas dominated by *G. dewevrei* [28]. This region has an equatorial climate, with maximum temperatures in February (25.8 °C) and minimum temperatures in October (23.6 °C).

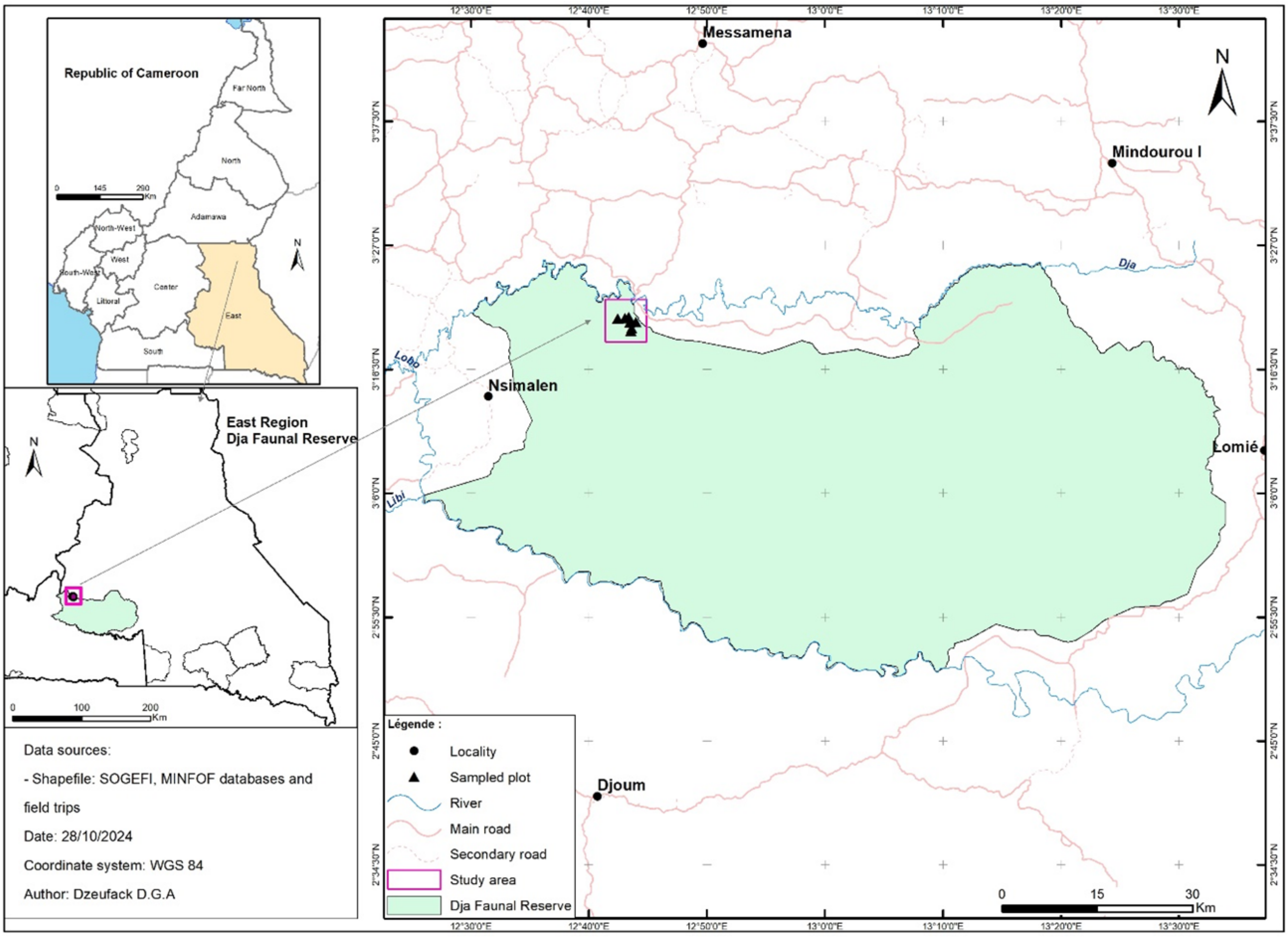

Figure 1: Location of the study site.

Data collection

Data were collected on eight permanent 100m^2 plots Libalah et al. [32], 05 of which were in F.mx, laid out by Libalah et al. [32], and 03 in F.mono. These plots were also selected so that the plot was in a F.mono. Each plot was subdivided into 25 sub-quadrats of 400m^2 according to a standard protocol [32]. All trees with a diameter at breast height (dhh) ≥10cm taken at 1.3m were identified, measured and labelled. If a tree had a deformity (stilt root, buttress), the circumference was measured above the anomaly using a telescopic scale. The species nomenclature was based on the work of [33] and the botanical families were updated according to the APG III phylogenetic classification [34].

Data analysis

Trees were grouped by 10cm diameter class. Principal component analysis was used to group variables showing differences or similarities around the variance. The dissimilarity matrix was used to assess the level of true dissimilarity or difference between the different plots of F.mx and F.mono. The student (t) test was used to determine the differences between the two forests. The inventory data collected were used to characterize the flora of the two types of forest sampled on the basis of diversity indices, namely Shannon's index (H'), Simpson's index (D') and Piélou's equitability (J), Either:

Shannon-Weaver diversity index: $$H' = -\sum_{i=1}^{N} \left(\frac{ni}{N}\right) \ln\left(\frac{ni}{N}\right)$$

In this formula, Ni: number of individuals of a given species, N: total number of individuals, H' = Shannon diversity index. The values of this index vary between 0 and ln(N), which is the maximum diversity (N being the total number of species). When the stand is composed of a single species, H' is equal to 0, otherwise it tends towards ln(N) [35].

Piélou equitability, $$J = \frac{H'}{\ln(N)}$$

It represents the ratio of the diversity of a stand to the number N of species present in the plot. This index can vary from 0 to 1. It is highest when the species have identical abundances in the stand and lowest when a single species dominates the entire stand.

Simpson index: $$D = \sum_{i=1}^{n} \left(\frac{ni}{N}\right)\left(\frac{ni}{N}\right)$$

This index measures the probability that two randomly selected individuals belong to the same species.

The structural parameters taken into account in this study include:

Species density: $Da = \frac{ni}{s}$

Where: Da=absolute density (ha); ni=number of individuals of the species; S=total area of the sampled units.

Basal area: $ST = \frac{\pi D2}{4}$

It corresponds to the sum of the cross-sections, at 1.3m above the ground, of all the trees with dbh ≥10cm inventoried in each of the 1ha plots and is therefore expressed in m^2/ha.

Ecological importance of species and families

The floristic composition of woody plants was analysed quantitatively using basal area, relative density, relative occurrence and relative dominance. The Importance Value Index (IVI) and the Family Value Index (FIV) of tree species and families were determined [36].

Floristic composition was assessed on the basis of IVI and FVI with:

$$Relative\,density = \frac{Number\ of\ tress\ of\ species\ or\ family\,(i)}{Total\ number\ of\ tress\ or\ family}100$$

$$Relative\,occurance = \frac{Number\ of\ occurances\ of\ species\ or\ family\,(i)}{Sum\ of\ occurances\ of\ species\ or\ family}100$$

$$Relative\,dominance = \frac{Basal\ area\ of\ species\ or\ family\,(i)}{Sum\ of\ basal\ area\ of\ all\ species\ or\ family}100$$

The IVI and FIV correspond to the sum of Relative density (species or family) + Relative occurrence (species or family) + Relative dominance (species or family).

Chorology and species status

In this study, we classified species by biological type and centre of endemism using previous research [27,37-40]. The IUCN status of the species was assessed at two levels. At national level, this was based on the work of [41], and through the world site (https://www.iucnredlist.org/) consulted in November 2024. Chorological status was assessed based on the species' centre of endemism. These are: Gc=endemic to the Guinean-Congolese region; Gu=endemic to the Guinea zone; Lg=endemic to Lower Guinea; Sw-Cam=endemic to the south-west; Tra=endemic to tropical Africa; WG=endemic to the western Guinean zone; Megaphanerophytes: 'Mgph' (trees over 30m tall); Mesophanerophytes 'MsPh': (trees between 10-30m tall); Microphanerophytes 'McPh'(trees between 2-10m tall); Ind=Indeterminate; np=Non pioneer light demandind; sw=swamp sb=Shade-bearer; pi=Pioner; Tr=Tree; Sh=Shrub; ri=Riverine; GC=Sub-omniguinéo-Congolaises; Centroguinéo-Congolaises; WG=Western. The conservation status of the species was assessed based on the various IUCN categories. The species identified during the inventory were classified according to the IUCN red list categories. In this study, 05 categories were used. These are: DD=Data Deficient; LC=Least Concern; NE=Not Evaluated; NT=Near Threatened; VU= Vulnerable. Statistical analyses were carried out using the Biodivesity R package of the R software, version 4.4.1.

Result

Floristic distinctions between mixed and monodominant forests

Diversity index and structural parameters: The floristic inventory in the two forest types identified 196±6 and 87±6 species in F.mx and F.mono respectively, which are significantly different from each other (p<0.005; Table 1). The mean stem density of F.mx (409±21 stems/ha) was not significantly different from that of F.mono (361±12 stems/ha). Analysis of the diversity indices showed that Shannon's index (H'), Simpson's index (D') and Piélou's equitability were significantly higher (p<0.05; Table 1) in F.mx than in F.mono.

Table 1: Diversity index and structural parameters (t-test: * =p-value≤0.5: Significant; ** =p≤0.01: Highly significant; *** =p≤0.001: Very highly significant).

Floristic and Diversity Index Parameters Studied	Mixed Forest	Monodominant Forest
Specific richness (number of species in the inventoried plot)	196±6***	84±6***
Number of family	43***	32***
Mean stem density (ni/ha)	409±21	361±12
Number of gender	144±5.42***	72±6.25***
Shannon-Weaver diversity (H')	3.98±1,93***	1.75±0,25***
Simpson index (D')	0.97±0,21*	0.56±0,06
Piélou equitability (J')	0.86±0,29***	0.46±0,05***

Matrix of dissimilarity between the abundance of stems in the mixed and monodominant forests

Figure 2 shows the degree of similarity between the monodominant and mixed plots. F.mono plots are structurally different from F.mx plots in terms of the number of trees. Mixed plots are represented by (P1_Mixed, P2_Mixed, P3_Mixed, P4_Mixed and P5_Mixed) and monodominant plots are represented by (P6_Mono, P7_Mono, P8_Mono). There is a similarity between plots belonging to the same forest typology, the difference not being significant. On the other hand, when we compare the mixed plots with the monodominant plots, they are easily distinguished by their difference. On the graph, the dark blue colour of the circles means a strong positive correlation, the light blue colour means a weak positive correlation and the bar at the bottom of the scale gives the correlation coefficients (-1 to 1).

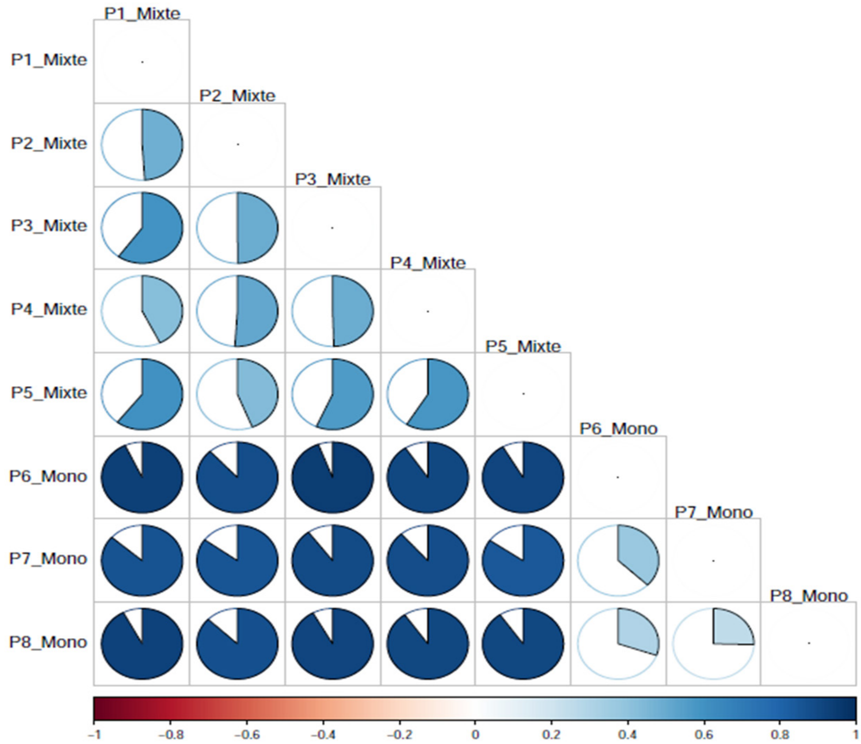

Figure 2: Dissimilarity matrix between plots in monodominant and mixed forests.
F.mx: Mixed forest; F.mono: Monodominant Forest

Demographic structure of the mixed and monodominant forests

Figure 3 shows that the distribution of the number of tigers by diameter class in the two types of forest has an inverted 'J' curve with the First Group (G1) having the greatest number of individuals (diameter class [10-20cm). The proportion of trees decreases rapidly in the upper classes, indicating strong renewal with young trees, but decreased in density in the large-diameter classes. The large diameter classes (G7 and above) are slightly better represented in monodominant forests, suggesting the presence of mature or long-lived trees. This curve highlights the importance of the small classes in the absolute density of the forest.

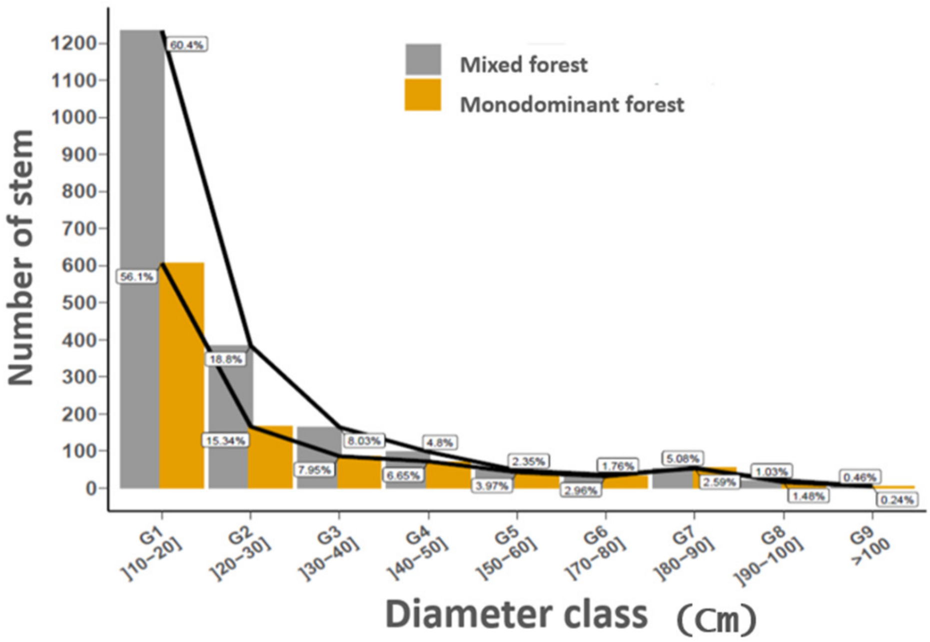

Figure 3: Proportion of stems by diameter class for the mixed and monodominant forests.

Ecological importance of species and families between the mixed and monodominant forests

Ecological importance of families between the mixed and monodominant forests: Within F.mx, the most dominant families in terms of Family Value Index (FVI) are Annonaceae (10.54%), Fabaceae (9.89%), Apocynaceae (8.51%), Meliaceae (8.29%) and Anacardiaceae (6.47%). Within F.mono, the most dominant families in terms of FIV are Fabaceae (71.61%), Anacardiaceae (6.96%), Meliaceae (2.96%) Moraceae (2.46%) and Phyllanthaceae (2.24%) (Table 2).

Table 2: Dominance of the 10 families with the highest family value index by forest type.

Forest Type	Family	Stem Density	Relative Dominance of the Families (%)	Relative Occurrence of the Family (%)	Relative Density of Families (%)	FIV (%)
F.mx	Annonaceae	241	10.54	2.8	10.8	24.16
F.mx	Fabaceae	234	9.89	2.8	10.49	23.2
F.mx	Apocynaceae	186	8.51	2.8	8.34	19.66
F.mx	Meliaceae	170	8.29	2.8	7.62	18.72
F.mx	Anacardiaceae	115	6.47	2.8	5.15	14.43
F.mx	Lecythidaceae	124	5.8	2.8	5.56	14.17
F.mx	Phyllanthaceae	130	4.83	2.8	5.82	13.47
F.mx	Irvingiaceae	138	4.02	2.8	6.188	13.02
F.mx	Olacaceae	123	4.67	2.8	5.51	12.99
F.mx	Euphorbiaceae	79	4.8	2.8	3.54	11.15
F.mono	Fabaceae	759	71.61	4.34	70.08	146.04
F.mono	Anacardiaceae	10	6.96	4.34	0.92	12.23
F.mono	Meliaceae	37	2.96	4.34	3.41	10.72
F.mono	Calophyllaceae	32	2.21	4.34	2.95	9.52
F.mono	Centroplacaceae	32	1.72	4.34	2.95	9.03
F.mono	Moraceae	35	2.46	2.89	3.23	8.59
F.mono	Olacaceae	25	1.54	4.34	2.3	8.2
F.mono	Irvingiaceae	24	1.53	4.34	2.21	8.09
F.mono	Phyllanthaceae	16	2.24	4.34	1.47	8.07
F.mono	Annonaceae	19	1.38	4.34	1.75	7.48

F.mx: Mixed Forest; F.mono: Monodominant Forest.

Ecological importance of species between the mixed and monodominant forests

Of the 196 species recorded in the F. mx, the 10 most represented species in terms of Importance Value Index (IVI) are *Tabernaemontana crassa* (13.63%), *Petersianthus macrocarpus* (12.32%), *Carapa procera* (10.72%), *Desbordesia glaucescens* (9.22%), *Anonidium mannii* (9.20%), *Trichoscypha acuminata* (6.68%), *Santiria trimera* (5.82%), *Sorindeia grandifolia* (5.62%), *Greenwayodendron suaveolens* (5.37%) and *Uapaca guineensis* (4.93%). Of the 83 species recorded in the F. mono, the 10 most represented species in terms of importance value index are *Gilbertiodendron dewevrei* (127.71%), *Hylodendron gabunense* (9.20%), *Trichoscypha acuminata* (7.53%), *Mammea africana* (7.39%) and *Treculia africana* (1.17%), *Centroplacus glaucinus* (6.90%), *Carapa procera* (6.73%), *Uapaca paludosa* (4.96%), *Dialium sp.* (3.87%) and *Irvingia gabonensis* (3.82%) (Table 3).

Table 3: Abundance of the 10 species with the highest importance value index by forest type.

Forest Type	Species Names	Stem Density	Relative Dominance of Species (%)	Relative Dominance Species (%)	Relative Occurrence of Species (%)	IVI (%)
F.mx	*Tabernaemontana crassa*	145	6.5	6.16	0.95	13.63
F.mx	*Petersianthus macrocarpus*	124	5.56	5.8	0.95	12.32
F.mx	*Carapa procera*	114	5.06	4.69	0.95	10.72
F.mx	*Desbordesia glaucescens*	113	5.11	3.15	0.95	9.22
F.mx	*Anonidium mannii*	94	4.21	4.02	0.95	9.2
F.mx	*Trichoscypha acuminata*	58	2.6	3.12	0.95	6.68
F.mx	*Santiria trimera*	56	1.97	2.88	0.95	5.82

F.mx	*Sorindeia grandifolia*	56	1.61	3.05	0.95	5.62
F.mx	*Greenwayodendron suaveolens*	48	2.51	1.9	0.95	5.37
F.mx	*Uapaca guineensis*	44	2.51	1.65	0.76	4.93
F.mono	*Gilbertiodendron dewevrei*	709	65.4	60.02	222	127.71
F.mono	*Hylodendron gabunense*	35	0.36	8.09	0.74	9.2
F.mono	*Trichoscypha acuminata*	32	0.18	5.86	1.48	7.53
F.mono	*Mammea africana*	32	2.95	2.21	2.22	7.39
F.mono	*Treculia africana*	25	3.23	2.46	1.48	7.17
F.mono	*Centroplacus glaucinus*	14	2.95	1.72	2.22	6.9
F.mono	*Carapa procera*	14	2.3	2.2	2.22	6.73
F.mono	*Uapaca paludosa*	14	1.29	2.19	1.48	4.96
F.mono	*Dialium sp.*	11	1.29	0.36	2.22	3.87
F.mono	*Irvingia gabonensis*	8	1.01	0.58	2.22	3.82

F.mx: Mixed Forest; F.mono: Monodominant Forest.

Chorological and conservation status of woody species in the mixed and monodominant forests

Conservation status of species: The status of woody species according to the IUCN shows that more than 77% of species in F.mono and F.mx belong to the 'LC' category according to IUCN 2024 (Figure 4). 5% and 2% of species in F.mx and F.mono respectively belong to the 'VU' category. 11% of species in the F.mx and F.mono belong to the 'NE' category. 2% and 4% of species belong to the 'NT' category. According to the work of [41], 5% of species located in F.mx belong to the 'VU' category, compared with 2% in F.mono. Some species, such as *Afzelia bipindensis* (*Fabaceae*) and *Anopyxis klaineana* (*Rhizophoraceae*), classified as 'LC' according to the work of [41] are 'VU' according to the IUCN. In the same order, *Anthonotha cladantha* (*Fabaceae*) and *Antrocaryon klaineanum* (*Anacardiaceae*) are classified as 'LC' and 'NE' respectively by the IUCN. *Anthonotha ferruginea* (*Fabaceae*) 'NE' is classified as 'LC' by the IUCN. *Baillonella toxisperma* (*Sapotaceae*) 'NE' is classified as 'VU' by the IUCN. (see Appendix A).

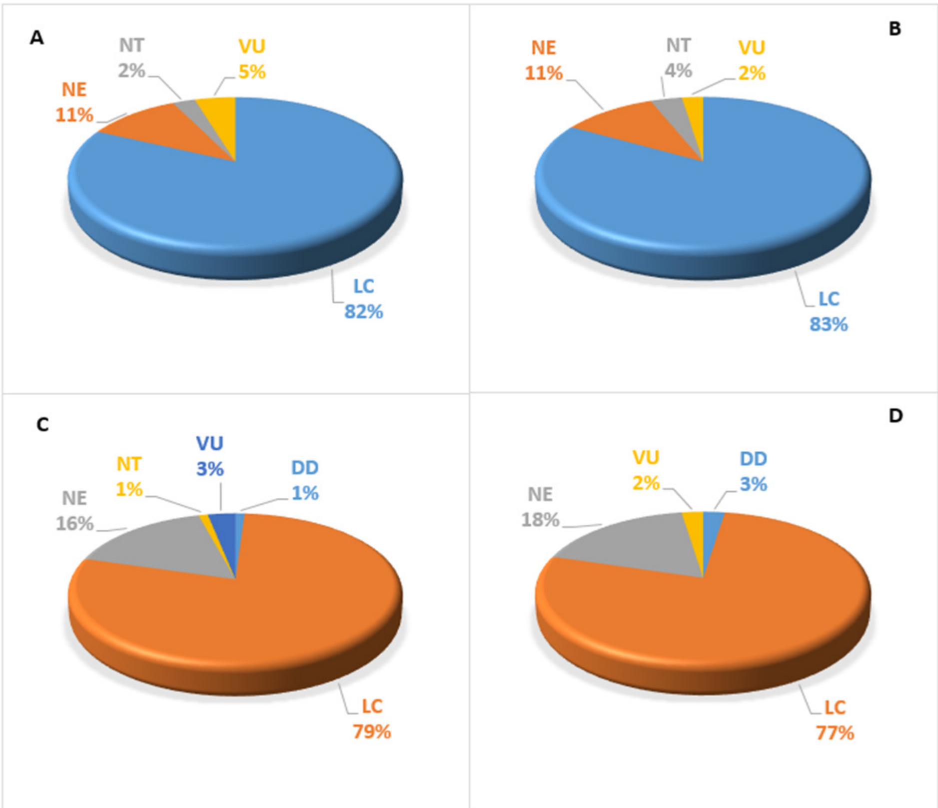

Figure 4: IUCN status of species between the mixed and monodominant forests: A=UICN status-F.mx (Global, 2024); B=UICN status-F.mono (Global, 2024); C=UICN status-F.mono (Onana, 2011); D=UICN status-F.mx (Onana, 2011). DD=Data Deficient; LC=Least Concern; NE=Not Evaluated; NT=Near Threatened; VU=Vulnerable).

Chorological status of species: The chorological satutre of species shows that in both types of forest, 58% of species belong to the Gc category (Figures 5A&5B), 8% to the Tra category and 4% to the Gu category. In the F.mx, 1% of the species *Dialium guineense* (Fabaceae) belong to the (Sw-Cam) category, and 1% to the (Pan) category-*Ceiba pentandra* (Malvaceae) (Figure 5A). In the F.mono (Figure 5B), 16% of the species belong to the Lg category, whereas in the F.mx, this figure is 10% (see Appendix A).

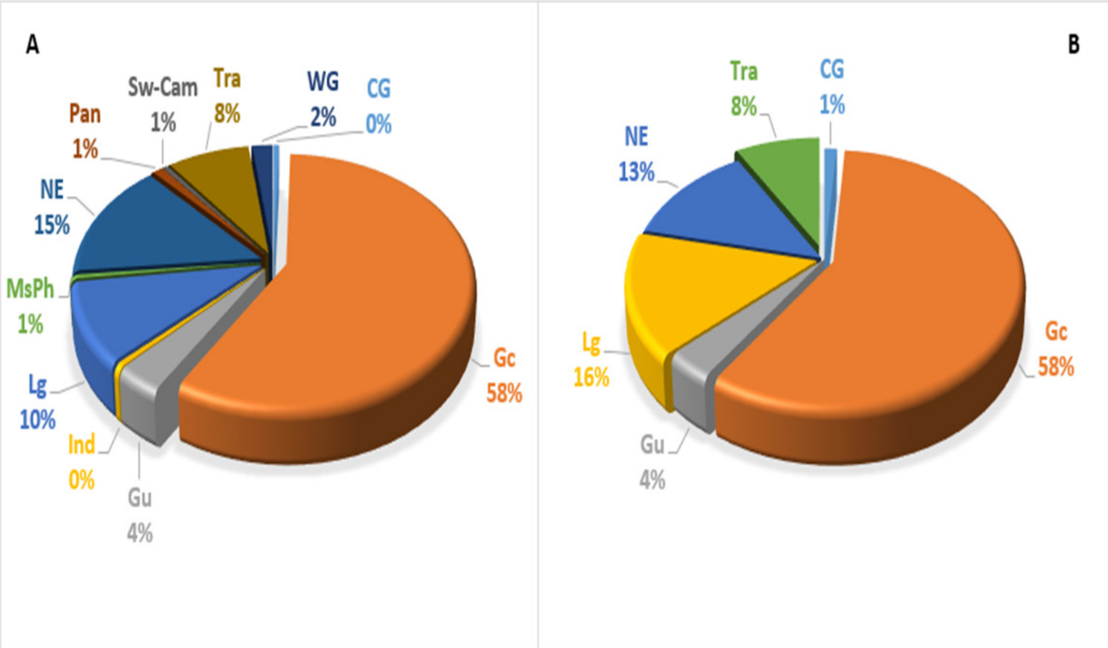

Figure 5: Chorological status of species between the mixed and monodominant forests: A=Mixed forest; B=Monodominant forest.
CG=Centroguineo-Congolese; Pi=Pioner; Ri=Riverine; Sb=Shade-bearer; Sh=Shrub, Sw-Cam=Endemic to the south-west; Tr=Tree; Tra=Endemic to tropical Africa; WG=Endemic to the western Guinean zone; In=Introduced species; Lg=endemic to Lower Guinea; Pan=Pantropical; Gu=Endemic to the Guinea zone; NE= undetermined; MsPh=Mesophanerophytes).

Appendix A: Table IV. Conservation status of woody species, biological type, chorology and number of stems between monodominant and mixed forests in the Dja Biosphere Reserve.

Forest Type	Species Names	Familles	Guild	Biologica Type	Chorology	UICN National (Onana [41])	UICN_Global
F.mx	*Afrocanthium lactescens*	Rubiaceae	Ind	Ind	Ind	NE	LC
F.mx	*Afzelia bipindensis*	Fabaceae	np	Tr	Gc	LC	VU
F.mx	*Albizia adianthifolia*	Fabaceae	pi	Tr	Gc	LC	LC
F.mx	*Albizia ferruginea*	Fabaceae	pi	Tr	Gc	LC	LC
F.mx	*Allanblackia floribunda*	Clusiaceae	sb	Tr	Gc	LC	LC
F.mx	*Allanblackia gabonensis*	Clusiaceae	sb	Tr	Gc	VU	VU
F.mx	*Allophylus africanus*	Sapindaceae	pi	Tr	Tra	LC	LC
F.mx	*Alstonia boonei*	Apocynaceae	pi	Tr	Tra	LC	LC
F.mx	*Amphimas ferrugineus*	Fabaceae	np	Tr	Lg	LC	LC
F.mx	*Amphimas pterocarpoides*	Fabaceae	np	Tr	Gc	LC	LC
F.mx	*Angylocalyx pynaertii*	Fabaceae	sb	Sh	Gc	LC	LC
F.mx	*Annickia affinis*	Annonaceae	Ind	Ind	Ind	LC	LC

F.mx	*Anonidium mannii*	Annonaceae	sb	Tr	Lg	LC	LC
F.mx	*Anopyxis klaineana*	Rhizophoraceae	np	Tr	Gc	LC	VU
F.mx	*Anthonotha cladantha*	Fabaceae	Ind	Ind	Ind	LC	NE
F.mx	*Anthonotha ferruginea*	Fabaceae	np	Tr	Lg	NE	LC
F.mx	*Anthonotha macrophylla*	Fabaceae	sb	Tr	Gc	LC	LC
F.mx	*Antidesma laciniatum*	Phyllanthaceae	sb	Tr	Gc	LC	LC
F.mx	*Antidesma membranaceum*	Phyllanthaceae	sb	Tr	Gc	LC	LC
F.mx	*Antrocaryon klaineanum*	Anacardiaceae	pi	Tr	Lg	LC	NE
F.mx	*Aoranthe cladantha*	Rubiaceae	sw	Tr	Gc	LC	LC
F.mx	*Baikiaea insignis*	Fabaceae	sb	Tr	Gc	LC	LC
F.mx	*Baillonella toxisperma*	Sapotaceae	np	Tr	Lg	NE	VU
F.mx	*Baphia pubescens*	Fabaceae	Ind	Ind	Ind	LC	NE
F.mx	*Barteria fistulosa*	Passifloraceae	pi	Tr	Gc	LC	NE
F.mx	*Beilschmiedia obscura*	Lauraceae	sb	Tr	Gc	LC	NE
F.mx	*Blighia sapida*	Sapindaceae	Ind	Ind	Ind	LC	LC
F.mx	*Blighia welwitschii*	Sapindaceae	np	Tr	Gc	LC	LC
F.mx	*Brenania brieyi*	Rubiaceae	sb	Tr	Gc	LC	LC
F.mx	*Bridelia micrantha*	Phyllanthaceae	pi	Tr	Gc	LC	LC
F.mx	*Calpocalyx dinklagei*	Fabaceae	sb	Tr	Lg	LC	LC
F.mx	*Canarium schweinfurthii*	Burseraceae	np	Tr	Tra	LC	LC
F.mx	*Carapa procera*	Meliaceae	sb	Tr	Gc	NE	LC
F.mx	*Casearia aculeata*	Salicaceae	NE	MsPh	Gc	NE	LC
F.mx	*Ceiba pentandra*	Malvaceae	pi	Tr	Pan	NE	LC
F.mx	*Celtis mildbraedii*	Cannabaceae	NE	NE	NE	NE	LC
F.mx	*Celtis tessmannii*	Cannabaceae	np	Tr	Gc	NE	LC
F.mx	*Centroplacus glaucinus*	Centroplacaceae	Ind	Ind	Ind	LC	LC
F.mx	*Chlamydocola chlamydantha*	Malvaceae	Ind	Ind	Ind	NE	LC
F.mx	*Chrysophyllum africanum*	Sapotaceae	sb	Tr	Tra	LC	LC
F.mx	*Chrysophyllum boukokoense*	Sapotaceae	Ind	Ind	Ind	LC	LC
F.mx	*Chrysophyllum giganteum*	Sapotaceae	Ind	Ind	Ind	LC	LC
F.mx	*Chrysophyllum lacourtianum*	Sapotaceae	Ind	Ind	Ind	LC	LC
F.mx	*Chrysophyllum pruniforme*	Sapotaceae	sb	Tr	Gc	LC	NE
F.mx	*Cleistopholis glauca*	Annonaceae	pi	Tr	Gc	LC	LC
F.mx	*Cleistopholis patens*	Annonaceae	pi	Tr	Gc	LC	LC
F.mx	*Coelocaryon preussii*	Myristicaceae	np	Tr	Gc	LC	LC
F.mx	*Cola acuminata*	Malvaceae	pi	Tr	Gc	LC	LC
F.mx	*Cola altissima*	Malvaceae	sb	Tr	Gc	LC	LC

F.mx	*Cola lateritia*	Malvaceae	sb	Tr	Gc	LC	LC
F.mx	*Cordia aurantiaca*	Boraginaceae	pi	Tr	Lg	LC	LC
F.mx	*Corynanthe macroceras*	Rubiaceae	Ind	Ind	Ind	NE	LC
F.mx	*Corynanthe pachyceras*	Rubiaceae	sb	Tr	Gc	LC	LC
F.mx	*Coula edulis*	Olacaceae	sb	Tr	Gc	LC	LC
F.mx	*Cylicodiscus gabunensis*	Fabaceae	np	Tr	Gc	LC	LC
F.mx	*Dacryodes igaganga*	Burseraceae	np	Tr	Lg	LC	VU
F.mx	*Desbordesia glaucescens*	Irvingiaceae	np	Tr	Lg	LC	LC
F.mx	*Desplatsia dewevrei*	Malvaceae	sw	Sh	Gc	LC	LC
F.mx	*Detarium macrocarpum*	Fabaceae	sb	Tr	Lg	LC	LC
F.mx	*Dialium bipindense*	Fabaceae	np	Tr	Lg	LC	LC
F.mx	*Dialium dinklagei*	Fabaceae	ri	Tr	Gc	LC	LC
F.mx	*Dialium guineense*	Fabaceae	np	Tr	Sw-Cam	LC	LC
F.mx	*Diospyros hoyleana*	Ebenaceae	sb	Tr	Gc	LC	LC
F.mx	*Diospyros mannii*	Ebenaceae	sb	Tr	Gc	LC	LC
F.mx	*Diospyros preussii*	Ebenaceae	sw	Sh	Gc	LC	LC
F.mx	*Discoglypremna caloneura*	Euphorbiaceae	pi	Tr	Gc	LC	LC
F.mx	*Distemonanthus benthamianus*	Fabaceae	pi	Tr	Gu	LC	LC
F.mx	*Drypetes gossweileri*	Putranjivaceae	sb	Tr	Gc	LC	NE
F.mx	*Drypetes klainei*	Putranjivaceae	sb	Tr	Gc	LC	NE
F.mx	*Drypetes leonensis*	Putranjivaceae	sb	Tr	Gc	LC	LC
F.mx	*Drypetes preussii*	Putranjivaceae	sb	Tr	Lg	LC	VU
F.mx	*Duboscia macrocarpa*	Malvaceae	sb	Tr	Gc	LC	LC
F.mx	*Duguetia staudtii*	Annonaceae	Ind	Mgph	Lg	LC	LC
F.mx	*Entandrophragma angolense*	Meliaceae	np	Tr	Tra	VU	NT
F.mx	*Entandrophragma candollei*	Meliaceae	np	Tr	Gc	LC	VU
F.mx	*Eribroma oblonga*	Malvaceae	np	Tr	WG	LC	VU
F.mx	*Eriocoelum macrocarpum*	Sapindaceae	sb	Sh	Gu	LC	LC
F.mx	*Erythrophleum ivorense*	Fabaceae	np	Mgph	Gu	LC	LC
F.mx	*Erythrophleum suaveolens*	Fabaceae	np	Tr	Tra	LC	LC
F.mx	*Fernandoa adolfi-friderici*	Bignoniaceae	NE Ind	MsPh	Gc	LC	NE
F.mx	*Ficus mucuso*	Moraceae	pi	Tr	Gc	LC	LC
F.mx	*Funtumia africana*	Apocynaceae	Ind	Mgph	Gc	LC	LC
F.mx	*Funtumia elastica*	Apocynaceae	np	Tr	Tra	LC	LC
F.mx	*Garcinia kola*	Clusiaceae	NE	Mgph	WG	VU	VU
F.mx	*Garcinia mannii*	Clusiaceae	Ind	MsPh	WG	LC	LC
F.mx	*Greenwayodendron suaveolens*	Annonaceae	sb	Tr	Gc	LC	LC
F.mx	*Grewia coriacea*	Malvaceae	Ind	WG	MsPh	LC	NE

F.mx	*Heisteria parvifolia*	Olacaceae	sb	Sh	Gc	LC	LC
F.mx	*Hexalobus crispiflorus*	Annonaceae	sb	Tr	Gc	LC	LC
F.mx	*Homalium le-testui*	Salicaceae	np	Tr	Gu	LC	LC
F.mx	*Hylodendron gabunense*	Fabaceae	pi	Tr	Gc	LC	LC
F.mx	*Hymenocardia heudelotii*	Phyllanthaceae	Ind	Ind	Ind	NE	NE
F.mx	*Hymenocardia lyrata*	Phyllanthaceae	Ind	Ind	Ind	NE	LC
F.mx	*Irvingia gabonensis*	Irvingiaceae	np	Tr	Gc	LC	NT
F.mx	*Irvingia grandifolia*	Irvingiaceae	np	Tr	Gc	LC	LC
F.mx	*Irvingia robur*	Irvingiaceae	NE	NE	NE	NE	LC
F.mx	*Isolona hexaloba*	Annonaceae	sb	Tr	Gc	LC	LC
F.mx	*Keayodendron bridelioides*	Phyllanthaceae	Ind	Ind	Ind	LC	LC
F.mx	*Klainedoxa gabonensis*	Irvingiaceae	np	Tr	Gc	LC	LC
F.mx	*Laccodiscus pseudostipularis*	Sapindaceae	sb	Sh	Gc	LC	LC
F.mx	*Lannea welwitschii*	Anacardiaceae	pi	Tr	Gc	LC	LC
F.mx	*Lasiodiscus mannii*	Rhamnaceae	sw	Tr	Gc	LC	LC
F.mx	*Lecaniodiscus cupanioides*	Sapindaceae	sb	Tr	Gc	LC	LC
F.mx	*Lepidobotrys staudtii*	Lepidobotryaceae	np	Tr	Gc	LC	LC
F.mx	*Leplaea cedrata*	Meliaceae	Ind	Ind	Ind	NE	NT
F.mx	*Lovoa trichilioides*	Meliaceae	np	Tr	Gc	VU	LC
F.mx	*Macaranga barteri*	Euphorbiaceae	pi	Tr	Gu	LC	LC
F.mx	*Macaranga spinosa*	Euphorbiaceae	pi	MsPh	CG	NE	LC
F.mx	*Maesobotrya klaineana*	Phyllanthaceae	Ind	Tr	Gc	NE	LC
F.mx	*Maesopsis eminii*	Rhamnaceae	NE	NE	NE	NE	LC
F.mx	*Mallotus oppositifolius*	Euphorbiaceae	pi	Sh	Tra	LC	LC
F.mx	*Mammea africana*	Calophyllaceae	Ind	Ind	Ind	NE	LC
F.mx	*Maranthes glabra*	Chrysobalanaceae	sb	Tr	Gc	LC	LC
F.mx	*Mareyopsis longifolia*	Euphorbiaceae	sb	Tr	Gc	LC	LC
F.mx	*Margaritaria discoidea*	Phyllanthaceae	NE	NE	NE	NE	LC
F.mx	*Markhamia tomentosa*	Bignoniaceae	pi	Tr	Gc	LC	LC
F.mx	*Massularia acuminata*	Rubiaceae	sb	Sh	Gc	VU	LC
F.mx	*Milicia excelsa*	Moraceae	pi	Tr	Tra	LC	NT
F.mx	*Millettia barteri*	Fabaceae	sw	Lwcl	Gc	LC	NE
F.mx	*Monodora tenuifolia*	Annonaceae	pi	Tr	Gc	LC	LC
F.mx	*Musanga cecropioides*	Urticaceae	pi	Mgph	Gc	NE	LC
F.mx	*Myrianthus arboreus*	Urticaceae	Ind	Ind	Ind	NE	LC
F.mx	*Nauclea diderrichii*	Rubiaceae	pi	Tr	Gc	VU	NT

F.mx	*Nesogordonia kabingaensis*	Malvaceae	Ind	Ind	Ind	NE	LC
F.mx	*Omphalocarpum elatum*	Sapotaceae	np	Tr	Gc	LC	LC
F.mx	*Oncoba dentata*	Salicaceae	Ind	Mgph	Gc	NE	LC
F.mx	*Oncoba glauca*	Salicaceae	Ind	Ind	Ind	NE	NE
F.mx	*Oncoba welwitschii*	Salicaceae	NE	McPh	Gc	LC	LC
F.mx	*Ongokea gore*	Olacaceae	np	Tr	Gc	NE	NE
F.mx	*Pachyelasma tessmannii*	Fabaceae	np	Tr	Gc	LC	LC
F.mx	*Pancovia laurentii*	Sapindaceae	sb	Tr	Gc	LC	LC
F.mx	*Panda oleosa*	Pandaceae	sb	Tr	Gc	LC	LC
F.mx	*Parinari excelsa*	Chrysobalanaceae	np	Tr	Gc	LC	LC
F.mx	*Parkia bicolor*	Fabaceae	Sca	MsPh	Gc	NE	LC
F.mx	*Pauridiantha floribunda*	Rubiaceae	sb	Sh	Lg	LC	NE
F.mx	*Pentaclethra macrophylla*	Fabaceae	Ind	Ind	Gc	NE	LC
F.mx	*Petersianthus macrocarpus*	Lecythidaceae	np	Tr	Gc	NE	LC
F.mx	*Phyllocosmus africanus*	Ixonanthaceae	Ind	Ind	Ind	LC	LC
F.mx	*Picralima nitida*	Apocynaceae	pi	Tr	Gc	LC	LC
F.mx	*Piptadeniastrum africanum*	Fabaceae	np	Tr	Gc	LC	LC
F.mx	*Poga oleosa*	Anisophylleaceae	sb	Tr	Lg	DD	LC
F.mx	*Pseudospondias microcarpa*	Anacardiaceae	sw	Tr	Tra	LC	LC
F.mx	*Psydrax subcordata*	Rubiaceae	pi	Tr	Gc	LC	NE
F.mx	*Pteleopsis hylodendron*	Combretaceae	pi	Tr	Gc	LC	NE
F.mx	*Pterocarpus mildbraedii*	Fabaceae	np	Tr	Gu	LC	LC
F.mx	*Pterocarpus soyauxii*	Fabaceae	np	Tr	Gc	LC	NE
F.mx	*Pycnanthus angolensis*	Myristicaceae	np	Tr	Gc	LC	LC
F.mx	*Quassia gabonensis*	Simaroubaceae	Ind	Ind	Ind	NE	LC
F.mx	*Rauvolfia caffra*	Apocynaceae	pi	Tr	Tra	LC	LC
F.mx	*Rauvolfia vomitoria*	Apocynaceae	pi	Sh	Tra	LC	LC
F.mx	*Ricinodendron heudelotii*	Euphorbiaceae	pi	Tr	Tra	LC	LC
F.mx	*Rinorea dentata*	Violaceae	sb	Sh	Lg	LC	LC
F.mx	*Rinorea oblongifolia*	Violaceae	sb	Tr	Gc	LC	NE
F.mx	*Rothmannia hispida*	Rubiaceae	sb	Sh	Gc	LC	LC
F.mx	*Rothmannia lujae*	Rubiaceae	sb	Sh	Gc	LC	LC
F.mx	*Rothmannia talbotii*	Rubiaceae	sb	Sh	Gc	LC	LC
F.mx	*Santiria trimera*	Burseraceae	np	Tr	Gc	LC	LC
F.mx	*Scottellia klaineana*	Achariaceae	sb	Tr	Gc	LC	LC
F.mx	*Shirakiopsis elliptica*	Euphorbiaceae	Ind	Ind	Ind	LC	LC
F.mx	*Sorindeia grandifolia*	Anacardiaceae	sb	Tr/sh	Gc	LC	LC

F.mx	*Spathodea campanulata*	Bignoniaceae	pi	Tr	Gc	LC	LC
F.mx	*Staudtia kamerunensis*	Myristicaceae	np	Tr	Gc	DD	LC
F.mx	*Sterculia tragacantha*	Malvaceae	pi	Tr	Tra	LC	LC
F.mx	*Strombosia grandifolia*	Olacaceae	sb	Tr	Gc	LC	LC
F.mx	*Strombosia pustulata*	Olacaceae	sb	Tr	Gc	LC	LC
F.mx	*Strombosiopsis tetrandra*	Olacaceae	sb	Tr	Gc	LC	LC
F.mx	*Symphonia globulifera*	Clusiaceae	sw	Tr	Pa	LC	LC
F.mx	*Synsepalum dulcificum*	Sapotaceae	sb	Tr	Gc	LC	LC
F.mx	*Syzygium rowlandii*	Myrtaceae	NE	MsPh	WG	LC	NE
F.mx	*Tabernaemontana crassa*	Apocynaceae	sb	Tr	Gc	LC	LC
F.mx	*Terminalia superba*	Combretaceae	pi	Tr	Gc	LC	LC
F.mx	*Tessmannia anomala*	Fabaceae	Ind	Ind	Ind	NE	LC
F.mx	*Tetrapleura tetraptera*	Fabaceae	pi	Tr	Tra	LC	LC
F.mx	*Tetrorchidium didymostemon*	Euphorbiaceae	pi	Tr	Gc	LC	LC
F.mx	*Treculia africana*	Moraceae	np	Tr	Tra	LC	LC
F.mx	*Trichilia prieuriana*	Meliaceae	np	Tr	Gc	LC	LC
F.mx	*Trichilia rubescens*	Meliaceae	np	Tr	Gc	LC	LC
F.mx	*Trichilia tessmannii*	Meliaceae	np	MsPh	Gc	LC	LC
F.mx	*Trichilia welwitschii*	Meliaceae	np	Tr	Gc	LC	LC
F.mx	*Trichoscypha acuminata*	Anacardiaceae	sb	Tr	Gc	LC	LC
F.mx	*Trichoscypha arborea*	Anacardiaceae	sb	Tr	Lg	LC	LC
F.mx	*Trichoscypha oddonii*	Anacardiaceae	sb	Tr/sh	Gc	LC	LC
F.mx	*Tridesmostemon omphalocarpoides*	Sapotaceae	np	Tr	Gc	LC	LC
F.mx	*Uapaca guineensis*	Phyllanthaceae	np	Tr	Gc	LC	LC
F.mx	*Uapaca mole*	Phyllanthaceae	Ind	Ind	Ind	NE	LC
F.mx	*Uapaca staudtii*	Phyllanthaceae	np	Tr	Lg	LC	LC
F.mx	*Uvariastrum pierreanum*	Annonaceae	sb	Sh	Lg	LC	LC
F.mx	*Uvariastrum zenkeri*	Annonaceae	sb	Sh	Lg	NT	LC
F.mx	*Vitex rivularis*	Lamiaceae	np	Tr	Gc	LC	LC
F.mx	*Xylopia aethiopica*	Annonaceae	ri	Tr	Gc	NE	LC
F.mx	*Xylopia aurantiiodora*	Annonaceae	NE	NE	NE	NT	LC
F.mx	*Xylopia hypolampra*	Annonaceae	np	Tr	Gc	LC	LC
F.mx	*Xylopia quintasii*	Annonaceae	sb	Tr	Gu	LC	LC
F.mx	*Xylopia staudtii*	Annonaceae	sb	Tr	Gc	LC	LC
F.mx	*Zanthoxylum gilletii*	Rutaceae	pi	Tr	Gc	LC	LC

F.mx	*Zanthoxylum leprieurii*	Rutaceae	Ind	Ind	Ind	LC	NE
F.mono	*Afrostyrax kamerunensis*	Huaceae	sb	Tr	Lg	LC	LC
F.mono	*Alstonia boonei*	Apocynaceae	pi	Tr	Tra	LC	LC
F.mono	*Angylocalyx pynaertii*	Fabaceae	sb	Sh	Gc	LC	LC
F.mono	*Annickia affinis*	Annonaceae	Ind	Ind	Ind	LC	LC
F.mono	*Anonidium mannii*	Annonaceae	sb	Tr	Lg	LC	LC
F.mono	*Anopyxis klaineana*	Rhizophoraceae	np	Tr	Gc	LC	VU
F.mono	*Anthonotha fragrans*	Fabaceae	np	Tr	Gc	LC	LC
F.mono	*Anthonotha macrophylla*	Fabaceae	sb	Tr	Gc	LC	LC
F.mono	*Antidesma membranaceum*	Phyllanthaceae	sb	Tr	Gc	LC	LC
F.mono	*Calpocalyx dinklagei*	Fabaceae	sb	Tr	Lg	LC	LC
F.mono	*Carapa sp.*	Meliaceae	sb	Tr	Gc	NE	LC
F.mono	*Carapa procera*	Meliaceae	sb	Tr	Gc	NE	LC
F.mono	*Centroplacus glaucinus*	Centroplacaceae	Ind	Ind	Ind	LC	LC
F.mono	*Chrysophyllum boukokoense*	Sapotaceae	Ind	Ind	Ind	LC	LC
F.mono	*Cola chlamydantha*	Malvaceae	sb	Tr	Gc	LC	LC
F.mono	*Cola lateritia*	Malvaceae	sb	Tr	Gc	LC	LC
F.mono	*Dacryodes buettneri*	Burseraceae	np	Tr	Lg	LC	VU
F.mono	*Dacryodes edulis*	Burseraceae	pi	Tr	Gc	LC	LC
F.mono	*Desbordesia glaucescens*	Irvingiaceae	np	Tr	Lg	LC	LC
F.mono	*Desplatsia dewevrei*	Malvaceae	sw	Sh	Gc	LC	LC
F.mono	*Dialium sp.*	Fabaceae	np	Tr	Lg	LC	LC
F.mono	*Diospyros hoyleana*	Ebenaceae	sb	Tr	Gc	LC	LC
F.mono	*Diospyros suaveolens*	Ebenaceae	sb	Tr	Lg	LC	LC
F.mono	*Drypetes sp.*	Putranjivaceae	sb	Tr	Gc	LC	NE
F.mono	*Duboscia macrocarpa*	Malvaceae	sb	Tr	Gc	LC	LC
F.mono	*Eriocoelum macrocarpum*	Sapindaceae	sb	Sh	Gu	LC	LC
F.mono	*Erythrophleum suaveolens*	Fabaceae	np	Tr	Tra	LC	LC
F.mono	*Gilbertiodendron brachystegioides*	Fabaceae	np	Tr	Lg	LC	LC
F.mono	*Gilbertiodendron dewevrei*	Fabaceae	sw	Tr	Gu	LC	LC
F.mono	*Greenwayodendron suaveolens*	Annonaceae	sb	Tr	Gc	LC	LC
F.mono	*Hannoa klaineana*	Simaroubaceae	pi	Tr	Gc	LC	NE
F.mono	*Heisteria sp.*	Olacaceae	sb	Sh	Gc	LC	LC
F.mono	*Hexalobus crispiflorus*	Annonaceae	sb	Tr	Gc	DD	LC
F.mono	*Hylodendron gabunense*	Fabaceae	pi	Tr	Gc	LC	LC
F.mono	*Irvingia gabonensis*	Irvingiaceae	np	Tr	Gc	LC	NT

F.mono	*Irvingia grandifolia*	Irvingiaceae	np	Tr	Gc	LC	LC
F.mono	*Irvingia robur*	Irvingiaceae	Ind	Ind	Ind	NE	LC
F.mono	*Klainedoxa gabonensis*	Irvingiaceae	np	Tr	Gc	LC	LC
F.mono	*Lasiodiscus mannii*	Rhamnaceae	sw	Tr	Gc	LC	LC
F.mono	*Macaranga barteri*	Euphorbiaceae	pi	Tr	Gu	LC	LC
F.mono	*Macaranga spinosa*	Euphorbiaceae	pi	MsPh	CG	NE	LC
F.mono	*Maesobotrya klaineana*	Phyllanthaceae	Ind	Tr	Gc	NE	LC
F.mono	*Mammea africana*	Calophyllaceae	Ind	Ind	Ind	NE	LC
F.mono	*Manilkara obovata*	Sapotaceae	pi	Tr	Tra	LC	LC
F.mono	*Musanga cecropioides*	Urticaceae	pi	Mgph	Gc	NE	LC
F.mono	*Napoleonaea talbotii*	Lecythidaceae	sb	Sh	Lg	LC	LC
F.mono	*Nauclea sp.*	Rubiaceae	pi	Tr	Gc	VU	NT
F.mono	*Nauclea diderrichii*	Rubiaceae	pi	Tr	Gc	VU	NT
F.mono	*Ochna afzelii*	Ochnaceae	Ind	Ind	Ind	LC	LC
F.mono	*Odyendea gabunensis*	Simaroubaceae	np	Tr	Lg	LC	LC
F.mono	*Omphalocarpum elatum*	Sapotaceae	np	Tr	Gc	LC	LC
F.mono	*Oncoba glauca*	Salicaceae	Ind	Ind	Ind	NE	NE
F.mono	*Ongokea gore*	Olacaceae	np	Tr	Gc	NE	NE
F.mono	*Ouratea sp.*	Ochnaceae	Ind	Ind	Ind	NE	LC
F.mono	*Pancovia laurentii*	Sapindaceae	sb	Tr	Gc	LC	LC
F.mono	*Panda oleosa*	Pandaceae	sb	Tr	Gc	LC	LC
F.mono	*Piptadeniastrum africanum*	Fabaceae	np	Tr	Gc	LC	LC
F.mono	*Porterandia cladantha*	Rubiaceae	Ind	Ind	Ind	NE	NE
F.mono	*Pseudospondias microcarpa*	Anacardiaceae	sw	Tr	Tra	LC	LC
F.mono	*Pterocarpus soyauxii*	Fabaceae	np	Tr	Gc	LC	NE
F.mono	*Rauvolfia macrophylla*	Apocynaceae	NE	Tr	Gc	LC	LC
F.mono	*Rhabdophyllum*	Ochnaceae	sb	Tr	Gc	LC	LC
F.mono	*Ricinodendron heudelotii*	Euphorbiaceae	pi	Tr	Tra	LC	LC
F.mono	*Rinorea sp.*	Violaceae	sb	Sh	Lg	LC	LC
F.mono	*Rothmannia lujae*	Rubiaceae	sb	Sh	Gc	LC	LC
F.mono	*Sacoglottis gabonensis*	Humiriaceae	Ind	Ind	Ind	NE	LC
F.mono	*Santiria trimera*	Burseraceae	np	Tr	Gc	LC	LC
F.mono	*Sorindeia grandifolia*	Anacardiaceae	sb	Tr/sh	Gc	LC	LC
F.mono	*Sorindeia juglandifolia*	Anacardiaceae	sb	Tr/sh	Gc	LC	LC
F.mono	*Staudtia kamerunensis*	Myristicaceae	np	Tr	Gc	DD	LC
F.mono	*Strombosia pustulata*	Olacaceae	sb	Tr	Gc	LC	LC

F.mono	*Strombosiopsis tetrandra*	Olacaceae	sb	Tr	Gc	LC	LC
F.mono	*Synsepalum sp.*	Sapotaceae	sb	Tr	Gc	LC	LC
F.mono	*Synsepalum longecuneatum*	Sapotaceae	sb	Sh	Lg	NE	NE
F.mono	*Treculia africana*	Moraceae	np	Tr	Tra	LC	LC
F.mono	*Tricalysia sp.*	Rubiaceae	sb	Sh	Lg	LC	LC
F.mono	*Trichilia tessmannii*	Meliaceae	np	MsPh	Gc	LC	LC
F.mono	*Trichilia welwitschii*	Meliaceae	np	Tr	Gc	LC	LC
F.mono	*Trichoscypha acuminata*	Anacardiaceae	sb	Tr	Gc	LC	LC
F.mono	*Uapaca paludosa*	Phyllanthaceae	sw	Tr	Gc	LC	NE
F.mono	*Vitex sp.*	Lamiaceae	np	Tr	Gc	LC	LC
F.mono	*Voacanga africana*	Apocynaceae	pi	Sh	Tra	LC	LC
F.mono	*Xylopia sp.*	Annonaceae	ri	Tr	Gc	NE	LC

F.mx=Mixed forest; F.mono=Monodominant forest; CG=Centroguineo-Congolese; Pi=Pioner; Ri=Riverine; Sb=Shade-bearer; Sh= Shrub, Sw-Cam=Endemic to the south-west; Tr=Tree; Tra=Endemic to tropical Africa; WG=Endemic to the western Guinean zone; In=Introduced species; Lg=endemic to Lower Guinea; Pan=Pantropical; Gu=Endemic to the Guinea zone; NE=undetermined; MsPh=Mesophanerophytes; DD=Data Deficient; LC=Least Concern; NE=Not Evaluated; NT=Near Threatened; VU=Vulnerable; MsPh=Mesophanerophytes; McPh=Microphanerophytes; np=Non pioneer light demandind

Discussion

The study on the biodiversity and conservation status of *Gilbertiodendron dewevrei* monodominant forests and adjacent mixed forests in the Congo Basin is essential for a better understanding of the ecological dynamics and sustainable management of these two types of forest. It focuses critically on a unique ecosystem that is often overlooked in major conservation initiatives. The study recorded the following limitations: Firstly, the geographical coverage of the study may be restricted, which could limit the generalization of the results to the whole of the Congo Basin. Secondly, seasonal and inter-annual variations in species composition and ecological interactions may not have been fully considered due to time constraints. Finally, the data available for some rare or poorly known species may be insufficient, limiting a full assessment of their role in these ecosystems. Despite these limitations, the study represents an important contribution to the conservation and sustainable management of the Congo Basin forests, highlighting the richness and challenges specific to both types of forest.

Structural differences between mixed and monodominant forests

Stem density is a key variable for understanding the structure and dynamics of forest ecosystems. In this study, the stem density did not differ between F.mx and F.mono although it seemed higher in F.mx. This suggests that the two forest types have a similar capacity to maintain dense stands, but with distinct compositions and ecological dynamics. The result obtained for stem density differs from the 437.3±43.5 and 342.7±25.2 obtained respectively in F.mx and F.mono in the DBR by Kearsley et al. [42]. Similarly, the number of trees obtained in F.mono is close to the 383 trees obtained in the Western Congo Basin Heimpel et al. [26]. This may be due to a better stem recruitment strategy, which is more important in F.mx than in F.mono. This result is also similar to that obtained by Phillips et al. [43] who showed that the density of stems in tropical forests is influenced by abiotic factors (soil and rainfall) and does not influence the specific richness of the ecosystem.

The number of families obtained in the F.mono in this study is relatively higher than the 38 families obtained in the Dja Biosphere Reserve [44]. However, the number of families obtained by these authors in the F.mx (44 families) is close to that obtained in this study. The number of species obtained in this study also differs from the 47 species (excluding *G. dewevrei*) in the F.mono and 140 species in the F.mx. These differences may be due to the fact that *G. dewevrei* is particularly adapted to conditions of low fertility and shows a high tolerance to shade, which influences species richness [25]. However, F.mx are TF characterised by greater species diversity, which may explain their slightly higher density compared with F.mono. This high diversity in F.mx allows better occupation of ecological niches, favouring more efficient use of resources such as light, water and nutrients [45,46].

The results obtained in this study differ from the 281 species, 179 genera and 44 families obtained in the north-eastern Central Congo Basin in forests similar to ours [47]. These differences may be due to the coexistence of different ecological niches in F.mx due to the high species richness as opposed to F.mono, which favours the abundance of trees in F.mx and results in a higher species richness than in F.mono [48,49]. These results may also be explained by higher seed mortality in F.mono compared with F.mx [50] or by intense competition between trees for access to mineral elements and light from the dominant species [11]. These results between F.mx and F.mono can be explained by the heterogeneity between the two types of forest due to the slightly higher stem density in F.mx, which allows a coexistence of species with varied ecological traits, competitive interactions and synergies between species that can play an important role in maintaining this high density. However, F.mono are able to monopolize space thanks to specific ecological strategies, such as a thick litter that limits the germination of other species and a tolerance to shady conditions [51,52]. This dominance can result in a slightly lower stem density due to increased structural homogeneity and reduced competitive diversity.

Are there any floristic distinctions between mixed and monodominant forests?

The F.mono and F.mx of the DBR are distinguished by their forest typology. The 03 most abundant species in terms of IVI that make up the floristic base in the F.mx are *Tabernaemontana crassa* (13.63%), *Petersianthus macrocarpus* (12.32%) and *Carapa procera* (10.72%), whereas in the F.mono, these are *G. dewevrei* (127.71%), *Hylodendron gabunense* (9.20%) and *Trichoscypha acuminata* (7.53%). However, these two forest types share *Carapa procera* (*Meliaceae*) and *Centroplacus glaucinus* (*Centroplacaceae*), which were found in both F.mx and F.mono. This shows that although the two ecosystems are distinct, they share a number of species. These common species are different from *Pentaclethra macrophylla* and Polyalthia suaveolens obtained in DBR in F.mx and F.mono by Peh et al. [53]. This result suggests a successful and distinct co-occurrence between the species during the two phtytogeographical inventory periods, in the data collection area, but also to competition between the species with *G. dewevrei*. In terms of IVF, the *Anonaceae* is the most represented family in the F.mx, whereas in the F.mono, it is the *Fabaceae*. This result is contrary to that obtained by Tabué et al. [54] in the DBR which obtained the *Euphorbiaceae* and *Anonnaceae* families as being the most represented. These results can also be explained by interspecific interactions (competition and facilitation), which significantly influence vegetation structure by favouring more or less rapid stem regeneration in tropical ecosystems [55].

Chorology and species conservation status between mixed and monodominant forests

In both forest types, species endemic to the Guinean-Congolese region are the most abundant (58%). This result indicates that these forests share a common phytogeographic base, as shown by White [37]. For this author, the forests of Central Africa are home to a large proportion of the endemic species of the Guinean-Congolese region. However, the proportion of species endemic to Lower Guinea is greater in F.mono than in F.mx. This result may be linked to the specific edaphic and/or climatic conditions that favor a particular flora, and suggests that the F.mono would be more representative of the flora of both forest types. This result is similar to that obtained by [56], who showed that the dominance of one species in F.mono can facilitate the proliferation of other species adapted to similar biotic and abiotic conditions. The slightly higher proportion of 'NE' non-rated species in F.mx may indicate a greater richness of rare or poorly studied species. These results are similar to those obtained by Connell [57], who showed that the greater ecological diversity of F.mx favours the emergence and coexistence of a varied flora Connell [57].

Nauclea sp. and *Nauclea diderrichii* located in the F.mono are locally vulnerable according to [41], yet according to the IUCN, they are not and belong to the 'NT' category. This suggests that the criteria used locally to assess the species' conservation status may differ from those of the IUCN. Local anthropogenic pressures and species habitat may a be underestimated on a global scale. On the other hand, in the F.mx, species such as *Allanblackia gabonensis* and *Garcinia kola* were jointly classified as vulnerable on a local scale and by the IUCN. These results indicate an imminent risk of decline for these species, requiring urgent action to protect them in both types of forest. Indeed, the conservation value of F.mono has recently been highlighted by various authors. The authors Cheek et al. [58] described F.mono species as containing the highest number of endangered species according to the IUCN. Jumbam et al. [29], Ebika et al. [59], and Buyck et al. [60] have shown that F.mono is important for mycological and mammalian diversity, as there are species that are strictly associated with it to this day. Heimpel et al. [26] identified 52 species significantly associated with *G. Dewevrei* in the western Congo basin, including 20 vascular plant families, 2 climbers, 1 hemiepiphyte and 1 hemiparasite. However, certain plants found only in the F.mono include the instard Dacryodes buettneri, which has been classified as 'LC' according to [41] and is in the 'VU' category according to the IUCN. F.mono is therefore an important ecosystem for the conservation of plant diversity within the DBR, and conservation plans will be more effective if they include both F.mx and F.mono.

Conclusion

Monodominant forests with *Gilbertiodendron dewevrei* (De Wild.) J. Leonard (Fabaceae-Caesalpinioideae) represents a unique forest type in the DBR. The diversity indices (Shannon, Simpson and Piélou equitability) of the *Gilbertiodendron dewevrei* forest, and the structural parameters (total species richness, number of trees, number of genera, number of families) are significantly different from and lower than those of the adjacent mixed forest. Monodominant forests differ from their adjacent mixed wood counterparts in their species composition and should be considered separately in ecosystem conservation planning. The conservation status of species in F.mono according to the IUCN Red List shows that these forests are also a refuge for many endangered species. As F.mx and F.mono are important ecosystems for biodiversity conservation. These forests of *Gilbertiodendron dewevrei* (De Wild.) J. Leonard (Fabaceae-Caesalpinioideae) should be considered separately when modelling management strategies for tropical forest ecosystems.

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Conflict of Interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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