

# Composition and floristic diversity of the swamp forests of Doumaintang, East Cameroon Region

## Abstract

In the wetlands of the Congo Basin, swamp forests represent a major ecological challenge. It is therefore important to know the floristic diversity and the way in which species function in order to conserve them more effectively. Three types of swamp were selected for the collection of floristic data: swamps on flat ground (MTP), swamps on steep ground (MTE) and swamps at the forest edge (MLF). Sixty-two plots covering an area of 15.5 ha were set up throughout the study area. The functional traits of the species recorded and their IUCN conservation status were determined. The results show a total of 263 species divided into 65 families and 177 genera throughout the study site. The MLFs are the richest and most species-diverse environments, with 214 species, 210 genera and 82 families. The Shannon index is average ( $3.25 \pm 0.27$  bits) in the study area and the Pielou equitability index ( $0.9 \pm 0.03$ ) is high. The flora of the Doumaintang swamps, based on the phytogeographical distribution areas, showed that this environment belongs to the Guineo-Congolese domain, with 59.2 %, 20.4 % and 58.5 % of species in the MTP, MTE and MLF respectively.

Key words: Floristic composition, floristic diversity, swamps, conservation, Doumaintang

## Introduction

Wetlands are transitional environments between the terrestrial and aquatic environments. For a long time, they were considered sterile and unhealthy, breeding grounds for disease and a haven for mosquitoes (Mabafei et al., 2021). For this reason, they were seen as worthless and unusable environments, which could only be exploited by draining and drying them out (Ranganathan et al., 2021). Today, it is recognised that wetlands are special ecosystems in terms of their flora and ecology (Kendall et al., 2021)

Swamp forests are of ecological, systematic, economic and medicinal interest in the tropics (Luna et al., 2022). Despite these multiple interests, little floristic and ecological data on them is available in Central Africa. This lack of vegetation data compromises any effective and sustainable ecological monitoring of biodiversity. Investigations into the structure and diversity of vegetation are key indicators for analysing trends in the qualitative and quantitative evolution of vegetation.

In Cameroon, swamp forests are currently in steep decline, with unstable ecological conditions compounded by anthropogenic pressures (Mbarga, 2017). These pressures lead to their accelerated degradation, resulting in the disappearance of many woody species. Despite this anthropisation, swampy areas are refuges for many plant species in regions with high anthropogenic pressure, as is the case in Doumaintang in the East Cameroon region. Several studies on floristic composition have already been carried out on farmland in the East Cameroon region (Koulbout 2024; Zekeng et al., 2021; Kabelong, 2019; Djomo et al., 2017). However, the swamp forests of this region remain unexplored. It therefore appears necessary to have information on the floristic and ecological aspects of swamp forests for their sustainable conservation. Conservation must be based on a sound knowledge of biological diversity if it is to be efficient and if appropriate action is to be taken (Kono et al., 2024). The aim of this study is to assess the diversity and floristic richness of the Doumaintang swamp forests and to determine their functional organisation.

## **II. Materials and methods**

### **II.1 Equipment**

#### **II.1.1. Location of the study site**

Located in the Haut-Nyong department (Fig.1), the Doumaintang district stretches from latitude 4°21'00"N to longitude 13°06'00"E. The district comprises 22 villages. It is bordered to the north by the arrondissement of Diang, to the south-west by the arrondissement of Mboma, to the south-east by the arrondissement of Angossas, to the east by the arrondissement of Doumé and to the west by the arrondissement of Nguelemdouka. The climate is equatorial, hot and humid, of the Guinean type, with four seasons (a short rainy season between mid-March and June, a short dry season between June and mid-August, a long rainy season between mid-August and mid-November and a long dry season between mid-November and mid-March). The temperature fluctuates around 24°C, with lows in July (22.8°C) and highs in April (24.6°C). The soil is red ferralitic, loose and permeable, with little humus, and can be several metres thick; in the low-lying areas the soil is hydromorphic to gley. The topography consists of a succession of low hills with generally gentle slopes interspersed with small, well-marked watercourses, or swampy depressions that are sometimes very extensive (several hundred metres) with no distinct watercourse. Three types of vegetation are found in the region. These include dense semi-caducifolia rainforest, wooded forest and swamp forest.

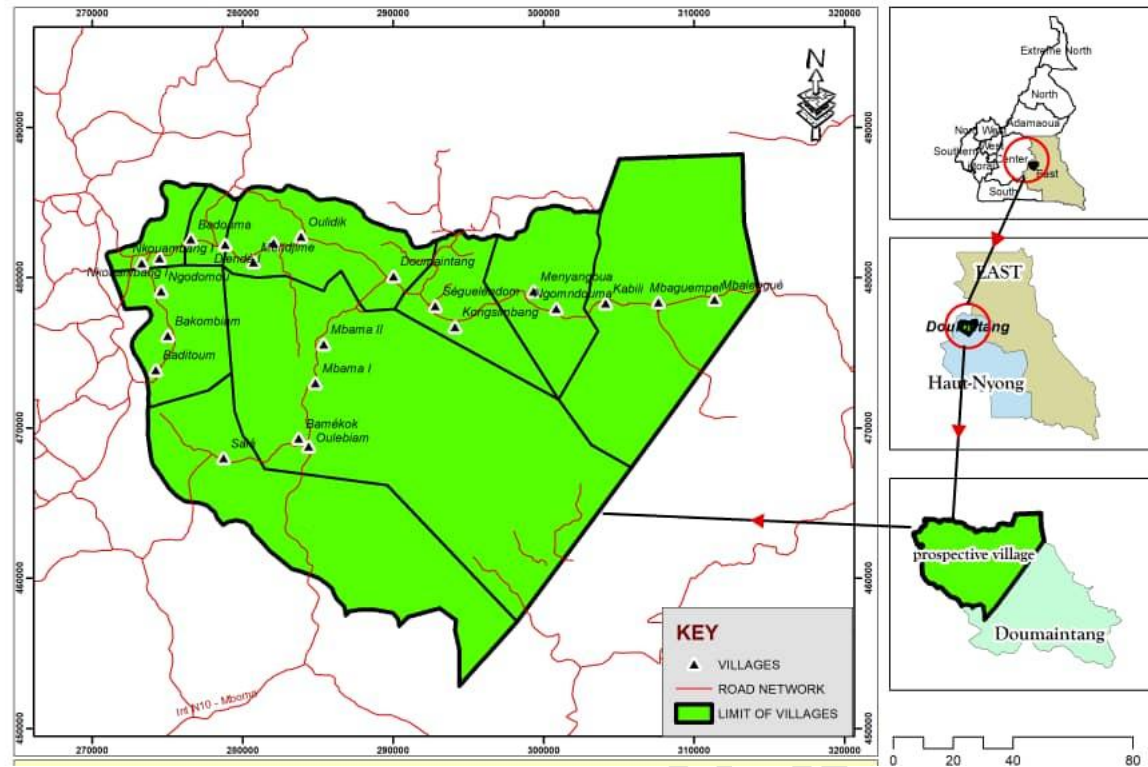


Fig.1: Location of the study area

## II.2 Methods

### II.2.1 Sampling plan for study stations

Three types of swamp were chosen for this study. These were swamps located at the forest edge (MLF), swamps on steep slopes (MTE) and swamps on flat land (MTP). This variability made it possible to assess the effects of microtopography on floristic composition and diversity. A total of 62 plots measuring 50 m × 50 m, or 2,500 m<sup>2</sup>, were set up, with 6 plots in each type of swamp forest. The spatial distribution of these plots is as follows: 13 plots in MTE, 23 plots in MLF and 26 plots in MTP.

### II.2.2 Data collection

Data on swamp forests were collected using stratified sampling representative of their woody vegetation. For each survey, an exhaustive list of species with a **DBH** ≥ 10 cm was drawn up. In order to characterise the woody vegetation, the number of individuals, the **dbh** and the height of each species were recorded. Measurements were taken at 1.30 m above ground level using a **dbh**-meter, in accordance with generally accepted recommendations for trees without anomalies. For species with stilt roots or buttresses, measurements were taken 0.30 m above the stilt roots and buttresses (Dallmeier et al., 1992; White and Edwrad, 2001;

Lewis et al., 2009). Species with a Diameter at Breast Height of less than 10 cm ( $Dbh < 10$  cm) were considered to be seedlings. To determine tree height, the method adopted was that of Missa et al. (2015). According to these authors, an 8 m high milestone was erected vertically and for trees that were beyond this measurement, their heights were estimated.

The Angiosperm Phylogeny Group (APG IV) was used for botanical nomenclature of families (Byng et al., 2016). For subfamilies of Leguminosae, the new subfamily classification based on a taxonomically complete phylogeny was used (LPWG; 2017).

### **II.2.3. Data analysis**

#### **II.2.3.1. Floristic data**

Species richness is the total number of species present in the population under consideration in a given ecosystem. Its purpose is to clarify the total number of species, genera and families present in an environment. In this work, the following indices were used to assess diversity:

#### **The Shannon diversity index**

$$H' = -\sum P_i \log_2 P_i$$

Where  $P_i = n_i/N$ ;  $n_i$  = number of individuals per species;  $N$  = number of individuals per plot.  $H'$  is expressed in bits. It generally varies from 0 to 5 bits. If  $H'$  is in the range [0; 2.5] then  $H'$  can be assumed to be low. If  $H'$  is between [2.6; 3.9] then it can be assumed to be medium; if  $H'$  is between [4; 5] then it can be assumed to be high (Morgenroth et al., 2020).

#### **The equitability index**

$$E = H'/H_{\max}$$

( $H'$ ) refers to the effective diversity and  $H_{\max}$  to the theoretical maximum diversity. Equitability tends towards 0 when almost all individuals belong to the same species and is equal to 1 when all species have the same abundance (Traore et al., 2020).

#### **The Simpson Index**

$$D = 1 - \sum (P_i)^2$$

(H') refers to the effective diversity and Hmax to the theoretical maximum diversity. Equitability tends towards 0 when almost all individuals belong to the same species and is equal to 1 when all species have the same abundance (Traore et al., 2020).

### **Sorensen's Similarity Index**

$$C_s = \frac{2C}{A + B}$$

Cs: Sorensen's coefficient, C: the number of species common to the two groups compared, A and B are the numbers of species absent in one but present in the other. Cs values vary between 0 and 100 % (Temgoua et al., 2018).

### **Family diversity indices**

$$Idr (\%) = \frac{\text{Number of species/families}}{\text{Total number of species/families}} \times 100$$

### **Dominance relative**

$$Dr (\%) = \frac{\text{Number of individuals/species}}{\text{Total number of individuals/species}} \times 100$$

## **II.2.3.2. Ecological characterisation of the flora**

### **II.2.3.2.1. Phytogeographical analysis**

Phytogeography is the way in which species are dispersed over the surface of the Earth. In the context of this study, it is used to situate the plant flora of the Doumaintang swamps in relation to other plant formations in the swamps of Central Africa. The phytogeographical distribution types are established according to the major chorological subdivisions for Africa proposed by (White, 1983; Miabangana et al., 2016).

- species with a very wide geographical distribution:
  - Cosmopolitan (Cos): species found on every continent.
  - Panropical (Pan): species known in tropical Africa, Asia and America, i.e. in all tropical zones;
  - Palaeotropics (Pal): species found in tropical Africa and Asia, Madagascar and Australia;

- Afro-American (Am): species found in Africa and America; -African species with a wide distribution :
- Afro-Malagasy (AM): these are species found in tropical Africa and Madagascar;
- Afro-tropical (At) refers to species distributed throughout tropical Africa
- African pluriregional: these are species whose range covers several African floristic regions or two floristic regions that are not in contact;
- Linking species
  - Guinean and Sudano-Zambézian (SZ): species that occur in ecological conditions that are more or less specific to the Guinean and Sudano-Zambézian elements.
- Guinean-Congolese endemic species
  - Guineo-Congolese (GC): these are species whose range extends throughout the Guineo-Congolese floristic region.

Biological types can be seen as all the ecomorphological features that characterise the vegetative apparatus of a species. For the present study, the main biological types used are based on the classification adopted by Raunkiaer (1934), which takes account of modifications and adjustments adapted to the tropical world (Senterre, 2005). For the purposes of this work, we distinguish between:

Phanerophytes (Ph), stem plants bearing persistent shoots and buds more than 40 cm above the ground. They include:

- nanophanerophytes (Nnph): shrub, sub-shrub, sapling:  $0.4 \leq h \leq 2$  m;
- microphanerophytes (Mcph): shrub:  $2 \leq h \leq 10$  m;
- mesophanerophytes (Msph): trees:  $10 \leq h \leq 30$  m;
- megaphanerophytes (Mgph): large trees:  $h > 30$  m.

#### **II.2.3.2.2. Types of diaspores and mode of dissemination**

The dissemination of diaspores plays an essential role in forest dynamics (Forget, 1998). In plants, this occurs via the fruits and seeds that make up the diaspores. The types of diaspores used in this study are based on the classification of Dansereau and Lems (1957), which is essentially based on morphological criteria. The different types of diaspores and modes of dissemination are:

- zoochory or dissemination by animals (mammals and birds). This includes sarcochorous diaspores (Sar): diaspores with a soft, fleshy envelope:
- anemochory or dissemination by the wind. It groups together the pogonochores (Pog) or diaspores with feathery or silky appendages, egret hairs; the pterochores (Ptero) are diaspores with aliform appendages; and the sclerochores (Sclero) or tiny, light diaspores with no particular characteristics and a mass of less than 1 gram
- autochory, which is dissemination carried out by the plant itself. It includes ballochores (Ballo), which are diaspores expelled by the plant itself, and barochores (Baro), which are dry or fleshy, heavy diaspores.

#### **II.2.3.2.3. Conservation status of species**

The International Union for Conservation of Nature (IUCN) red list is recognised as the most reliable reference tool on the status of biological diversity (Kengne et al., 2022). For the purposes of this study, the species identified were included in the IUCN red list in order to determine their conservation status. Several categories were used. These are : VU = Vulnerable; NT = Near Threatened; EN = Endangered.

### **III.1 Results**

#### **III.1.1. composition**

##### **III.1.1.1. Floristic diversity**

A total of 263 species have been recorded, divided into 65 families and 177 genera. Marshes on steep slopes (MTE) have 161 species, 123 genera and 51 families. Flat-lying marshes (MTP) total 188 species, 141 genera and 58 families, and marshes on forest edges (MLF) have 214 species, 154 genera and 59 families. This study shows that the marshes located at the forest edge are the richest and most diverse in terms of species.

The dominant families (Table I) in these forest zones are classified as follows: Malvaceae (MTP> MTE> MLF); Meliaceae (MTE> MTP> MLF); Euphorbiaceae (MLF> MTE> MLF); Rubiaceae (MLF> MTP> MTE). In the MTEs, Malvaceae and Euphorbiaceae have the highest index of family diversity (7.45 %) respectively. In MTPs, Malvaceae and *Rubiaceae* are the most diverse (7.98 %). In the MLFs, Malvaceous (8.41 %) was the most diverse family, followed by Euphorbiaceae (7.98 %). In the study area, the most diverse

families are *Malvaceae* (8.75 %), *Euphorbiaceae* (6.46 %), *Rubiaceae* (6.08%), *Annonaceae* (5.70 %) and *Meliaceae* (4.94 %).

**Table I:** Gross spectrum of families

Families	Gross spectrum (%)			
	MTE	MTP	MLF	Total
Malvaceae	7,45	7,98	8,41	8,75
Euphorbiaceae	7,45	5,85	7,48	6,46
Rubiaceae	6,83	7,98	5,60	6,08
Annonaceae	6,83	7,45	6,54	5,70
Meliaceae	4,97	4,79	5,14	4,94
Phyllantaceae	3,73	3,19	4,21	4,56
Apocynaceae	4,97	4,79	4,21	3,8
Leguminosae-Caesalpinioideae	3,11	4,79	4,21	3,8
Leguminosae-Papilionoideae	4,97	3,19	3,27	3,8
Leguminosae-Detarioideae	1,86	3,19	3,27	3,42
Irvingiaceae	4,35	1,6	1,4	3,04
Moraceae	2,48	1,06	2,34	2,28
Anacardiaceae	1,86	2,13	2,8	2,28
Salicaceae	1,86	1,6	2,34	1,9
Burseraceae	1,86	2,13	2,34	1,9
Clusiaceae	1,86	1,6	1,87	1,9
Myristicaceae	1,86	1,6	1,87	1,52
Strombosiaceae	1,24	1,06	1,87	1,52
Lamiaceae	1,24	2,13	0,93	1,52
Sapotaceae	1,24	1,06	1,87	1,52
Cannabaceae	2,48	1,6	1,4	1,52
Rutaceae	1,24	2,13	0,93	1,52
Bignoniaceae	2,48	2,13	0,93	1,52
Urticaceae	1,24	1,06	1,4	1,14
Lauraceae	1,24	1,6	0,93	1,14
Achariaceae	1,24	1,6	1,4	1,14
Arecaceae	0,62	1,06	0,93	0,76
Araliaceae	0,62	0,53	0,93	0,76
Sapindaceae	1,24	1,06	0,93	0,76
Rhamnaceae	1,24	1,06	0,93	0,76
Melastomataceae	0,62	1,06	0,93	0,76
Calophyllaceae	1,24	0,53	0,93	0,76
Ochnaceae	1,24	0,53	0,93	0,76
Putranjivaceae	0,62	/	0,93	0,76
Myrtaceae	0,62	1,06	0,47	0,76
Combretaceae	0,62	1,06	0,47	0,76



Simaroubaceae	0,62	0,53	0,93	0,76
Leguminosae-Dialioideae	0,62	0,53	0,93	0,76
Passifloraceae	/	1,06	0,47	0,76
Aptandraceae	0,62	/	0,93	0,76
Erythroxylaceae	/	/	0,93	0,76
Cordiaceae	0,62	0,53	/	0,76
Ebenaceae	0,62	/	0,47	0,76
Violaceae	0,62	0,53	0,47	0,38
Cyatheaceae	0,62	0,53	0,47	0,38
Gentianaceae	0,62	0,53	0,47	0,38
Cephalotaxaceae	/	0,53	0,47	0,38
Lecythidaceae	0,62	0,53	0,47	0,38
Pandaceae	0,62	0,53	0,47	0,38
Asteraceae	0,62	0,53	0,47	0,38
Lepidobotryaceae	0,62	0,53	0,47	0,38
Chrysobalanaceae	0,62	0,53	0,47	0,38
Erythralaceae	0,62	0,53	0,47	0,38
Verbenaceae	0,62	0,53	0,47	0,38
Hypericaceae	/	0,53	0,47	0,38
Vochysiaceae	/	/	0,47	0,38
Caricaceae	/	0,53	/	0,38
Ixonanthaceae	/	0,53	0,47	0,38
Leguminosae-Mimosoideae	/	/	0,47	0,38
Polygalaceae	/	0,53	0,47	0,38
Caprifoliaceae	/	/	0,47	0,38
Coulaceae	/	0,53	/	0,38
Loganiaceae	/	0,53	/	0,38
Menispermaceae	/	0,53	/	0,38
Stemonuraceae	/	0,53	/	0,38
<b>Total</b>	<b>100</b>	<b>100</b>	<b>100</b>	<b>100</b>

According to Table II, the average number of species is  $41.31 \pm 6.75$  in the MTEs,  $32.85 \pm 9.3$  in the MTPs and  $41.17 \pm 10.62$  in the MLFs, i.e. an average of  $38.44 \pm 8.89$  over the entire study area. The Shannon index varies from  $3.09 \pm 0.3$  to  $3.41 \pm 0.17$  bits. The average is  $3.25 \pm 0.27$  bits. These forest areas are therefore disturbed. The Pielou and Simpson equitability indices are  $0.9 \pm 0.03$  and  $0.94 \pm 0.02$  respectively (Table II). These results reveal an average specific diversity in the floristic composition and an equitable distribution of species.

**Table II:** Floristic diversity indices for wetlands

Types of wetlands	Number of plots	Average number of species	H'	E	1-D'
MTE	13	41,31±6,75	3,41±0,17	0,92±0,02	0,96±0,01
MTP	26	32,85±9,3	3,09±0,3	0,90±0,03	0,93±0,03
MLF	23	41,17±10,62	3,25±0,35	0,88±0,05	0,93±0,03
Average	20,67±6,81	38,44±8,89	3,25±0,27	0,9±0,03	0,94±0,02

H': Shannon bit diversity index; E: Equitability index; 1-D'=Simpson index.

The values of the similarity coefficients are greater than 50% in the MTE, MTP and MLF . (Table III). It varies from 71.93% to 74.86%. The different types of swamp forest belong to the same plant community.

Tableau III : Indices of similarity

Types of wetlands	Common species	Cs
MTE-MTP	123	71,93 %
MTE-MLF	140	74,86 %
MTP-MLF	145	73,23 %

### **III.1.2. Ecological characteristics of woody stands**

Guineo-Congolese species are by far the most abundant phytogeographic type in the MTEs, MTPs and MLFs, with 70.63%, 68.28% and 69.81% respectively (Fig.2). Next come the ink species in the MTEs, MTPs and MLFs, with 6.25%, 8.06% and 8.02% respectively. Binding species were insignificant overall.

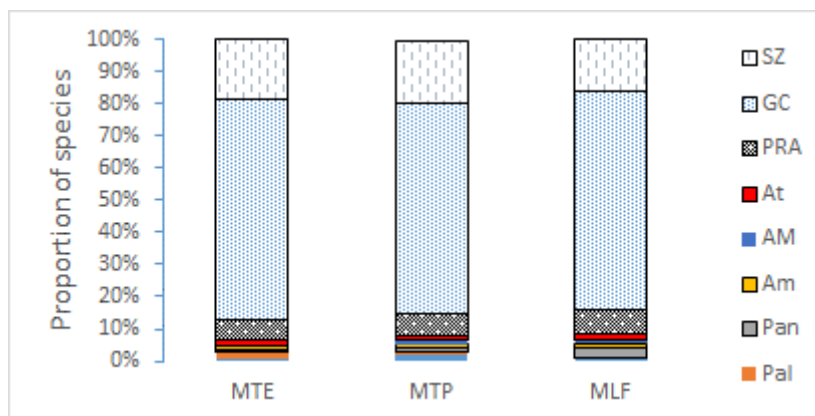


Fig. 2. Phytogeographic spectra of different types of marshes

### III.1.2.1. Types Biologiques

The spectrum of biological types of the flora of the Doumaintang marshes allows us to highlight a predominance of nanophanerophytes with 44,64 %, 43,41 % et 39,39 % respectively in MTE, MTP and MLF (Fig.3), followed by microphanerophytes with 31.79%, 35.63%, 36.62% respectively in MTE, MTP and MLF.

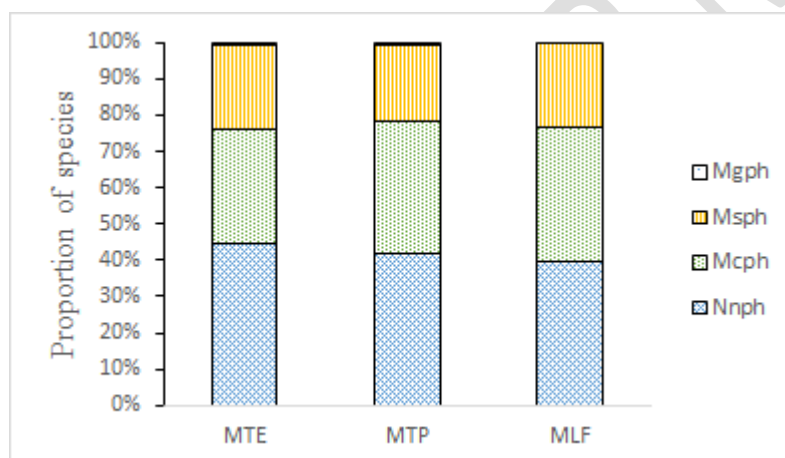
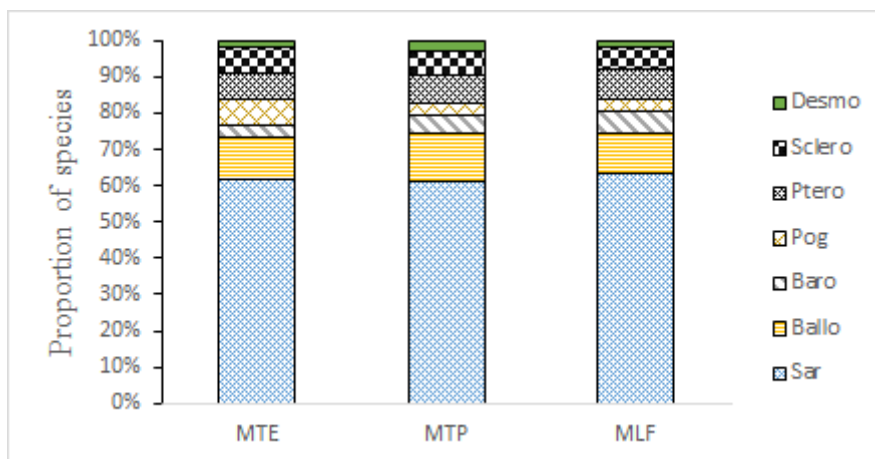


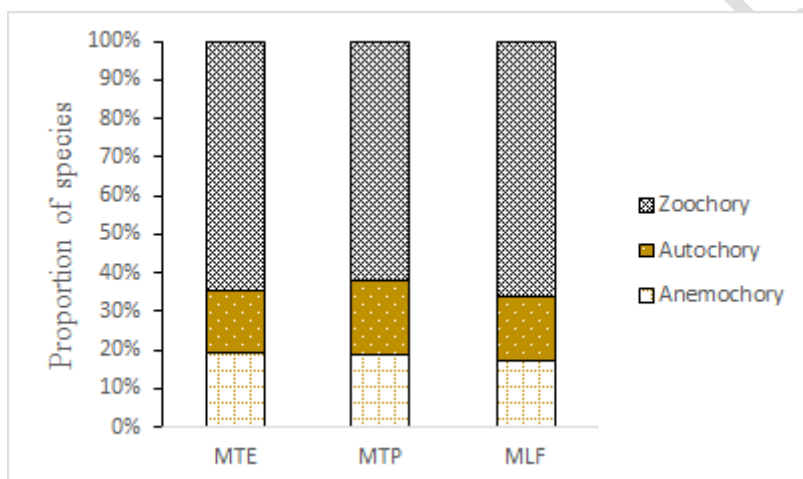
Fig.3: Phytogeographical spectra of different types of swamps

Six types of diaspores were identified in the swamps (Fig.4). Sarcochorous diaspores were in the majority in the MTE, MTP and MLF (64.78%, 62.and 65. respectively). They are followed by ballochores at 11., 14.and 11.in the MTE, MTP and MLF. Desmochores were the least represented at 1.92%, 3% and 1.74% respectively in the MTE, MTP and MLF (Fig.4).



**Fig.4.** Types of diasporas in the Doumaintang swamps

Zoochory is the most common mode of dissemination, with 64.78%, 79.65% and 65.38% respectively in MTE, MTP and MLF, followed by anemochory and autochory (Fig.5).



**Fig.5.** Mode of dissemination

### III.1.3. Conservation status of species

A total of 31 endangered species on the IUCN Red List (2023) have been identified. Of these, 3 species have been identified as endangered (*Cola hypochrysea*, *Guibourtia tessmannii*, *Strombosia gossweileri*), 19 species as vulnerable (*Afzelia pachyloba*, *Allanblackia kisonghi*, *Beilschmiedia anacardioides*, *Calpocalyx heitzii*, *Cephalotaxus mannii*, *Cordia platythyrsa*, *Drypetes preussii*, *Entandrophragma candollei*, *Entandrophragma cylindricum*, *Garcinia staudtii*, *Lophira alata*, *Macaranga paxii*, *Nesogordonia papaverifera*, *Ochna calodendron*, *Pachylobus edulis*, *Pterygota macrocarpa*, *Pycnanthus microcephalus*, *Strychnos elaeocarpa*, *Turraeanthus africanus*)

and 9 species are near-threatened (*Albizia ferruginea*, *Cylicomorpha solmsii*, *Entandrophragma angolense*, *Irvingia gabonensis*, *Leplaea cedrata*, *Leplaea thompsonii*, *Milicia excelsa*, *Mitragyna stipulosa*, *Nauclea diderrichii*).

## Discussion

### Floristic composition

The inventory of the floristic composition in the swamps showed that the species richness of Doumaintang is 263 species divided into 65 families and 177 genera. This result is lower than the work presented by Missa et al., (2015) in the Tanoé-Ehy swamp forest in south-west Côte d'Ivoire. The latter, for an area of 400 m<sup>2</sup>, sampled 115 square plots and obtained 432 species divided between 297 genera and 105 families. The difference between our results and those obtained by these authors could be explained by the surface area surveyed, the itinerant data collection technique and the project funding.

This study made it possible to determine the species richness in the different swamps areas of Doumaintang. It appears that the MLFs are more diverse and species-rich than the MTEs and MTPs, yet the MTPs had a higher number of plots than the MTEs and MLFs. This study is similar to the work presented by Alignier (2010) and Boupoya (2011). This high diversity within the MLFs can be explained by the heterogeneity of the edges and the coexistence of several microclimatic gradients.

The family diversity index shows that Malvaceae (7.45% and 8.41%) and Euphorbiaceae (7.45% and 7.48%) are the most diverse families in MTEs and MLFs, while in MTPs Malvaceae (7.98%) and Rubiaceae (7.98%) appear to be the most diverse families. The abundance of Malvaceae and Euphorbiaceae in MTE and MLFs could be explained by the fact that these hydromorphic environments have been disturbed by human activity but are in the process of recovering. This is justified by the abundance of these families in these swampy forest areas. These results are similar to those presented by Koné et al., (2024) and Kengne et al., (2018). For the latter, Malvaceae show a good capacity for adaptation and ecological development and the presence of Euphorbiaceae is indicative of colonising and scarring species whose role is to restore plant biodiversity in degraded environments. MTPs, on the other hand, are highly disturbed environments. This is justified by the abundance of Malvaceae and Rubiaceae in this swampy forest zone. Indeed, as Taonda et al., (2021) have shown, the abundance of the Rubiaceae family is a general characteristic of forests under anthropogenic pressure.

A better characterisation of a plant stand is based on the interpretation of diversity indices Mbololo et al., (2016). A forest community is considered rich when it is characterised by a Shannon diversity index value greater than or equal to 3.5 bits (Kent and Cooker, 1992). In the present study, the Shannon index of  $3.25 \pm 0.27$  bits is less than 3.5 bits, indicating that these ecosystems are degraded. This result is different from that presented by (Bocko et al., 2016) in the swamp forests of Likouala, North Congo. The Shannon index in the swamp forests of Doumaintang is below 3.5 bits due to sand mining and logging in the locality. On the other hand, the mean Pielou and Simpson equitability indices of  $0.9 \pm 0.03$  and  $0.94 \pm 0.02$  respectively for the Doumaintang swamp forests are rather high. This result is similar to that presented by (Bocko et al., 2016) this demonstrates that Doumaintang swamps have a very equitable distribution of species. The average Simpson index ( $0.96 \pm 0.02$ ) in the different types of swamp is high. The high values of this index express a weak organisation of the ecological system and correspond to environmental conditions favourable to the establishment of numerous species represented by a small number of individuals (Tiokeng et al., 2020). The Sorensen index in the Doumaintang swamp forests shows that they belong to the same plant community. This floristic similarity between the species of the different types of swamp is explained by the quality of the environment, as numerous studies in the region have shown that this factor influences the composition of the soil and the topography of the habitat (Zekeng et al., 2020).

### **Ecological characteristics of woody stands**

Guineo-Congolese species are by far the most abundant phytogeographic type in the MTEs, MTPs and MLFs, with 70.63 %, 68.28 % and 69.81 % respectively. Linking species in MTEs, MTPs and MLFs follow with 6.25 %, 8.06 % and 8.02 % respectively. These proportions are similar to those described by Ngonmadje (2012) in the Ngovayang massifs. The predominance of Guineo-Congolese species is justified by the fact that the plots selected in the Doumaintang swamp forests are mature and little disturbed by human activities, whereas the proportion of widely distributed species, which reveal the secondary or substitution character of a given site as a result of human activities (Habiaremye, 1997), is insignificant in the Doumaintang swamp forests.

In the Doumaintang swamp forests, the dominant mode of spread of diaspores in the three types of swamp forests is zoochory 64.78 %, 79.65 %, 65.38 % respectively in MTE, MTP, MLF. This study is similar to that presented by Adingra et al., (2014), since according to these authors, the dominance of zoochory is reported in most studies in the Congo Basin,

with proportions generally exceeding 50%. This result can be explained by the fact that animals depend on species with fleshy fruits for their food (Sonké, 1998).

### **Involvement in conservation**

The Doumaintang swamp forests contain 31 threatened plant species. These species are of great conservation interest. The presence in these Doumaintang swamp forests of IUCN special status species proves that these swamp forests have a high ecological value (Missa et al., 2015).

### **Conclusion**

The aim of this study was to assess the diversity and richness of the flora of the Doumaintang swamp forests. A total of 263 species were recorded in 65 families and 177 genera throughout the study area. Among the types of swamp forest surveyed, the MLF appeared to be the richest and most diverse in terms of species, due to the heterogeneity of the edges. The Shannon, Piélou and Simpson equitability indices revealed that there is good species equitability, but these environments are disturbed by anthropogenic activities such as sand extraction and logging. The different types of swamp forest belong to the same plant community. This is due to the environment, which influences the composition of the soil and topography. The phytogeographical type spectrum showed that Guineo-Congolian species are in the majority in MLFs, MTEs and MTPs, illustrating the maturity of these swamps. Given their ecological value, the Doumaintang marshes play an important role not only in terms of floral biodiversity, but also in terms of faunal biodiversity. Management and conservation systems need to be put in place to prevent the loss of this high biodiversity potential. To achieve this, similar studies in all the marshes in the East Cameroon region will be crucial.

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