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Floristic and structural description from the Banco Forest located in the south of Ivory Coast

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Abstract
Background : *The forest of Banco National Park is fully part of this dynamic of biodiversity conservation and regulation of ecological balances, as a replica of dense humid forest in the heart of an urban environmen. This study explores the floristic and structural aspects of the swamp forest of Banco Forest, with the aim of assessing its conservation.*
Materials and Method : *To achieve this objective, we adopted a floristic and structural approach, including methods of plot survey and line transect survey.*
Results: *The results showed the presence of 48 plants species, according to phylogenetic classification. In this area, 47 genera belonging to 26 families were recorded. The swamp area presents a relatively low species diversity. This low diversity could be linked to habitat degradation due to anthropogenic disturbances. The analysis of structural profiles also showed that species dominance is much more pronounced with a dominance of large-sized trees. This dominance is distributed along the entire transect. This indicates a relatively well-conserved, minimally disturbed environment in which tree species have been able to reach ... This indicates a relatively well-preserved, little-disturbed environment in which tree species have been able to reach their full development. These findings have significant implications for the conservation of plant biodiversity.*
Conclusion *: this study provides an advantage as it shows us that human activities affect the floristic integrity of this forest, which has great ecological value for the microclimate, and therefore deserves to be conserved. Future research could focus on the valorization of the other habitats of the Park.*
Keywords: *Floristic, Structural, Swampy, Degradation, Anthropogenic*

I.INTRODUCTION

Between 2015 and 2020, globally, according to [1], approximately 10 million hectares of forest disappeared each year. Among these forests, rainforests are among the richest and most complex ecosystems in the world [2]. They harbor exceptional plant biodiversity and perform many essential ecological functions.The forest of Banco National Park is fully part of this dynamic of biodiversity conservation and regulation of ecological balances, as a replica of dense humid forest in the heart of an urban environment. However, this forest is not homogeneous: it breaks down into several types according to edaphic, topographic, and hydrological conditions [3]; [4]. Among these types, the swamp forests, located on hydromorphic soils, stand out from the other forests. This environment directly influences the floristic composition and the structure of woody stands [5]. It thus develops vegetation adapted to its ecological constraints [6]. For sustainable management and the conservation of wetland areas, it is essential to understand its floristic composition and the structure of its vegetation. However, studies concerning wetlands remain limited in the southern part of Côte d'Ivoire. This work aims to study the floristic composition and the structure of woody stands in the swamp forest of Banco National Park.

II.MATERIALS AND METHODS

Study Site : Banco National Park (PNB) is located in the south of Côte d'Ivoire, more precisely on the northern outskirts of the large Abidjan metropolitan area (Fig 1). It covers an area of 3,438.34 hectares [7]. It is situated between 5° 21' and 5° 25' North latitude and 4° 01' and 4° 05' West longitude.

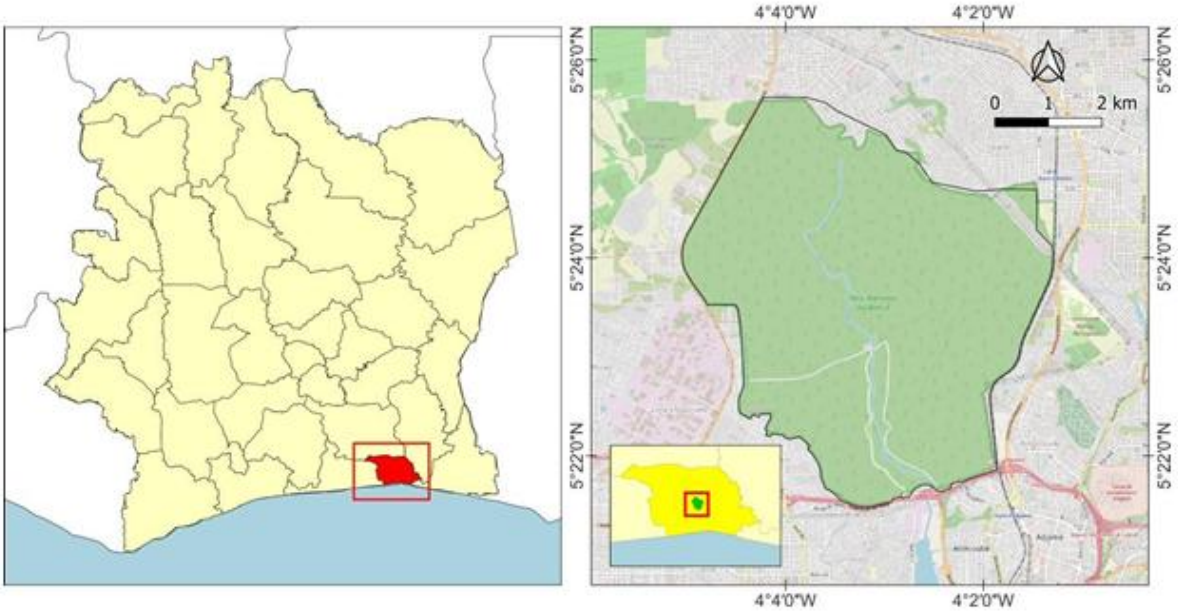

Fig 1. Location of Banco National Park

Data Collection : For this study, two methods were used. The first method is the plot survey. For this method, square plots measuring 10 meters on each side, with an area of 100 m², were established in the different studied biotopes. In each biotope along a 200-meter line, three (3) plots were set up. In this way, 12 plots corresponding to an area of 1200 m² were inventoried. The floristic inventory involved recording all individuals with a diameter at breast height of 5 centimeters or more (i.e., a circumference of 15.70 centimeters or more) across each 100 m² plot. The second method is the linear survey, which is a method of linear surveys, initially described by [8], and constitutes an effective approach for studying vegetation.. It involves laying a 200-meter-long rope horizontally along the ground, along which surveys are carried out at regular intervals. In this study, 100 measurement points were taken every two meters using stackable 4-meter-high stakes, positioned vertically at each point. At each location, all contacts between the vegetation and the stake are recorded, with no height limit. For each contact point between the stake and a plant species, it is identified, and the minimum and maximum heights of its contact with the stake are noted.

Data analysis : [**9**] diversit index was used to assess species diversity. It is commonly used in studies of Ivorian forests to assess the heterogeneity and diversity of a biotope [10]. This index is calculated using the following formula:

$$H' = -\sum(\frac{Ni}{N}) \times Ln(\frac{Ni}{N})$$

In this formula, H is the Shannon index; Ni is the number of individuals of species i and N is the total number of individuals of all species. The limiting values of this index are 0 and ln S, with ln S rarely exceeding [11].

Species Importance Value Index : The estimation of the tree plant species diversity was done using the Importance Value Index [12]. This index highlights the most important species. It is the sum of three factors (relative dominance, relative density and finally relative frequency). It is expressed as a percentage [13]. For each species, these factors are calculated as follows:

$$\text{Relative frequency (a)} = \frac{\text{Numbers of species occurences(a)}}{\text{Sums of occurences of all species}} \text{x } 100$$

$$\text{Relative densité (a)} = \frac{\text{Numbers of indivudials in the families (a)}}{\text{total numbers of indivudials}} \text{x } 100$$

$$\text{Relative dominance (a)} = \frac{\text{Sums of the basal areas of the indivuduals in the family}}{\text{Sums of basal areas of the indivudials in al families}} \text{x } 100$$

III. RESULT

The flora of the swamp forest investigated in the central sector of the park includes 48 plant species, according to phylogenetic classification APG IV. In this area, 47 genera distributed across 26 families were recorded. The overall analysis of this zone highlights the predominance of the genus Adenia, represented by 2 species, including Adenia cissampeloides and Adenia mannii. The other genera each include one species. In this forest, the most represented families are Fabaceae (6 species), followed by Apocynaceae and Rubiaceae, each with 5 species, and finally Phyllanthaceae with 3 species (Fig. 2). At the scale of the swampy area of the forest, the composition in biological types is largely dominated by megaphanerophytes (MP), which account for 46% of the species (Fig.3) They are followed by microphanerophytic lianas (19%), microphanerophytes (11%), nanophanerophytic lianas (8%), mesophanerophytes (6%), and geophytes (4%). Chamaephytes (Ch) are the least widespread, with a proportion of 2%.

The floristic diversity of the swamp area of the Banco Forest is relatively high, with a Shannon-Weaver index (H') of 4.251. As for Piélou's evenness (E), it shows a value of 0.910, indicating a good distribution of individuals among the different species, hence a high evenness. The Importance Value Index (IVI) helps identify the most dominant species in the swamp area of the park. The species with a value equal to or greater than 10% are, in descending order: Uapaca esculenta, Carapa procera, Xylopia rubescens, Allanblackia parviflora, Aganope leucobotrya, Anthostema aubryanum, and Coelocaryon oxycarpum. Table 1 provides a summary of these results. Regarding the structure, Fig. 4 shows the structural profile of the swamp forest. In this profile, we observe that the vegetation is heterogeneous along the transect, with areas of high density and other more open areas. The height of this vegetation varies from 0 to about 30 meters. The upper stratum (20 to 30 m in height) is primarily occupied by the species Carapa procera and occasionally by Xylopia rubescens. The intermediate stratum (10 to 20 m in height) shows a strong presence of Symphonia globulifera and Carapa procera. Below 10 m in height, species such as Gaertnera paniculata are encountered. The species Aganope leucobotrya is weakly represented along the transect and rarely reaches 15 m in height.

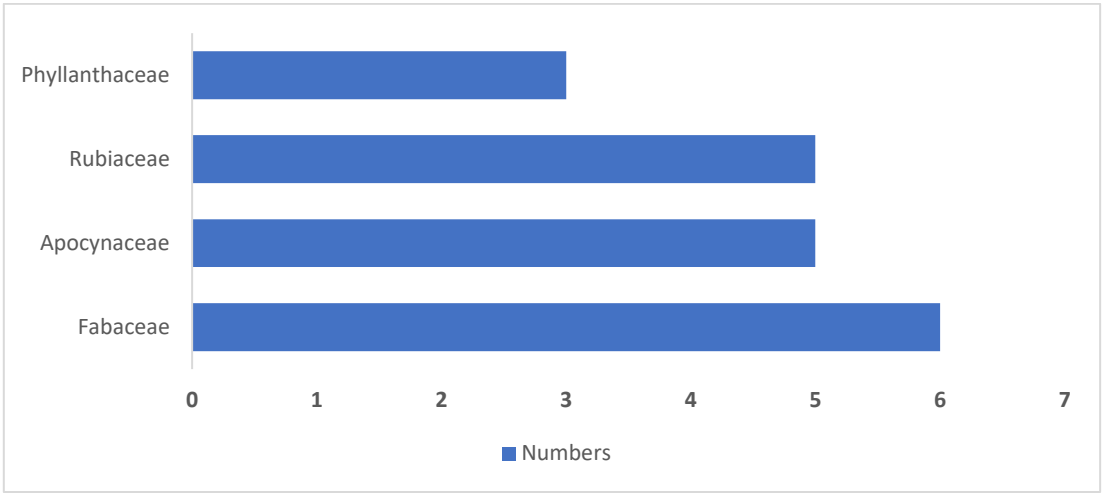

Fig 2. Dominant families of the swampy forest of PNB

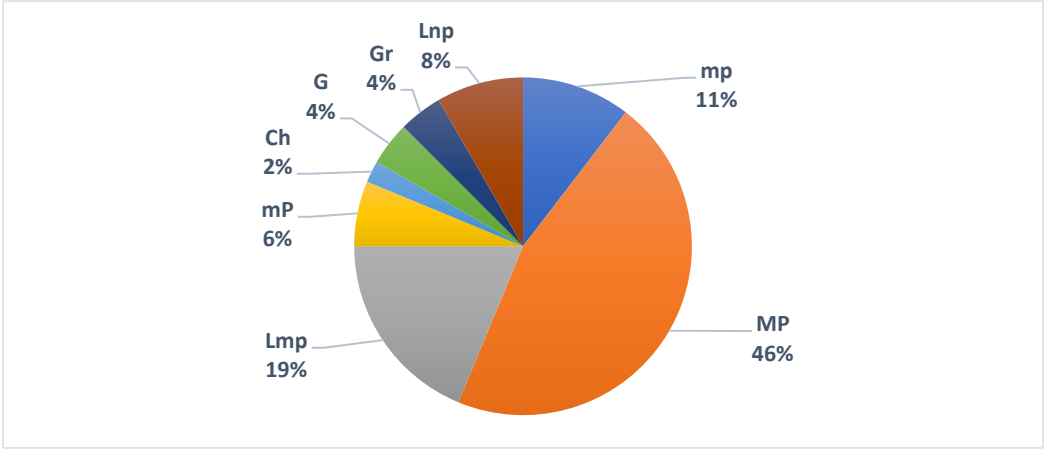

Fig. 3. Spectrum of the proportions of biological types in the swamp forest

Table 1. Importance Value Indices of Species

Species	Relative Dominance (%)	Relative Density (%)	Relative Fréquency (%)	IVI (%)
Uapaca esculenta	49.43	45.16	15	109.60
Carapa procera	12.87	22.58	15	50.45
Xylopia rubescens	20.88	11.83	10	42.71
Allanblackia parviflora	6.36	5.38	10	21.74
Aganope leucobotrya	1.56	3.23	15	19.78
Anthostema aubryanum	1.10	3.23	10	14.33
Coelocaryon oxycarpum	3.70	3.23	5	11.92
Homalium longifolium	2.42	1.08	5	8.49
Gilbertiodendron splendidum	0.64	2.15	5	7.79
Symphonia globulifera	0.73	1.08	5	6.81
Laccosperma secundiflorum	0.31	1.08	5	6.38
Total	100	100	100	300

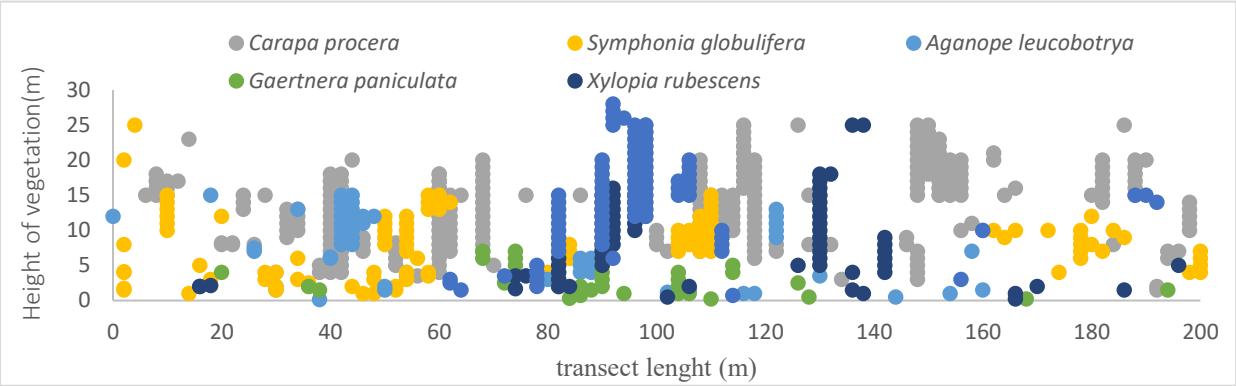

Fig. 4. Structural profile of the marsh area showing the characteristic species.

IV. Discussion

Overall in the forest, the Fabaceae and Apocynaceae families are the dominant families. These same families are noted as predominant in species in most studies conducted in forests [14] ; [15]. The dominance of these families could be explained by the fact that all the areas studied in the park still retain forest traits. The analysis of the distribution of biological types in the different areas studied reveals a dominance of megaphanerophytes in the swamp forest. This strong representation reflects the presence of mature vegetation, characterized by a closed canopy and a relatively stable forest structure. Indeed, megaphanerophytes are typical of dense, undisturbed humid forests, where competition for light favors large tree species.

[16] also observed the dominance of this biological type in the central area of Tai National Park, where human disturbances are limited. The swamp area has relatively low species diversity. This low diversity could be linked to habitat degradation due to human disturbances, as suggested by [17]. The analysis of species importance values overall indicates a prevalence of certain dominant species characteristic of each forest type. In the swamp forest, Uapaca esculenta shows the highest importance value index (109.60%).This species plays a structuring role in this environment, both due to its abundance, wide distribution, and high biomass. In the periodically flooded area, Raphia hookeri dominates with an IVI of 78.03%, according to our results. This typically hygrophilous species seems to be well adapted to the water fluctuations of the environment.

The study of the vertical structure of the vegetation shows a homogeneous horizontal structure, with individuals reaching up to 30 meters in height. This indicates a dominance of large-sized trees. This dominance is distributed along the entire transect. It reflects a relatively well-preserved, minimally disturbed environment, in which tree species have been able to reach their full development.

V.CONCLUSION

This study, conducted within Banco National Park, made it possible to understand the floristic composition and the structure of woody stands in the swamp forest. According to this study, it appears that the marshes of BNP have a floristic richness of 48 plants species. These species are numerically dominated by the

Fabaceae and Apocynaceae families. However, the marsh area shows visible signs of degradation, reflected by low floristic diversity. Structurally, there is a high proportion of tall species. These observations indicate disturbances experienced by these environments, likely due to increasing human pressures or local changes in ecological conditions.

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