International Journal of Innovation and Scientific Research
ISSN 2336-0046 Vol. 80 No. 1 Aug. 2025, pp. 25-34

http://www.ijisr.issr-journals.org/

Floristic diversity of the partial Aghien nature reserve (Bingerville, Southern Côte d'Ivoire)

Sounan Gatien TOURE[1], N'Guessan Olivier YAO[2], Ménéké Distel KOUGBO[3], Richard Kouassi KOUADIO[3], and Konan Edouard KOUASSI[4]

[1]Félix Houphouët-Boigny University, Climate Change, Biodiversity and Sustainable Agriculture Laboratory, Côte d'Ivoire

[2]Félix Houphouët-Boigny University, Researcher National Center of Floristics (CNF), Systematics, herbarium and museum, botany, Côte d'Ivoire

[3]National Center for Agronomic Research, Forest and Environment Program, Côte d'Ivoire

[4]Félix Houphouët-Boigny University, Lecturer-Researcher at the Laboratory of «Natural Environments and Conservation of Biodiversity» of the UFR Biosciences, Associate Researcher at the National Center for Floristics (CNF), Côte d'Ivoire

ABSTRACT: The Aghien estate, the site of this study, is part of the dynamic of creating a new peri-urban nature reserve. Following the regression of the surface areas of protected areas by human activities within the Ivorian parks and reserves, the partial Aghien nature reserve was created to allow the survival of this particular ecosystem, essential for the preservation of the peri-urban forest and the conservation of biological diversity.
The general objective of this study is to assess the floristic diversity of the Partial Nature Reserve of Aghien. To do this, 36 plots of 625m2 (25 m x 25 m) each were first distributed in six (06) biotopes of the partial nature reserve of Aghien (RNPA). These are rubber plantation (n = 6) palm plantation (n = 6), secondary forest (n = 6), swamp meadow (n = 6), fallow land (n = 6), Bare soil (n = 6). Then botanical inventories based on itinerant and surface survey methods were carried out in each plot. A total of 265 species divided into 174 genera and 63 families were inventoried in the RNPA. Finally, the assessment of the floristic composition of the vegetation and that of the floristic composition of the vegetation were determined by the floristic variability and the diversity indices.

KEYWORDS: Vegetation, Floristic diversity, Nature reserve, Aghien.

1 INTRODUCTION

Forest ecosystems provide significant amounts of natural resources for most tropical countries and play an important role in the conservation of diversity and ecological balance [20]. These forest resources help to combat poverty in rural areas by ensuring food security and providing livelihoods. The world's forests, and in particular those of Côte d'Ivoire, are in constant decline due to the pressure of population growth [9]. Indeed, forests are converted into agricultural land or other uses [9]. This situation has led to habitat degradation, loss of biodiversity and climate change [12]. Indeed, man, through his activities (industrial units, transport (automobile, rail, air and naval traffic in different proportions), deforestation (reduction of carbon sequestration by plants), fossil fuel combustion (oil, coal), intensive agriculture and many other activities), emits very large quantities of greenhouse gases (GHG) into the atmosphere. Some of the GHGs (CO2, CH4, N2O) are naturally present in the atmosphere, and contribute to global warming [14]. Faced with this situation, the State of Côte d'Ivoire has taken measures by creating protected areas, classified forests and by implementing new approaches that could lead to obtaining a legal status allowing more effective conservation of forest relics such as sacred forests, protected areas and reserves, etc. The most promising of these approaches is the creation of Voluntary Nature Reserves (VNR). The VNR designates a partial nature reserve

Corresponding Author: Sounan Gatien TOURE

created at the initiative of a local authority, a public institution or a private person on an area belonging to it and for the preservation of an ecosystem or a remarkable landscape [10]; [3]. It is in this context that the rAghien Partial Nature Reserve was created on July 8, 2020. However, since its creation, the reserve has not been the subject of any study on its biological diversity. In addition, like the protected areas of Côte d'Ivoire, the Aghien Partial Nature Reserve is experiencing a sharp decline in its plant cover, mainly due to agriculture and the rapid urbanization of the city of Abidjan. This study was initiated to address this deficit. It aims to answer the following questions: (1) What is the plant diversity of the land use types of the Aghien Partial Reserve ? (2) What are the compositional parameters (richness, diversity) and structures of this reserve ?

This study aims to assess the floristic diversity of the Aghien Partial Nature Reserve. Specifically aim 1: to determine the floristic composition of the vegetation of the RNPA, 2: to analyse the variability of the floristic composition, 3: to assess the floristic diversity within the different plant formations of the RNPA.

2 MATERIALS AND METHODS

2.1 STUDY SITE

The Aghien Partial Nature Reserve (RNPA) is located in the southern region of Côte d'Ivoire between 3° 56' 53" and 3° 48' 00" West and 5° 20' 00" and 5° 30' 00" North (Fig. 1). Declared a public utility area by Law No. 2002-102 of February 11, 2002 on National Parks and by Decree No. 2020-561 of July 8, 2020 [22], it covers a gross area of 5,675 ha taking into account part of the dry land around the Aghien lagoon. It is located in the commune of Bingerville, more precisely in the village of Aghien straddling the sub-prefectures of Bingerville to the South and Brofodoumé to the North. The neighboring villages are: Bébakoi to the North; Débarcadère, Ahoué Andokoi to the East; Akandjé in the Center, Akoyaté, Aghien in the South, and Aghien Télégraphe in the West. The slightly uneven relief consists of a low coastal plain that is often marshy [21]. Its hydrographic network consists of the Aghien lagoon which is fed by the Djibi River to the North and the La Mé River to the South from which it communicates with the Ebrié lagoon. The local climate is that of the northern coast of the Gulf of Guinea. It is a transitional equatorial climate characterized by a long rainy season and a long dry season alternating with a short rainy season and a short dry season [21]. The site is characterized by low amplitude temperatures ranging from 25 °C to 28.9 °C and abundant precipitation reaching 292.61 mm in October. Three main types of plant landscape share the study region: the forest, and the hydrophilic formations of the marshy areas on the edge of the lagoon [21]. The reserve has a configuration dominated by industrial crops and shifting food crops.

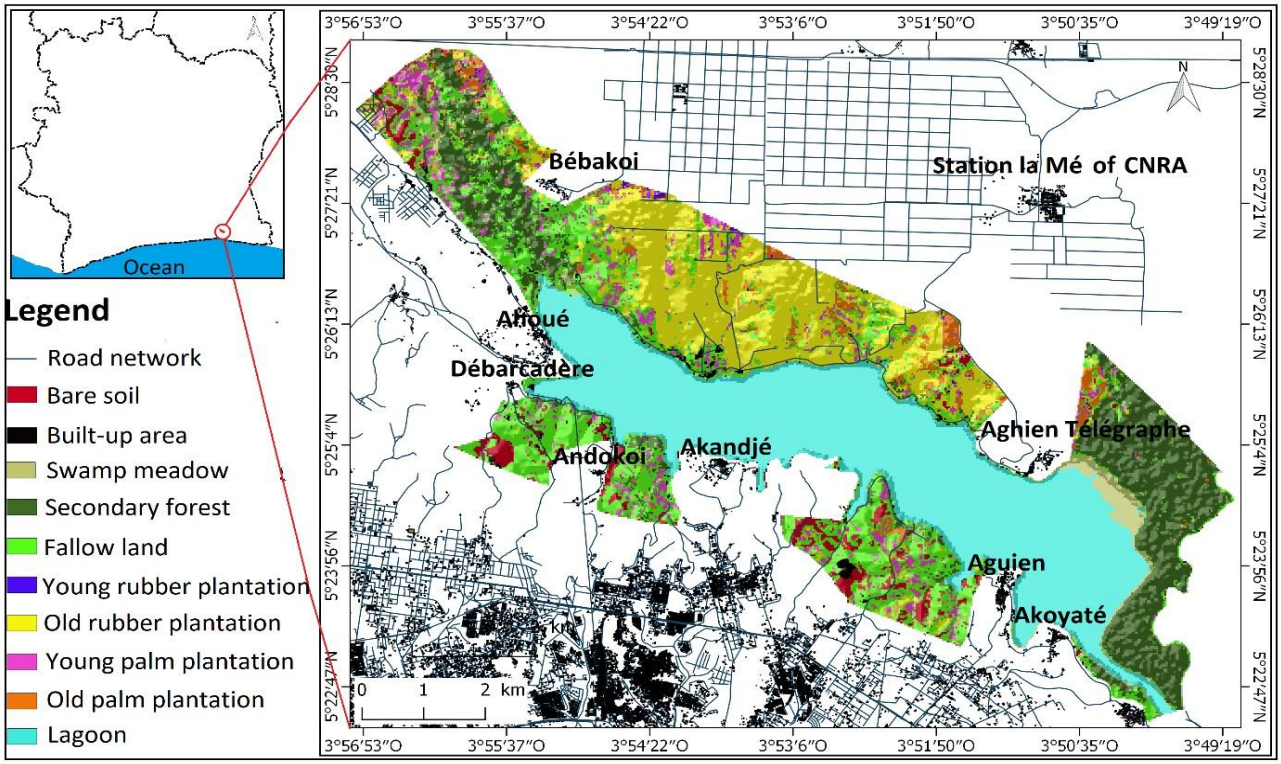

Fig. 1. Location of the study area

2.2 STUDY METHODS

2.2.1 DATA COLLECTION

Data collection was mainly based on the surface survey method and the traveling inventory [13], [30]. To do this, based on the land use of the RNPA, thirty-six plots (36) of 625 m2 (25 m x 25 m) each were first distributed as follows: 6 plots in the rubber plantations, 6 plots in the palm plantation, 6 plots in the secondary forest, 6 plots in the swamp meadow, 6 plots in the fallow land and 6 plots in the Bare soil. Then in each of the plots, the data collected focused on measuring the circumference of trees other than crop plants and the inventory of all plant species present. From one plot to another, a traveling inventory was carried out in order to have a more exhaustive list of the flora of the RNPA. Samples of species not identified in the field were collected and compared to those in the Herbarium of the National Center for Floristics (CNF) of the Félix Houphouët-Boigny University, with a view to their identification.

2.2.2 DATA ANALYSIS

2.2.2.1 EVALUATION OF THE FLORISTIC COMPOSITION OF THE VEGETATION OF THE RNPA

The floristic analysis focused on floristic richness (species, genus, family) and floristic composition (biological and chorological types). The analysis of floristic richness was done by counting all the species recorded in each habitat without taking into account their abundance. The same was true for the families and genera of the species recorded. The nomenclature of plant species adopted is that of APG IV. The analysis of the floristic composition consisted of recording for each species identified, the biological and chorological type by comparison with those listed in the literature [4], [5] (***Table 1).***

Table 1. Classification of biological characteristics used

Biological characteristics	Classification	Sources
Phytogeographic types	Guinean-Congolese species (GC), Guinean-Congolese species endemic to the West African forest block (GCW), Guinean-Congolese species endemic to Ivory Coast (GCi), species common to the Guinean-Congolese region and the Sudan-Zambezi region (GC-SZ)	Aké Assi[4]
Biological types	Megaphanerophyte (MP), Mesophanerophyte (mP), Microphanerophyte (mp), Nanophanerophyte (np), Champephyte (Ch), Therophyte (Th), Hydrophyte (Hyd), Epiphyte / Semi-epiphyte (E), Geophyte (G), Hemicryptophyte (H), Parasite (Par)	Aké Assi[4]

2.2.2.2 EVALUATION OF FLORISTIC DIVERSITY WITHIN THE VARIOUS PLANT FORMATIONS OF THE RNPA

Several indices are used to assess floristic diversity. Those used in this study are: the diversity index of plant formations and the index of importance of native tree species in plant formations.

- Diversity index of plant formations

The floristic diversity within the biotopes was analysed by calculating the indices of Shannon diversity and Piélou equitability in the biotopes. The diversity of the species was assessed through the diversity indices (H') of [27] and equitability (E) of [23]. The Shannon index (H') made it possible to measure the species composition of the different populations by taking into account the specific richness and relative abundance. This index has a value between normally between 0 and 5 according to [15]. It is calculated using the following formula:

$$H' = -\Sigma (N_i/N). \ln (N_i/N)$$

Where Ni is the number of species i and N is the total number of species. It is used to assess the heterogeneity and diversity of a biotope.

The equitability index (E) of [23], also called the equidistribution index [7], is the ratio between the Shannon index of the sample and the maximum diversity. Equitability varies from 0 to 1. It tends towards 0 when almost all of the numbers are concentrated on one species and towards 1 when all species have the same abundance. This index was used to provide information on the distribution of numbers between the different species. It is calculated using the following formula:

$$E = H' / \ln S$$

Where E is the Piélou equitability index and S is the total number of species in a biotope.

Density (D) is defined as the number of individuals per unit area (number of stems per hectare) [25]. It reflects the occupation of the land by the species and is calculated with the following formula:

$$D = N/S$$

D: density, N: number of stems counted and S: total area expressed in hectares.

Where n is the total number of stems recorded and s is the inventory area in hectares.

- Index of importance of natic tree species in plant formations

The basal area **(A),** also called basal area [8], represents the surface area of the trunk section of all trees in a survey if we assume that the cut is made at 1.30 m above the ground. Its formula is as follows:

$$A = \pi D^2/4$$

With A expressed in m2/ha, π = 3.1416 and D is the diameter determined from the circumference

2.2.2.3 Analysis Of Variability In Floristic Composition

The degree of resemblance between the different biotopes was assessed, taking into account the presence of species through the Sorensen similarity coefficient (1948) whose formula is:

$$Cs = \frac{2c}{a+b} x\ 100$$

With Cs similarity coefficient, a number of species in environment A, b number of species in environment B and c number of species common to environments A and B. In this study, A and B will represent biotope I and II. The Cs values vary between 0 and 100 p.c. The more species the lists have in common, the more Cs tends towards 100 p.c. The more the two floristic lists are different, the more the Cs value tends towards 0. The analysis of the horizontal structure of the stand was assessed to highlight the physiognomy of the reserve. It was analyzed through various parameters including density, the basal area of all stems with a DBH of at least 5 cm.

2.2.3 Statistical Analyses Of Data

The one-way Analysis of Variance (ANOVA 1) was used in this study to compare the means of the Shannon diversity and Piélou equitability indices of the different biotopes studied. The Kruskal-Wallis test, which is the non-parametric equivalent of the Anova test, was used to compare the average species richness, the average densities and basal area of the different biotopes studied. The significance level chosen for these analyses is 5 p.c. (p = 0.05). The XLSTAT 2014 software was used to carry out these tests.

3 Results

3.1 Floristic Composition Of The Vegetation Of The RNPA

3.1.1 Floristic Richness

The partial nature reserve of Aghien is rich in 265 species divided into 174 genera and 63 families. The most dominant genera are Ficus, Dichapetalum with 6 species respectively; Cola and Millettia, with 5 species and Albizia, Anthocleista, Diospyros with 4 species respectively. The most diverse family is Fabaceae with 41 species, a rate of 15.29%. It is followed by Euphorbiaceae with 24 species (8.96%), Poaceae with 14 species (5.22%), Rubiaceae, Moraceae with 11 species each, or 4.10% ***(Fig. 2).*** When considering the different biotopes, the swamp forest are richer with 111 species recorded (75.66 ± 17.21) divided into 76 genera and 44 families. They are followed by fallow land with 96 species (72.33 ± 16.25) divided into 74 genera and 41 families. On the other hand, the lowest specific richness is observed at the level of the swamp meadow with 24 species (33.33 ± 10.33) divided into 8 genera and 8 families. Statistical analyses showed a significant difference between certain biotopes. (χ^2 = 12.33; p < 0.008) ***(Table 2).***

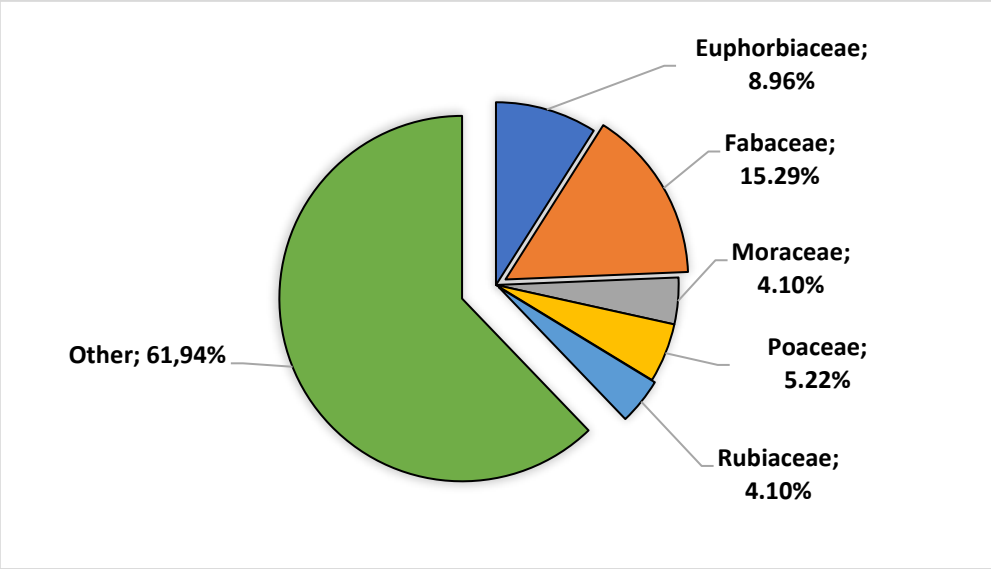

Fig. 2. Spectrum of dominant families in the reserve

Table 2. Floristic richness of the different biotopes with the specific means of each biotope

Biotopes	Species	Genera	Families	Average specific richness
Secondary forest	111	76	44	75.66 ± 17.21[b]
Palm plantation	62	46	36	60.33 ± 12.25[ab]
Rubber plantation	70	65	40	68.66 ± 13.23[b]
Fallow land	96	74	41	72.33 ± 16.25[b]
Swamp meadow	24	8	8	33.33±10.33[a]
Bare soil	51	43	29	41. 33 ± 11.33[a]
Kruskal-Wallis test				$\chi^2 = 12.33$ / $p < 0.008$

3.1.2 BIOLOGICAL TYPES

The overall biological spectrum of the species inventoried shows that phanerophytes dominate the undergrowth of the various biotopes, accounting for 77.87% of all species (Fig. 3). Chamaephytes, therophytes, hemicryptophytes, epiphytes and geophytes are poorly represented in this flora. Among the phanerophytes, microphanerophytes are the most represented (54.60%). Megaphanerophytes, mesophanerophytes and nanophanerophytes account for 7.26%, 17.53% and 20.61% of the total number of phanerophytes inventoried, respectively.

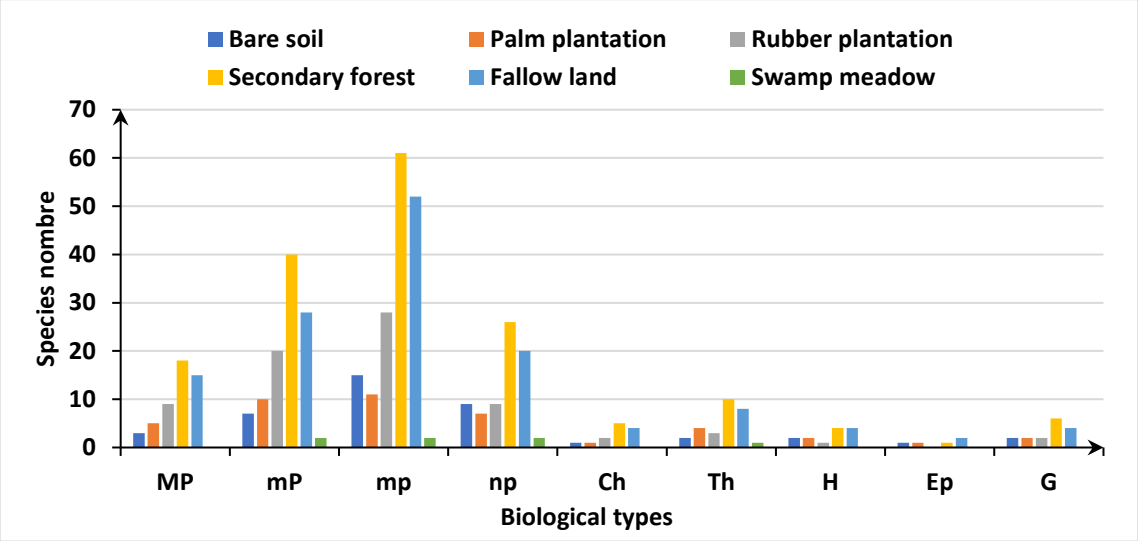

Fig. 3. Histograms of the biological types of the species of the reserve

3.1.3 CHRONOLOGICAL TYPES

All the species inventoried on the study site belong to 5 phytogeographic types. The flora of the partial nature reserve of Aghien is mainly made up of species from the Guinean-Congolese region (GC) with 58% ***(Fig. 4).*** They are followed by species from the forest-savannah transition zone (GC-SZ) with a rate of 26%, introduced species (i) represent 7%, that of the West African region (GCW) accounts for 8%. The species endemic to Côte d'Ivoire (GCi) are only represented by 1%.

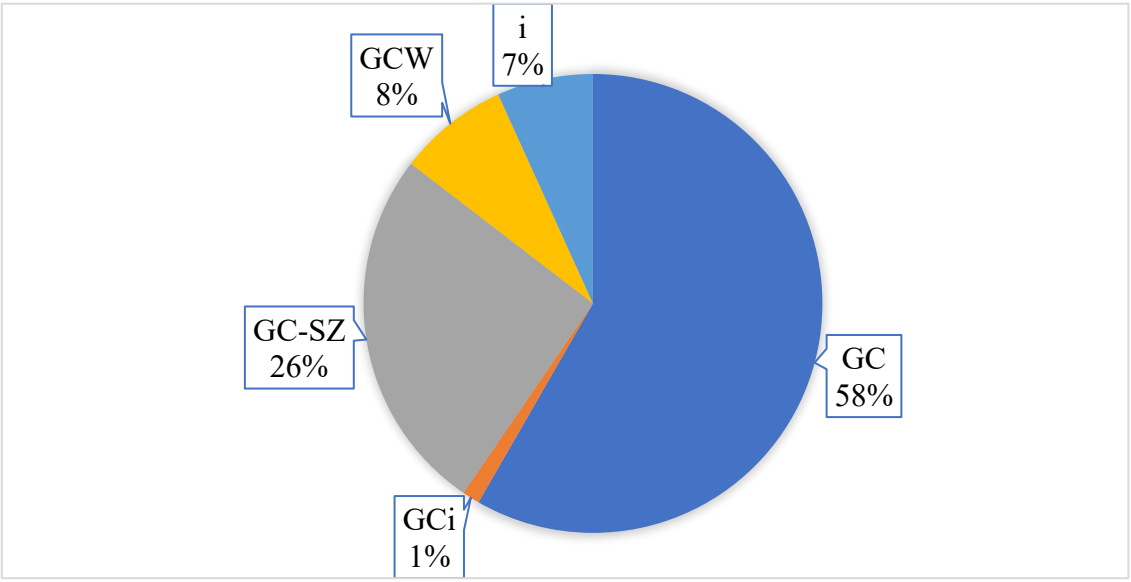

Fig. 4. Spectrum of chorological types of species in the reserve

3.1.4 VARIABILITY IN PLANT COMPOSITION

The Sørensen similarity coefficient, calculated between the different biotopes of the reserve, shows that they have less than 50% of their species in common. From a floristic point of view, no biotope is similar to another ***(Table 4).***

Table 3. Floristic similarities of the different biotopes

Biotopes	Bare soil	Secondary forest	Fallow land	Palm grove	Rubber plantation	Swamp meadow
Bare soil	100					
Secondary forest	27.6	100				
Fallow land	23.4	48.6	100			
Palm plantation	28.8	20.1	27.6	100		
Rubber plantation	26.3	37.6	31	28.6	100	
Swamp meadow	6.8	8.3	8.5	2.1	34	100

3.2 FLORISTIC DIVERSITY WITHIN THE DIFFERENT PLANT FORMATIONS OF THE RNPA

3.2.1 ALPHA DIVERSITY IN BIOTOPES

The Shannon index (H') varies from 1.81 to 3.41 ***(Table 3***). Secondary forests and fallows are the most diverse environments with respectively 3.41 ± 0.54 for secondary forests and 3.26 ± 0.5 for fallows. The least diverse environments are the Crop Association and the marshy meadow with respectively 2.45 ± 0.21, 1.81 ± 0.2 as Shannon value.

The Piélou equitability index varies from 0.87 to 0.51 ***(Table 3).*** All habitats have index values (E) relatively close to 1. These habitats therefore record a good equidistribution of individuals between species. However, the secondary forest with a value of 0.87 ± 0.09, has the best equidistribution of individuals between species. Conversely, the swamp meadow constitutes the biotope which presents more dominance of species; with a value of 0.51 ± 0.02.

These values reveal that the distribution of species is more or less regular in the different biotopes. The statistical test of Anova carried out indicates that there is no significant difference between the different Pielou and Shannon means of the different biotopes (K = 2.448 and p-value = 0.01)

Table 4. Mean values of Shannon diversity and Piélou equitability indices of the different biotopes

Biotopes	Shannon diversity index	Piélou equitability index
Rubber plantation	3.02 ± 0.47^{ab}	0.72 ± 0.04^{ab}
Palm plantation	2.42 ± 0.21^{ab}	0.69 ± 0.02^{a}
Fallow land	3.26 ± 0.51^{b}	0.78 ± 0.07^{ab}
Secondary forest	3.413 ± 0.54^{b}	0.87 ± 0.1^{b}
Swamp meadow	2.45 ± 0.21^{a}	0.51 ± 0.09^{a}
Bare soil	1.81 ± 0.20^{a}	0.64 ± 0.03^{a}
Statistical parameters of Anova	*DI= 2.77 /F= 2.45 / p < 0.01*	*DI= 2.7/ F= 2.45 / p < 0.01*

3.2.2 DENSITY AND BASAL AREA IN PLANT FORMATIONS FOREST TREE SPECIES

- Density

The inventory identified 1008 individuals for an average density of 148 ± 92.59 84,59 stems/ha. When considering the different types of biotopes, the Secondary forest and Fallow land record the highest densities with 180.28 ± 101.87 and 160.82 ± 99.88 stems/ha respectively. On the other hand, the Bare ground and the swamp meadow have the lowest tree densities with 83.42 ± 28.17 and 13.28 ± 3.18 stems/ha respectively ***(Table 5).*** The Kruskal-Wallis test carried out indicates that the average density values of the different biotopes are statistically different. (X^2 =7.52 p-value = 0.021).

- Basal area

The average basal area of individuals recorded on the entire study site is 10.14 m^2/ha. This area varies according to the different types of biotopes. Indeed, secondary forests have the highest basal area (20.59 m^2/ha). They are followed by fallow

land and rubber plantations with respectively 16.17 and 9.12 m^2/ha, while swamp meadows have the lowest basal area with 2.71 m^2/ha. (X^2 =5.07 p-value = 0. 322.) ***(Table 5).***

Table 5. Density and average basal area of forest trees in the different biotopes

Biotopes	Average density	Average basal area
Rubber plantation	52.35	9.12
Palm plantation	27.42	6.33
Secondary forest	180.28	20.59
Fallow land	160.82	16.17
Bare soil	83.42	5.92
swamp meadow	13.28	2.71
Kruskal-Wallis test	X^2 =7.52 / p = 0.021	X^2=5.07 / p = 0.322

4 DISCUSSION

This study identified 265 species, divided into 174 genera and 63 families. this floristic richness would be due à la diversité de biotopes présents sur le site de la RNPA. En effet, the greatest floristic diversities are linked to the diversity of habitats or environmental heterogeneity [16]. This floristic richness, which contrasts with the urban environment, would be higher if the area was well preserved and was not threatened by the galloping urbanization of the city of Abidjan. Humans, through their activities, often impact the biodiversity of this area. A more effective conservation policy for the partial nature reserve of Aghien is therefore needed. Given the wealth of flora in nature reserves such as Dahliafleur, Mabi yaya and Bossématié, the RNPA would have a large pool of plant species in its current state.This study demonstrated the predominance of the Fabaceae, Euphorbiaceae, and Moraceae families. These results are consistent with the dominance of botanical families in the majority of Ivorian forests [18]. According to [3]; [30] the majority of forests in Côte d'Ivoire are dominated by these families.

The high diversity index values show that this area is diversified. Indeed, the investigations carried out in this reserve for the collection of floristic data show a good distribution of each species at the level of each biotope. The highest diversity indices in the secondary forest biotopes (3.413 ± 0.54; 0.87 ± 0.1) are justified by the absence of human activities within the formation where access remains difficult. In fallow land (3.26 ± 0.51; 0.78 ± 0.07), this diversity is explained by an abundance of undergrowth species. At the level of biological types, the abundance of Microphanerophytes shows the shrubby aspect of the woody stands of the Aghien partial nature reserve.). This demonstrates the conservation and awareness efforts put in place for the protection of biodiversity. Furthermore, the presence of such endemic species demonstrates a preserved environment [2]. This characteristic gives it the first High Conservation Value (HCV 1) which requires a concentration of biological diversity including endemic species and rare, threatened or endangered species important on an international, regional or national scale. These species present on the red list of [29] and [4]; [5], and species with commercial categories shows the need to make this area a Voluntary Nature Reserve. The partial nature reserve of Aghien is dominated by species from the Guinean-Congolese region (GC). This is explained by the fact that the study area belongs to the forest zone dominated by this category of species.

According to [30] a high proportion of species from the Guinean-Congolese region in an environment could be proof of a reconstitution of the vegetation, and reflect a high level of conservation of the site.

The Shannon index which varies from 1.814 to 3.413 in the different biotopes, could be explained by the fact that the environments where the index values are high benefit from ecological conditions and stability relatively favorable to the maintenance of several groups of species than in environments with faible value. The values of the equitability of piélou varying from 0.872 to 0.515 indicate that there is a good distribution of individuals between the species in the different biotopes of the reserve.

The strongest similarity (48.6%) observed between the Secondary forests and the Fallows, could be explained by the fact that the Fallows are forests in the making. These two environments have several species of undergrowth in common compared to the different biotopes encountered in the reserve given the floristic similarity that exists between these two biotopes.

The higher density observed in the swamp forest could be due to the good level of conservation of this environment. Studies show that the lower strata of wetlands have a greater diversity of species thanks to the microtopography (classical analysis) that prevails at ground level and which allows some of them to establish themselves above the water table in certain places [1]; [17].

The highest values of the basal areas observed in the Secondary forest (with 180.28 ± 101.87) could be explained by the density of large woody plants in this biotope, linked to its good conservation.

5 CONCLUSION

Knowledge of the floristic diversity of the Aghien Partial Nature Reserve was at the heart of this work. It showed that the study area presents a diversified ecosystem with good floristic diversity in the peri-urban area, specifically in the department of Bingerville. As a result we have noticed that the reserve has a significant floristic richness. There are 265 species distributed among 174 genera and 63 families.

The most diverse families are Fabaceae, Euphorbiaceae, and Moraceae. In terms of biological types, an abundance of Microphanerophytes is observed in the partial nature reserve of Aghien. The Shannon index (H') varies from 1.81 to 3.41 The Piélou equitability index varies from 0.87 to 0.51

This study made it possible to characterize the plant structure of the stands of this reserve. This shows that the parameters of composition (richness, diversity) and structures (density, basal area) are good. However, better conservation of this reserve will increase the number of species, which will give particular interest to the conservation of the partial nature reserve of Aghien. However, conservation efforts for this site must be a priority to perpetuate such a peri-urban reserve.

ACKNOWLEDGMENTS

At the end of this research, we would like to express our gratitude to all those who contributed, directly or indirectly, to its realization. To this end, we extend our thanks to the staff of the African Center of Excellence on Climate Change, Biodiversity and Sustainable Agriculture (CEA-CCBAD), with the support of its financial partners.

We thank Dr. KOUASSI Konan Edouard (Lecturer) at the African Center of Excellence on Climate Change, Biodiversity and Sustainable Agriculture (CEA-CCBAD) and Dr. YAO N'guessan Olivier (Assistant Professor) of the National Center of Floristics (CNF), all from the University Félix Houphouët-Boigny, who accepted the scientific direction of this thesis, despite their multiple occupations. Their advice, directives, support and rigor at work were sources of comfort and immeasurable motivation, which allowed us to achieve our academic objectives. We cannot thank them enough for their follow-up.

Finally, we would like to thank Dr. KOUGBO Ménéké Distel at the National Center for Agronomic Research, Forest and Environment Program who spared no effort to contribute to the improvement of this document.

REFERENCES

[1] Abrou J.E.N., Kouamé D. & Adou Yao CY. 2019. Diversité floristique des communautés végétales dans l'espace de la Forêt des Marais Tanoé-Ehy (FMTE), Sud-est de la Côte d'Ivoire. *International journal of biological and chemical sciences* 13 (6): 2874-2887. http://ajol.info/index.php/ijbcs.

[2] Adou Yao C.Y., 2005. Pratiques paysanes et dynamiques de la biodiversité dans la forêt classée de Monogaga (Côte d'Ivoire). Thèse Doctorat unique, Département Hommes Natures et Société, Université MNHN, Paris. 233p.

[3] Adou Yao, C., Kpangui, K., Kouao, K., Adou, L., Vroh, B. & N'Guessan, K. (2013). Diversité floristique et valeur de la forêt sacrée Bokasso (Est de la Côte d'Ivoire) pour la conservation. *VertigO, 13* (1).

[4] Aké Assi L. 2001. Flore de la Côte d'Ivoire 1: catalogue systématique, biogéographique et écologique. *Conservatoire et jardin botanique Genève* (Suisse), 396 p.

[5] Aké-Assi L. 2002. Flore de la Côte d'Ivoire 2: catalogue systématique, biogéographie et écologie. Mémoire de Botanique systématique, *Conservatoire et Jardin Botanique de Genève. Boisseria,* 58: 441p.

[6] APG IV. 2016. An update of the Angiosperm Phylogeny Group classification for the orders and families of flowering plants. Botanical Journal of the Lean Society, 181: 1–20.

[7] Blondel J., 1979. - Biologie et Ecologie. Masson & Cie, Paris (France), 173 p.

[8] Cissé A., 2013. Caractérisation phytoécologique et estimation de la biomasse des espèces arborescentes des agroforêts à base de cacao du Département de Lakota (Centre-Ouest, Côte d'Ivoire), DEA de Botanique, UFR Biosciences, Université de Cocody, Abidjan (Côte d'Ivoire), 56 p.

[9] FAO, 2020. Evaluation des ressources forestières mondiales 2020 - Principaux résultats. Rome. https://doi.org/10.4060/ca8753fr.Consulté le 12/06/2022 à 22h54.

[10] Journal Officiel de Côte d'Ivoire, 2002, Loi n° 2002-102 du 11-02-2002 relative à la création, à la gestionet au financement des parcs nationaux et réserves, Abidjan, Côte d'Ivoire, 26 p.
[11] Konan A.E. 2019. Diversité écosystémique et emprunte carbone de la réserve naturelle partielle de Dahhliafleur dans la commune de Bingerville (Sud de la Côte-d'Ivoire. Mémoire de master UFR Biosciences de l'université Félix Houphouët-Boigny de Cocody 50p.
[12] Kouadio, Y. J., Serge, K., Soiret, P., Kpan, W. B., Yao, N. G. O., Guessan, K. E. N., Philippe, K. & José, P. (2018). Valeur de conservation de la Réserve Naturelle Volontaire (RNV) de la Dodo, Sud- Ouest de la Côte d ' Ivoire (Afrique de l'Ouest), *12*: 2784–2796.
[13] Kouassi, K. E. 2007. Flore de la Forêt Classée de la Haute Dodo, dans le Sud-Ouest de la Côte d'Ivoire. Etude de quelques espèces commercialisées: cas de *Garcinia afzelii* (Clusiaceae), des rotins (palmiers lianes) des genres *Calamus, Eremospatha,* et *Laccosperma* (Arecaceae). Mém. Thèse unique. UFR Biosciences, Université de Cocody, Abidjan, 214 P.
[14] Le Quéré C., Andrew R. M., Canadell J. G., Sitch S., Ivar Korsbakken J., Peters G. P. & Zaehle S. 2016. Global Carbon Budget. Earth System Science Data, 8 (2): 605-649. (available http://doi.org/10.5194/essd-8-605-2016).
[15] Magurran A.E. 2004.-Measursuring biological diversity. Blackwelll Publ. Company United Kingdom, New Jersey, US, 248 p.
[16] Mbayngone, E. et A. Thiombiano (2011). «Dégradation des aires protégées par l'exploitation des ressources végétales: cas de la réserve partielle de faune de Pama, Burkina Faso (Afrique de l'Ouest)», *Fruits,* 66 (3): 187-202.
[17] Missa K, Ouattara D, Koné M. & Bakayoko A. 2015. Etude floristique et diversité de la forêt des Marais Tanoé-Ehy (Sud-Est de la Côte d'Ivoire). *Journal of Animal & Plant Sciences,* 25 (3): 3917-3938. http://www.m.elewa.org/JAPS.
[18] N'Da DH, Adou Yao CY, N'Guessan KE, Koné M. & Sangne YC. 2008. Analyse de la diversité floristique du Parc National de la Marahoué, Centre-ouest de la Côte d'Ivoire. *Afrique sciences* 4 (3): 552-579.
[19] N'Guessan A E. 2018. Dynamique de la végétation et facteurs de reconstitution de la biomasse dans les forêts secondaires: cas de la forêt classée d'Agbo 1 (Sud-Est de la cote d'ivoire). Thèse de doctorat de l'Université Félix Houphouët-Boigny (Cote d'ivoire) 221p.
[20] N'Guessan K.E., Kassi N'J., Yao NO., Amani HKM., Gouli GZR., Piponiot C., Irie Bi CZ. & Hérault B. 2019. Drivers of biomass recovery in a secondary forested landscape of West Africa.
[21] Odoukple S.G.K., Kra K.H., Gueye M.F., Zerhon M.W., Yaokokore-Beibro K.H. Données préliminaires sur l'avifaune de la Réserve Naturelle Partielle d'Aghien (Sud-Est Côte d'Ivoire). Bulletin de la Société Zoologique de France 2022, volume 147 (2), pages 61 à 68*ISSN: 0037-962X.*
[22] OIPR 2025. Réserve partielle naturelle d'Aghien. *En ligne.* Consulté le 18 Avril 2025. Disponible sur: https://oipr.ci/index.php/parcs-reserves/reserves-naturelles/reserve-naturelle-partielle-aghien.
[23] Piélou E. C. 1966.The measurement of diversity in different types of biological collections. *Journal of Theoretical Biology, 13: 131-144.*
[24] Poorter L., Bongers F., Kouamé F. N. & Hawthorne W. D. 2004. Biodiversity of West African Forests: An Ecological Atlas of Woody Plant Species. *Centre for Agriculture and Bioscience International Publishing,* Nederland, Pays-Bas, 521 p.
[25] Rollet B., 1979. La régénération naturelle en forêts dense humide sempervirente de la plaine en Guyane Vénézuélienne. *Bois et Forêts des Tropique,* 124: 19-38.
[26] Shannon C. E. 1948. A mathematical theory of communication. *Bell System Technical Journal* 27: 379-423.
[27] Sørensen, T. 1948. A method of establishing groups of equal amplitude in plant sociology based on similarity of species content, and its application to analysis of the vegetation on Danish commons. In GOUNOT, P. M. [ed.], Méthode d'étude quantitative de la végétation. Masson et Cie, Paris, pp. 1-34.
[28] UICN, 2022 La liste rouge mondiale des espèces menacées https://portails.uicn.org/librairie/ documents/pag-014-fr.pdf
[29] Vroh B. T. A. 2013. Évaluation de la dynamique de la végétation dans les zones agricoles d'Azaguié (Sud-Est, Côte d'Ivoire). Thèse de l'Université Félix Houphouët-Boigny, Spécialité Foresterie et Biodiversité Végétale, 259p.