

Variation within the Bird Community of a Rehabilitated Urban Environment, Case of the Félix Houphouët-Boigny University Campus (Côte d'Ivoire)

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ABSTRACT--- *In order to understand the ecological impact of the rehabilitation of the Félix Houphouët-Boigny University Campus on the bird community, a study was carried out over two months (October-November 2016). The ornithological inventory carried out by the IPA method in five different habitats identified on the campus gave a total species richness of 51 bird species of 41 genera, 27 families and 13 orders for 1374 birds, with $H' = 2.93$ and $J = 0.74$. Five species dominate the population (819 individuals, Fr = 59, 61%). These are *Bubulcus ibis* (9.32 %), *Apus affinis* (8.95 %), *Corvus albus* (19.94 %), *Ploceus cucullatus* (10.48 %), *Lonchura cucullata* (10.92 %). The most diversified habitat is the Habitations (26 bird species), while the most abundant is the Brush (416 individuals). Only seven species are common to all sampled habitats. Thus, 12 species observed on campus formerly could not be observed during the present study. Similarly, 18 species observed in this study were not observed in the previous study. The profound transformation of the environment following the rehabilitation has led to a slight increase in diversity but a significant drop in numbers. It is therefore important to better understand the different interactions between the components of the habitat and the various species involved. Such data would be crucial in urban planning policies.*

Keywords--- Urban ecology, Avifauna, Biodiversity, University campus, Côte d'Ivoire

1. INTRODUCTION

The city of Abidjan, the economic capital of Côte d'Ivoire, is a rapidly growing agglomeration with the expansion from 10 to 13 communes. This poses the thorny problem of the place of nature in the city. Indeed, biological diversity is still considered, at least in popular discourse, as an issue reserved for natural environments far from urban areas [10]. City and nature are therefore generally seen as incompatible, with the city embodying the remoteness of nature [14]. Fortunately, the issue of urban biodiversity conservation has now become an object of scientific research and an important issue in urban policies [3]. This interest would be justified by the fact that urban environments are a complex and dynamic mosaic of biotopes [18]. They provide multiple habitats for many species of animals and plants and host a substantial portion of global biological diversity [19]. Thus, the main question at the heart of these studies is to understand and even predict the impact of the densification of the city on its biodiversity, and to indicate to urban decision-makers the key elements to preserve or reconstitute in order to preserve elements of nature in the city, in order to avoid transforming urban environments into gigantic mineral blocks, breaking any ecological connection and forcing the city to evolve in an empty universe of life [12].

To measure the quality of habitat in urban areas, it's important to select zoological groups that are easy to follow and that at all times capture the state of the habitat under consideration. One of the zoological groups able to provide fairly satisfactory answers is birds, which are considered to be very good indicators of ecological change [22].

This study was carried out in an urbanized environment represented by the Félix Houphouët Boigny University Campus, the first public university in Côte d'Ivoire which has the advantage of presenting the physiognomy of a city in miniature. Thanks to the post-electoral crisis in Côte d'Ivoire, this university has undergone a profound rehabilitation that has contributed to changing its global landscape.

Thus, the objective of this study is to understand the impact of the rehabilitation of this campus on the diversity of birds by assessing the links between bird communities and elements of the landscape.

2. MATERIALS AND METHODS

2.1. Description of the study area

The Félix Houphouët Boigny University, located in the commune of Cocody in the east of the city of Abidjan. The Campus of Félix Houphouët Boigny University, formerly known as University of Cocody, covers an area of 205 hectares [16]. Located between 5° 19'N and 4° 01'W, it's bounded to the north by the road to Bingerville, to the south by the road leading to the Riviéra Golf, to the east by the road leading to the third bridge (Henri Konan Bédié Bridge) and to the west by the Cocody Hospital and University Center (CHU) (Figure 1). It has a hot and humid equatorial climate with four seasons: a long rainy season (April-July); a short rainy season (October-November); a short dry season (August-September) and a long dry season (December-March) [7].

The university campus's vegetation is represented by large, well-maintained lawns bordered by ornamental plants. The peripheral parts of the campus, less frequented and poorly maintained, sometimes turn into real brush composed of tall grass such as *Panicum maximum* Jacq. (Poaceae). Between the buildings, there are a few large trees and non-woody plants such as *Coco nucifera* Jacq. (Arecaceae) and palm trees *Elaeis guineensis* L. (Arecaceae). The site contains three heavily forested areas. These are the National Center for Floristics (CNF), the garden of the restaurant complex "les Palmiers" and the closed park of the UFR Biosciences. This vegetation is fairly recent and dates from the rehabilitation, as [25] report that in 2008, 14 hectares of the campus were occupied by mosaics of fallows and food crops that no longer exist today.



Figure 1: AERIAL view of the Félix Houphouët-Boigny University campus with location of the different habitats.

2.2. Methods

2.2.1. Description of the different habitats sampled

Across the campus, five habitats were chosen and were the subject of an ornithological inventory. These are the habitats of Lowland, Scrub, Palm Trees, Dwellings and the National Floristic Center.

The Lowland habitat (5°20'38.8"N and 3°59'29.6"W) is crossed by a drainage channel, with vegetation mainly consisting of creeping plants regularly mowed and forming a lawn and dense herbaceous vegetation along the canal, made up of reeds (*g. Phragmites*), other grasses and bananas (*g. Musa*) which give this habitat the appearance of a wetland. (Figure 2a).

The CNF (5°20'50.4"N and 3°59'02.4"W), with an area of 10 ha is a fully planted forest environment which includes a botanical garden (arboretum) and a fallow looking like a young secondary forest (Figure 2b). The vegetation of the arboretum consists of forest species *Triplochiton scleroxylon* (Triplachitonaceae), *Sterculia tragacanta* (Sterculiaceae), *Entondrophragma cylindrium* (Meliaceae) and savanna species *Vitellaria paradoxa* (Sapotaceae) and *Adansonia digitalia* (Bombacaceae).

Habitations habitat (5°20'32.3'N and 3°59'16.2'W) is represented by buildings (offices, amphitheatres, university residences, restaurants), asphalt roads, street lighting and sports fields. Its vegetation consists largely of cover plants *Chysopogon aciculatus* (poaceae) forming regularly mowed lawns, bordered by ornamental plants of various species, as well as coconut and woody plants, most of which are ornamental trees (Figure 2c).

Palm Tree habitat (5°20'15.3"N and 3°59'24.9"W), a place to relax and stroll, is made up of a restaurant complex associated with a garden. Restaurants take up less than a quarter of the space. One-fifth of the garden is planted with *Elaeis guineensis* L. oil palms (Arecaceae) and the rest for the most part Eucalyptus. The ground is covered with lawn (Figure 2d).

Brush habitat (5°20'36.7"N and 3°59'01.0"W) consists mainly of tall grasses with open spikes such as *Panicum maximum*. A few banana trees (*g. Musa*) can be seen here and there. At its periphery, a garbage bin is regularly supplied with organic waste (Figure 2e).

These five habitats, determined by the physiognomy of their landscapes, represent all possible habitat types visible on campus.



(a) View of Lowland habitat

(b) View of CNF habitat

(c) View of Habitations habitat



(d) View of Palm tree habitat



(e) View of Brush habitat

Figure 2: DIFFERENT habitat types sampled on the university campus

2.2.2. Data collection

The Point Abundance Index (API) method [4] was used in this study. On each habitat, a listening point was identified. These points are sufficiently distant from each other (at least 300 m). From each point, all the birds observed or heard within a radius of 150 meters were inventoried, ie a covered area of 70,686 m² (7 ha) per habitat and 353,429 m² for all the sites (35 ha).

Ornithological surveys were conducted for two months, from October to November 2016, during which each habitat was sampled once a week from 6:00 a.m. to 6:20 p.m. During one day of inventory carried out per habitat, seven observation sessions of 20 min each are carried out. Two consecutive sessions are separated by a time interval of 1:40, for a total of 140 min per habitat per week and an overall sampling effort of 5,600 min of data collection across the campus.

Each survey mentions both the species specific richness and relative abundance. These were recorded by sight and listening and identified with the help of the West African Birds guide [6] and the CD-Rom of the cries and songs of the Birds of 'Africa [8], for those heard.

Lists of bird species are given in the phylogenetic order used by [5]. The nomenclature used is the 2019 catalogue of life.

2.2.3. Data processing

The specific richness of the site is obtained by the formula $S = \Sigma$ Species. The relative frequency of each species in the community is determined by $Fr = ni / N \times 100$. It was used to determine the abundance index. According to [21] a species is said to be dominant (D) if $Fr \geq 5\%$; it is regular (Re) if $1\% \leq Fr < 5\%$; it is said to be rare (Ra) if $0.2\% \leq Fr < 1\%$; it is accidental (Ac) if $Fr < 0.2\%$. The Shannon-Wiener [20] and Equitabilié [1] diversity indices are expressed as $H' = -\Sigma(ni/N) \times \ln(ni/N)$ and $J = H' / \ln S$, respectively. The different populations of the sampled habitats were compared with each other by the similarity index [2] expressed as follows: $Si = (2 \times C / A + B) \times 100$. In terms of preferred bird habitat, we thus determine the species of wetlands (E), species of open areas (f), species of secondary forest (F) [22], anthropophilic species (V) [9]. The international threat status of each species was determined according to IUCN (2018). To process all the data collected, three types of multivariate analyzes were used. These are principal component analysis, hierarchical ascending classification analysis (ACA), analysis of variance (ANOVA) and the General Linear Model.

3. RESULTS AND DISCUSSION

3.1. University campus global avifauna

A total of 51 species of birds of 41 genera, 27 families and 13 orders were recorded, or 1,374 birds, with $H' = 2.93$ and $J = 0.74$. The Passeriformes, with 26 species from 14 families are more numerous, against 25 species in 13 families for the 12 non-Passeriform orders. In terms of abundance, the Passeriformes are more numerous, with 813 individuals, followed by the Apodiformes (213 individuals) and the Pelecaniformes (129 individuals) (Table I).

Table I: List of species and some characteristics of birds observed on the Félix Houphouët-Boigny university campus in October and November 2016.

Orders / Families / Species	PH	IUCN	Hab	Pal	Bas	Bro	CNF	Code
PELECANIFORMS								
Ardeidae								
<i>Bubulcus ibis</i> (Linnaeus, 1758)	E/f	LC	51	11	48	17	1	Bubib
<i>Butorides striata</i> (Linnaeus, 1758)	E	LC	-	-	1	-	-	Butst
ACCIPITRIFORMS								
Accipitridae								
<i>Milvus migrans</i> (Boddaert , 1783)	f.	LC	16	7	4	12	10	Milmi
<i>Accipiter tachiro</i> (Daudin , 1800)	F	LC	-	-	-	-	1	Accta
<i>Accipiter badius</i> (JF Gmelin , 1788)	F	LC	1	2	2	1	3	Accba
FALCONIFORMS								
Falconidae								
<i>Falco ardosiaceus</i> Vieillot, 1823	f.	LC	2	-	-	1	-	Falar
GRUIFORMS								
Rallidae								
<i>Amaurornis flavirostra</i> (Swainson , 1837)	E	LC	-	-	6	-	-	Amafl
<i>Gallinula chloropus</i> (Linnaeus, 1758)	E	LC	-	-	11	-	-	Galch
COLUMBIFORMS								
Columbidae								
<i>Streptopelia senegalensis</i> (Linnaeus, 1766)	f.	LC	5	-	2	10	-	Strse
<i>Streptopelia semitorquata</i> (Ruppell , 1837)	f.	LC	5	13	5	7	4	Strsm
PSITTACIFORMS								
Psittacidae								
<i>Psittacus erithacus</i> Linnaeus, 1758	F	Seen	-	2	-	-	2	Psier
<i>Psittacus timneh</i>	F	Seen	-	5	-	-	2	Psiti
<i>Poicephalus senegalus</i> (Linnaeus, 1766)	f.	LC	8	7	-	-	4	Poise
<i>Psittacula krameri</i> (Scopoli , 1769)	f.	LC	4	10	-	-	2	Psikr

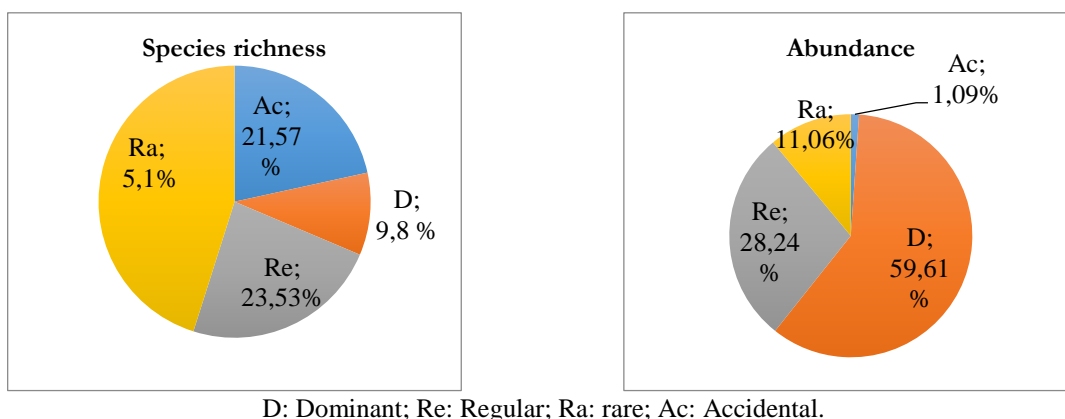
Orders / Families / Species	PH	IUCN	Hab	Pal	Bas	Bro	CNF	Code
MUSOPHAGIFORMS								
Musophagidae								
<i>Crinifer piscator</i> (Boddaert , 1783)	f.	LC	-	5	-	-	5	Cripi
CUCULIFORMS								
Cuculidae								
<i>Chrysococcyx caprius</i> (Boddaert , 1783)	f.	LC	1	-	-	-	-	Chrca
<i>Centropus senegalensis</i> (Linnaeus, 1766)	f.	LC	-	-	4	3	-	Cense
STRIGIFORMS								
Tytonidae								
<i>Tyto alba</i> (Scopoli , 1769)	f./V	LC	1	-	-	-	-	Tytal
APODIFORMS								
Apodidae								
<i>Telacanthura ussheri</i> (Sharpe, 1870)	F	LC	10	-	-	-	-	Telus
<i>Cypsiurus parvus</i> (Lichtenstein, 1823)	f.	LC	11	3	19	6	20	Cyppa
<i>Apus apus</i> (Linnaeus, 1758)	f.	LC	5	-	7	9	-	Apuaf
<i>Apus affinis</i> (JE Gray, 1830)	f.	LC	31	2	68	-	22	Apuap
CORACIIFORMS								
Alcedinidae								
<i>Halcyon senegalensis</i> (Linnaeus, 1766)	f.	LC	3	6	-	1	-	Halse
Meropidae								
<i>Merops pusillus</i> Statius Muller, 1776	f.	LC	-	-	5	-	-	Merpu
BUCEROTIFORMS								
Bucerotidae								
<i>Lophoceros fasciatus</i> (Shaw, 1811)	F	LC	2	3	-	-	4	Tocfa
PASSERIFORMS								
Hirundinidae								
<i>Hirundo aethiopica</i> Blanford , 1869	f.	LC	3	-	-	2	-	Hirae
<i>Hirundo abyssinica</i> Guerin-Meneville , 1843	f.	LC	5	-	2	-	-	Hirab
Motacillidae								
<i>Macronyx croceus</i> (Vieillot, 1816)	f.	LC	-	-	6	3	-	Maccr
<i>Anthus leucophrys</i> Vieillot, 1818	f.	LC	-	-	-	2	-	Antle
Pycnonotidae								
<i>Pycnonotus barbatus</i> (Desfontaines, 1789)	f.	LC	14	6	6	8	13	Pycba
<i>Eurillas virens</i> (Cassin, 1858)	F	LC	-	-	-	-	1	Andvi
Turdidae								
<i>Turdus pelios</i> Bonaparte, 1850	f.	LC	-	-	-	-	1	Turpe
Cisticolidae								
<i>Cisticola erythrops</i> (Hartlaub , 1857)	f.	LC	-	-	1	3	-	Ciser
<i>Cisticola galactotes</i> (Temminck , 1821)	f.	LC	-	-	21	15	-	Cisga
<i>Prinia subflava</i> (Gmelin, 1789)	f.	LC	-	-	2	2	-	Caught
<i>Camaroptera brachyura</i> (Vieillot, 1821)	f.	LC	-	-	-	-	2	Cambr
Cettiidae								
<i>Hylia prasina</i> (Cassin, 1855)	F	LC	-	-	-	-	1	Hylpr
Nectariniidae								
<i>Cyanomitra olivacea</i> (Smith, 1840)	F	LC	-	-	-	-	4	Cyaol
<i>Cinnyris chloropygius</i> Jardine, 1842	F	LC	-	-	-	-	4	Cincl
<i>Cinnyris cupreus</i> (Shaw, 1812)	f.	LC	6	1	2	-	-	Cincu
<i>Cinnyris coccinigastrus</i> (Latham, 1802)	f.	LC	2	2	-	-	1	Cinco
Laniidae								
<i>Lanius collaris</i> Linnaeus, 1766	f.	LC	-	-	5	-	-	Lanco
Corvidae								
<i>Corvus albus</i> Statius Muller, 1776	f.	LC	51	163	5	50	5	Coral
Sturnidae								
<i>Lamprolornis splendidus</i> (Vieillot, 1822)	F	LC	3	7	-	3	13	Lamsp
Passeridae								
<i>Passer griseus</i> (Vieillot, 1817)	f./V	LC	40	3	-	-	-	Pasgr
Ploceidae								
<i>Ploceus cucullatus</i> (Muller, 1776)	f.	LC	12	-	7	125	-	Plocu
<i>Quelea erythrops</i> (Hartlaub , 1848)	f.	LC	-	-	-	2	-	Queer

Orders / Families / Species	PH	IUCN	Hab	Pal	Bas	Bro	CNF	Code
Estrildidae								
<i>Estrilda melpoda</i> (Vieillot, 1817)	f.	LC	-	-	5	16	-	Estme
<i>Lonchura cucullata</i> (Swainson , 1837)	f.	LC	5	-	34	111	-	Specu
<i>Lonchura bicolor</i> (Fraser, 1843)	F/f	LC	-	-	-	5	-	Spebi
Viduidae								
<i>Vidua macroura</i> (Pallas, 1764)	f.	LC	-	-	-	2	-	Vidma

Biogéo: Biogeographic origin; PH: Preferred habitat; IUCN: IUCN Status; R: Resident; M: Intra-African migrant; P: Palearctic migrant; E: Wetlands; F: Forest; f: Open areas; V: Anthropophilic species; A04: Sudano-Guinean biome; A05: Guinean-Congolese biome; LC: Least concern; VU: Vulnerable; Hab: Dwellings; Pal: Palm trees; Bas: Lowland; Bro: Brushwood; Code: Codes for the realization of CFA.

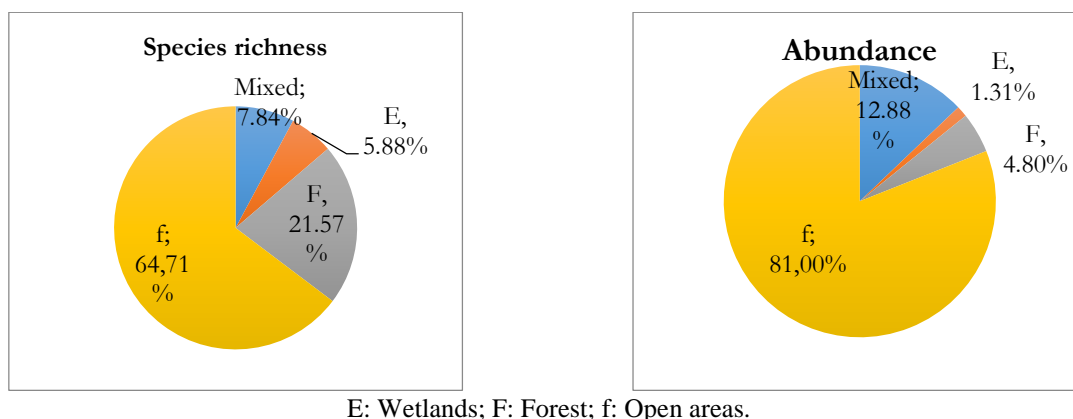
3.2. Characterization of the bird population according to the abundance index

The avifauna comprises five dominant species (819 individuals; Fr = 59, 61%); 12 regular species (388 individuals; Fr = 28.24%); 23 rare species (152 individuals; Fr = 11.06%) and finally 11 accidental species (15 individuals; Fr = 1.09%) (Figure 3). In terms of preferred habitats, the population includes 34 species (Fr = 81%) of open environments, ten species (Fr = 4.80%) typical of forests, three species (Fr = 1.31%) of wetlands, two species *Passer griseus* and *Tyto alba*, of open and anthropophilic environments (Fr = 3, 20%), one species *Spermestes bicolor* (Fr = 0.36%) is found in both forests and open areas, and one species *Bubulcus ibis* is found in both wetlands and open areas (Fr = 9.32%) (Figure 4). Based on IUCN status, 49 of the 51 species observed are of Least Concern (LC). However, two species *Psittacus erithacus* and *Psittacus timneh* are vulnerable (V).



D: Dominant; Re: Regular; Ra: rare; Ac: Accidental.

Figure 3: Comparison of abundance indices according to species richness and relative abundance



E: Wetlands; F: Forest; f: Open areas.

Figure 4: COMPOSITION of the bird population according to preferred habitats

3.3. Avifauna of the different habitats

The Habitations are home to 26 species of birds, with an API of 297 individuals in 18 families of nine orders, a Shannon index of 2.65 and an equitability of 0.8. *Bubulcus ibis* and *Corvus albus*, with 51 individuals each, are the most abundant. In the Lowlands, 25 species and 278 birds in eight orders and 16 families were observed, with a Shannon index of 2.55 and an equitability of 0.79. The most abundant species is *Apus affinis*, with 68 individuals. At the level of the Palms, 19 species and 258 birds in eight orders and 13 families were counted, with a Shannon index of 1.65 and an equitability of 0.56. *Corvus albus* is the most important species, with 163 individuals. In the Brushwood, 25 species and 416 birds were

positively correlated respectively by the first axis (49.93%) and the second axis (25.94%), represented by CNF, Pal and Hab, is associated with the species *Psittacula krameri*, *Accipiter badius*, *Poicephalus senegalus*, *Passer griseus*, *Lamprotornis splendidus*, *Streptopelia semitorquata*, *Apus apus*, *Cypsiurus parvus* and *Corvus albus*. The second set, made up of the Low and Bro mediums, is positively correlated to axis 1 (49.93%) and negatively to the second axis (25.94%), contains the *Streptopelia senegalensis*, *Apus affinis*, *Estrilda melpoda*, *Cisticola galactotes*, *Ploceus cucullatus*, *Lonchura cucullata* and *Bubulcus ibis*. The General Linear Model confirms this observation by noting that the habitat significantly influences the distribution of bird species (dof = 4; W = 9.68; p < 0.05).

3.5. Similarity between different habitats

Of all the combinations made, the greatest number of common species (17 species) is recorded between Lowland and Scrub habitats. The smallest number of common species (eight species) is observed between CNF and Lowland habitats and between CNF and Brushwood. Based on the number of species common to the two habitats, the similarity index is highest for the CNF and Palm tree habitat pair (Si = 76.19%) and low for the Lowland and CNF habitat pair and the Scrub and CNF habitats where it is 33.33%. In addition to the similarity index, analyses with hierarchical ascending classification, on the basis of the matrices “Presence/absence of species by habitat” on the one hand and “number of individuals/species/habitat” on the other hand give dendrograms which show different associations according to the matrices considered. The dendrogram from the "number of individuals/species/habitat" matrix indicates that all habitats can be grouped into two well hierarchical groups A and B. The first group is made up of the CNF and Palm tree habitats, to which are added the Dwellings. The second group is made up of the Bas-fond and Broussailles habitats (Figure 6). The second dendrogram produced with the matrix ‘Presence / absence of species by habitat’ reveals three hierarchical groups A; B and C. The first group (A) is formed by the CNF, Bas-fond and Habitations habitats. The other two groups (B) and (C) are formed one by the Palm tree habitat and the other by the Brushwood habitat (Figure 7).

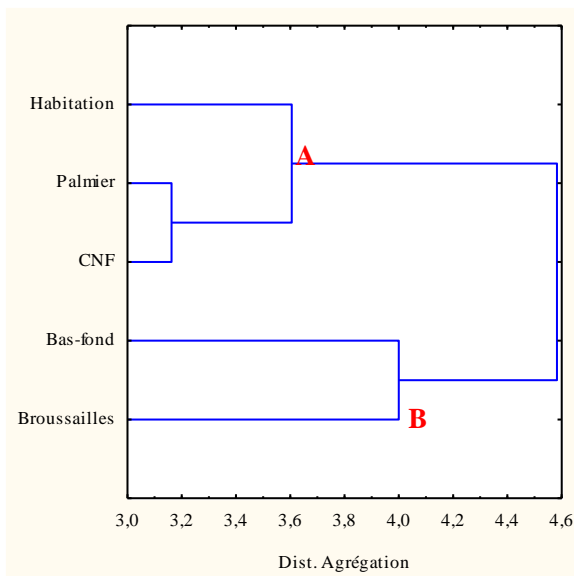


Figure 6: DENDROGRAM showing the grouping of habitats based on the abundance of species in common

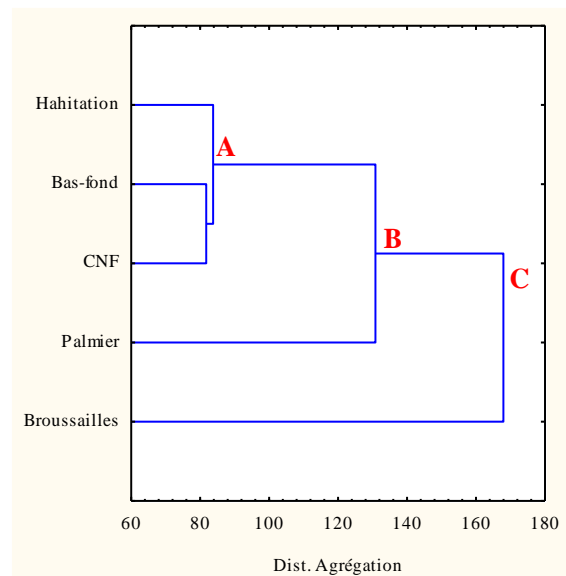


Figure 7: DENDROGRAM showing the grouping of habitats on the basis of their common specific richness

3.6. Discussion

This study made it possible to inventory, on the Félix Houphouët Boigny university campus, 51 species and 1374 birds. This is a very important diversity, given the short time frame (two months) of sampling and the highly urbanized physiognomy of the environment. Prior to the University’s rehabilitation, a first three-month study conducted on campus in 2007 recorded the presence of 42 bird species with a cumulative population of 8,797 birds [25]. As a result of the rehabilitation, the specific richness of the environment increased while the abundance of birds decreased considerably. The rehabilitation of the campus has brought about considerable changes in its landscape. These are the remarkable expansion of the areas covered by lawns, the disappearance of fallow land and fields, the sharp reduction in trees, and the filling in of temporary ponds. This has resulted in a good individualization of the habitats which are now well isolated from each other, with a predominance of buildings and cover plants. These modifications would be at the origin of the reduction in the number of individuals, since the most gregarious species which are families of Estrildidae and Ploceidae would have been

attracted by the cereal fields present formerly on the campus which no longer exist, as well as by an important cover of grass plants very reduced today. Rehabilitation has not profoundly affected the specific richness. Indeed, some species have been replaced by others. 12 species identified by Yaokokr -B ibro & al. (2016) as *Treron calvus*, *Turtur afer*, *Poicephalus robustus*, *Alcedo cristata*, *Hirundo rustica*, *Chlorocichla simplex*, *Cossypha niveicapilla*, *Ploceus aurantius*, *Ploceus velatus*, *Ploceus ocularis*, *Ploceus nigerrimus* and *Nigrita bicolor* could not be observed in this study. Similarly, 18 species observed in this study were not observed in the previous study. These are *Butorides striata*, *Accipiter tachiro*, *Amaurornis flavirostris*, *Falco ardosiaceus*, *Gallinula chloropus*, *Psittacus timneh*, *Tyto alba*, *Telacanthura ussheri*, *Macronyx croceus*, *Anthus leucophrys*, *Andropadus virens*, *Camaroptera brachyura*, *Cisticola galactotes*, *Cisticola erytrops*, *Cyanomitra olivacea*, *Hylia prasina*, *Turdus pelios* and *Quelea erytrops*. This would be linked, on the one hand, to the destruction of certain suitable habitats and micro habitats such as groves, growing environments and temporary pools and, on the other hand, to the choice of habitats. In fact, in addition to the three habitats chosen during the first study (Dwellings, Brushwood and CNF), two other habitats (Lowland and Palm tree) which significantly contributed to enhancing the avifauna diversity of the campus were surveyed. The most abundant species on campus was *Corvus albus*. Indeed, Corvidae are birds with very diverse habitat preferences, but which have adapted to the exploitation of anthropogenic food sources [11]. The number of species observed remains comparable to those obtained by [23], in the commune of Cocody (Angr -Djibi) and by [26] at the bay of Cocody, i.e. 73 and 68 species respectively. The slightly higher number of species in these environments could be explained by longer inventories, notably 12 and 09 months, respectively. These studies show that the very high level of urbanization and the small size of the areas surveyed are the cause of low diversity.

For larger areas such as entire cities and for longer monitoring periods, campus diversity is much lower. Thus, in the cities of Yamoussoukro, Grand-Bassam and Cotonou, respectively 188 species in 24 months [15], 165 species in 12 months [24] and 115 species in 72 months [17] were identified. Considering the avifauna of each of the habitats defined in this study, some differences in quality and quantity appear. However, these do not seem to be significant. The species would use the different habitats offered by the environment for their different activities. However, contrary to [17] who reported that in Cotonou, heavily built-up areas are poor in birds, on campus, the most diverse habitat is the one with the most buildings. Indeed, several bird species prefer more densely built and sparsely vegetated areas that offer an abundance of food and are areas inaccessible to predators [3]. In addition, this could be explained by the small areas of the CNF (considered forest) and Palm tree (densely wooded garden) habitats and the lack of corridors that would allow exchanges with other urban forest sites, such as the Banco National Park. However, on the campus, each of the habitats appears to be a specific environment for a small group of bird species. Thus, 19 of the 51 species inventoried were only found in one or other of the five habitats. This shows that the conservation of birds in the city requires a combination of several habitats. According to [17], this must be achieved by safeguarding and developing wetlands and increasing the number of wooded areas. Similarly, [12] has noted the fundamental role of biodiversity reservoirs in low-density districts with trees in the city of Lyon in France.

4. CONCLUSION AND RECOMMENDATION

The changes that urban ecosystems regularly undergo can profoundly affect their biodiversity. The present study therefore provides a better understanding of the different variations that have occurred in the bird community of the F lix Houphou -Boigny University Campus following its rehabilitation from 2011 to 2012. Overall, with a slightly higher species richness compared to the first pre-rehabilitation inventories, it is above all the structure of the bird community that has been profoundly modified. The choice of 05 habitats with different physiognomies made it possible to understand that tree vegetation is of vital importance for maintaining bird diversity. However, the results showed that the different environments are complementary. For a better policy of sustainable management of birdlife in the city, in addition to the influence of habitats, it is essential to understand the relationships that the various species present have with the different elements of the urban landscape.

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