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Floristic, ecological and phytogeographical study of the forest islet of the Father Eyimard Eucharistic center in Mont-ngafula / Kinshasa

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Abstract : A floristic, ecological and phytogeographic study of the forest block of the Father Eymard Eucharistic Center in Kinshasa Mont-Ngafula was carried out in the context of urban afforestation. Harvests, field observations followed by scientific identifications and phytogeographic analysis revealed the presence of 63 species divided into 59 genera and 34 families among which the families of Fabaceae, Rubiaceae, and Euphorbiaceae predominate. The phytogeographic analysis of these results indicates the numerical dominance of the guineo-congolese elements, of which cordia gilletii (boraginaceae) is harvested in Kinshasa for the first time. Ecological spectra analysis indicates the abundance of phanerophytes, sarcochores, and mesophylls. The studied forest block presents agronomic, economic, scientific and environmental interests for the city of Kinshasa. From a dynamic point of view, this island presents two evolutionary series; progressive and regressive. The plant species are erected on sandy soil. These various resources are exploited by the occupants of the parish and visitors for the collection of forest products and this site plays an important role in maintaining the ecological balance in urban areas. The conservation and sustainable use of this islet is one of the important recommendations we formulate.

Résumé: Une étude floristique, écologique et phytogéographique de l'îlot forestier du Centre Eucharistique Père Eymard à Kinshasa Mont-Ngafula a été réalisée dans le contexte de boisement urbain. Les récoltes, les observations de terrain suivies des identifications scientifiques et analyse phytogéographique ont révélé la présence de 63 espèces réparties en 59 genres et 34 familles parmi lesquelles les familles de Fabaceae, Rubiaceae, et Euphorbiaceae prédominent. L'analyse phytogéographique de ces résultats indique la dominance numérique des éléments guinéo-congolais, dont Cordia gilletii (Boraginaceae) est récoltée à Kinshasa pour la première fois. L'analyse des spectres écologiques indique l'abondance des espèces phanérophytes, sarcochores, et des mésophylles. L'îlot forestier étudié présente à la fois des intérêts agronomiques, économiques, scientifiques, et environnementaux pour la ville de Kinshasa. Au point de vue dynamique cet îlot présente deux séries évolutives ; progressives et régressives. Les espèces végétales sont érigées sur un sol sablonneux. Ces diverses ressources sont exploitées par les occupants de la paroisse et les visiteurs, pour la cueillette des produits forestiers et ce site joue un rôle important dans le maintien de l'équilibre écologique en milieu urbain. La conservation et l'utilisation durable de cet îlot est l'une des recommandations importantes dont nous formulons.

I. Introduction

Problems

The world is currently facing several environmental problems including problems related to pollution, greenhouse gas emissions, the disappearance of species, degradation or fragmentation of habitats, the destruction of the ozone layer, etc.

These problems are at the root of many ecological disturbances such as climate change and desertification that affect life on the planet. To deal with all these problems, one of the effective strategies is the protection of forest cover.The forest plays an important role in carbon sequestration during photosynthesis. This phenomenon allows the reduction of carbon dioxide (one of the greenhouse gases) in the atmosphere.

Despite this importance of the forest and its ecological role, it is a victim of human activities that lead to their complete degradation. In Kinshasa, the activities of the systematic search for firewood, agriculture, anarchic constructions lead to the pollution of the atmosphere, the destruction of the forest with negative impact on the urban ecology and on the socio-economic level. These adverse effects can be: the accumulation of

greenhouse gases in the atmosphere responsible for acid rain thus polluting the soil and causing the erosion of biodiversity (Miti, T. & Aloni, K. 2005).

In addition, the firewood trade and embers have become worrying in Kinshasa, some butchers are working to cut the trees along the main roads of the city to turn into ember.

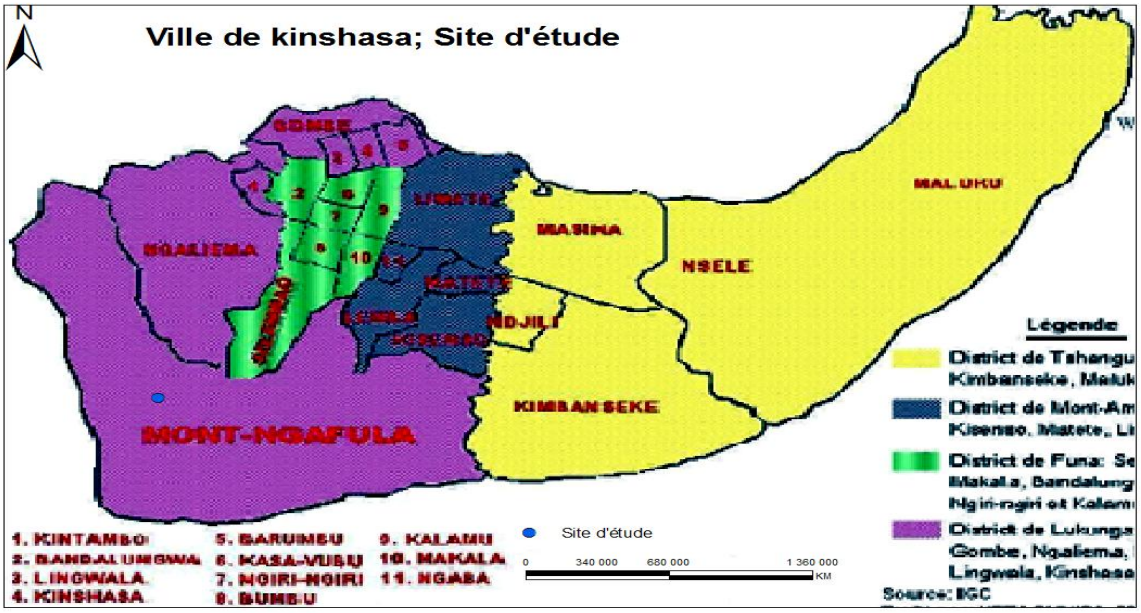
In addition, there are agricultural activities on the slopes around the city. Despite this destruction of the vegetation of the city of Kinshasa, it incorporates by its extensive forest islets among others, the forest islet of Notre Dame d'Assomption, Plateau Professors, Mount Ngaliema, MARENSA Center Eucharistic Father Eymard, etc.These forests are also subject to control of human pressures that can contribute to their complete degradation. As part of the scientific research, the UNIKIN Department of the Environment has initiated several works of memory devoted to these forests. Several studies of the flora of these forests are conducted in most cases.

II. Study Environment

Geographical framework of the site

Location

The concession of the Father Eymard Eucharistic Center is located in the south-west of Mont Ngafula town, Lukunga District in the City of Kinshasa (map n ° 1). Its geographical boundaries are between 04 ° 27 '36.3' 'and 04 ° 27' 44.0 " South Latitude and between 015 ° 14 '31.2' 'and 015 ° 14' 39.3 " longitude Is. It covers an area of 7.29 hectares, of which 4.31 are occupied by the forest islet. Map 1 locates the study area in the city of Kinshasa.



Map1. Location of the concession of the Father Eymard Eucharistic Center in Kinshasa

Climatic factors

Located in the city of Kinshasa, the concession of the Eucharistic Center Father Eymard enjoys the climate of this city. According to Crabbe (1980), in Kinshasa there is the climate of the AW 4 type according to Ko ppen's classification. It is a tropical (A) wet (W) climate with 4 dry months (4) from mid-May to mid-September. (MITI & Aloni, 2005). The site is particularly characterized by a pleasant microclimate.

Edaphic factors

Edaphic factors are ecological elements related to the physical and chemical characteristics of the soil. Generally speaking, on the hills of the southwestern part of Kinshasa, the soil is essentially sandy with some special elements.

Geomorphology

The concession of Father Eymard Eucharistic Center at Kimbondo (Mount Ngafula / Kinshasa) is part of the Mount Cristal region stretching from Boma in the west to the Lufimi / Kwango Basin watershed N'sele to

the east. This region forms a relief resulting in a succession of hills interspersed with valleys and is very rugged (Lubini, 1997). The altitude of the concession varies between 502 and 533 m. The slope due to this altitudinal variation forms a steep slope.

The general view of the spatial occupation of the study site is given in Map 2.

Map 2. Delimitation and spatial occupation of the Father Eymard Eucharistic Center grant (Source: GIS Digital Mapping Laboratory for all of the Faculty of Science)

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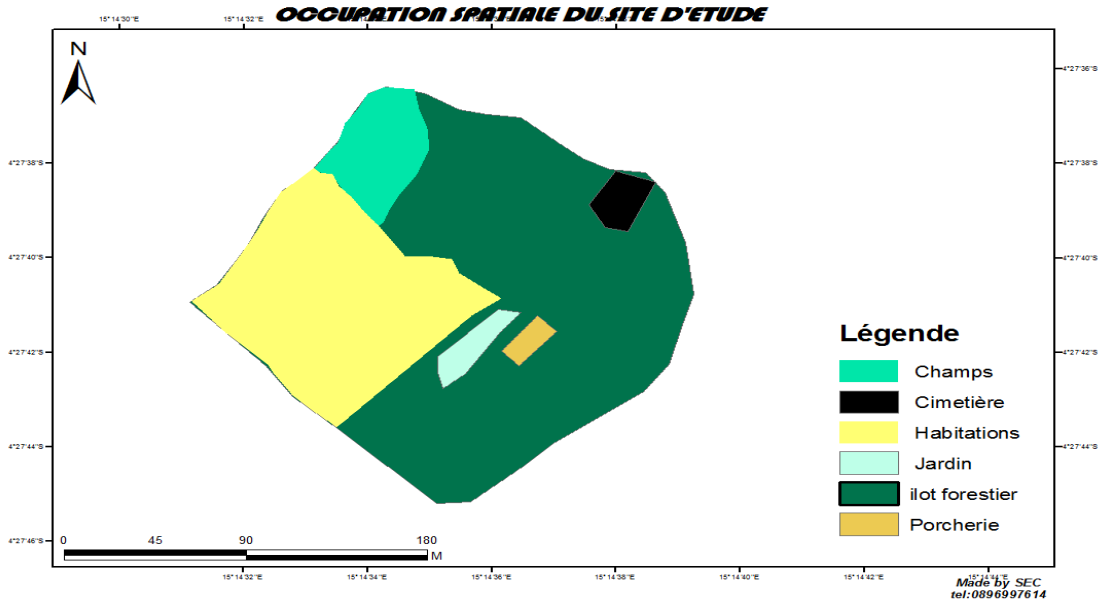

Map 2. Delimitation and spatial occupation of the Father Eymard Eucharistic Center grant (Source: GIS Digital Mapping Laboratory for all of the Faculty of Science)

Material and methods

In this paragraph we describe and explain the material, the methods used to obtain the results.

Equipment

The material used for this study consists essentially of botanical samples harvested in the forest block of the Father Eymard Eucharistic Center. The following equipment has been used: GPS (geographical positioning system) for taking geographical coordinates, digital camera for taking pictures.

Methods

The method is a rational approach of the mind to arrive at the knowledge or the demonstration of a truth. Larousse (2011). We used the method of observation (description and analysis), floristic inventories, supported by statistical analysis.

Method for the study of ecological spectra

Biological types

Les spectres biologiques d'un groupement sont une représentation relative des types biologiques. Ils permettent de donner de précieuses indications sur la structure, la physionomie et les stratégies adaptatives de la communauté (Gillet 2000, cité par Ngok 2005 et Harari 2009). Les types biologiques utilisés dans ce travail sont principalement ceux définis d'après la classification de Raunkiaer (1934) et extensibles aux régions tropicales (Lebrun 1947et1960, Munders1954, Koechlin1971, Léonard 1962, Germain 1964, troupin 1966, Troupin 1980, Schmitz 1971, SChnell 1971, 1977, Hbiyeramiye 1997, Lubini 1997. (Harari, 2009).

Types of diaspores

The spectra of the types of diaspores give information on the nature of the diaspores of the species and give indications as to their mode of dissemination, which reflects the physiognomy of the group or the community considered, in order to be able to speak about the nature of the diaspores as well as their possible disseminating agents.We used two types of diasporic classification: morphological classification of dansereau and Lems (1957) which is commonly used; in particular by Evrad (1968), Lubini (1997), Masens (1997) and the ecomorphological classification of Molinier and Muller (1938), which is more suggestive of the possible dispersal agent.

Types of leaf sizes

The type spectra of leaf sizes were inspired by the 1934 Raunkiaer system. Reprinted by Lubini 1997, Masens 1997 (Harari, 2009).

Phytogeographic analysis of the flora

Habari (2009) specifies that the chorological spectra of the grouping are arelative representation of phytogeographic types. It provides valuable information on the origin and distribution of the different species in the group. This information in turn helps to define chorological affinities at the local, sub-regional, regional and other levels.

III. Results and discussion

3.1. Presentation of the results

3.1.1 Floristic composition

The floristic composition of this forest block is studied in the attached table. This gives a summary of the results obtained in the field. This analysis reveals that the flora of this forest island is composed of several different families, genera and species.

3.1.2. Specific wealth

Specific richness gives an idea of the diversity of species inventoried in a given environment. Thus the inventory made in the forest block of the Father Eymard Eucharistic Center shows 63 species divided into 59 Genres and 34 Families.

The complete floristic list is appended to this memo. This analysis shows that the distribution of species is not uniform. Indeed, we notice that there are species, genera and families, some of which are better represented than others.

This is the case of *Fabaceae* (9 species); *Euphorbiaceae, poaceae*, and *Rubiaceae* (5 species for each family); *Lamiaceae* (4 species); *Phyllantaceae* (3species); *Apocinaceae*, *Asteraceae*, *Conaraceae*, and *Ochnaceae* (2 species each); the other families each have one species only. These are: *Amaranthaceae, Annonaceae, Bignoniaceae, Boraginaceae, Combretaceae, Commelinaceae, Convolvulaceae, Cyperaceae, Dennstaedtiaceae, Ebenaceae, Gentianaceae, Malvaceae, Menispermaceae, Melastomantaceae, Myrtaceae, Nyctaginaceae, Passifloraceae, Sapindaceae, Sapotaceae, Similacaceae, Salicaceae, Strychnaceae, Ulmaceae,* and *Zenziberaceae.*

Ecological study

In order to characterize our florule, we considered the analysis of the biological forms of all the species recorded, the analysis of the types of diaspores and the types of leaf size.

Biological types of the studied species

Analysis of the biological type examination shows that the majority of species are dominated by phanerophytes, ie 71%. The rest of categories appear weak. The established model shows that each group corresponds to a divergent percentage, with r = - 0, 78074; p = 0, 031. Figure 1. Give the centesimal proportion according to the biological types.

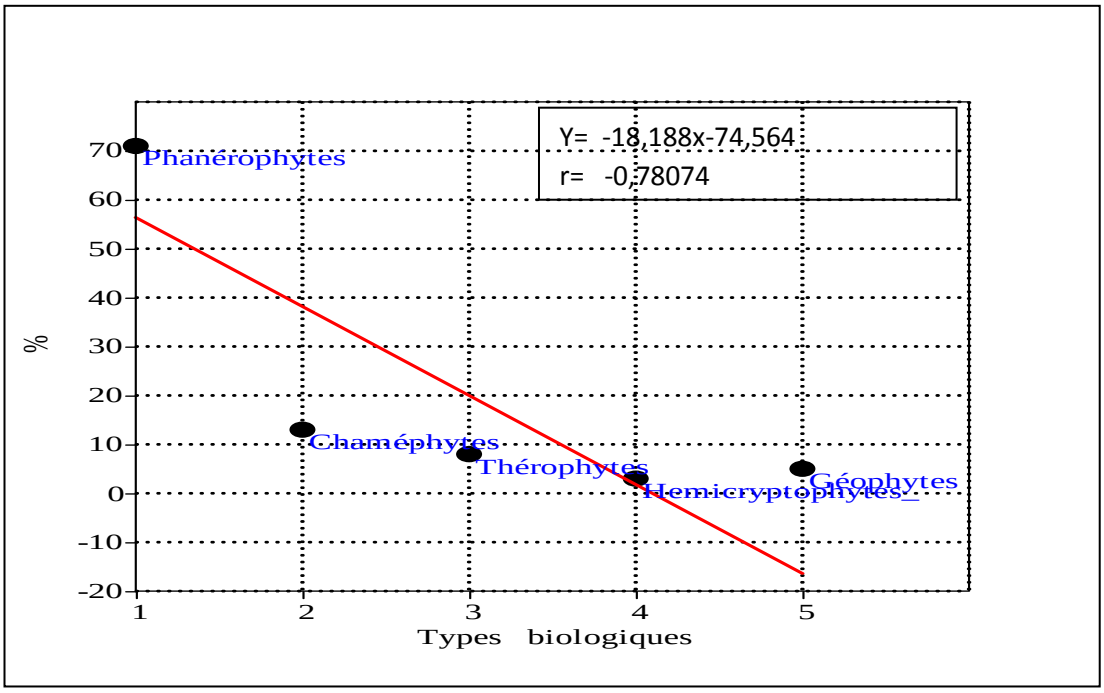

Figure 1. Model showing the percent percentage of biological types of species. We notice the dominance of phanerophyte species

Types of diaspores

The types of diaspores of the species identified in our study are shown in Figure 2

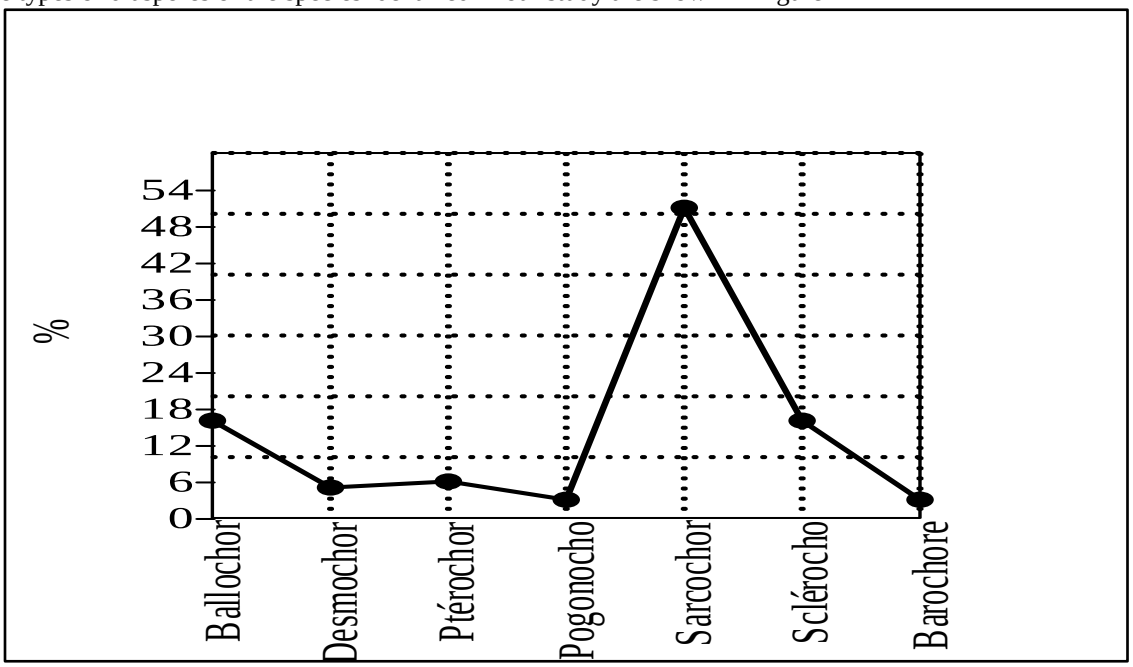

Figure 2. Distribution of species by types of diaspores

The analysis of the results in Figure 3 shows the presence of several types of diaspores. Note the strong presence of sarcochores followed by ballochores and sclerocores. Whereas pterochoras, desmochores, pogonochores and barochores are poorly represented.

Types of leaf sizes

The types of foliar quantities of the forest is shown in Figure 3.

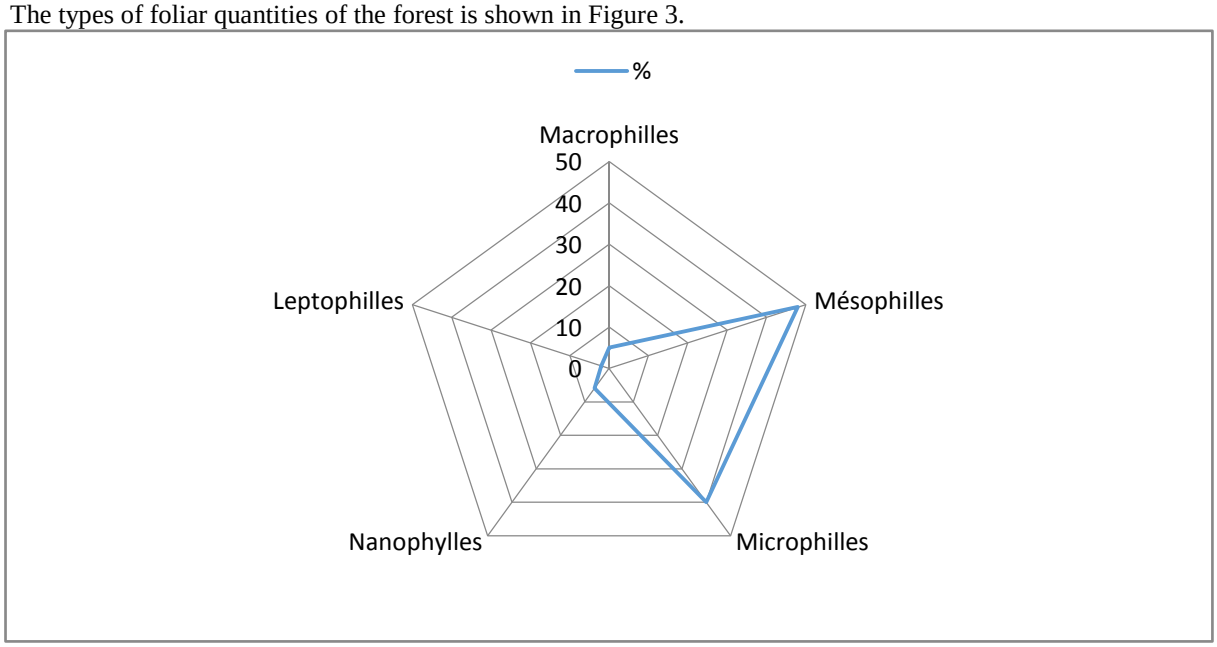

Figure 3. Distribution of species by type of leaf size (T.F)

Examination of Figure 4 shows the abundance of mesophyllous species, followed by microphylls, and the low presence of macrophyllous species, nanophylls, and leptophylls.

Chorological study of species

The chorological study of a plant group is the representation of the species according to the geographical distribution area in the surface of the terrestrial globe. Indeed, Figure 4 analyzes the phytogeographic distribution of species.

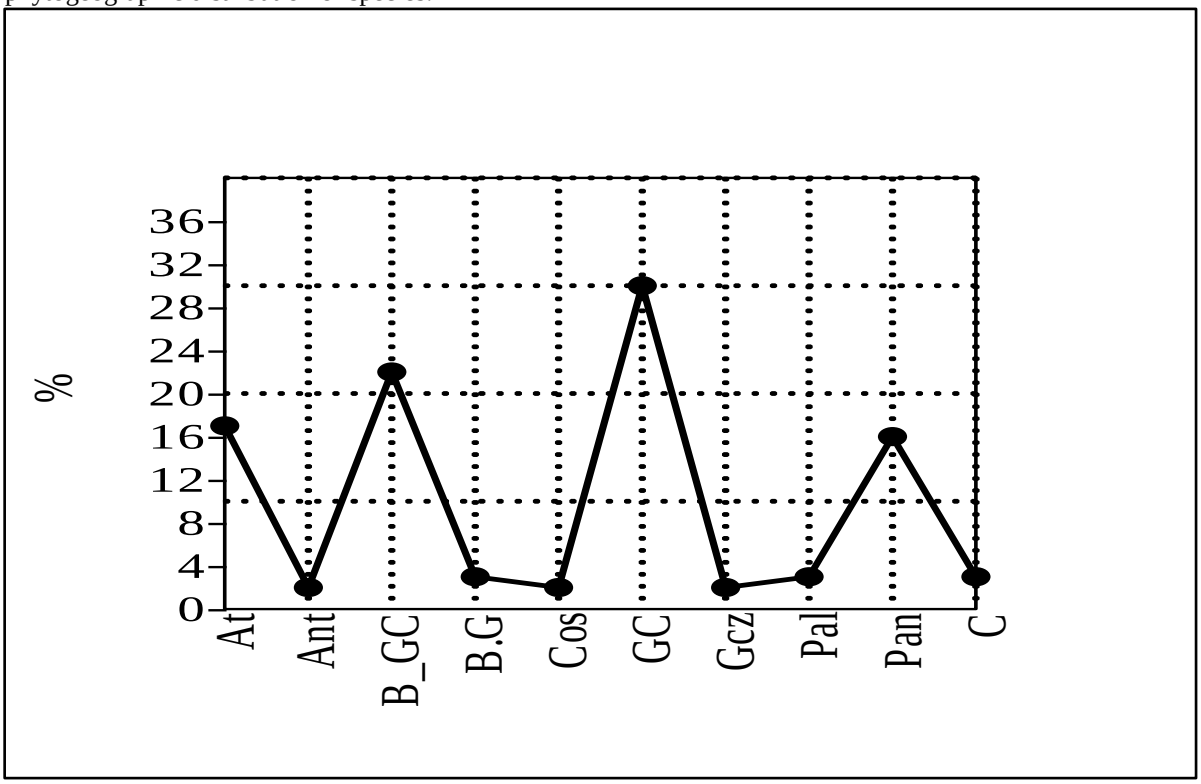

Figure 4. Distribution of species according to phytogeographic distribution

This figure shows that most of the species in this forest island belong to the Guineo-Congolese, Lower Guinean-Congolese, Afro-tropical and Pantropical elements. It is in these phytogeographic units that we encounter most species of our site.

3.2. Discussion of results

Despite the intensity of human activities currently observed in the peripheral areas of the city of Kinshasa; the inventory made in the forest block of the Father Eymard Eucharistic Center revealed the existence of 63 species divided into 59 genera and 34 families.

The best represented families are Fabaceae (9 species); Euphorbiaceae, Rubiaceae, and poaceae (5 species for each family); Lamiaceae (4 species). These results confirm the observations made in the flora around the city of Kinshasa by Habari (2009) and as far as this study is concerned, we note the first harvest of Cordia gilletii of the family Boraginaceae.Indeed the review of the literature carried out for the corroboration of the results especially on the floristic studies of the vegetation of Kinshasa realized by Habari (2009); TShiabembi (2002) on the forest island Notre Dame d'Assomption; the observations made in the flora of the funa basin by Kikufi (2000) and others do not indicate the presence of the species in Kinshasa.

Few species observed in this island due to its reduced extent. Belesi (2009) confirms that the diversity of ecological sites promotes isolation, that is, adaptation to particular ecological conditions. These conditions can induce or introduce morphological and physiological changes and create new populations. The more geologically and climatically varied a country is, the more species it will have more species than another little diversified. In the same way a sufficiently large and varied geologically and climatically diverse area will be richer in species than another as geologically and climatically but having a limited extent.The observation of the biological types of the listed species reveals the abundance of phanerophytes and the rarity of hemicriptophytes. The abundance of phanerophytes is justified by the forest character of this islet due to its protection status. If we carry a too deep analysis of biological types, we notice the predominance of the Mesophanerophytes.

Examination and observation of the diasporic types shows the dominance of the Sarcochores followed by the Ballochores and Sclerofores. On the other hand, there is a weak representation of the Desmochores, Pterochores, Pogonochores and Barochores. More sarcochores, translates a general fact observed in the forest, fleshy fruit species dominate. The species of this type of diaspores would have preceded those with dry diaspores.

The observation made on the types of leaf sizes of the species shows the abundance of the mesophyllous species, followed by the microphyllous species and the weak presence of the macrophyllous species, nanophylls and leptophylls. This abundance indicates the morphological character of the species of this forest island.

The chorological analysis, ie the phytogeographic distribution of the harvested species reveals several distribution groups in which there is the predominance of Guineo-Congolese species, followed by the Lower Guineo-Congolese species, Afro-tropical species and pantropical. This observation is a confirmation of the forest character of the studied site and its phytogeographic belonging to the Guineo-Congolese region. There is an abundance of Guinean-Congolese species. This is obvious since the study site is in the city of Kinshasa, located in the phytogeographical sector of Bas-Congo, which is part of the regional center of Guinean-Congolese endemism.

Conclusion

The study of the flora of the forest block of the Father Eymard Eucharistic Center carried out between April and November 2014 aimed at the flora inventory. This inventory revealed the presence of 63 species per hectare belonging to 59 genera and 34 families. The results of the floristic analysis show the first harvest of Cordia gilletii in Kinshasa. The chorological analysis shows the abundance of Guinean-Congolese species is 30.15% and Bas-Guineo-Congolese elements is 22.22%.Ecological examination and observation specify the abundance of phanerophytes 71.42% for the biological types of the species; the predominance of Sarcochor species 50.79%; Ballochores and Sclerochores (15.79% each) for the diasporic types; and mesophylls dominate the consideration of the species' leaf size types. It should be noted that various anthropogenic activities have been observed in this forest block, some of which are negative for the conservation of resources, such as gardening, hog farming, charring, etc.Others are positive like the full protection of the concession by the fence; this would slow down the frequency of activities of the population on this forest island. At the end of this study, we suggest the sustainable conservation of this forest island; continuation of other studies such as phytosociological study; the therapeutic, nutritional value of the species of this islet for the development of resources in order to reconcile use with conservation.

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Annex

Family	Genus and species	**T.P**	**T.B**	**T.D**	**T.F**
Amaranthaceae	*CyatulaprostrataL.Blume*	Pan	Thd	Desm	Micro
Annonaceae	*Annonasenegalensis. Pers. Subs*	BG	Mcph	Sar	Meso
Apocinaceae	*Rauvolfiamannii. Stapf.*	GC	Nph	Sar	Meso
	Landolphia camptoloba(Schum)pichon	BGC	Lph	Sar	Meso
Asteraceae	*Chromolaenaodorata. King etRobuns*	Pan	Ch	Pog	Meso
	Emilia coccinae(Syms) G. Don	Pan	Chd	Pog	Meso
Bignoniaceae	*Markhamiatomentosa. Benth*	GC	Msph	Ptér	Meso
Boraginaceae	*Cordiagilletii. De wild*	C	Msph	Sar	Meso

Combretaceae	*Combretumracemosum. P.Beauv*	GC	Lph	Ptér	Meso
Commelinaceae	*Commelina diffusa. Burm.f.*	Pan	Chr	Scl	Micro
Convolvulaceae	*Ipomoeainvolocrata. P.Beauv.*	GC	Chgr	Bal	Micro
Cyperaceae	*Cyperusfertilis. Boeck*	GC	Grh	Scl	Micro
Connaraceae	*Manotesexpansa(ex.Planch)*	BGC	Lph	Sar	Meso
	Cnestisferruginea. D.C	GC	Lph	Sar	Micro
Dennstaedtiaceae	*Ptéridiumaquilinum. L.Kuhn*	Cos	Grh	Scl	Micro
Euphorbiaceae	*Sclerocrotoncornutus. Pax*	BGC	Msph	Bal	Micro
	Maprouneaafricana .Mull.Arg	AT	Msph	Bal	Micro
	Chaetocarpusafricanus. Pax	BGC	Msph	Bal	Meso
	Croton hirtus. L'Herit	BGC	Thd	Bal	Micro
	Alchornea cordifolia. Schum et thonn	AT	Msph	Sar	Meso
Ebenaceae	*Diospyrospseudomespilus. Muld.br*	BG	Mcph	Sar	Meso
Fabaceae/Mimosoideae	*Albiziaadianthifolia. Schum*	AT	Msph	Bal	Nano
	Albiziaferruginea(Guill,perr. Benth)	GC	Msph	Bal	Micro
	Samanealeptophylla. Harms	GCZ	Msph	Sar	Lepto
Fabaceae/Feboideae	*Millettialaurentii. De wild*	BGC	Mgph	Bal	Meso
	Millettiadrastika. Welw	BGC	Msph	Bal	Micro
	Centrosemapubescens. Benth	Ant	Chgr	Bar	Micro
Fabaceae/Ceasalpinioideae	*Sennaoccidentalis. LINK*	Pan	Nph	Bar	Micro
	Cassia mimosoides. P.Beauv.	Pal	Chd	Bal	Meso
	Amphirmasferrugineus(Pierre ex.pell.)	GC	Mgph	Sar	Meso
Gentianaceae	*Anthocleistaschweinfurthii. Gilg.*	C	Msph	Sar	Macro
Lamiaceae/Vitexioideae	*Vitex ferruginea. Schum&Thonn.*	GC	Msph	Sar	Meso
	Vitex madiensis. Oliv.	AT	Msph	Sar	Meso
Lamiaceae/Clerodendroideae	*Clerodendroncapitatum. schum&Th.*	GC	Lph	Sar	Meso
Lamiaceae/lamioideae	*Lantana camara. L.*	Pan	Mcph	Sar	Micro
Malvaceae/Malvoideae	*Urenalobata(L.)ASA-SP-C*	Pan	Nph	Desm	Meso
Menispermaceae	*Cissampelosowariensis. P.Beauv*	GC	Lph	Sar	Micro
Melastomantaceae	*Dissotisbrazzeana. Cogn*	AT	Nph	Scl	Meso
Myrtaceae	*Syzygiumguineensis(Wild).DC.subs g*	AT	Msph	Sar	Micro
Nyctaginaceae	*Boerhavia diffus. (H.Virud.*	Pan	Chp	Desm	Micro
Ochnaceae	*Campylopermumréticulatum.P.Beauv*	GC	Mcph	Sar	Meso
	Rhabdophillum arnoldianum.A.for.gw	BGC	Mcph	Sar	Meso
Phyllantaceae	*Brudelliaferruginea. Benth.*	AT	Msph	Sar	Meso
	Hymenocardiaacida. tull.	BGC	Msph	Pter	Nano
	Hymenocardiaulmoides. Oliv.	AT	Msph	Pter	Nano
Passifloraceae	*Paropsiabrazzeana. Baill*	BGC	Msph	Sar	Macro
Poaceae	*Anthephoracristata(Doell)Hack .*	AT	Thd	Scl	Micro
	Hyparrheniadiplandra(Hack)Stapf.	BGC	HC	Scl	Micro
	Penisetumpolystachyon(L.).Schult	Pan	HC	Scl	Micro
	Pseudochilolaenapolystachya. Kunth.	Pan	Chr	Scl	Nano
	Setariabarbata(Lam).Kunth.	AT	Thc	Scl	Micro

Sapindaceae	*Allophylus africanus. P.Beauv.*	GC	Msph	Sar	Meso
Rubiaceae	*Cremasporatriflora. Thonn.*	GC	Lph	Sar	Micro
	Crossopteryxfebrifuga. Benth.	BGC	Msph	Sar	Micro
	Gaertnerapaniculata	GC	Mcph	Sar	Meso
	Leptactinaleopoldi. At.Buttner	BGC	Msph	Sar	Meso
	Spermacocelatifolia. Aubl	GC	Thpr	Scl	Micro
Sapotaceae	*Manilkaraobovata. Sabine,G.Don*	GC	Msph	Sar	Meso
Similacaceae	*Similaxanceps. Willd*	AT	Lph	Sar	Meso
Salicaceae	*Oncobawelwetschii.Oliv.*	GC	Msph	Sar	Macro
Strychnaceae	*Strychnos variabilis.DE.wild*	GC	Lph	Sar	Meso
Ulmaceae	*Tremaorientalis. L.Blume.*	Pal	Mcph	Sar	Meso
Zenziberaceae	*Aframomum alboviolaceum. Schum.*	BGC	mGrh	Sar	Meso