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Characterization of the vegetation of the submontane forest of the kala massif in Cameroon

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ABSTRACT
Objective: The main objective of this study conducted from January to February 2023 is to describe the spatial heterogeneity of the vegetation of the submontane forest of the Massif Kala in Cameroon through the identification and characterization of the flora and plant groups present. This study also highlights the sociological organization of the forest vegetation and contributes to broaden the phytosociological knowledge which still remains elementary on the vegetation of the forest ecosystems of the highlands of Cameroon.
Methodology and Results: The surveys are made by plots of 100 m x 25 (2500 m²) and the lists of specific sets of individuals whose diameter is greater than or equal to 1 cm, and those whose diameter at breast height (dbh) ≥ 10 cm, are established. The analyses are based on data from 21 phytosociological surveys, carried out through the facies of the vegetation of the Kala massif.
Based on the partition of the records by Detrended Correspondence Analysis and an Ascending Hierarchical Classification, three plant groups were respectively individualized, characterized and classified in the higher syntaxons (class, order and alliance). This is the class of Strombosio-Parinarietea Lebun & Gilbert 1954, Erythrophleetea africani Schmitz 1963, Musango-Terminalietea Lebun & Gilbert 1954. In the forest of the Kala massif, the typology of the vegetation obeys a gradient of humidity and temperature. The anthropization and the edge effect clearly mark the biological diversity of the three plant groups. The individualized plant groups explain the spatial heterogeneity within the same plant formation of the Kala massif.
Conclusion and application of resulta application of results: From the matrix of 21 readings and 211 listed species (Appendix 1), we highlighted three (3) groups of plants. based on the relative frequencies of species (Fig.3). The results obtained are effective contributions to scientific research. They serve as avenues for similar or comparative studies of the flora of the Central African Republic.
Keywords: plant group, biological diversity, spatial heterogeneity, vegetation, anthropization, Cameroon.

INTRODUCTION

After the Amazon, the Congo Basin is made up of a large forest that occupies a large area (Talbott, 1993; FAO, 1995). Cameroon's great forest contains the most diverse ecosystems (Alpert, 1993). Altitudinally, these forests are classified as low and medium altitude forests, submontane forests and montane forests (Letouzey, 1985). In Cameroon, as in many other tropical countries, the last 20 years have been marked by high rates of deforestation and forest degradation, linked to the expansion of agriculture, population growth and development activities. In general, (FAO, 1995). In the Kala massif, the area of the forest sector is in perfect decline. Indeed, the massif contains high altitude vegetation around 1000 m, a transition zone that can be described as a submontane stage (Letouzey, 1968). The altitudinal environment is a very mixed environment where various types of vegetation develop. These types of vegetation vary from one geographical area to another. In the specific case of the Kala massif, it is interesting, within the framework of environmental planning and space management, to inventory and describe the different types of vegetation as well as the biodiversity which develops there with these types of vegetation. The central hypothesis states that the existence of plant communities reflects the spatial heterogeneity of forest vegetation according to ecological parameters (Aoudji *et al.*, 2011). The main objective of this study is to describe the spatial heterogeneity of the vegetation of the forest of the Kala massif. The specific objectives are, among other things, to identify the plant groups present and to characterize them instantly on the analysis of their specific diversity and their respective sociological organization. Indeed, plant groups constitute complexes with the value of phytocenoses which are of interest not only to foresters, but also to scientists (Bangirinama *et al.*, 2010).

Photo 1: Nephelophilic forest of Kala (Source: Madiapevo, 2023). (1st plan): Ecosystem with a fragile ecology due to the outcrops of rocks on which in places, the thin layer of soil can only support herbaceous vegetation, and a forest in the background.

METHODOLOGY

Presentation of the study site: Cameroon is located in Central Africa (1°40' and 13°05' N; 8°30' and 16°10' E) with an area of 475,000 km². It shares 4700 km with Nigeria, Equatorial Guinea, Gabon, Congo, Central African Republic and Chad. The Yaoundé massif extends from North to South and from East to West over less than one degree: 3°42' and 4°05' North latitude, 11°17' and 11°35' East longitude. The Kala massif extends from North to South and from East to West between 3°42' and 4°05' North latitude, 11°17' and 11°35' East longitude. To the south-west of the Yaoundé region, the Kala massif has an SSW-NNE orientation over 40 km in length and 35 km in width. It is located in the village Kala in the Center region of Cameroon, located in the district of Mbankomo, department of Méfou-et-Akono. It includes three high peaks over 1100 m: Mount Kala itself (1128 m); Mount Nkol nlong (1156 m); Mount Nkol mylon (1100 m). Added to this is Mount Nkol byon whose altitude does not exceed 1100 m. These hills are geographically close and are located in the southwest of the Yaoundé region in the same phytogeographical district of White (1983). The generally undulating relief is traversed by close and shallow valleys through which flow small streams. The Kala massif, like the entire area covered by the so-called Congolese forest in Cameroon (Letouzey, 1968) is located on the Precambrian plateau. All of the forests in this massif are made up of two-mica or biotite-only brecciated gneiss (Champetier, 1959). The climate is of the subequatorial type with an equatorial tendency, western subtype with a short accentuated dry season (Schnell, 1970). Precipitation is quite abundant with an annual average of 1800 mm. The annual average temperature is 23.8°C. The forest is of the submontane type of the order of Garcinietalia (Noumi, 1998). In Kala, the presence of cocoa plantations, food crops, the current fire regime and the illegal harvesting of natural plant resources testify to human activities on the slopes of the Kala massif. Under these conditions, the area of the forest sector decreases and their biodiversity continues to erode (Nzigidahera, 2009). Livestock farming remains traditional where the animals live in free grazing in nature, to which is added poultry farming of a purely economic nature. In 1965, the Kala village had 285 inhabitants, mainly of the Ewondo ethnic group. In 2018, the number rose to 309 inhabitants.

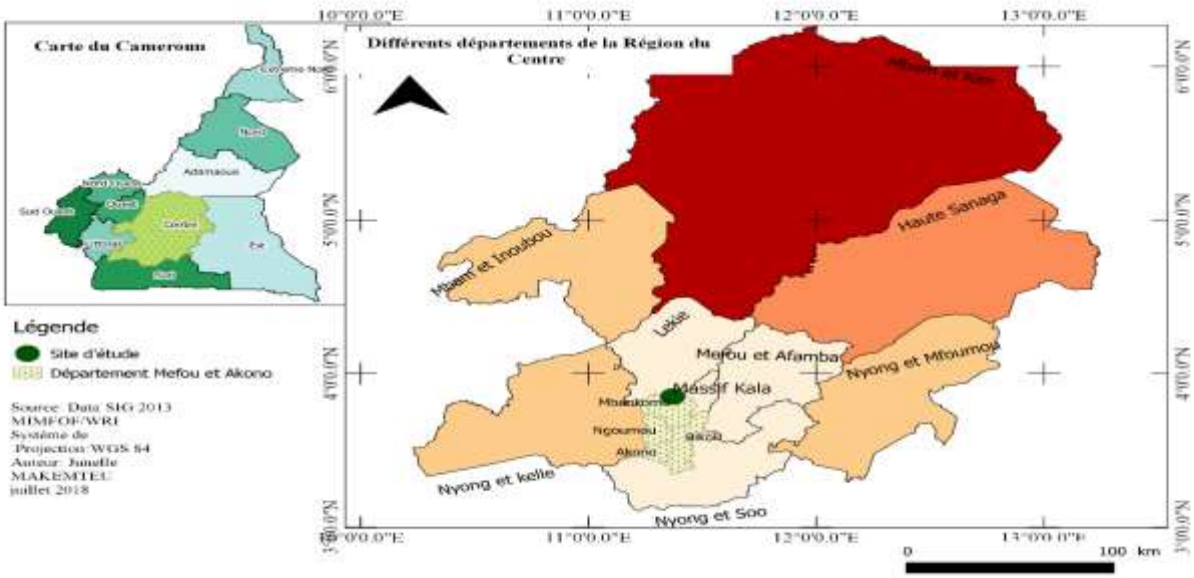


Fig.2: Map of the geographical location of the study site.

Sampling method: In the context of this study, the technique used for the botanical inventories was the Lejoly plot sampling method (1995). This method, considered suitable, made it possible to delimit the sampling areas and to make a rapid qualitative and quantitative description of the flora. It also made it possible to collect the maximum amount of spatial information without measurement constraints. The inventories were made in 21 rectangular plots 100 m long and 25 m wide. These strips constituted the sample plots of 2500 m^2 (0.25 ha). That is a total of 5.25 ha. A 100 m long path was drawn inside each plot. On either side of the layon, trees with dbh (diameter at breast height) ≥ 10 cm were counted over a distance of 12.5 m. Shrubs (dbh < 10 cm) were surveyed on sub-plots of 12.5 x 10 m^2 area along the traced path. The scientific determination of the species was carried out using the criteria defined by Normand (1964). For the three (3) forests, the identification of the plant groups constituting the vegetation was made thanks to the ecosociological groups distinguished in tropical Africa (Schnell, 1952; Lebrun and Gilbert, 1954) and according to the CEPS classification system (Delpech, 2006). Only classes, orders and alliances are retained in this work.

Data analysis methods: The determination of the plant groups was made by Detrended Correspondence Analysis (DCA) and an Ascending Hierarchical Classification (CHA) with the MVSP 3.22 software (Multi-Variate Statistical Package). This technique provides us with a dendrogram discriminating plant groups. Several indices of a use are used to highlight the specific diversity of plant groups. These specific mathematical models are among others:

• Sorensen's similarity index (1948) was used to measure the resemblance of the three identified plant groups. This index is given by the following formula (1):

$K = (2 c / a + b) x 100$

where c is the number of species common to the two groups compared, a and b are the numbers of species in group (1) and group (2).

• The Margalef index (Rmg) (Magurran, 2004) was used to compare the specific diversity of plant communities. This index is obtained by the following formula (2):

$Rmg = S – 1 / \ln (N)$

where S is the species richness and N is the number of individuals

• The Shannon, Weaver (1949) (ISH) diversity index is expressed as a function of the proportions of each species in bits. Formula (3) is as follows:

$$ISH = \sum (Ni / NLog_2 Ni / N)$$

where Ni is the number of individuals of species i and N the number of individuals of the species present.

• Simpson's Index (1949) expresses the probability that two individuals taken at random from the stand under study belong to the same species. Formula (4) is as follows:

$$D' = \sum (Ni / N)^2$$

This index expresses the sum of the proportions of all the species listed.

The Piélou (1966) evenness index makes it possible to account for the distribution of species in the sample. This index is obtained by the following formula (5):

$$R = H/H_{max}$$

where H corresponds to the observed diversity and Hmax corresponds to the maximum diversity.

RESULTS

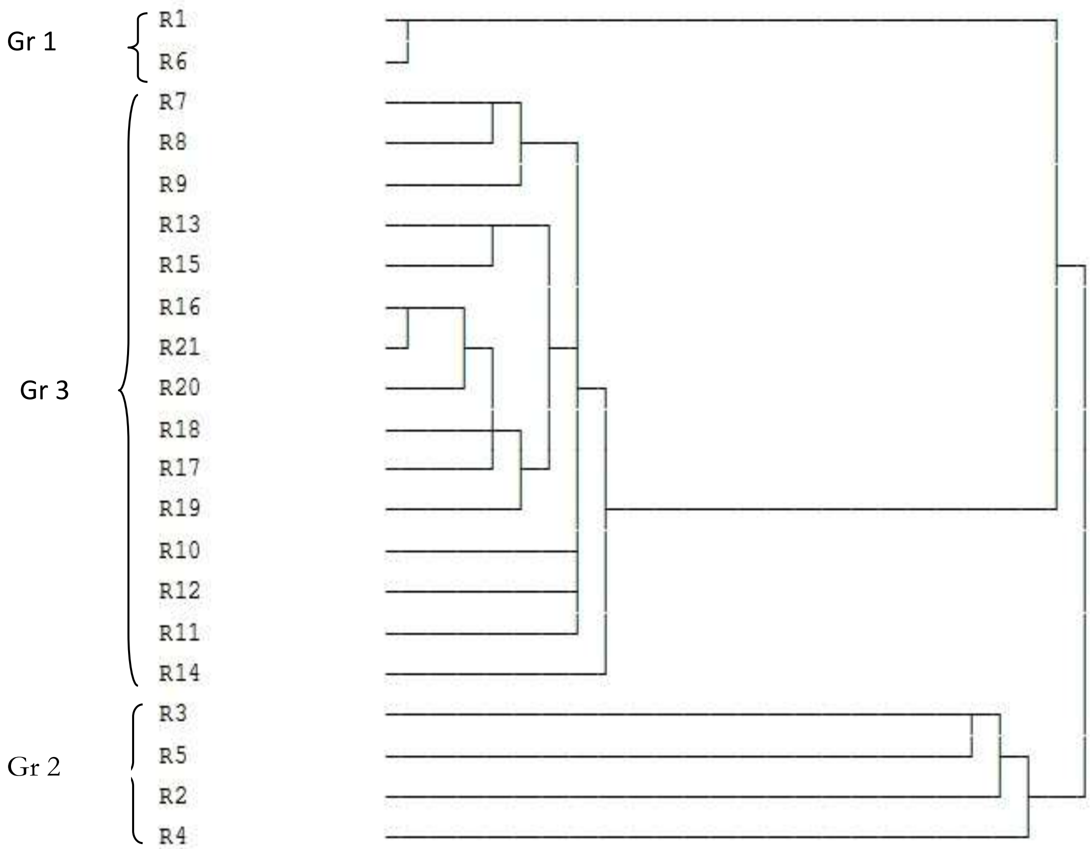
Characterization of plant groups in the forest of the Kala massif

Determination of plant groups: Starting from the matrix of 21 readings and 211 listed species (Appendix 1), three (3) plant groups were highlighted on the basis of the relative frequencies of the species (Fig.3). The level of similarity of 23 considered for the definition of these groupings made it possible to obtain the maximum possible. The criterion of the stratification of the readings and the field observations guided the determination of the vegetation zone corresponding to each of the 3 individualized groups:

• Group 1 of the surveys corresponds to the submontane forest on the steep slope (Gr 1);

• Group 2 of the surveys corresponds to the forest at low and medium altitudes rising in the submontane stage (Gr 2);

• Group 3 of the surveys corresponds to the submontane forest on the steep slope (Gr 3).



Legend: R is the readings corresponding to the forest, Gr represents the group of surveys corresponding to the forest.
Fig.3: Arrangement of the three (3) individualized groupings of the Kala forest on a dendrogram

Ecological determinism of individualized plant groups: The spatial distribution of the individualized groupings is represented on the plan (Fig.4). The first two axes of the DCA express the gradients of the ecological parameters. The ecological significance of the two axes is explained by field observations, the stratification of surveys and the ecology of characteristic species.

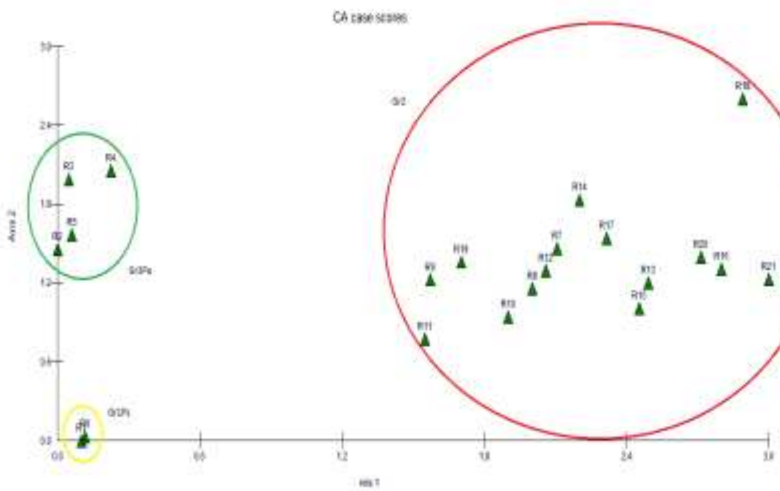


Fig.4:. Representation of the distribution of plant groups in the plane of axes 1 and 2 of the DCA. Axis 1 represents the increasing gradient of anthropization while axis 2 expresses the increasing gradient of humidity.

In the present case, no reading is placed on the negative side of axis 1 (on the abscissa), relative to the less disturbed core of the forest. On the positive side of this same axis, the statements forming group 1 (virgin forest with *Aulacocalyx caudata*), group 2 (wooded savannah meadow of Nkol nlong and forest-plantation edges) corresponding to the areas more degraded by forest activities are distributed. Human resources, agriculture, illicit resource extraction and fire, group 3 (vegetation on the tops of hills) corresponding to areas moderately disturbed by human activities. Obviously, axis 1 expresses an increasing gradient of disturbances of anthropic origin exerted from the forest towards its peripheral zones. On the ordinate, on the negative side of axis 2, are positioned 2 statements from group 3 (R3 and R4) and 5 statements from group 2 (R16, R17, R18, R20, R21) corresponding to the dry areas of the forest. On the other hand, on the positive side of this axis are the elevations forming groupings 1 and certain elevations of groupings 2 and 3. Grouping 1 corresponds to the nephelophilic forest. Axis 2 represents an increasing gradient of atmospheric humidity, from that provided in the valleys incised by tributaries of the large Akomo, Ngobo, Nkadip and Yegue rivers towards the zone of mist and clouds which represents the upper part (from 1400 m to 1800-2000 m) of the Guineo-Congolese submontane forest. These mists and clouds begin in the Yaoundé area at an altitude of 1000 m (Letouzey, 1985).

Biological diversity of plant communities: Values for species richness and other indices of diversity and evenness are provided in Table I.) is more diverse than the other two. For this group, the value of the Margalef index is higher (Rmg = 23.86) compared to those of the other groups. Grouping 2 corresponding to the zone which presents various stages of degradation of the zone of the virgin forest is less diversified because it presents a lower value of the Margalef index (Rmg = 9.50). The values of the Piélou index are greater than 0.5 for groups 2 and 3. This means that, in the two groups, the species share the ecological niches relatively equitably. The Piélou equitability value of group 1 is less than 0.5. The virgin forest on steep slope does not share the ecological niche with the other 2 groupings.

Table 1: Biodiversity indices of plant communities in the Kala forest

Groupings	Number of readings	*S*	*H*	R_{mg}	*R*
Group 1	2	111	2.43	15.21	0.36
Group 2	15	54	4.89	9.50	0.85
Group 3	4	191	4.70	23.86	0.62

S: Specific richness; H: Shannon-Weaver diversity index; Rmg: Margalef diversity index; R: Piélou equity index

The degree of similarity between the three plant groups compared two by two by Sorensen's similarity index is shown in Table 2. The floristic affinity between the 3 groups is greater than 50 between groups 1 and 2, less than 50% between group 3 and 1, then 3 and 2. In these latter cases, the Sorensen indices show that each individualized group constitutes a unit relatively distinct from the others.

Table 2: Sørensen similarity values (in %) between pairs of plant groups in the Kala forest

	Group 1	Group 2	Group 3
Group 1	100		
Group 2	60.3%	100	
Group 3	40.2%	39.3%	100

Identification of ecosociological groups: In the forest of the Kala massif, the classification of plant groups in the higher syntaxa gives 3 classes, three orders and three alliances:

• Class of *Strombosio-Parinarietea* Lebrun & Gilbert 1954, from equatorial rainforests; Order of *Garcinietalia* Noumi 1998, Alliance of *Garcinion* Noumi 1998; represented by group 1. Its edition is the north-eastern slope of Nkol byon, with steep slopes, carrying a virgin forest with *Aulacocalyx caudata*. The edition is rich in hygromesothermal species such as *Allanblackia gabonensis*, *Aulacocalyx caudata*, *Aulacocalyx jasmifolia*, *Aulacocalyx taboltii*, *Cola verticillata*, *Garcinia mannii*, *Garcina smeathmannii*, *Leplaea mayombensis*, *Myrianthus libericus* and *Santiria trimera*. The edition is also penetrated by hygro-oligothermal species with *Carapa grandiflora*, *Memecylon polyanthemos.*

Fig.5: Group of submontane rain forest.
A: forest undergrowth; B: stilt roots at the summit of Mount Kala; C: slice of *Allanblackia gabonensis*, brittle, reddish on the outside and yellow on the inside, exuding a yellow latex.

• Class of *Erythrophleetea africani* Schmitz 1963, from the Guineo-Sudano-Zambézian tropical forests; Ordre of *Julbernardio-Brachystegietalia* spiciformis Schmitz 1988, Alliance of *Bierlinio-Marquesion* Lebrun & Gilbert 1954, characterizing the whole open forest dominated by *Brachystegia* and *Uapaca* tree species with *Erythrophleum ivorense*, *Paraberlinia bifoliolata* (*Julbernarda pellegriniana*), *Tetraberlinia bifoliolata* (*Julbernardia bifoliolata*). The class is represented by cluster 2. Its edition is the summit of Nkol nlong (or hill covered with grassy meadow in the local language). In this site, Mr. Mesmer (a Swiss national) built a hut, as one of the eloquent signs of the phases of alteration, corresponding to regressive series which lead to grassy savannah formations or dotted with residual shrubs (Fig.6).

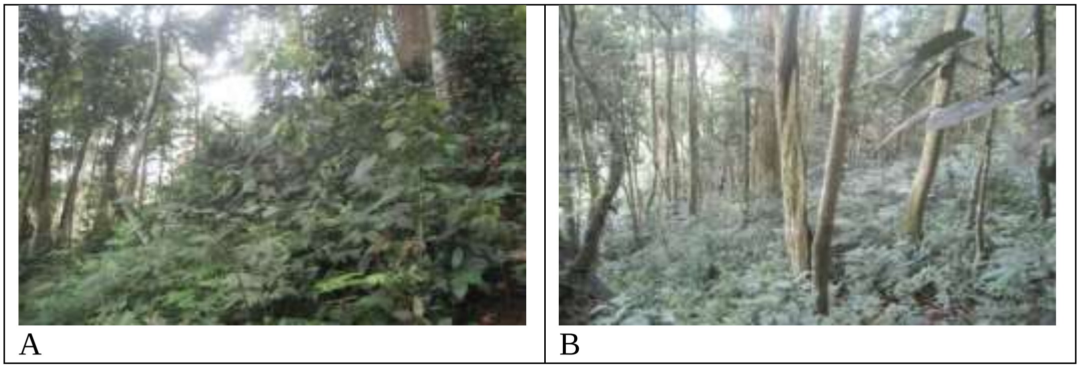


Fig.6: Nkol nlong thinned (trophophilic) forest.

In the background in A and B, phases of alteration, corresponding to regressive series which lead to the grassy savannah formation dotted with residual shrubs.

- Class of *Musango-terminalietea* Lebrun & Gilbert 1954, forests of the Guineo-Malagasy liaison group, with very wide Sudano-Zambézian penetration; Order of *Musangetalia* Lebrun and Gilbert 1954, Alliance of *Caloncobo-Tremion* Lebrun and Gilbert 1954. The class is represented by grouping 3 of the summit forests of Nkol byon, Kala and Nkol mylon. The class is dominated by species like *Pycnanthus angolensis*, *Albizia adianthifolia*, *Elaeis guineensis*, *Nauclea latifolia*, *Nauclea diderrichi* (Fig.7).

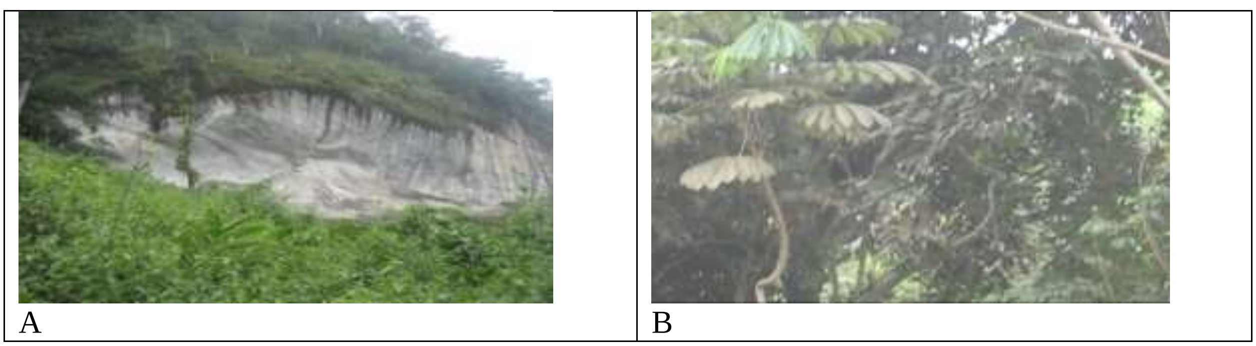


Fig.7: Secondary forest resulting from the degradation of the submontane ombrophile forest.
A) Forest regrowth with Costusafer and *Chromolaena odorata* (Asteraceae); (B) Secondary forest showing a foot of *Chlorophora excelsa* in the foreground.

DISCUSSION

The study of plant groups is a fundamental source of important basic data for the conservation, development and sustainable management of natural ecosystems. But frequently, in some cases, the ecological interpretation of the identified groups may seem meticulous (Bangirinama *et al.,* 2010; Hakizimana *et al.,* 2012). The individual plant groups in the Kala forest explain the spatial heterogeneity of this forest ecosystem. The analysis of this spatial heterogeneity shows that the Kala forest is subdivided into three floristically distinct zones:

- the core of the forest remained virgin, is on a slope and dominated by species of small trees like *Aulacocalyx preussii*, *Garcinia mannii*, *Garcinia smeathmannii*, *Aulacocalyx caudata* and *Aulacocalyx jasmiflora* (group 1);
- the degraded part of the forest is the summit of Nkol nlong, nephelophilous, where low and medium altitude trees dominate, those of mountain or sub-mintagnard species (group 2). The open, undiversified, ubiquitous forest is dominated by *Allanblackia*, *Brachystegia*, *Erythrophleum*, *Garcinia*, *Gilbertiodendron*, *Uapaca*;
- the formations of the summits of Kala, Nkol byon, Nkol mylon, surrounded by cocoa plantations, plantations and orchards which rise to 800 - 1000 m in altitude, form group 3 where *Pycnanthus angolensis*, *Anthocleista schweinfurtii*, *Myrianthus arboreus* dominate.

The organization of the Kala forest is manifested in the horizontal plane by a more or less marked heterogeneity, such as the open forest zone alternating with zones covered with more or less dense forest cores, and an agglomerated-type distribution, individuals. This characteristic, confirmed by the low values of the Sorensen index for groups 1 and 3 and groups 2 and 3 and a value well above 50% for groups 1 and 2 (Table 2) had already been underlined by the studies on the humid intertropical forests carried out by Oldeman (1990), Hakizimana *et al.*, 2012. The values of the Piélou evenness index show that the species of the three plant groups do not share ecological niches equitably. Group 2 and 3 have high values compared to group 1 with a lower value; 0.36. (Gillet, 2000). Considering the factors of the. ecological determinism (the gradient of humidity and that of anthropization), we note that groups 1 and 2 are floristically close, on the one hand, and that, on the other hand, groups 2 and 3 are floristically close (Fig. 3 and 4). The strong floristic similarity between the identified plant groups (group 1 and 2) is confirmed by the high value of the Sorensen similarity index. This suggests that the spatial heterogeneity of facies observed in the Kala forest is either linked to any ecological gradient, or could be explained by the history of localized degradation of the forest. In the dense Kala forest, the floristic diversity depends on the landscape unit considered. We consider that the central core of the less disturbed forest (cluster 1) represents the average species diversification (Table 1). It is rich in forest species such as *Allanblackia gabonensis*, *Coelocaryon preussii*, *Dacryodes macrophylla*, *Guarea thompsonii*, *Leplaea mayombensis*, *Pycnanthus angolensis*, *Ricinodendron heudelotii*, *Strombosia grandifolia*, and *Trilepisium madagascariensis*. These species ensure the development of a significant lower tree stratum consisting of *Aulacocalyx jasmiflora*, *Aulacocalyx talbotii*, *Coffea brevipes*, *Garcinia smeathmannii*, *Myrianthus arboreus*, *Rauvolfia macrophylla*, *Tabernaemontana crassa*. The zone of forest alteration phases (group 2) is less diversified. We observe that its vegetation keeps the same bottom of the floristic procession and a core of common species. Similar conclusions were made by Nzigidahera (2000). The secondary education group is the most diversified. This order of increasing diversity was expected. Indeed, some authors (Burel and Baudry, 1999) affirm that, up to a certain threshold, disturbances increase the diversity of an ecosystem. In addition, these authors indicate that disturbances are intense in edge zones which tend to diversify. The edge effect therefore induces a change in facies by promoting both the heterogeneous development of certain forest species and heliophilous species, ruderal species, segetal species, adapted to various disturbances linked to trampling, water stress and human activities (Harper *et al.,* 2005). Plant group 2 has the lowest value of the Margalef diversity index (IDM) (9.50) (Table 1), although this includes 15 records from the interior of the forest. On the other hand, plant group 3, which includes four peripheral statements, has an IDM value (23.86), higher than for plant group 1 (IDM = 15.21) which includes 2 statements from the interior of the forest. We can therefore conclude that, for this forest, the overall floristic composition is not significantly affected by the edge effect (Harper *et al.,* 2005). The plant groups identified in the Kala forest can be linked to those already described by other authors. The grouping of Aulacocalyx spp., Garcinia spp., and *Albizia gummifera*, *Allanblackia gabonensis*, *Leplaea mayombensis*, encountered on the northeast slope of Nkol byon is similar to that described on the summits of the Nkolobot hills of the Mbam minkom massif by Noumi (1998) and the one encountered in the Kouoghap gallery forest of the Batoufam village by Makemteu and Noumi (2015). Finally, the dominance of species of *Brachystegia* (*Brachystegia laurenti*), *Distemonanthus benthamianus*, *Gilbertiodendron brachystegioides*, *Paraberlinia bifoliolata*, *Tetraberlinia bifoliolata* and *Uapaca togoensis* as well as *Pycnanthus angolensis* accompanied by *Spathodea campanulata* represent respectively the tropophilic and periguinean identity of the forest at the summit of Nkol nlong of the Kala massif. The group with *Pycnanthus angolensis*, *Albizia adianthifolia* and that with *Pycnanthus angolensis*, *Anthocleista schweinfurthii* and *Treculia africana*, individualized in the zone at the edge of the forest of the Kala massif are to be compared to the secondary formations described on the summit of the Minloua inseberg by Noumi (2010). These descriptions and names corroborate the conclusions of the studies carried out by Malaisse (1968) and Lewalle (1972). In addition, the presence of species like *Albizia adianthifolia*, *Elaeis guineensis*, *Myrianthus arboreus* and pyrophyte species like *Combretum* sp. are eloquent signs of the imprint of human action (trampling, agriculture, livestock, fishing) and the secondaryization of Kala forests.

CONCLUSION AND PERSPECTIVES

This study made it possible to identify and characterize the plant groups forming the vegetation of the forest of the Kala massif. The floristic inventory made in this massif has identified 211 species belonging to 154 genera and 46 different families. Among these species, 210 have been determined at the specific level, 1 at the generic level. The individualization of the plant groups on the basis of the partition of the statements by Detrended Correspondence Analysis (DCA) and an Ascending Hierarchical Classification (CHA) gave three groups which, classified in the higher syntaxes are:

- Class *Strombosio-Parinarietea* Lebrun & Gilbert 1954, equatorial rainforests; with *Allanblackia gabonensis*, *Leplaea mayombensis*, *Pycnanthus angolensis*, *Strombosio parinarietea*, in the tree layer, *Cola verticillata*, *tabernaemontana crassa*, *Garcinia smeathmannii*, *Garcinia mannii*, *Aulacocalyx jasminiflora*, *Aulacocalyx talbotii* in the shrub layer;
- Class of *Erythrophleetea africani* Schmitz 1963, from the Guineo-Sudano-Zambézian tropical forests, with a representative at the top of the Nkol nlong hill, characterized by species poverty marking this degraded forest, the whole of which is dominated by tree species of *Brachystegia* and *Uapaca* with *Erythrophleum* ivorense, *Paraberlinia bifoliolata* (*Julbernarda pellegriniana*), *Tetraberlinia bifoliolata* (*Julbernardia bifoliolata*);
- Class of *Musango-terminalietea* Lebrun & Gilbert 1954, forests of the Guineo-

Malagasy liaison group, with very wide Sudano-Zambézian penetration, the class is dominated by species such as *Pycnanthus angolensis*, *Albizia adianthifolia*, *Elaeis guineensis*, *Nauclea latifolia*, *Nauclea diderrichii*.

In relation to the results obtained, it emerges from research perspectives that should be undertaken in the near future. These include, in particular:

- analysis, through diachronic observations, of the dynamic relationships in time and space between the plant groups that have been defined within the vegetation of the forest;
- analysis of life traits and ecology of the main tree species in the two forests;
- the study of natural regeneration mechanisms, mortality, growth and recruitment of tree species to better understand the dynamics of natural renewal of the Kala forest.

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Annex 1: Phytosociological presentation of the floristic list of the Kala massif forest, with sequences of the 21 surveys carried out and phytosociologicalsyntaxa

Families	TB	TP	Stage	UP	TF	TD	Species	R1	R2	R3	R4	R5	R6	R7	R8	R9	R10	R11	R12	R13	R14	R15	R16	R17	R18	R19	R20	R21	Grand total
Strombosio-Parinarietea Lebrun & Gilbert 1954																													
Euphorbiaceae	Msph	At	Bm/Sm	Str	Méso	Ballo	*Alchornea floribunda* Müll. Arg.	2	3	11		3	2																21
Annonaceae	Mgph	G	Bm/Sm	Str	Macro	Sarco	*Anonidium mannii* (Oliv.) Engl. et Diels.		24	22	5	19	10		1		2		1	2		3	6	6	1	6	6	5	119
Euphorbiaceae	Mcph	G	Bm	Str	Méso	Sarco	*Antidesma laciniatum* Müll. Arg.	5			1		2																8
Meliaceae	Mcph	Aam	Bm/Sm	Str	Méso	Ballo	*Carapa procera* DC.	5		6	1	11	5		1					1		1	2	1			1	3	38
Samydaceae	Mcph	At	Bm/Sm	Str	Méso	Ballo	*Casearia barteri* Jacq.	4	1		3	1	4											1					14
Sterculiaceae	Nnph	G	Bm/Sm	Str	Méso	Sarco	*Cola attiensis* var. bordardii (Pellegr.) N. Halle	6	6	14	37	25	6																94
Burseraceae	Msph	G	Bm	Str	Méso	Sarco	*Dacryodes macrophylla* (Oliv.) Lam	18	5	6	1		18				1				1								50
Rubiaceae	Mcph	G	Bm/Sm	Str	Méso	Sarco	*Massularia acuminata* (K. Schum.) Hoyle	9	3	3		4	9																28
Ochnaceae	Mcph	Bg	Bm	Str	Macro	Sarco	*Campylospermum elongatum* (Oliv.) Vahl Tiegh	16					2																18
Violaceae	Nnph	G	Bm/Sm	Str	Méso	Ballo	*Rinorea oblongifolia* (C.h. Wright) Marg. ex chipp		1	8	2																		11
Olacaceae	Msph	G-Sz	Bm/Sm	Str	Méso	Sarco	*Strombosia grandifolia* Hook. f. ex Benth.	17	13	9		16	17																72
Olacaceae	Msph	Cg	Bm/Sm	Str	Méso	Sarco	*Strombosiopsis tetrandra* Eng.	9					9																18
Olacaceae	Mcph	G	Bm/Sm	Str	Méso	Sarco	*Strombosia pustulata* Oliv.	8		3	6		8																25
Rubiaceae	Nnph	Cg	Bm/Sm	Str	Macro	Sarco	*Schumanniophyton magnificum* Harms			1	10																		11
Moraceae	Mcph	G-Sz	Bm/Sm	Str	Méso	Sarco	*Sloetiopsisusambarensis* Engler		8																				8
Myristicaceae	Mcph	Cg	Bm/Sm	Str	Méso	Sarco	*Staudtia kamerunensis* Warb.	9	2		16	7	9					2								1			46
Meliaceae	Mcph	Cg	Bm/Sm	Str	Méso	Ballo	*Trichilia rubenscens* Oliv.	1	1	5		3	1																11
Piptadeniastro-Celtidetalia Lebrun & Gilbert 1954																													
Apocynaceae	Msph	G	Bm	Pip	Méso	Pogo	*Alstonia boonei* De Willd.		3	1	5	14																	23
Moraceae	Mcph	G	Bm	Pip	Méso	Sarco	*Antiaris toxicaria* Lesch.	1	1			5	1																8
Moraceae	Msph	G	Bm	Pip	Méso	Sarco	*Antiaris welwitschii* Lesch.		3												1				1			1	6
Sapotaceae	Msph	G	Bm	Pip	Méso	Ballo	*Blighia welwitschii* (Hiern) Radlk.				1	3					2		1										7
Bombacaceae	Msph	G	Bm	Pip	Méso	Ballo	*Bombax buonopozense* P. Beauv.			3	2																		5

Leguminosae	Msph	Cg	Bm	Pip	Méso	Ballo	*Brachystegia laurentii* (De Wild.) Louis			14		1																	15
Celtidaceae	Msph	Pal	Bm/Sm	Pip	Méso	Sarco	*Celtis philippensis* Blanco	2					2																4
Celtidaceae	Msph	Bg	Bm	Pip	Méso	Sarco	*Celtis tessmannii* Rendle	9		1	1	1	9																21
Celtidaceae	Msph	G-Sz	Bm	Pip	Méso	Sarco	*Celtis zenkeri* Engl.	9	8		10	9	9																45
Sterculiaceae	Mcph	G	Bm	Pip	Méso	Sarco	*Cola acuminata* P. Beauv.					4								1	1	2							8
Sterculiaceae	Msph	Cg	Bm	Pip	Méso	Sarco	*Cola lateritia* K. Schum.			2	3	1																	6
Leguminosae	Msph	G	Bm	Pip	Méso	Ballo	*Cylicodiscus gabunense* Harms		1																				1
Combretaceae	Phgr	Ind	Ind	Pip	Méso	Ptéro	*Combretum* sp.			16	4																		20
Boraginaceae	Msph	G	Bm	Pip	Méso	Sarco	*Cordia platythyrsa* Bak.	14	2		4	12	14													2			48
Leguminosae	Mgph	Cg	Bm	Pip	Lepto	Ptéro	*Gossweilerodendron balsamiferum* (Verm.) Harms	8		13	1	2	8																32
Chrysobalanaceae	Msph	G	Bm	Pip	Méso	Sarco	*Maranthes glabra* (Oliv.) Prance			1																			1
Meliaceae	Msph	At	Bm	Pip	Méso	Sarco	*Guarea thompsonii* Harms.	29	3	1	5	22	29							2				1		1			93
Simaroubaceae	Msph	G	Bm	Pip	Méso	Sarco	*Hannoa kleineana* Pierre et Engl.	3	2		2		3																10
Annonaceae	Msph	G	Bm	Pip	Méso	Sarco	*Hexalobus crispiflorus* A. Rich.				1																		1
Flacourtiaceae	Mgph	Cg	Bm	Pip	Méso	Sarco	*Homalium letestui* Pellgr.		1	5		3																	9
Flacourtiaceae	Mgph	G	Bm	Pip	Méso	Sarco	*Homalium* sp.		4	1	5	9																	19
Leguminosae	Msph	G	Bm	Pip	Micro	Ballo	*Hymenostegia afzelii* (Oliv.) Harms		1																				1
Lauraceae	Mcph	Cg	Bm	Pip	Méso	Sarco	*Hypodaphnis zenkeri* (Engl.) Stapf	9	3	18	6	3	9																48
Apocynaceae	Phgr	G-Sz	Bm/Sm	Pip	Méso	Sarco	*Landolphia congolensis* (Stapf) Pichon			9	4																		13
Leeaceae	Mcph	At	Bm/Sm	Pip	Méso	Sarco	*Leea guineensis* G. Don		12		1	7																	20
Euphorbiaceae	Mcph	Am	Bm	Pip	Méso	Sarco	*Mallotus oppositifolius* (Geisel.) Müll. Arg.		2	2	2	3																	9
Bignoniaceae	Mcph	G-Sz	Bm	Pip	Méso	Ptéro	*Markhamea lutea* (Benth.) K. Schum.			2	1																		3
Tiliaceae	Msph	G	Bm/Sm	Pip	Méso	Sarco	*Desplatsia subericarpa* Bocq.		31	1	8	1																	41
Ebenaceae	Msph	Cg	Bm	Pip	Méso	Sarco	*Diospyros crassiflora* Hiern		1		6	6																	13
Leguminosae	Msph	G	Bm	Pip	Lepto	Baro	*Distemonanthus benthamianus* Baill.				1										3								4
Tiliaceae	Msph	G	Bm	Pip	Méso	Sarco	*Duboscia macrocarpa* Bocq.	7					7																14
Meliaceae	Msph	G	Bm/Sm	Pip	Méso	Ptéro	*Entandrophragma cylindricum* Sprague				1																		1

Meliaceae	Msph	Cg	Bm/Sm	Pip	Méso	Ptéro	*Entandrophragma utile* Dawe et Sprague				5																		5
Sterculiaceae	Msph	G	Bm	Pip	Méso	Ballo	*Eribroma oblangum* (Mast.) Bodard	2					2									1							5
Sapotaceae	Msph	Cg	Bm	Pip	Méso	Sarco	*Gambea boukokoensis* Aubr. et Pellegr.				1													1					2
Clusiaceae	Mcph	G	Bm/Sm	Pip	Méso	Sarco	*Garcinia kola* Heckel		1	1	2									1									5
Leguminosae	Msph	G-Sz	Bm	Pip	Lepto	Ballo	*Erythrophleum ivorense* A. Chev.		1	1		13																	15
Euphorbiaceae	Mcph	G	Bm	Pip	Méso	Baro	*Microdesmis puberula* Hook.	9	1	4			9																23
Annonaceae	Mcph	G	Bm	Pip	Méso	Sarco	*Monodora tenuifolia* Benth		2			4																	6
Annonaceae	Mcph	Cg	Bm/Sm	Pip	Méso	Sarco	*Monodora myristica* (Geartn.) Dinal	15	12		4	10	15																56
Rubiaceae	Mcph	G	Bm	Pip	Méso	Sarco	*Nauclea latifolia* Sm.				2																		2
Sterculiaceae	Msph	G	Bm	Pip	Méso	Ptéro	*Nesogordonia papaverifera* (A. Chev.) R.			2		2							1			1							6
Leguminosae	Msph	G	Bm	Pip	Lepto	Ballo	*Parkia bicolor* A. Chev.	1	1	2		1	1																6
Leguminosae	Mgph	G	Bm/Sm	Pip	Lepto	Ptéro	*Piptadeniastrum africanum* (Hook. F.) Brenan		1							1													2
Leguminosae	Msph	G	Bm/Sm	Pip	Lepto	Ballo	*Plagiosiphon emarginatus* Hutch. et Dalz.	1				1	1																3
Combretaceae	Msph	G	Bm	Pip	Micro	Ptéro	*Pteliopsis hylodendron* Mild.			3		4							1										8
Leguminosae	Msph	Cg	Bm	Pip	Micro	Ptéro	*Pterocarpus mildbreadii* Engl.	2	1	3			2																8
Leguminosae	Msph	G	Bm	Pip	Micro	Ptéro	*Pterocarpus soyauxii* Taub.	7	3		7	2	7																26
Sterculiaceae	Mcph	Cg	Bm	Pip	Méso	Ballo	*Sterculia rhimopetala* K. Schum.	2	12	2		12	2																30
Myristicaceae	Msph	G	Bm	Pip	Méso	Sarco	*Sizygium rowlandii* Sprague		3	46		16																	65
Combretaceae	Mgph	G	Bm	Pip	Méso	Ptéro	*Terminalia superpa* Engl. et Diels					2																	2
Leguminosae	Mcph	G	Bm	Pip	Lepto	Baro	*Tetrapleura tetraptera* (Schum. et Thonn.) Taub.	8	10		1		8		1							1							29
Euphorbiaceae	Msph	At	Bm	Pip	Méso	Sarco	*Tetrorchidium didymostermon* (Baill.) Pax																				1		1
Sterculiaceae	Mgph	G	Bm	Pip	Méso	Ptéro	*Triplochiton scleroxylon* K. Schum.			1	9																		10
Annonaceae	Msph	G	Bm	Pip	Méso	Ballo	*Xylopia aethiopica* (Dunal) A. Rich.	1	8		1		1																11
Verbenaceae	Msph	Cg	Bm/Sm	Pip	Méso	Sarco	*Vitex grandifolia* (C. H. Wright) Marq. ex chipp	1					1																2
Gilbertiodendretalia dewevrei Lebrun & Gilbert 1954																													
Leguminosae	Msph	Cg	Bm	Gilb	Méso	Ptéro	*Amphimas pterocarpoides* Harms.	7	1		2	1	7																18
Annonaceae	Msph	Cg	Bm	Gilb	Méso	Sarco	*Annickia chlorantha* Oliv.	12	27		5	12	12																68
Leguminosae	Msph	G	Bm	Gilb	Méso	Ballo	*Anthonotha fragrans* (Bak. f.) Excell. Hill.		1	2																			3

Leguminosae	Mcph	At	Bm	Gilb	Méso	Ballo	*Anthonotha macrophylla* P. Beauv.			11	2	13		1											1				28
Sterculiaceae	Msph	G-Sz	Bm/Sm	Gilb	Méso	Ballo	*Cola ballayi* M. Cornu		4	1	22			1	2	2	4						1	3	1	2	2	3	48
Euphorbiaceae	Mcph	G	Bm/Sm	Gilb	Méso	Sarco	*Antidesma mambranaceum* Müll. Arg.		1			3	3																7
Anacardiaceae	Msph	Cg	Bm	Gilb	Lepto	Sarco	*Antrocaryon klaineanum* Pierre		1	1	2	2																	6
Leguminosae	Mcph	G-Sz	Bm	Gilb	Méso	Baro	*Baphiopsis parviflora* Benth. et Bak.	2	1			1	2																6
Lauraceae	Mcph	Ca	Bm	Gilb	Méso	Sarco	*Beilschmiedia grandifolia* (Vahl.) Hutch. et Dalz.				9	8	14																31
Rubiaceae	Chd	Cg	Bm	Gilb	Méso	Sarco	*Bertiera adamsii* (Hepper) N. Halle	1					1																2
Leguminosae	Msph	Cg	Bm	Gilb	Méso	Ballo	*Brachystegia cynemetroides* Harms	1	2	5			1																9
Polygalaceae	Msph	Aam	Bm/Sm	Gilb	Méso	Sarco	*Carpolobia lutea* G. Don.	1	1				1																3
Tiliaceae	Mcph	Aam	Bm	Gilb	Méso	Baro	*Christiana africana* DC.		2			1						1											4
Sterculiaceae	Msph	Cg	Bm/Sm	Gilb	Méso	Baro	*Cola pachycarpa* K. Schum.	4			1	1	4																10
Sterculiaceae	Msph	Cg	Bm/Sm	Gilb	Méso	Baro	*Cola rostrata* K. Schum.	2					2																4
Rubiaceae	Nnph	Cg	Bm	Gilb	Méso	Sarco	*Coffea brevipes* Hiern	15	9		2	9	15																50
Leguminosae	Msph	Cg	Bm	Gilb	Méso	Sclér o	*Crudia gabonensis* Pierre ex De Willd.			2	2	1																	5
Burseraceae	Msph	G	Bm	Gilb	Méso	Sarco	*Dacryodes igangaga* Aubr. et Pellegr.				5										1								6
Burseraceae	Msph	Cg	Bm	Gilb	Nano	Sarco	*Dacryodes buettneri* (Engl.) Lam	1	3		11	3	1																19
Irvingiaceae	Msph	Cg	Bm	Gilb	Méso	Ptéro	*Desbordesia glaucescens* (Engl.) Vans Tiegh	10	3	2	2	14	10					1											42
Leguminosae	Msph	Cg	Bm	Gilb	Nano	Baro	*Dialum bipendense* Harms	1	1	5		7	1																15
Leguminosae	Msph	Ca	Bm	Gilb	Méso	Baro	*Dialum zenkeri* Harms	5	1	4	14	1	5														1		31
Ebenaceae	Mcph	G-Sz	Bm/Sm	Gilb	Méso	Sarco	*Diospyros hoyleana* F. White				1	3																	4
Ebenaceae	Mcph	G	Bm	Gilb	Méso	Sarco	*Diospyros longiflora* R. Let.			15	1																		16
Ebenaceae	Mcph	G	Bm	Gilb	Méso	Sarco	*Diospyros simulans* F. White	8	9	3	7	1	8																36
Euphorbiaceae	Msph	Cg	Bm/Sm	Gilb	Méso	Sarco	*Drypetes gossweilerii* S. Moore	1					1																2
Euphorbiaceae	Msph	Cg	Bm	Gilb	Méso	Sarco	*Drypetes klainei* Pierre ex Pax	8		1	3	15	8																35
Sapindaceae	Mcph	G	Bm	Gilb	Méso	Sarco	*Eriocoelum macrocarpum* Gilg.	14	2		10	3	14																43
Vochyliaceae	Msph	Cg	Bm	Gilb	Méso	Ptéro	*Erysmadelphus exsul* Mildbr.	11			9	2	11																33
Sapotaceae	Msph	G	Bm	Gilb	Méso	Sarco	*Gambeya africana* (G. Dan. ex Bak.) Pierre.	1	1	2	1	1	1																7
Leguminosae	Msph	Cg	Bm	Gil b	Lepto	Ballo	*Librevillea klainei* Pierre (ex Harms) Hoyle			6																			6

Euphorbiaceae	Msph	G	Bm	Gilb	Meso	Sarco	*Macaranga barteri* Müll. Arg.			3	1																		4
Euphorbiaceae	Msph	Cg	Bm	Gilb	Meso	Sarco	*Macaranga monandra* Müll. Arg.		3		1																		4
Euphorbiaceae	Msph	G	Bm	Gilb	Meso	Sarco	*Macaranga saccifera* Pax					1																	1
Euphorbiaceae	Mcph	G	Bm	Gilb	Meso	Sarco	*Maesobotrya dusenii* (Pax) Hutch.		3		1																		4
Euphorbiaceae	Mcph	Cg	Bm	Gilb	Meso	Sarco	*Maesobotrya klaineana* Benth.	1		1			1																3
Clusiaceae	Msph	G-Sz	Bm	Gilb	Méso	Sarco	*Mammea africana* Sabine		1	1																			2
Leguminosae	Msph	Cg	Bm	Gilb	Méso	Ballo	*Gilbertiodendron brachystegioides* Harms		17	12	8	1																	38
Leguminosae	Msph	Cg	Bm	Gilb	Méso	Ballo	*Gilbertiodendron preussii* Harms		10	4	12	1																	27
Tiliaceae	Msph	G	Bm	Gilb	Méso	Ballo	*Glyphaea brevis* (Sprague) Manachino	4	1	5	12	1	4																27
Annonaceae	Mcph	Cg	Bm/Sm	Gilb	Méso	Sarco	*Greenwayodendron suaveolens* (Engl. et Diels) Verd.	19	3	1	14		19				1	3	2		1								63
Meliaceae	Msph	G	Bm/Sm	Gilb	Méso	Ballo	*Guarea cedrata* (A. Chev.) Pellegr.			4	1	6		1		3	2	2	2	3	2	2		2		1			31
Irvingiaceae	Msph	G-Sz	Bm	Gilb	Méso	Sarco	*Klainedoxa gabonensis* Pierre ex Engl.	2	9	4	1	1	2	1					2	1			1	1			1		26
Annonaceae	Msph	Cg	Bm	Gilb	Méso	Sarco	*Isolana hexaloba* Engl.	1	1	6		1	1				1	1											12
Rhamnaceae	Msph	G	Bm	Gilb	Méso	Sarco	*Lasiodiscus mannii* Hook. f.			1																			1
Leguminosae	Mcph	Cg	Bm	Gilb	Méso	Ballo	*Milletia sanagana* Harms		1	1		2																	4
Leguminosae	Msph	Cg	Bm	Gilb	Micro	Ballo	*Newtonia griffoniana* (Baill.) Keay			5																			5
Sapotaceae	Msph	G	Bm	Gilb	Méso	Sarco	*Omphalocarpum procerum* P. Beauv.	1		1	1	1	1		1	1	1		1										9
Pandaceae	Msph	G	Bm	Gilb	Méso	Sarco	*Panda oleosa* Pierre	2					2																4
Leguminosae	Msph	G	Bm	Gilb	Méso	Ptéro	*Paraberlinia bifoliolata* Pellegr.		2		4																		6
Rubiaceae	Msph	Cg	Bm	Gilb	Méso	Ballo	*Pausinystalia macroceras* (K. Schum) Pierre	1					1																2
Rubiaceae	Mcph	pan	Bm/sm	Gilb	Méso	Sarco	*Psydrax arnoldianum* (De Willd. et Th.Dur.) Hepper	1	2	9		16	1																29
Rubiaceae	Mcph	G	Bm	Gilb	Méso	Sarco	*Rothmannia hispida* (K. Schum) Fagerlind	8	4		1		8																21
Rubiaceae	Msph	Cg	Bm	Gilb	Méso	Sarco	*Rothmannia lujae* (De Wild.) Keay	9		15	5	1	9				1	1		1		2	1			1		1	47
Rubiaceae	Mcph	G-Sz	Bm	Gilb	Méso	Sarco	*Rothmannia whitfieldii* (Lind.) Dandy	1					1																2

Flacourtiaceae	Msph	G	Bm	Gilb	Méso	Ballo	*Scottellia coreacea* A. Chev.	5	2			1	5																13
Flacourtiaceae	Mcph	G	Bm	Gilb	Méso	Ballo	*Scottellia minfiensis* Gilg.		1	3																			4
Leguminosae	Msph	Cg	Bm	Gilb	Lepto	Baro	*Tessmania anomala* (Mich.) Harms		3																				3
Leguminosae	Msph	Cg	Bm	Gilb	Méso	Ballo	*Tetraberlinia bifoliolata* (harms) Hauman		2	1																			3
Meliaceae	Mcph	Cg	Bm/Sm	Gilb	Méso	Ballo	*Trichilia welwitschii* C.DC.	4	2	1			4				2	1	1			1							16
Annonaceae	Mcph	Cg	Bm	Gilb	Méso	Sarco	*Uvariastrum pynaertii* De Wild.				1																		1
Annonaceae	Msph	Cg	Bm	Gilb	Méso	Ballo	*Xylopia staudtii* Engl.	1	1	1		6	1																10
Tiliaceae	Mcph	G	Bm	Gilb	Lepto	Sarco	*Grewia coriacea* Mast.	2	5	11	18		2	5	2	1	1							1			1		49
Tiliaceae	Mcph	Cg	Bm/Sm	Gilb	Méso	Baro	*Desplatsia dewevrei* De wild. et Th. Dur	8	2			4	8													1			23
Garcinietalia Noumi 1998																													
Euphorbiaceae	Mcph	G	Sm	Gar	Méso	Sarco	*Antidesma venosum* Tul.				3	1													1				5
Rubiaceae	Mcph	Cg	Sm	Gar	Méso	Sarco	*Aulacocalyx caudata* Hook. f.		10	9	28	10																	57
Rubiaceae	Mcph	Cg	Sm	Gar	Méso	Sarco	*Aulacocalyx jasmiflora* Hook. f.	30	33	36	5	32	18																154
Rubiaceae	Mcph	Cg	Sm	Gar	Méso	Sarco	*Aulacocalyx talbotii* (Wernham) Keay					5	12																17
Clusiaceae	Msph	G	Sm	Gar	Méso	Sarco	*Allanblackia gabonensis* (Pellegr.) Bamps	13	36	57	34	39	13																192
Lauraceae	Mcph	Cg	Sm	Gar	Méso	Sarco	*Beilschmiedia obscura* (stapf) Engl. et A.		1	12		5																	18
Sapotaceae	Msph	G-Sz	Sm	Gar	Méso	Sarco	*Aningeria altissima* (A. chev.) Aubr. et Peller.	3	8				3																14
Cyatheaceae	Nnph	G	Sm/ Mi	Gar	Lepto	Sclér o	*Cyathea camerooniana* Hook. f		8	9		2																	19
Cyatheaceae	Nnph	G	Sm/ Mi	Gar	Lepto	Sclér o	*Cyathea manniana* Hook. f.		7			1																	8
Sterculiaceae	Msph	Aam	Sm	Gar	Méso	Sarco	*Cola verticillata* (Thonn.) stapf ex A. chev		13	10	9	51																	83
Leguminosae	Msph	Cg	Sm	Gar	Méso	Sarco	*Erythrina mildbraedii* Harms	4	2	11			4																21
Euphorbiaceae	Mcph	G	Mi	Gar	Méso	Sarco	*Erythrococca africana* (Baill.) Prain			11	2	3																	16
Clusiaceae	Mcph	Cg	Sm/Mi	Gar	Méso	Sarco	*Garcinia mannii* Oliv.		1		4										1	1							7
Clusiaceae	Mcph	At	Sm/Mi	Gar	Méso	Sarco	*Garcinia smeathmannii* Oliv.	10	12	29	11	16	10																88
Meliaceae	Msph	Cg	Sm	Gar	Méso	Sarco	*Leplaea mayombensis* (Under.) Alst.	10		11	12		10																43
Menispermaceae	Nnph	Cg	Sm	Gar	Macro	Sarco	*Penianthus longifolius* Miers		11	1	2																		14
Cecropiaceae	Mcph	G	Sm	Gar	Macro	Sarco	*Myrianthus libericus* P. Beauv.		4	3		12			1	1	1												22

Anacardiaceae	Msph	G	Sm	Gar	Micro	Sarco	*Sorindeia grandifolia* Engl.		1		3	3																	7
Bignoniaceae	Msph	At	Sm	Gar	Méso	Ballo	*Spathodea campanulata* P. Beauv.	1					1																2
Burseraceae	Mgph	G	Sm	Gar	Méso	Sarco	*Santiria trimera* (Oliv.) Aubr.	19	1	16	11	13	19	2	1	3		1	2					2		2			92
Meliaceae	Mcph	Cg	Sm	Gar	Méso	Ballo	*Trichilia dregeana* Sond.			2	4	5																	11
Euphorbiaceae	Msph	G	Sm	Gar	Méso	Sarco	*Uapaca esculenta* A. Chev.	2				1	2																5
Euphorbiaceae	Msph	G	Sm	Gar	Méso	Sarco	*Uapaca guineensis* Müell. Arg.	1	2	11		2	1	1	1	2	2	1											24
Annonaceae	Mcph	Cg	Sm	Gar	Méso	Ballo	*Xylopia rubescens* Oliv.					3																	3
Bignoniaceae	Mcph	At	Sm	Gar	Méso	Baro	*Kigelia africana* (Lam.) Benth.			1	1	1																	3
Musango-Terminalietea Lebrun & Gilbert 1954																													
Flacourtiaceae	Mcph	At	Bm	Mus	Méso	Sarco	*Caloncoba echinata* (Oliv.) Gilg.	1	4	3			1																9
Flacourtiaceae	Msph	Bg	Bm/Sm	Mus	Méso	Sarco	*Caloncoba glauca* (P. Beauv) Gilg.		1	3		1																	5
Flacourtiaceae	Msph	Bg	Bm/Sm	Mus	Méso	Sarco	*Caloncoba welwitschii* (Oliv.) Gilg.	7	1	4	4	2	7																25
Mimosaceae	Msph	At	Bm/Sm	Mus	Lepto	Ballo	*Albizia adianthifolia* (Schum.) W. F. Wight			3	5	3																	11
Mimosaceae	Msph	Cg	Bm/Sm	Mus	Lepto	Ballo	*Albizia glaberrima* (schum. et thonn.) Benth.	14	9				4																27
Euphorbiaceae	Msph	G	Bm	Mus	Méso	Baro	*Discoglypremna caloneura* (Pax) Prain	1					1				2			1									5
Moraceae	Msph	Pal	Bm/Sm	Mus	Méso	Sarco	*Ficus exasperata* Vahl.	4	5	7	1	1	4																22
Leguminosae	Msph	Cg	Bm	Mus	Méso	Ptéro	*Hylodendron gabunense* Taub.	2	3			5	2																12
Moraceae	Mcph	At	Bm	Mus	Méso	Sarco	*Milicia excelsa* (Welw.) C.C. Berg.			8		9																	17
Euphorbiaceae	Msph	G-Sz	Bm/Sm	Mus	Méso	Sarco	*Maesopsis eminii* Engl.	1	2	3		6	1																13
Cecropiaceae	Msph	G	Bm/Sm	Mus	Macro	Sarco	*Musanga cecropioides* R. Br.	5	3				5			1		1										1	16
Cecropiaceae	Mcph	G	Bm	Mus	Macro	Sarco	*Myrianthus arboreus* P. Beauv.	13	19		4	4	13				3				1								57
Rubiaceae	Msph	Cg	Bm	Mus	Méso	Sarco	*Nauclea diderrichii* (De Wild. et Th. Dur .) Merrill			2		1																	3
Rubiaceae	Mcph	G	Bm	Mus	Macro	Sarco	*Oxyanthus speciosus* DC.		6	4	1																		11
Lecythidaceae	Msph	G	Sm	Mus	Méso	Ptéro	*Petersianthus macrocarpus* (P. Beauv.) Liben		2	3																			5
Myristicaceae	Msph	G	Bm	Mus	Macro	Sarco	*Pycnanthus angolensis* (Welw.) Warb.	13	25	12	16	11	13	1		1			1	2		3	1				2		101
Apocynaceae	Mcph	Cg	Bm	Mus	Méso	Sarco	*Rauvolfia macrophylla* Stapf	2	2	1		1	2																8
Apocynaceae	Mcph	G	Bm/Sm	Mus	Méso	Sarco	*Rauvolfia vomitoria* Afzel			1	1																		2

Euphorbiaceae	Msph	G	Bm	Mus	Méso	Sarco	*Ricinodendron heudelotii* (Baill.) Pierre ex pax .	3	1				3				1		1										9
Apocynaceae	Msph	G	Bm	Mus	Macro	Sarco	*Tabernaemontana crassa* Benth.	25	25	5	35	52	25						1	1	1	2	2	1			2	1	178
Moraceae	Msph	G	Bm	Mus	Méso	Sarco	*Trilepisium madagascariensis* DC.	12	4		18		12																46
Apocynaceae	Mcph	Cg	Bm	Mus	Méso	Sarco	*Voacanga africana* Stapf	1					1																2
Apocynaceae	Mcph	At	Bm	Mus	Méso	Sarco	*Voacanga braeteata* Stapf		3		10	4																	17
Pterygotetalia Lebrun &Gilbert 1954																													
Burseraceae	Msph	Cg	Bm/Sm	Ptery	Méso	Sarco	*Canarium schweinfurthii* Engl.		5		7	1									1								14
Rutaceae	Msph	G	Bm/Sm	Ptery	Méso	Baro	*Zanthoxylum gillettii* De Willd.		2	8		4																	14
Rutaceae	Msph	G	Bm/Sm	Ptery	Méso	Baro	*Zanthoxylum tessmannii* (Engl.) R. Let.	2	1	2		4	2			1													12
Meliaceae	Msph	G	Bm/Sm	Ptery	Méso	Ballo	*Khaya anthotheca* (welw.) C. DC.		1		4																		5
Euphorbiaceae	Msph	At	Bm/Sm	Ptery	Méso	Ballo	*Margaritaria discoidea* (Benth) K. Schum.		3																				3
Sterculiaceae	Msph	G	Bm/Sm	Ptery	Macro	Ptéro	*Pterygota macrocarpa* K. Schum.		1	17																			18
Meliaceae	Mcph	G	Bm	Ptery	Méso	Ballo	*Turraeanthus africanus* (Welw. ex DC.)	5	11	7	2	17	5	1	1	2					2						1		54
Euphorbiaceae	Msph	G	Bm	Ptery	Méso	Sarco	*Uapaca togoensis* Pax et Engl.				1																		1
Mitragynetea Schmitz 1963																													
Annonaceae	Msph	G	Bm	Mit	Méso	Sarco	*Cleistopholis patens* (Benth.) Engl. et Diels	5	4	2	1	1	5			1													19
Myristicaceae	Msph	G	Bm	Mit	Méso	Sarco	*Coelocaryon preussii* Warb.	33					33				4	1	3	4	1	2							81
Clusiaceae	Msph	Pan	Bm	Mit	Méso	Sarco	*Symphonia globulifera* L. f.		5		3	8														1			17
Sapotaceae	Mcph	Cg	Bm	Mit	Méso	Sarco	*Synsepalum dulcificum* Schum. etThonn.		1	9	1	12																	23
Delliniaceae	Phgr	At	Bm	Mit	Méso	Ptéro	*Tetracera alnifolia* Willd.		1																				1
Moraceae	Msph	At	Bm	Mit	Méso	Sarco	*Treculia africana* Decne.		2		13	9																	24
Araceae	Mcph	Pal	Bm/Sm	Mit	Méga	Sarco	*Elaeis guineensis* Jacq.		1																				1
Moraceae	Mcph	G	Bm	Mit	Méso	Sarco	*Ficus mucuso* Ficalho		3	1																			4
Anacardiaceae	Msph	Am	Bm	Mit	Méso	Ptéro	*Pseudospondias microcarpa*(A. Rich.) Engl.	1			1		1	1	1														5
Sterculiaceae	Msph	Pra	Bm	Mit	Méso	Ballo	*Sterculia tragacantha* Lindl.	2			2	17	2			1													24
*Ficalhoeto-Podocarrpetalia*Lebrun &Gilbert 1954																													
Meliaceae	Msph	G	Mi	Fic	Méso	Sarco	*Carapa grandiflora* (Pax) Hutch	3					3																6
Melastomataceae	Mcph	G-Sz	Mi	Fic	Méso	Sarco	*Memecylon polyanthemos* Hook. f.	1					1																2

Euphorbiaceae	Msph	G-sz	Mi	Fic	Méso	Sarco	*Sapiumellipticum* (Hochst.) Pax				1																		1
Oleo-Jasminetalia Lebrun & Gilbert 1954																													
Leguminosae	Phgr	G	Sm	Oleo	lepto	Ballo	*Acacia pennata* (L.) Willd.	1	1	3		12	1																18
Sapindaceae	Msph	At	Sm	Oleo	Méso	Sclér o	*Allophylus africanus* P. Beauv.	5					5																10
Hyparrhenietea Schmitz 1963																													
Leguminosae	Mcph	Aam	Bm	Hyp ar	Méso	Ptéro	*Entada gigas* (Linn.) Fawcett et Rendle	13	1		1	2	13																30
*Polyscietalia fulvae*Lebrun & Gilbert 1954																													
Alangiaceae	Msph	Pal	Mi	Pol	Macro	Baro	*Alangium chinense* (Lour.) Harms		10	12	4	2																	28
Indéterminé																													
Euphorbiaceae	Mcph	At	Ind	Ind	Méso	Sarco	*Antidesma* sp.			1		17																	18
								692	664	743	645	818	692	15	13	21	31	16	20	20	17	22	14	20	5	18	18	15	4519

Abbreviations used.

<table>
<tr><th>Biological Forms (FB)</th><th>Phytogeographic types (TP)</th><th>Types of Diaspores (TD)</th><th>Types of leaf size (TF)</th></tr>
<tr><td>UC : Upright Chamaephyte</td><td>Am: Afro-Malagasy</td><td>Ballo : Ballochore</td><td>Lepto : Leptophyll</td></tr>
<tr><td>PC : Prostrate Chamephyte</td><td>At: Afro-tropical</td><td>Baro : Baroque</td><td>Macro : Macrophyll</td></tr>
<tr><td>BG : Bulbous Geophyte</td><td>Cg : Centro-Guineo-Congolese</td><td>Desmo : Desmochore</td><td>Méso : Mesophyll</td></tr>
<tr><td>RG : Rhizomatous Geophyte</td><td>Cosmo : Cosmopolitan</td><td>Pleo : Pleochorus</td><td>Micro : Microphyll</td></tr>
<tr><td>TG : Tuberous Geophyte</td><td>G : Omni- or subomni-Guineo-Congolese</td><td>Pogo : Pogonochorus</td><td>Nano : Nanophyll</td></tr>
<tr><td>O-EP : Optional Epiphyte</td><td>G-Sz : Guineo-Sudano-Zambezian</td><td></td><td>Ptero : Pterochore</td></tr>
<tr><td>CH : Cespitose Hemicryptophyte</td><td>Pal : Paleotropical</td><td></td><td>Sarco : Sarcochorus</td></tr>
<tr><td>CH : Crawling Hemicryptophyte</td><td>Pan : Pantropical</td><td></td><td>Sclero : Sclerochore</td></tr>
<tr><td>RH : Rosette hemicryptophyte</td><td colspan="3" rowspan="9">The average recovery is calculated according to the formula $Rm=\frac{\sum_1^n R}{n}$ where n is the number of readings
The values related to the recovery (table 6) are obtained by adding the average recoveries of each species. Relative recoveries are calculated with the following average percentage : + = 0,5 % ; 1= 3 % ; 2 =15 % ; 3 = 37,5 % ; 4 = 62,5 % ; 5 = 87</td></tr>
<tr><td>Mcph : Microphanerophyte</td></tr>
<tr><td>Mg : Megageophyte</td></tr>
<tr><td>Msph : Mesophanerophyte</td></tr>
<tr><td>Nnph : Nanophanerophyte</td></tr>
<tr><td>FrPh: Sufrutescent phanerophyte</td></tr>
<tr><td>CPh : Climbing phanerophyte</td></tr>
<tr><td>HPh : Herbaceous Phanerophyte</td></tr>
<tr><td>ETh : Erect Therophyte</td></tr>
</table>