Characterization of the spontaneous flora under plurispecific and monospecific afforestations in zone of semi-deciduous dense forest of Côte d'Ivoire: case of the classified forest of Bouaflé

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Abstract

The present study relates to the analysis and the evaluation of the spontaneous flora under various types of afforestation in the classified forest of Bouaflé in semi-deciduous dense forests zone of Côte d'Ivoire. The main aim of this study was to evaluate the richness and the diversity of the flora under various types of afforestation in order to find decision-making tools for the orientation of the future afforestation campaigns aiming to the restoration of the flora of the degraded zones of Côte d'Ivoire. The flora was characterized starting from floristic inventories realized under retimbered spaces. The methods used were that of the surface combined with that of the itinerant one. The results showed that the flora is slightly diversified under the the monospecific type of afforestations except the afforestations containing Cedreala odorata and is slightly diversified under the plurispecific type of afforestations. The majority of the species inventoried under the two types of afforestation are zoochores and/or anémochores. Twenty-seven (27) species with particular status were inventoried under the afforestations of the zone of study. These species were mainly inventoried under the plurispecific afforestations.

Keywords*: characterization; flora, type of afforestations, classified Forest, Bouaflé; Côte d'Ivoire*

Introduction

Since long decades, the afforestation, one of palliative measurements is recommended by the actors of development, the world scientists and the official authorities of the forest countries to compensate for the losses in biodiversity. But in spite of the many afforestation campaigns realized in the world over the years the degradation of the forest ecosystems remains major problems and represents one of the most important causes of reduction of the biodiversity in the world. The countries in the process of development record the most important reduction ratios of forest surfaces. In Côte d'Ivoire, forest surfaces which amounted to 15 million ha at the beginning of the years of independences, were according to SODEFOR (1996), estimated at 3 or 4 million hectares in 1996. This situation is the result of the abusive forestry holding combined to the development of the cultures of speculations (Hevea, palm tree with oil, cacao-tree and coffee-tree). Face to this situation, the first emergency measures were sensitizing, the attempts at rehabilitation of the sites degraded by the afforestation campaigns, the integrated management of assets etc On the other hand, force is to recognize that even if sensitizing is one of the way of solution, the forest degradation of spaces always does not wait to conform to the human calendars. This degradation is gradual over the years. Also, the changes noted within nature impose on each period of climatic upheaval, of new adaptive measurements for organic-eco-climatic balance. In many cases, the afforestation is the recommended palliative measure. But with which woody plants does one retimber in Côte d'Ivoire ?

What is the impact of the quality and the type of afforestation on the dynamics of the flora and by rebound on the conservation of the biodiversity? Such are there some questions of research not yet solved in the process of reconstitution of the flora after a major or partial degradation. The present study was initiated to evaluate the quantity and the quality of the flora under afforestations at exotic and local woody plants of the mesophilious sector in Côte d'Ivoire.

I-Material and method

1-1-zone of study

The Classified Forest of Bouaflé (FCB) is located at the Mid-west of Côte d'Ivoire, 30 km from Daloa and at 50 km from Bouaflé, on the Daloa-Bouaflé road axis. This forest belongs to the field of mésophilious forests (Monnier, 1983). The FCB is localised between 6°46 ′ and 6°55 ′ of

Northern latitude and between 6°04 ′ and 6°15 ′ of Western longitude (SODEFOR, 2014).situated between the Region of Marahoué and that of Haut Sassandra this forest set out again between the Departments of Daloa (20%) and Bouaflé (80%; Fig. 1). The highest temperatures (26.2 and 27,9°C) are obtained between November and May. The distribution of the rains reveals the existence of two seasons. One dry season (from November to February) and a rainy season (from March to October). The soils met in the FCB ferralitic for the majority are fairly denatured. They result from the deterioration of the rock (Perraud, 1971). These soils present good aptitudes for the forest afforestations and the farmings.

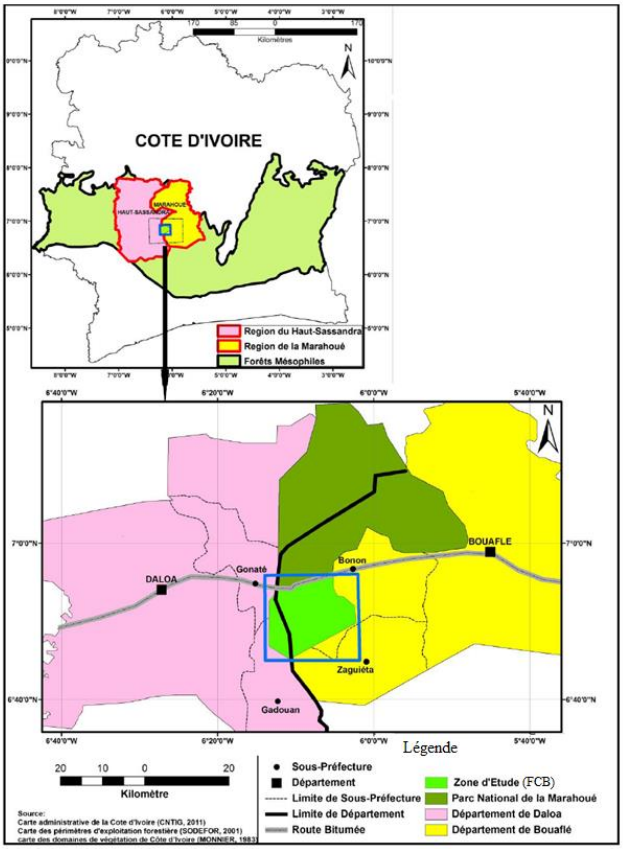

Fig.1: Localization of the Classified Forest of Bouaflé (Sidibé (2016)

1-2-Material

Two types of material were used: the technical and the vegetable material.

1-2-1-Technical material

The technical material used for the realization of this study is composed of a GPS; for the geolocation, the retimbered plots; a numeric photography, a ribbon-meter for the delimitation of the plots of inventories and the map of FCB for the plots sampling (Fig. 2)

1-2-2-Vegetable material

Vegetable material comprises the flora of the study and the samples of plant species taken in the classified forest.

1-3- Methods of study

1-3-1- The choice of the retimbered plots

The sampling of the plots was guided by the information consigned on the map of the soils occupation (Fig. 3). This map comprised all the blocks in which the various types of afforestation were gathered. The retimbered plots were located using GPS starting from the geographical contact registered on the map. The investigations made it possible to do a grouped sampling comprising two types of afforestations of 4 plots each one (Fig. 2).

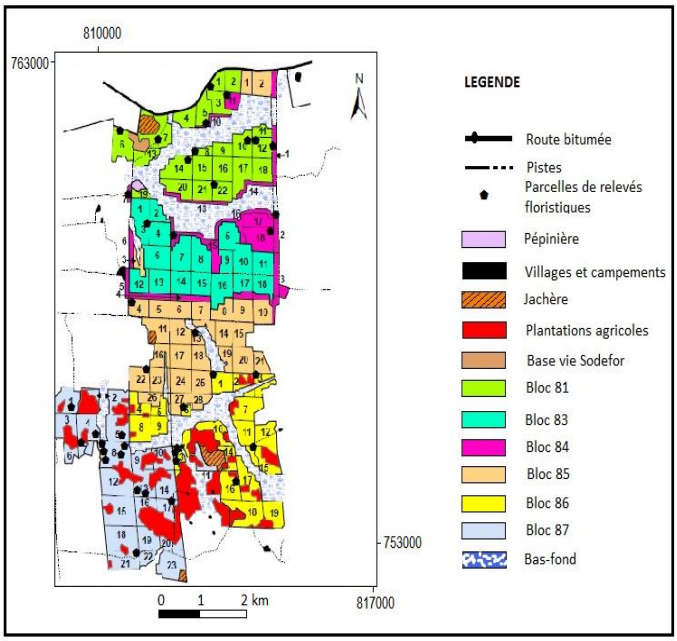

Fig. 2: Localization of the retimbered pieces (SODEFOR, 2014)

With resulting from the investigations, four plurispecific types of afforestation were retained. They are afforestations of the types: *Terminalia superba*, *Terminalia ivorensis* and *Gmelina arborea* going back to 1981; *Terminalia superba-Terminalia* ivorensis going back to 1981,1983,1984 and 1985; *Cedrela odorata-Tectona grandis*, going back to 1986 and 1987; *Terminalia superba-Tectona grandis* going back to 1986 and 1987.

Four (4) monospecific afforestation were retained. They are the afforestations containnig *Cedrela odorata* going back to 1981.1986, 1987 and the afforestations containing *Tectona grandis* going back to 1984; afforestations containing *Terminalia superba* going back to 1985.1986 and 1987; afforestations containing *Gmelina arborea* going back to 1987.

1-3-2-Floristic inventory

Two methods were combined during the inventories of the flora: the method of surface which consisted in counting, within the sampled plots, all the vegetable as it is recomended by Adou et al. (2007) and Kouamé et al. (2008) and the itinerant methods which consists in traversing the vegetation in all the directions to fill the deficits of information during the inventories as it was mentioned by Aké-Assi (1984). Thus, Five (5) quadrats of 10 m X 10 m were delimited in each of the 8 retimbered plots selected; that is to say on the whole, 40 quadrats. In these quadrats, all the species of trees, shrubs, lianas and grasses met were listed. The names of the plants inventoried were brought up to date thanks to the works of Lebrun & Stork (1991-1997) and those of Aké-Assi (2001; 2002).

1-3-3-Methods of data processing

Characterization of the biological types and the species with particular status

The biological and morphological types were characterized on the basis of the model recommended by Raunkiaer (1934) and the modifications and adjustments suggested by Adjanohoun (1964) for the tropical zone. The modes of dissemination of the diaspores (seeds, fruits or any other part of plant) of the vegetable inventoried were also given while following the classification of Lebrun (1947). The categorization of the species with particular status was carried out starting from list UICN (2016). In addition, some plant species with interests such the endemic ones, gather the plants whose presence informs about the chorologic links of the vegetations studied with neighbouring vegetations and, on their originality within this whole like

it underlined by Adou and Guéssan (2005). Thus, the types of phytogeographical distribution were established according to the great chorologic subdivisions for Africa suggested by Aké-Assi (1984).

1-3-4-Evaluation of the diversity of the flora of the retimbered pieces

The floristic diversity of the retimbered plots was evaluated starting from the index of diversity of Shannon & Weaver (1948) whose formula is H = $-\sum_{i=1}^{s}(\frac{ni}{N})\ln(\frac{ni}{N})$, H being the index of Shannon, NR the manpower of the individuals and nor the floristic contribution. The more H is raised, the more the medium is diversified. H evolves of o with Log (NR).

The floristic homogeneity was based on the estimate of the equitability of Piélou. The equitability of Piélou (E) was calculated in each plots retimbered to evaluate the equal distribution of the species in the various plots. Its value results from the report of the index of diversity (H) of Shannon & Weaver (real diversity) and of maximum theoretical diversity (Hmax). Its formula is the following one: E = H/Hmax, with Hmax = ln NR (NR being the full number of the species of the considered zone). The equitability of Piélou (E) varies between 0 and 1. More the value of E tends towards 1 more the species of the considered zone are equitably distributed. If E tends towards 0, the presence of a number of rare species or a small number of species is dominant. The comparison of the zone was carried out starting from the Sorensen similarity coefficient (1948). Its formula is the following one: Cs = with, Cs: a:, scale factor the number of species of the list of a plot A, b: the number of species of the list of another plot B, C: the number of species common to both plots A and B which one wants to compare. The Cs values vary between 0 and 100%. More the plot have joint species, more Cs tends around 100%. In the contrary case, Cs tends towards 0. The plots whose value of Cs is higher than 50% have a floristic resemblance; those with a coefficient lower than 50% are not homogeneous on floristic point of view.

Ecological groups and groupings of species per type of afforestation

For the present study, ascending hierarchical classification (CHA) was carried out starting from the specific richness of the types of afforestation. In order to facilitate the classification of the

data, only the species having a frequency of higher or equal to appearance three (3) were taken into account.

II-Results

2-1-Characteristic of the flora of the study

2-1-1-Floristic richness

Two hundred twenty-seven (227) plant species were inventoried in the retimbered plots of the FCB. These species are distributed in 165 genus and 68 families. The floristic richness (table 1) estimated in each type of afforestation shows that the highest values were observed in the plots of Cedrela odorata (47 species), *Terminalia superba-Terminalia ivorensis* (35 species), *Terminalia superba-Terminalia ivorensis-Gmelina arborea* (29 species) and *Terminalia superba-Tectona grandis* (23 species). The retimbered plots in which were recorded the low number of species are those of *Cedrela odorata-Tectona grandis*, *Terminalia superba* and *Tecctona grandis*, with 17 species each one. The least rich plots in cash are those retimbered with *Tectona grandis* (TK) in which recorded 16 genus and 12 families.

Table I: Floristic richness of the types of afforestation

Type of afforestation	Retimbered plot	Species number	Genus number	Family number
Monospécific retimbered	CE	47	39	26
	FK	17	17	16
	GM	19	19	14
	TK	17	16	12
Plurispécific retimbered	CE-TK	17	16	15
	FK-FR	35	33	24
	FK-FR-GM	29	27	20
	FK-TK	23	23	15

CE = *Cedrela odorata*; FK = *Terminalia superba* ; GM = *Gmélina arborea*; Tk = *Tectona grandis* ; CE-TK = *Cedrela odorata-Tectona* grandis ; FK-FR = *Terminalia superba-Terminalia ivorensis* ; FK-FR-GM = *Terminalia superba-Terminalia ivorensis-Gmelina arborea* ; FK-TK: *Terminalia superba-Tectona grandis*

2-1-2-Biological types of the listed species

The biological types of the species in the retimbered plots (table 2) are the phanerophytes, the therophytes, the chamephytes, the geophytes, the geophytes with rhizome and the hemicryptophytes.

Table II: Distribution of the biological types listed in each type of afforestation

Biological Type	Monospécific afforestation				Plurispécific afforestation			
	CE	GM	TK	FK	CE-TK	FK-FR	FK-FR-GM	FK-TK
Ch	-	1	-	-	-	2	1	-
G	1		-	-	-	1	1	-
Gr	1	1	-	1	-	1	-	-
Hc	-	-	-	1	-	-	1	1
Th	-	-	-	-	-	-	-	2
Mp	9	4	4	1	1	8	5	2
MP	5	3	1	3	1	4	2	2
mp	22	5	9	9	12	13	13	11
np	4	5	2	2	2	6	4	4

NB Ch : Chamépyte, G : Géophyte, Gr: Géophyte rhizomateux, Hemi-cryptophytes, Th : Thérophytes, Mp : Mesoophanérophyte, MP : Mégaphanérophyte, mp : microphanérophyte , np : nanophanérophyte

The phanérophytes were abundant in the monospecific afforestations (RM), with 88 species that corresponds to 43.13% of the inventoried species. They are in particular the microphanérophytes (22 species), the mésophanérophytes (9 species) and the mégaphanérophytes (5 species) listed in the plot of *Cedrela odorata*. The therophytes, the chamephytes, the geophytes, the geophytes with rhizome and the hemicryptophytes were slightly represented in all the plot of the monospecific afforestation (RM), with, six (6) species, that corresponds to, 3% of the total staff complement. Within the plurispecific plot of afforestations (RP), the biological types most present were the phanérophytes which counted 90 species, that corresponds to 44.11% of the inventoried total flora. Also, the microphanérophytes were more abundant in all the pieces of

plurispecific afforestation, with 94 species, that corresponds to 46, 07% of the inventoried species. The flora of the afforestation containing the association of *Terminanalia superba-Terminalia ivorensis* was dominated by the microphanérophytes, with 13 species, either 6.38% of the inventoried species, followed by the mésophanérophytes, with 8 species, or 3.92%. The microphanérophytes were mainly represented with 13 species that corresponds to 4% of the inventoried species, in the retimbered plot of *Terminanalia superba-Terminalia ivorensis-Gmelina arborea.* The thérophytes, the chaméphytes, the geophytes, geophytes with rhizome, and the hemicryptophytes were also lowly represented in all the plots of plurispécific afforestation.

2-1-3-Mode of dissemination of the diaspores of the inventoried species.

The estimates (Fig. 3) show that the local species scattered by the animals and those wich are species scattered by the wind are represented, with 48 species that corresponds to, 54% of the inventoried species. These species were mainly listed in the types of plurispecific afforestation (afforestations containing *Terminalia superba-Terminalia ivorensis* and *Terminalia superba-Terminalia ivorensis-Gmelina arborea*), with 20 and 11 species, these correspond respectively to 11.36% and 6.25% of the inventoried species. In addition, thirty one (31) species scattered by the wind were listed in the plurispecific afforestation. Ten (10) among these species were listed in the retimbered plots of *Terminalia superba-Terminalia ivorensis.*

The species scattered by the wind were more abundant (35) in the monospecic afforestations. The afforestations containing *Cedrela odorata* sheltered more a large number of species scattered by the wind and local species scattered by the animals with respectively 16 and 25 species, that corresponds to 9.09% and 14.20% of the inventoried total flora.

The inventoried local species scattered by animals are: *Abrus precatorius* (Fabaceae), Adenia gracilis (Passifloraceae) and numerous species of the genus of Clerodendrum of which *Clerodendrum formicarum* (Verbenaceae) and *Clerodendrum splendens* (Verbenaceae). The species scattered by water as *Phoenix reclinata* (Araceae) and *Pteris atrovirens* (Adiantaceae) are almost absent in the two types of afforestation.

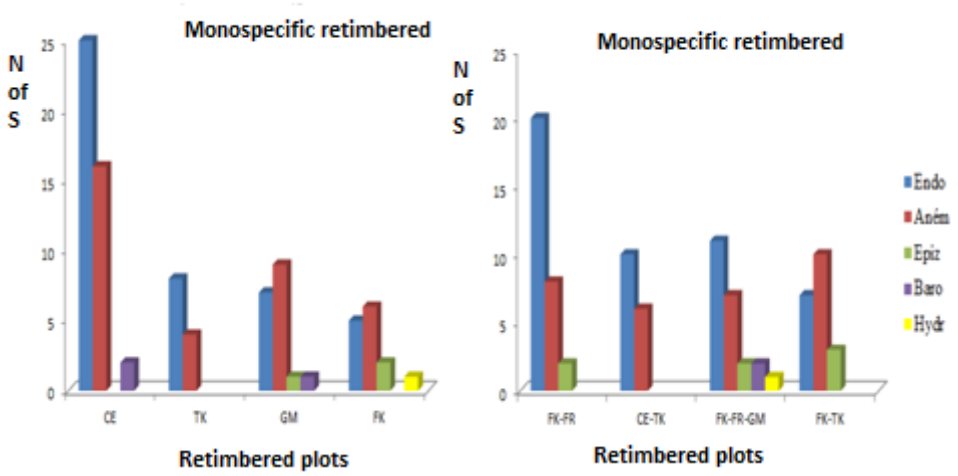

Fig.3: Mode of dissemination of the diaspores of the inventoried species

2-1-4-Secies with particular status listed

Among the species which were inventoried in the plots of the FCB, one counts twenty-seven (27) with particular status, that corresponds to 13, 23% of the whole of the inventoried flora (table V). including fifteen (15) endemic west African, (7.35%), and two (2) endemic of Côte d'Ivoire (*Albertisia cordifolia*; Fig. 4 and *Baphia bancoensis*; Fig. 5). These two (2) species were inventoried in the retimbered plots of *Terminalia superba-Terminalia ivorensis*; *Terminalia superba-Terminalia ivorensis-Gmelina arborea*; *Cedreala odorata-Tectona grandis* and of *Cedrela odorata*. In addition, ten (10) other species among the thirteen (13) endemic species, were listed in the plurispecific afforestation whereas three (3) only were inventoried in the monospecific afforestations. They were: *Cola caricaefolia* (Sterculiaceae) and *Dalbergia albiflora*. (Fabaceae) present in the plot of *Cedrela odorata* and *Euadenia eminens* Hook.f (Capparidaceae) found in the plot of *Gmelina arborea*. In this category of species with particular status (table 5), two (2) species are classified “weak risk” they are *Triplochiton scleroxylon* (Sterculiaceae) present in the retimbered plots of *Terminalia superba-Terminalia ivorensis; Terminalia superba-Terminalia ivorensis-Gmelina arborea, Cedrela odorata* and *Milicia excelsa* (Moraceae), listed in the monospecific afforestations of *Tectona grandis* and plurispecific afforestation of *Terminalia superba-Terminalia ivorensis-Gmelina arborea*.

The “vulnerable” category contains ten (10) species of which one with a trend ubiquist (*Baphia nitida*). The species of the “vulnerable” category were inventoried in the afforestations type of

the *Terminalia superba-Terminalia ivorensis* and respectively had nine (9) and seven (7) species. These species are inter alia *Acroceras zizanioides*, *Albizia adianthifolia, Albizia ferruginea, Baphia nitida*, *Terminalia ivorensis* and *Triplochiton scleroxylon*. On the other hand, the monospecific afforestations of *Tectona grandis* and *Terminalia superba* are poorest with *Albertisia cordifolia* and *Baphia bancoensis* (endemic species of Côte d'Ivoire). Polynomial regression (fig. 6) shows that the number of species with particular status is relatively riche in the pieces of afforestation in the monospecific afforestations of *Tectona grandis*. *Terminalia superba*, *Terminalia ivorensis*) and the plurispecific afforestations of *Terminalia superba-Tectona grandis*, *Cedrela odorata-Tectona grandis* type.

Fig. 4: *Albertisia cordifolia*

Fig. 5: *Baphia bancoensis*

This number rise slightly in the plurispecific afforestations as *Terminalia superba-Terminalia ivorensis, Terminalia superba-Terminalia ivorensis-Gmelina arborea* and monospecific afforestations like *Cedrela odorata*. The coefficient of determination of the regression is low and shows that the number of species with particular status slightly varies a kind of afforestation to the other.

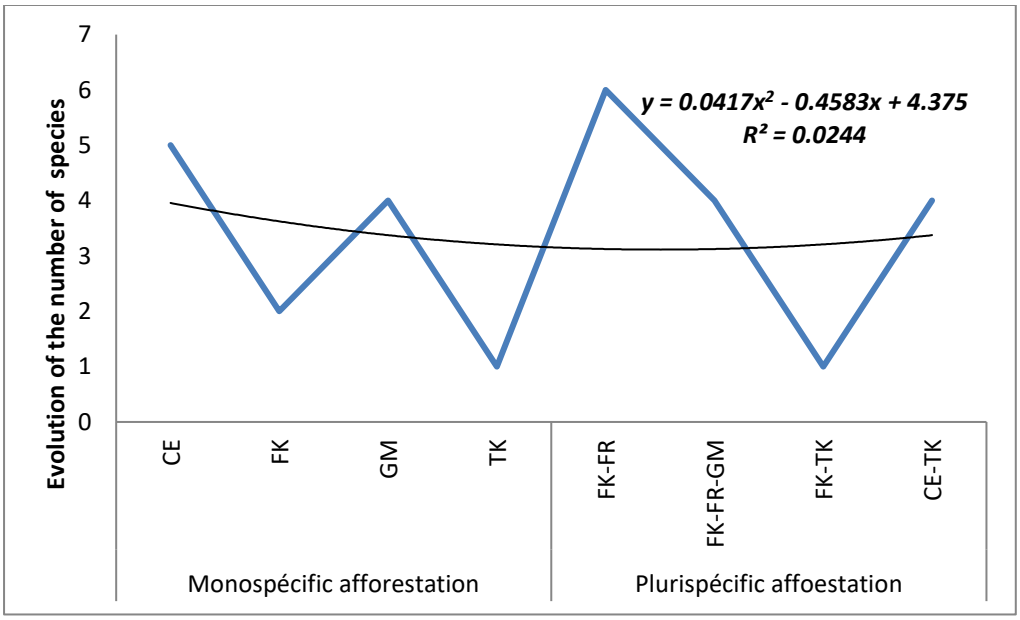

Fig 6: Evolution of the number of species with particular status according to the types of afforestation

2-1-5-Evolution of the diversity of the retimbered plots

The values obtained during the estimate of the indices of diversity of Shannon (H) vary from 413,76 to 4.44 (table 3). In this table, woody species associations of afforestation of the plurispecific type present the highest values (4,00-4,44). The maximum value of H was considered in the retimbered plots of *Terminalia superba-Terminalia ivorensis* (4.44), followed by retimbered plots of *Terminalia superba-Terminalia ivorensis-Gmelina arborea* (4.31). The low values were obtained in the monosspecific afforestations (3,76-4,00). An exception is however obtained with the retimbered plots of *Cedrela odorata* (4.00).

The indices of equitability of Piélou (E) of the mono and plurispecific afforestations present for all the plots the values of about 0.95 except for the case of the association of *Terminalia superba-Terminalia ivorensis* (0.96). The low value (0.97) was obtained in the plot of *Gmelina arborea.*

Table III: The indices of diversity of the retimbered plots

Type of afforestation	CE	CE-TK	FK	FK-FR	FK-FR-GM	FK-TK	GM	TK
Shannon H	4,00	4,00	3,89	4,44	4,31	4,15	3,76	3,80
Equitability E	0,957	0,956	0,951	0,966	0,958	0,953	0,943	0,954

2-2-Floristic similarity between the types of afforestations

Table IV show the level of resemblance of the plots of the point of floristic considering. The similarity coefficient calculated between these plots indicates several values higher than 50%. The greatest coefficients (59,1%, 59%, 58,9%,58,7%,58,3% and 55,6%) were obtained between the following retimbered plots: *Cedrela odorata-Tectona grandis*/Cedrela odorata, *Terminalia superba-Gmelina arborea*/*Cerela odorata-Tectona* grandis, *Terminalia superba*-Terminalia ivorensis *Gmelina arborea*/Terminalia *superba-Terminalia ivorensis/Cedrela odorata, Gmelina arborea/Cedrela odorata-Tectona grandis* and *Terminalia superba Tectona grandis* /*Cedrela odorata-Tectona grandis*. More the low level of resemblance (37,7%) was obtained between the retimbered plots of *Tectona grandis* and *Terminalia superba-Terminalia ivorensis*. The flora of the plots of *Tectona grandis* is different from that of the other retimbered plots.

Table IV: Matric table of similarity of Sørensen of the various retimbered plots

	CE	CE-TK	FK	FK-FR	FK-FR-GM	FK-TK	GM	TK
CE	1							
CE-TK	59,1	1						
FK	58,7	54	1					
FK-FR	54,2	51,8	50,0	1				
FK-FR-GM	53,8	59,0	49,3	58,9	1			
FK-TK	51,4	55,6	46,4	51,7	53,6	1		
GM	50,0	58,3	47,4	48,1	48,6	45,5	1	
TK	46,7	48,3	42,1	37,7	41,7	40,9	40,7	1

The values in bold indicate the superscripts than 50%

2-3-Ecological group

Ascending hierarchical classification (CHA; Fig.7) presents a separation of the types of afforestation which made it possible to identify six (6) ecological groups. On this figure, the first four zone which emerge find at distances higher than 0.50. They are the monospecific

afforestations containing *Cedrela odorata* and the plurispecic afforestations containing Cedrela odorata-Tectona grandis. These two groups are separated by a distance from 0.59. The second group is consisted pluurispecific afforestations containing Terminalia superba-*Terminalia ivorensis-Gmelina arborea* and *Terminalia superba-Terminalia* ivorensis, with respective distances of about 0.58. The third group is formed by the monospecific afforestations bases on *Terminalia superba,* with a distance of about 0.56. The fourth group formed by plurispecific afforestations containing *Terminalia superba-Tectona grandis*, with a distance of about 0.52. The fifth and sixth group are formed by the monospecific afforestations of *Gmelina arborea* and *Tectona grandis* with distances of about 0.50 and 0.42 respectiely.

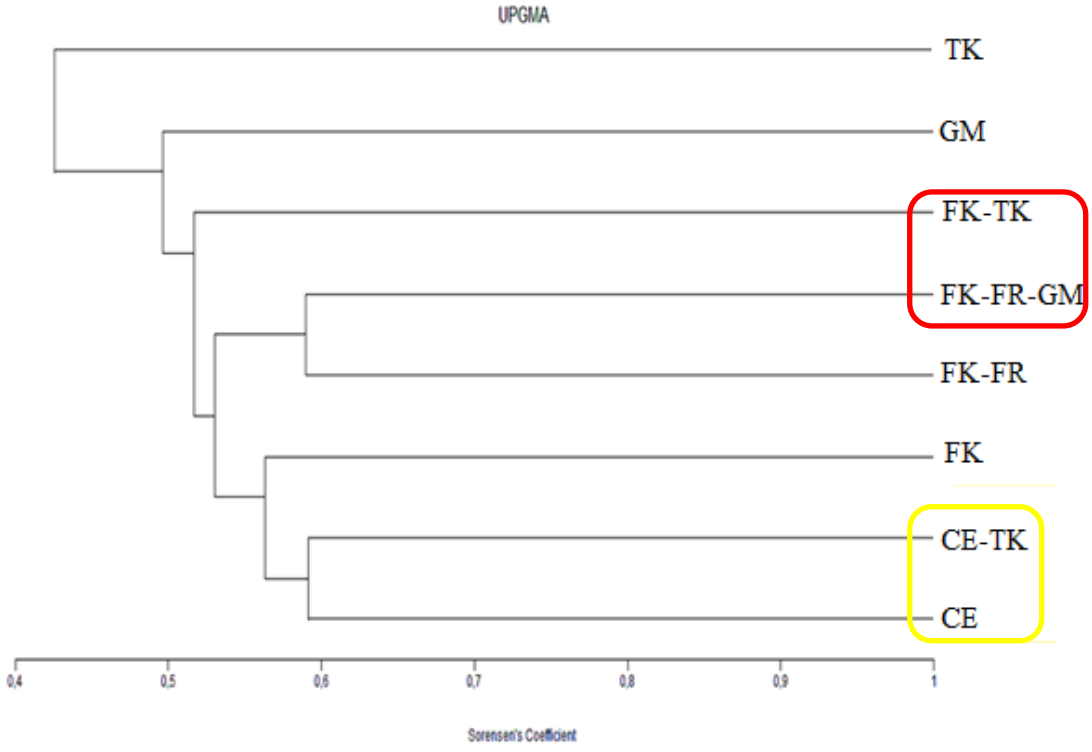

Fig. 7: Regrouping of the plots starting from the matrix of similarity of Sørensen

III-Discussion

3-1-type of afforestation and characteristic of the spontaneous flora

The floristic composition of a geographical space data is influenced by the type of installation. The specific and/or floristic competitions that sometimes the types of afforestations induce constitutes a major criterias of selection of the species which develop in the zone.

The botanical inventories carried out in the retimbered plots of the FCB, made it possible to count 227 species. The families best represented, are in the decreasing order, Fabaceae, Sterculiaceae, Apocynaceae, The Hippocrateaceae, Moraceae, Rubiaceae and Poaceae. The abundance of Leguminous plants was often evoked by Guillaumet & Adjanohoun (1971) as the botanical feature characteristic of the forests of Côte d'Ivoire.Also, the families, strongly represented, belong she, according to the same authors, of those common in the majority of the wet tropical forests. All the monospecific afforestations are diversified, except the plots of Cedrela odorata. This kind of monospecific afforestation where a high number of species was listed dates from the years 1987; that corresponds more than thirty (30) years of regeneration. The time of regeneration and/or reconstitution is a discriminating factor which significantly influences the quality and the quantity of the flora; what makes these old piots of the zone homogeneous, stable and rich in species.

The analysis of the biological spectrum showed an abundance of the microphanérophytes species and a small proportion of the mégaphanérophytes in the two types of afforestation. This small proportion of the mégaphanérophytes is strongly related to the frequent exploitation of the woody plants of the FCB. This activity very often involves the puncture of the large trees (more than 32 m height) to commercial purposes. For Trochain (1980), the biological spectra can present certain differences according to the areas and the types of inventoried vegetations, but the hémicryptophytes, the géophytes and the thérophytes are always slightly represented, sometimes even absent. This reality was observed in the types of mono and plurispecific afforestation of the FCB. The species inventoried in these types of afforestations are dominated by the phanérophytes (87.24%). Other analyses of biological spectra of the semi-deciduous forests of Côte d'Ivoire carried out by Kassi (2006) and Adingra (2013) gave similar conclusions.

The predominance of the arborescent species compared to the species lianescentes in the two great types of afforestation of the FCB, would be a frequent situation in the majority of the forests of Côte d'Ivoire, because of herbaceous numerous species and lianescentes heliophilous do not support the shade in forest (VROH Bi, 2013). Importance of the plant scattered by the animals in what horn the form of dissemination of the diaspores is announced in most work of Chapman (1995) on the forests of Côte d'Ivoire and those of Kouka (2000) in the basin of Congo with proportions generally higher than 50%. This method of dissemination is similar to that noted in the plurispecific afforestations of the FCB. The abundance of the plants scattered by the wind and and the local plants scattered by the animals respectively in the monospecific and plurispecific afforestations, seems to be related to the proximity of the National park of Marahoué as it was announced by Sidibé, (2016). This park is a reserve of phylogenetic resources from which the majority would come from the diaspores. According to this author, in addition to the wind of many agents faunal disseminators, in particular the birds, the bats, the rodents, the squirrels,… are sheltered by the National park of Marahoué the dissemination of the diaspores by the animals and the scattered by the wind, observed in the types of afforestations of the FCB, was also announced by Kassi (2006) in the classified forest of Sanaimbo and by Adingra (2013) in the classified forest of Bamo.

The floristic diversity, the abundance and the presence of the species with particular status on the sites of statements, comfirms the central role played by the biodiversity in the conservation of the protected areas. The abundance of the species with particular status in the plurispecific afforestation compared to the monospecific afforestation attests the importance of this kind of afforestation for the conservation of the biodiversity.

3-2-Types of afforestations and conservation of vegetable diversity

The weak floristic similarity obtained between the retimbered plots of Gmelina arborea and Tectona grabdis and the five other retimbered plots of Cedrela odorata, of Terminalia *superba-Terminalia ivorensis, Cedrela odorata-Tectona, grandis Terminalia superba-terminalia ivorensis-Gmelina arborea, Terminalia superba-Tectona grandis* and *Terminalia superba* indicates that the flora of the plots of *Gmelina arborea* and *Tectona grandis* does not have any floristic resemblance to the five other retimbered plots. This floristic dissimilarity shows the importance of the biodiversity in the conservation of the biodiversity. Indeed, the diversification

of retimbered plant species supports the diversification of the flora. The important rate of species inventoried under plurispecific afforestations contrary to the monospecific afforestations indicates that this types of afforestation constitute an environment more favorable to the development of the species. However, the important specific richness noted within this kind of afforestations could be related to the stage at the duration of the afforestation. Indeed, the ageing of the plots of the plurispecific afforestation is connected to the climacic stage of evolution of the forest flora rich in species. Also, the woody plants (*Terminalia superba*, *Terminalia ivorensis*, Cedrela odorata) with less dense canopy support the growth of the heliophilous species. Contrary to the plurispecific afforestations, the monospecific afforestations recorded the least high index of diversity except for the plots of Cedrela odorata (EC). This situation, more accentuated in the plots of *Tectona grandis*, is not related to it dense canopy which does not support endogenous floristic diversity as it was announced by Diégo & Sinsin (2006). In addition, Kouassi and al. (2015) indicated that this effect of shade created by the increasingly important foliages of the houppiers of Tectona grandis, causes a strong competition between heliophilous species for the light; what constitutes a limiting factor for the development of the heliophilous species.

The analysis in principal component (ACP) indicated that certain species present an affinity with the groups G 1 composed of *Terminalia superba-Terminalia ivorensis*, *Terminalia superba-terminalia ivorensis-Gmelina arborea*, and of *Cedrela odorata*) and G3 (*Terminalia superba-terminalia ivorensis* and *Cedrela odorata-Tectona grandis*). Thus, the homogeneity of the floristic compositions of groups 1 and 3 could be explained by the fact why these plots comprise all of the plurispecific afforestations except for the monospecific afforestation of Cédrela odorata of G1. The Works of Barber and al (2007) also showed that the plantations with several woody species support overall the specific richness of the flora. In addition, this diversity highlights a close link between the woody plants of afforestation. The regrouping of certain species compared to the four (4) groups of woody plants of afforestation obtained was also confirmed by the CHA. The other species of group 5 have a broader distribution since they are influenced by no woody species of afforestation.

Conclusion

The flora of the zone fo study is rich approximately of two hundred and twenty seven (227) plant species. The principal results showed that all the plurispecific afforestations, in particular the plot of *Terminalia superba-Terminalia ivorensis-Gmelina arborea* and the monospecific afforestation of *Cedrela odorata*, are a major ecological interest. Indeed, specific richness and endemism combine to make these woody plants of afforestation those which support vegetable diversity as well as possible. Indeed, the underwood of these woody plants is more diversified and has the greatest specific richness what is not the case of *Terminalia superb Gmelina arborea* and *Tectona grandis*. One meets there endemic numerous species of the forests of High Guinea as well as species rare or threatened of extinction of the flora of Côte d'Ivoire. The distribution of the species according to the woody plants of afforestation showed that the plurispecific afforestations and the monospecific afforestaion of *Cedrela odorata* are more preserving vegetable diversity

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