International Journal of Academic Research and Development
ISSN: 2455-4197
Impact Factor: RJIF 5.22
www.academicsjournal.com
Volume 3; Issue 2; March 2018; Page No. 1368-1374

Impact of the type of afforestation on the dynamics of the flora in the semi-deciduous forest zone: Case of the classified forest of Bouaflé (West-center of Côte d'Ivoire)

Kouassi Kouadio Henri*, Kouamé Djaha, Yao Flores Elias
Université Jean Lorougnon Guédé BP 150 Daloa, Côte d'Ivoire

Abstract
The present study relates to the evaluation of the impact of the typology of afforestation on the dynamics of the richness and the diversity of the flora. It was carried out in the classified forest of Bouaflé in semi-deciduous forests zone at the western center of Côte d'Ivoire. The main objective of this study was to evaluate the effects of the type of afforestation on the quantitative and qualitative evolution of the flora of this zone. With this intention, floristic inventories of the spontaneous flora under afforested spaces were carried out starting from the method of the itinerant statements and that of the surface statements. The data analysis showed that the plurispecific afforestations support the diversification and the conservation of the spontaneous flora that guarantees safeguard of vegetable diversity. Thus, the got results show that it would be of a great ecological interest to privilege the plurispecific afforestations, in particular associations of the type: *Terminalia superba-Terminalia ivorensis* and *Terminalia suprba-Terminalia ivorensis-Gmelia arborea*.

Keywords: impact, typology of afforestation, spontaneous flora, semi-deciduous-forest, Côte d'Ivoire

Introduction
The degradation of the forest ecosystems represents one of the most important causes of reduction of the biodiversity in the world. Surfaces of the world forests which were estimated at 4.077 billion hectares in 1990, passed to 3.952 billion hectares in 2005 (FAO, 2009) [7]. The rhythm of the world annual deforestation of 2000 to 2005 was of 7.317 million hectares (Achard *et al*., 2002; FAO, 2007) [1, 8]. According to FAO (2010) the countries in the process of development record the most important reduction ratios of forest surfaces. In West Africa, between 2000 and 2005, the countries like Benin, Burkina Faso-Faso, Niger, Nigeria and Togo respectively recorded 2,5%,0,3%,1%,3,3% and 4,5% of rate of deforestation, while that of the Côte d'Ivoire bordered the 10% (FAO, 2009) [7].
In Côte d'Ivoire, forest surfaces which amounted to 15 million hectares at the beginning of the years of independences, were according to SODEFOR (1996) [20], estimated at 3 or 4 million hectares. This situation is the result of the abusive forestry holding combined with the development of the cultures of speculations (Hévea, palm tree with oil, cacao-tree and coffee-tree). The destruction of several thousands of hectares of forest was the direct consequence. Also, one attended the progressive erosion of vegetable diversity and the rarefaction of a significant number of woody species. Among these species, appear of the rare and endemic plants (Aké-Assi, 1984) [3]. Thus, face to the irreversible threat of erosion of the biodiversity, the Côte d'Ivoire based the conservation of its flora and its fauna on the creation of protected spaces (national parks, nature reserves and classified forests) and the restoration of degraded spaces through the intensive industrial afforestation by the use of multi-purpose species (sawlog, wood energy). Thus, approximately 150,000 hectares of artificial forest made up mainly of whoody species such as: *Tectona grandis* Linn. (Verbenaceae), *Gmelina arborea* Roxb. (Verbenaceae), *Terminalia superba* Engl. & Diels (Combretaceae) and de *Cedrela odorata* L. (Meliaceae) were planted (Koné, 2012) [11]. These afforestation campaigns did not save certain classified forests confronted with several types of anthropic pressures. In addition, the data relating to dynamics of the reconstitution of the flora and the vegetations after the afforestations quoted above is quasi non-existent and sometimes my known. And yet, this characterization should be decision-making tools for the orientation of work of reconstitution of the biodiversity in Côte d'Ivoire and in various agroecologic zones of the tropical areas.
The present study devoted to the evaluation of the impact of the typology of afforestation on the dynamics of vegetable diversity is a contribution to the knowledge of the quality of the afforestation on the quantitative and qualitative evolution of the flora of retimbered spaces.

I-Materials and methods
1-1-Zone of study
The classified forest of Bouaflé (FCB) is located at the Mid-west of the Côte d'Ivoire, 30 km of the town of Daloa and at fifty (50) km of that of Bouaflé, on the Daloa-Bouaflé road axis. According to Guillaumet & Adjanohoun (1971) [9] and Monnier (1983) [16], this forest belongs to the field of the mesophilious forests. With a surface of 20350 ha, 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) [20]. With the administrative plan, the FCB depends on the region of Haut-Sassandra. However, it is located between the Region of Marahoué and that of Haur-Sassandra and set out again between the Departments of Daloa (20%) and

Bouaflé (80%). This forest is delimited in North by the Daloa-Bouaflé road axis and the national park of Marahoué; in the East and South-east by the Sub-prefecture of Bonon; in South-west by the Sub-prefecture of Zaguiéta and the West by the Sub-prefectures of Gadouan and Gonaté (Fig. 1).

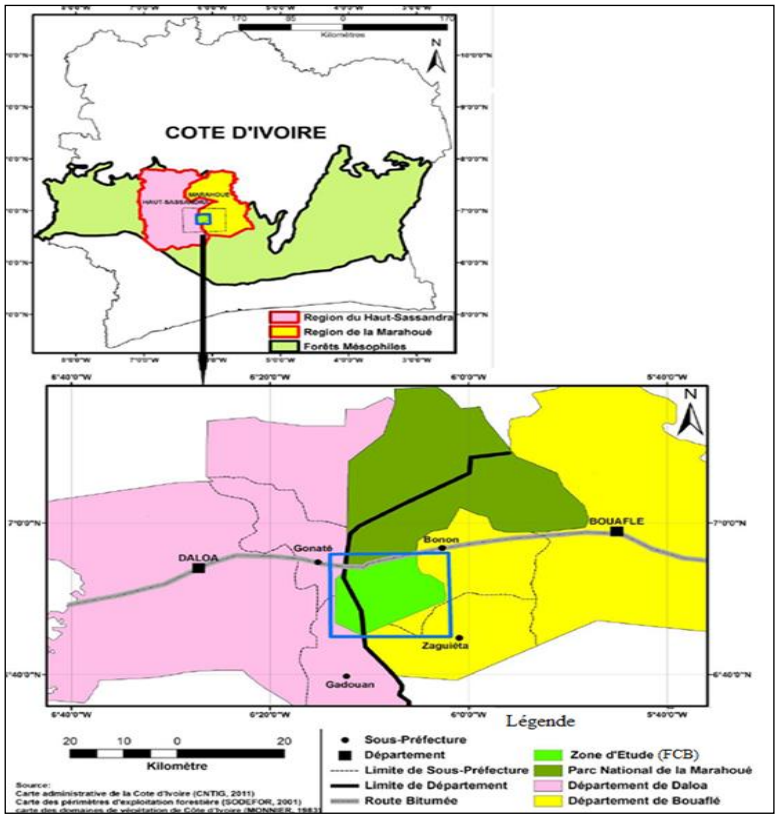

Fig 1: Location of the classified forest of Bouaflé (Source: Sidibé (2016)

The highest temperatures are obtained between November and May. They variate between 26.2 and 27, 9°C, with an average of 26.3 °C. The thermal variation is less marked. Pluviometry is high between March and October and weak between November and February. It reveals the two existence seasons: one dry season and wet season. The dry season lasts four (4) months. It begins in November and ends in February. The rainy season lasts eight (8) month (from March to October). In January, average pluviometry is very weak. It believes gradually to reach it maximum in August with 103.58 mm of rain

The soils of the FCB are ferralitic and fairly denatured. They result from the deterioration of the caused rocks and are characterized by a humus-bearing horizon not very thick but rich in organic matter, slightly acid and structured well. These soils present good aptitudes for the afforestations and agriculture (Perraud, 1971) [17]. The Classified Forest of Bouaflé has a vegetation which belongs to the zone of semi-deciduous wet dense forest (Guillaumet & Adjanohoun, 1971) [9] dominated by Celtis spp. and by *Triplochiton scleroxylon* K.Schum (Sterculiaceae). This sector is characterized by, woody species such as: *Triplochiton scleroxylon* K.Schum (Sterculiaceae), *Mansonia altissima* (A.Chev.) A. Chev, Sterculia rhinopetala K.Schum (Sterculiaceae), *Pterygota macrocarpa* K. Schum (Sterculiaceae), *Milicia excelsa* (Welw.) Benth (Moraceae), *Chrysophyllum giganteum* A. Chev (Sapotaceae). The highest woody layer of this kind of forest is from approximately 40 m whereas the average height of the woody layers lies between 5 m and 20 m.

1-2-Material

1-2-1-Biological Material

Biological equipment relates to all the plant species collected in the zone of study.

1-2-2- Technical material

Technical equipment is composed of a GPS (Total Positioning System), used for the plots geographical location; of a device of numeric photography for the catches of sight; of shears, to take the sampling of plant species; of string, for the delimitation of the plots; of a ribbon for the delimitation of the plots and a map of the FCB, for the location of the types of afforestation.

1-3- Method

Choice of the sites of study

The map of occupation of the soil of the FCB established by SODEFOR (2014) [20] was used as a basis for sampling of the retimbered plots (Fig. 2). This map comprises all the blocks in which the plots of the various geolocated types of afforestation are. the sampling of the plots of study consisted in inventorying, using GPS, the plots retimbered starting from the geographical contact which is reproduced on the map.

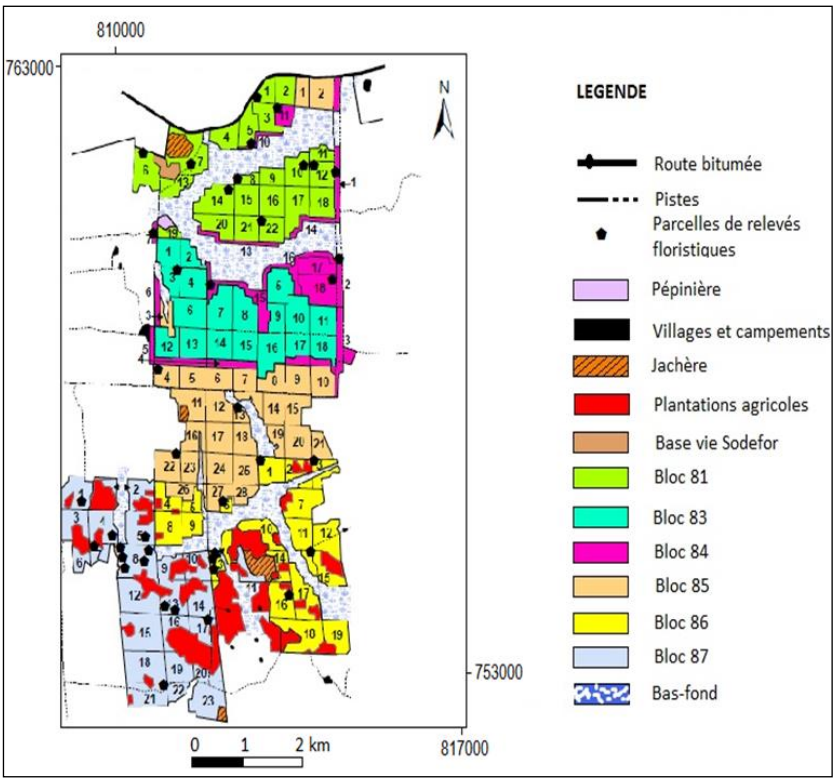

Fig 2: Map of identification of the retimbered plots (Source: Map of installation of the FCB, (Sodefor, 2014)

The prospection made it possible to carry out a grouped sampling, comprising two types of afforestations of four (4) plots whose age varies between one (1) and thirty (30) years. plurispecific afforestations, comprising associations of *Terminalia superba*, *Terminalia ivorensis* and *Gmelina arborea* were carried out since 1981; afforestations containing *Terminalia superba* and *Terminalia ivorensis*, were carried out since 1981, 1983.1984 and 1985; afforestations containing *Cedrela odorata* and *Tectona grandis* (Fig. 3) were carried out since 1986 and 1987; Afforestations of the types grown *Terminalia superba* and Tectona going back to 1986 and 1987; afforestations monospecific, containing *Cedrela odorata* realized in 1981, 1986 and 1987; afforestations containing *Tectona grandis* realized in 1984 (Fig. 3); afforestations containing *Terminalia superba* realized in 1985, 1986 and 1987 and the afforestations containing *Gmelina arborea* going back to 1987 (Fig. 4).

Fig 3: Afforestation containing *Tectona grandis*

Fig. 4: Afforestatio *Gmelina arborea*

1.3.1 Floristic inventories

Two floristic inventory methods were associated during the study. They were the the method of surface survey and the itinerant inventory used by Kouamé *et al*. (2008). The method of surface, used for the inventories in the forests of the tropical zones, according to Adou *et al*. (2007), consist in counting, within a surface of variable form (square, rectangular, circular, etc), all vegetable species. For this study, the positioning of the quadrats (floristic pieces of statements) was made according to the various sites of the Blocks on the map of the FCB containing the plots sheltering the types of afforestations. Five (5) quadrats of 10 m X 10 m were delimited in each sampled plots. Thus, forty (40) quadrats were inventoried. In each quadrat, all the species of trees, shrubs, lianas and grasses met were characterized. Also, only the species listed in the quadrats were taken into account during the statistical data processing. The method of surface were complete by itinerant method which consisted in the plots traversing in all the directions by noting all the species of plants met as Aké-Assi (1984) [3] recommends it. This method permeted to make up the deficits of information concerning the wealth and floristic diversity

1.3.2 Identification of the species and description of the flora

All the plant species met in the quadrats were named according to the nomenclature of Hutchinson & Dalziel (1954-1972). The names of the species were brought up to date thanks to the works of Lebrun & Stork (1991-1997) and of Aké-Assi (2001; 2002).

1.3.3 Methods of analysis

The diversity of the flora inventoried was estimated starting from the indices of diversity of Shannon and Weaver (1948). The statute of the species was defined on the basis of the list of UICN (2016).

Evaluation of the diversity of the flora of the retimbered pieces

The floristic diversity of the retimbered pieces was evaluated starting from two indices. The indices of diversity of Shannon & Weaver (1948) and of equitability (E) of Piélou, described below, were used. The mathematical expression of the index

of shannon is the following one: $= - \sum_{i=1}^{s} \left(\frac{ni}{N}\right) \ln \left(\frac{ni}{N}\right)$

Where NR, is the abundance of the species and ni, is the number of a species I. When the value of H is raised, the medium is diversified.

The index of equitability of Piélou (E) was estimated in each plots retimbered to evaluate the equal distribution of the species in the various plots. It also translates the degree of diversity reached by a medium. Its value results from the report of the index of diversity (H) of Shannon & calculated. Its formula is the following one: E =H/Hmax, with Hmax= lnS (S): full number of the species of the medium considered). The equitability of Piélou varies between 0 and 1. The high value of E tends towards 1, when the species of the medium considered are distributed equitably in the medium. If E tends towards 0, the presence of a number of rare species or a small number of species is dominant.

Similarity enters the retimbered plots

The coefficient of Sørensen (1948) [21] was used in this study to compare the flora of the various plots. This coefficient is

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

calculated as follows:

with a has = number of the species of the list of the plot A, b = the list of the species of another plot B and 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%. When the plots have more species in common the Cs tends around 100%. In the contrary case, Cs tends towards 0. The plot in wich the value of Cs is higher than 50% have a floristic resemblance; those with a scale factor lower than 50% have a floristic dissimilarity. Cs was used also basic for the ascending hierarchical classification carried out with the Multivariate software Statistical Package (MVSP), for a regrouping of the retimbered plots which have a rate of floristic resemblance higher

Determination of ecological groups per type of afforestation

An ACP was carried out in order to release the ecological groups of the retimbered plots, and to explain, the distribution of the plant species according to the retimbered plots. This analysis was carried out starting from XLSTAT 19.02. For this study, the discrimination of the woody plant of afforestation was carried out starting from the specific wealth of each plot.

2. Results

2.1 Specific richness of the plots of afforestation

The floristic inventory has made it possible to inventory 227 plants species divided into 165 genus and 68 families (table 1). The highest values were observed in the plots of *Cedrela odorata* (47 species), of *Terminalia superba-Terminalia superba* (35 species), *Terminalia superba-Termina superba-Terminalia ivorensis-Gmelina arborea* (29 species) and *Terminalia superba-Tectona grandis* (23 species). The low values were obtained in the plots of *Cedrela odorata-Tectona grandis*, *Terminalia superba* and *Tectona grandis*, with 17 species each one. In the eight (8) retimbered plots, the most important families, of many species, are respectively that of Fabaceae with 16 species (either 27%), Sterculiaceae with 9 species (or 15%), Apocynaceae, Hippocrateaceae, Moraceae, Rubiaceae, with 7 species each one (or 12%) and Poaceae with 6 species (or 10% ; Fig. 5).

Table 1: Floristic richness of the types of afforestations

Type of afforestation	Retimbered plots	Species number	Genus number	The number of family
Monospecific afforestation	CE	47	39	26
	FK	17	17	16
	GM TK	19 17	19 16	14 12
Plurispecific afforestation	CE-TK	17	16	15
	FK-FR	35	33	24
	FK-FR GM	29	27	20
	FK-TK	23	23	15

CE : *Cedrla odorata* ; *Terminalia superba* FK : GM : *Gmélina odorata*; 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*

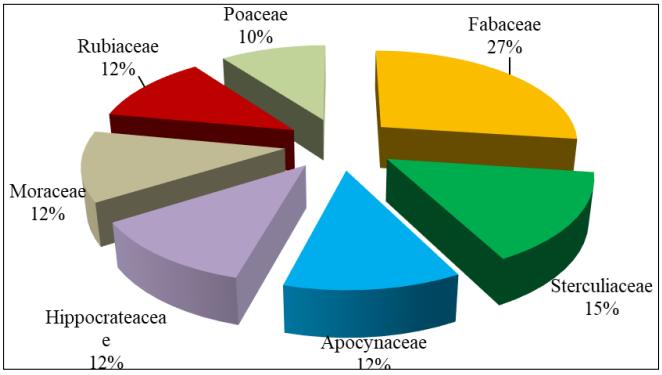

Fig 5: Representation of the botanical families most important of the retimbered plots

2.2 Floristic diversity of the plots retimbered of the classified forest of bouaflé

The index of diversity of Shannon (H) calculated for the retimbered plots of the FCB vary of 3, 76 to 4.44 (table 2). woody plants associations of afforestation of the plurispecific

type present the highest values (4,00-4,44). The maximum value of H was observed in the retimbered plots of *Terminalia superba-Terminalia ivorensis* (4.44), followed by *Terminalia superba-Terminalia ivorensis-Gmelina arborea* (4.31). The low values (3.76 and 4.00) were obtained in the afforestations of the monospecific types. However, the value obtained in the monospecific afforestation of *Cedrela odorata* is relatively high (4.00).Fig. 5: Presentation of the botanical families most important of the retimbered plots.

The index of equitability of Piélou (E) of the mono and plurispecific afforestations present for all the plots, the values of the order of 0.95 except for the association *Terminalia superba-Terminalia ivorensis* which has the greatest equitability (0.96). The weakest index was estimated in the plots of *Gmelina arborea* (0.94).

Table 2: Index of diversity and Equitability of the plots of FBC

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

CE: *Cedrla odorata* ; *Terminalia superba* FK: GM: *Gmélina odorata*; 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*

H = Indice de Shannon et E= indice d'équitabilité de Pielou

2.3 Floristic similarity enters the types of afforestations

Table 3 presents the degree of resemblance between the various retimbered plots. The rate of resemblance calculated between these plots give several values higher than 50%. The high coefficients (59, 1%, 59%, 58, 9%, 58, 7%, 58, 3% and 55, 6%) were estimated respectively between the retimbered plots of: CE-TK/EC, FK-FR-GM/CE-TK, FK-FR-GM/FK-FR, FK/EC, GM/CE-TK and FK-TK /CE-TK. More the low level of resemblance (37, 7%) was estimated between the retimbered plots of types TK and FK-FR. The flora of the pieces of TK is dissimilar with that of the other types of afforestation.

Table 3: Similarity coefficient 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 fat indicate the superscripts than 50%

2.4 Ecological groups and groupings of species

An analysis in principal component (ACP) was carried out on the basis as of data of the relative frequencies of the species in relation to the types of afforestations (Fig. 6). On this figure, the distribution of the variables shows that the factorial design formed by the first two components (axes F1 and F2) contains the essential of the relative information to the distribution of the studied types of afforestation. These two axes explain 46, 57% from the total variability observed of which 31.62% are applied to the axis F1 and 14.95% with the axis F2. Thus, the projection of the ecological parameters on the F1 axes and F2 emphasize 4 ecological groups. The analysis of the diagram of the ACP shows that the woody plants of group 1 (G1) located positively on the axes F1 and F2, are strongly correlated. It is association FK-FR, FK-FR-GM and the afforestation monospecific containing CE. The afforestations monospecific of GM and FK of the second group (G2), positively located on axis 1 and 2, are correlated. Also, the woody plants of the association FK-TK and CE-TK) forming group 3 forming group 3 (G3) are also correlated. However, Tectona grandis afforestation which sets up the fourth group (G4) does not have any correlation with the other studied woody species

.

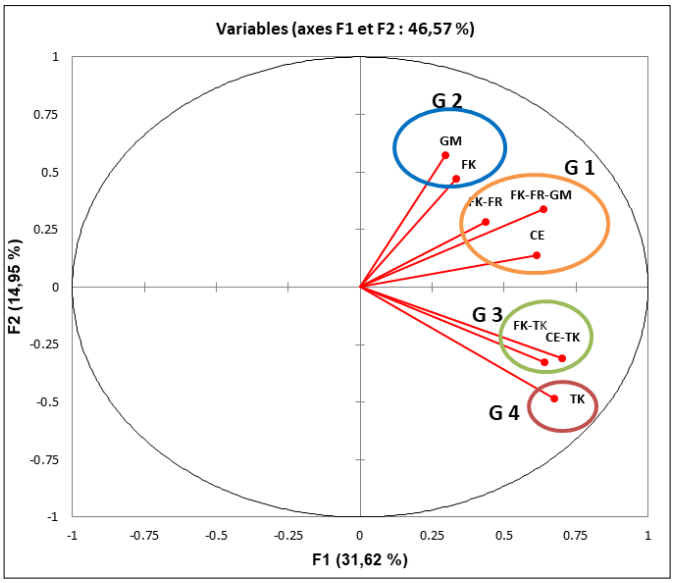

Fig 6: Projection of the woody species of afforestation on the axes (X, Y) in the factorial plan

GM : *Gmelina arborea*, FK : Fraké, FK-FR : *Terminalia superba-Terminalia ivorensis* FK-FR-GM : *Terminalia superba-Terminalia ivorensis-Gmelina arborea*, CE: *Cedrela odorata*, FK-TK : *Terminalia superba-Tectona grandis*, CE-TK : *Cedrela odorata-Tectona grandis*, *Tectona grandis*

2.5 Regrouping of the species by type of afforestation

The projection of the species and the types of afforestations on the F1 axes and F2 of the ACP makes it possible to determine five groups of species set out again in the factorial plan formed by the first two components (Axes F1 and F2; Fig. 7). The axes F1 and F2 explain 46, 57% of the total variability observed, of which 31, 62% are applied to the axis F1 and 14,95% with the axis F2. The groups 1 and 2, positively located on axis 1 and 2, are respectively made up of a species (*Turraea heterophylla*) related to monocultures of GM and FK and nine (9) species (*Tiliacora dinklagei* Engl., *Motandra guineesis* A. Benth., *Griffonia simplicifolia* (Vahl ex cd.), *Rhaphiostylis beninensis* (H.f ex P.), *Cedrela odorata* L, *Elaeis guineensis* jacq., *Tilacora dinklagei* Engl., *Sida acuta* Burm.f., *Agelaea pentagyna* (Lam.), *Baphia nitida* Lodd.) related to the pieces of FK-FR, FK-FR-GM and CE. Group 3, located positively on the axis F2 and negatively on the axis

F1, comprises 5 species (*Morinda morindoides* (Baker), *Blighia unijugata* Baker, *Millettia zechiana* Harms, *Dioscorea bulbifera*. and *Antiaris toxicaria* var. africana (Engl)) characterize associations CE-TK and FR-TK. Located positively on the axis F2 and negatively on the axis F1, group 4 comprises only one species (*Tectona grandis*) which characterizes the afforestation of TK. Avec a broad distribution, 43 other species forming group 5, are not specifically related to a woody species of afforestation.

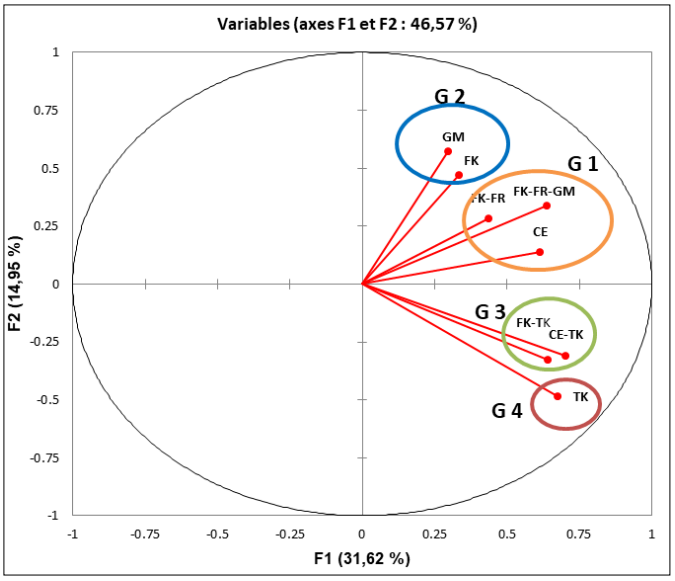

Fig 7: Distribution of the species according to the retimbered plots

3. Discussion

Formerly made up of dense forest, the Classified Forest of Bouaflé counts today, only a series of afforestations of production and reconstitution. The series of afforestation are constitute of plantations of plurispecific and monospecific afforestations, with a total surface area of 4 833.65 ha. The comparisons between the data resulting from this study and those of other dense forests from Côte d'Ivoire relate as well to the composition as on floristic diversity.

3.1 Floristic richness and types of Afforestations

The botanical inventories carried out in the retimbered plots of the FCB, made it possible to count 227 species. The families best represented, were in the decreasing order, Fabaceae, Sterculiaceae, Apocynaceae, Hippocrateaceae, Moraceae, Rubiaceae and Poaceae. The abundance of Leguminous plants was often evoked by Guillaumet & Adjanohoun (1971) [9] like the botanical feature characteristic of the forests of Côte d'Ivoire. These families, the most represented, make to also part, according to the same authors, families almost common in the majority of the wet tropical forests. They are characteristic of a flora of wet dense forest, except for Poaceae very present in savannas.

All the monospecific afforestations are less diversified, except the plots of Cedrela which records a large number of species (47). The high number of species in the retimbered plots of Cedrela (47) and in association FK-FR (35), is related to the age of the retimbered plots or the duration of the afforestation which was at least 29 years for these two types of afforestation. Indeed, the old plots receive in the course of time more diaspores and are diversified in woody plants than the young plots. Moreover, with time the microlimat creates becomes more favorable to the reconstitution of the flora and by rebound to the diversification of this one.

3.2 Types of afforestations and conservation of vegetable diversity

The floristic similarity obtained between the plots retimbered containing *Gmelina arborea* (GM), *Tectona grandis* (TK) K and five (5) other types of afforestation (Cedrela odorata, *Terminalia superba-Terminalia ivorensis*; *Cedrela odorata-Tectona grandis*, *Terminalia superba-Terminalia ivorensis-Gmelina arborea* and *Terminalia superba*). The significant variation of the relative abundance of the species of the retimbered mediums of the FCB reveals that the specific richness varies according to the type of afforestation. Indeed, the types of afforestation with the procession of species creates differential ecological conditions conditions which impact significantly the biology of the forest species preserved at the state of seeds in the soil of retimbered spaces. The retimbered plots of FK-FR, FK-TK and FK-FR-GM are diversified in species. This richness of the plots sometimes comprising several types of associations of woody species can be related to the presence of woody numerous species on the retimbered plots. This ecological state is closer to the conditions offered by the climacic forests which comprise numerous species whose associations support the development and blooming many other species. Thus, the conditions of development which the plurispecific afforestations offer are closer to those which offrer by the mediums forester more favorable to the development of the forest species. In addition, the quality of the species used favors the biology of other forest species *Terminalia superba*, *Terminalia ivorensis*, *Cedrela odorata* and *Gmelina arborea*, with less dense canopy, facilitate, the growth of the forest species mainly heliophilous. Contrary to the mediums of plurispecific (RP) afforestations, the low values of index of diversity were estimated in the monospecific (RM) afforestations This situation, more accentuated in the plots of *Tectona grandis* could be related to the dense canopy of *Tectona grandis* which according to Diégo and Sinsin (2006) does not support endogenous floristic diversity. In addition, Kouassi *et al*. (2015) [13], indicated that this effect of shade created by the increasingly important foliages of the houppiers of *Tectona grandis*, would cause a strong competition between heliophilous species for the light. This situation would be a limiting factor for the development of the majority heliophilous species in the tropical flora. The species met in the FCB are well distributed in the inventoried mediums and more still in the plots of *Terminalia superba-Terminalia ivorensis b*ecause the values of the indices of Equitability are close to 1; attesting that the timbered plots with several woody species, in particular associations of FK-FR and FK-FR-GM are much homogeneous than the mediums which shelter the monospecific afforestations.

The ACP has indicates that certain species present an affinity with the groups G1 built around the afforestations of the type (FK-FR, FR-FR-GM and of CE and G3 with the

afforestation's of type (FK-TK and CE-TK). Thus, the homogeneity of the floristic compositions of groups 1 and 3 could be related to the typology of the afforestations Indeed, the homogenous plots are all of the plurispecific afforestations except for the monospecific afforestation containing Cedrela odorata. The works of Barber *et al*. (2007) also showed that the plantations with several woody plant support overall the specific wealth of the flora. In addition, this diversity highlights a close link between the woody species of afforestation. The index of similarity of Sorensen confirms it for the plots of which this one is higher than 53%.

4. Conclusion

This study made it possible to count 227 plant species. The principal results showed that all the plurispecific afforestations, in particular the plots of *Terminalia superba-Terminalia ivorensis* and *Terminalia superba-Terminalia ivorensis-Gmelina arborea* as well as the monospecific afforestation containing *Cédrela odorata* are of a major ecological interest. Specific richness and endemism combine to make these types of afforestation those which support vegetable diversity as well as possible. Indeed, the underwood of these woody species of afforestation is more diversified and has the greatest specific richness, contrary to the afforestations containing *Terminalia superba*, of *Gmelina arborea* and *Tectona grandis*.

As, the distribution of the species according to the species of afforestation showed as theas the plurispecific afforestation as well as the monoculture of Cedrela odorata are more preserving vegetable diversity than the monospécific afforestations of Terminalia superba, of Gmélina arborea and Tectona grandis. The results of the evaluation of the effect of certain types of afforestations on the dynamics of vegetable diversity in semi-deciduous zone showed that it would be of a great ecological interest to privilege the plurispecific afforestations, in particular associations of the type of: Terminalia superba-Terminalia ivorensis and Terminalia suprba-Terminalia ivorensis-Gmelia arborea.

5. References

1. Achard F, Eva HD, Stibig HJ, Mayaux P, Gallego J, Richard T. Manlingreau J. P Determination of deforestation rates of the world's humid tropical forest,. Scence. 2002; 297(5583):999-1002.
2. Adjanohoun E. Végétation des savanes et des rochers découverts en Côte d'Ivoire, 1964 Mém. ORSTOM, 7, 178.
3. Aké-Assi L Flore de la Côte d'Ivoire : étude descriptive et biogéographique avec quelques notes ethnobotaniques, 1984, Thèse d'Etat Université faculté des Sciences, (Côte d'Ivoire, Abidjan).tome III, 1984, 1069-1206.
4. Aké-Assi L, Flore de la Côte d'Ivoire 1, catalogue, systématique, biogéographie et écologie. Genève, Suisse, Conservatoire et Jardin Botanique de Genève ; Boisseria. 2001; 57:396.
5. Aké-Assi L. Flore de la Côte d'Ivoire 2, catalogue, systématique, biogéographie et écologie, Genève, Suisse : Conservatoire et Jardin Botanique de Genève; Boisseria. 2002; 58:441.
6. Barbier S, Gosselin F, Balandier P. Le mélange d'essences est-il favorable à la diversité végétale ? 2007.: Cemagref, Unité de recherche Ecosystèmes Forestiers. Regefor, 2007, 1.
7. FAO. Situation des forêts du monde, Organisation des Nations Unies pour l'Alimentation et l'Agriculture, Rome, Italie, 2009, 152.
8. FAO. Situation des forêts du monde, Département des Forêts. Archives de Documents de la FAO. FAO : Rome, Italie, 2007, 143.
9. Guillaumet JL, Adjanohoun E. La végétation de la Côte d'Ivoire. *In* : Le milieu naturel de la Côte d'Ivoire, Mémoires ORSTOM n°50, Paris, France, 1971, 157-263.
10. Hutchinson J, Dalziel JM. Flora of West Tropical Africa.2nd edition, revue par Hepper London. 1954-1972 ; 3(1):828. 2, 544, 3, 850.
11. Koné KHC. Etude écologique et phytosociologique des peuplements monospécifiques à haut rendement ligneux de *Tectona grandis* L. f. (Verbenaceae) dans les forêts classées de la Sangoué et de la Rasso en côte d'ivoire, Thèse de doctorat, Université Félix Houphouët-Boigny, Côte d'Ivoire, 2012, 221.
12. Kouamé D, Adou Yao CY, Kouassi KE, Guessan NKE, Akoi K. Preliminary Floristic Inventory and Diversity in Azagny National Park (Côte d'Ivoire), European Journal of Scientific Research. 2008; 23(4):537-547.
13. Kouassi KE, Sangne YC, Kouassi KH. Richesse et diversité floristique dans les biotopes environnants la Forêt Classée de la Téné dans le département, d'Oumé en Côte d'Ivoire. Journal of Animal &Plant Sciences. 2015; 24(1):3700-3713.
14. Lebrun JP, Stork AL. Énumération des plantes à fleurs d'Afrique tropicale. Genève, Suisse, 1991-1997, Conservatoire & Jardin Botanique, 4 volumes. Vol. 1, 249 p., vol. 2, 257 p., vol. 3, 341 p. et vol. 4, 712 p.
15. Lebrun J. La végétation de la plaine alluviale au sud Lac, 1947, Edouard. Institut des Parcs Naturels du Congo-Belge, Mission Lebrun. 1937-1938, 800.
16. Monnier Y. Carte de la végétation de la Côte d'Ivoire, In : Atlas de Côte d'Ivoire, éd. 2. Jeune Afrique, Paris.
17. Perraud A. Les sols de la Côte d'Ivoire, 1971, *In :* Le milieu naturel de la Côte d'Ivoire. Mémoire ORSTOM n°50, Paris (France): 263-401.
18. Raunkiaer C. The lifes forms of plants and statistical plant geography. 1934, Oxford University Press, London (UK). 1983, 632.
19. Shannon CE, Weaver W. The mathematic theory of communication, Univ. Illinois Press, Urbana. 1948, 117.
20. SODEFOR. Plan d'aménagement de la forêt classée de Bouaflé, Ministère de l'agriculture et des ressources animales, Abidjan, Côte d'Ivoire, 1996, 58.
21. Sørensen T. A method of establishing group of equal amplitude in plant sociology based on similarity of species content and its application to analyze of the vegetation on Danish common, Kjöbenhavn. 19485; (4):1-34.
22. UICN. IUCN Red List of Threatened Species. [Online], URL. Downloaded on, 2016.