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Floristic Diversity of Recruits in Plantations of *Eucalyptus Deglupta* B., 1863, *Pinus Caribeae* M., 1851, And *Gmelina Arborea* R., 1814: Case of Cellucam Plantations Near Edea (Litoral, Republic of Cameroon)

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ABSTRACT: *Floristic diversity is the set of plant species of an ecosystem or a given environment. Recruits are species regenerated after a disturbance in an environment. In this study it is a natural regeneration different from the artificial regeneration. The main objective of this study is to assess the level of natural regeneration under the artificial plantations. The strip sounding method is used over approximately two (2) hectares per type of plantation. Parameters measured are the abundance of recruits, the specific richness, the abundance of genera and families and the diameters of the stems. The floristic diversity was assessed through five indices. These are the Shannon indices, Simpson indices, Hill indices, regularity indices and generic diversity indices. . The results of the inventory show that the abundance of recruits is significantly different in the plantations and the surrounding forest. Species richness varies by type of plantation. Almost all of the three types of vegetation in the plantations have a Shannon index significantly greater than 1 and testifies to the very high diversity. The 1-Hill difference reached the value 0.97, 0.94 and 0.9 which values very close to 1. The regularity index shows that the taxa of plant communities of the recruits are not regularly distributed and have a low taxonomic richness. The lowest value of the generic diversity indices is 1.07. This shows that generic diversity is low in the three plantations. The floristic affinity between the 3 plantations is greater than 50%. According to Sørensen, these results demonstrate that the three plantations have the same floristic composition and constitute the same biological unit.*

KEY WORDS: diversity, recruits, plantation, CELLUCAM, Republic of Cameroon.

INTRODUCTION

Floristic diversity is the set of plant species in an ecosystem or a given environment. Recruits are species regenerated after a disturbance in an ecosystem or in an environment. The regeneration, is also the ability of a living entity (genome, cell, organ, organism, ecosystem) to reconstitute itself after the destruction of a part of this entity (Inza Koné Joanna E. Lambert, Johannes Refisch, Adama Bakayoko 2016). In this study, it is about ecological regeneration that is the reconstitution of vegetation cover of an environment after destruction. This reconstitution can be natural, naturally assisted or artificial. Several definitions were proposed by foresters on natural regeneration. Natural regeneration designates the ability of an ecosystem (generally forest) to reconstitute itself spontaneously after removal of all or part of the forest cover, whether by clear cutting, partial cutting or creation of patches of light or clearings (Gómez, J. L. and Hódar, J. A. 2008). In the context of gentle management known as close to nature, which seeks to imitate the systems and cycles at work in the evolution and self-maintenance of the natural forest (Wahl, D. C. 2016), natural regeneration is a form of ecological resilience. This has proven itself on the scale of geological time (Lobova et al., 2003). For forests that have benefited from it in historical times, it requires certain rigorous conditions for the success of regeneration, including the conservation of a source of seeds or propagules (Dalling et al., 2011, Kosso Daînou, and al, 2011,). These conditions are related to (1) the minimum amount of fresh water available all year round (water tables accessible to roots and their symbionts (Mahall et al., 2009), rain and meteoric waters from mist and dew; (2) In the case of species dispersing their seeds only by zoochory, the presence of animals to disperse or bury the seeds is necessary (Lobova et al., 2003); (3) A flooding of the area concerned for alluvial forest species (Vanthomme et al., 2010) whose seeds are transported by water or on the contrary the absence of asphyxiating conditions in the soil for species requiring well-drained soils (Nicoll and Coutts, 1998); (4) herbivorous pressure compatible with the regeneration potential (Debreyne, 1965, Randall and Walters, 2011); (5) a favorable microclimate which depends on the size of the gap or the cut (Pardé, 1962, d'Oliveira and Ribas, 2011); (6) a form of humus suitable for species requiring deep and rapid rooting of young seedlings (Le Tacon and Malphettes, 1976) and (7) the absence of negative interference (Allelopathy) with other plant species whose development can make a site unsuitable for any natural regeneration (Ponge et al., 1998, Putz, 1983). Natural assisted regeneration is an agroforestry practice that later extended to forestry. It is an agroforestry technique that consists of protecting and managing natural regrowth produced by the stumps of trees and shrubs in the fields or sowing by direct seeding that can also be carried out to enrich biodiversity (Larwanou, M., M. Abdoulaye and C. Reij, 2006). Naturally assisted regeneration techniques began in the dry regions of the Sahel, especially in Niger in the 1980 (Larwanou, M., M. Abdoulaye and C. Reij, 2006) and quickly spread to other sahelian countries (Burkina Faso, Chad, Senegal, Mali) and in other parts of Africa (Kenya, Ethiopia). This practice, which has the option of enriching the environment by direct sowing of species of interest, aims to accelerate the rehabilitation or recolonization of species of interest in order to supply cities with firewood and livestock feed. Artificial regeneration or uniform planting is a technique that consists of manually or mechanically planting young plants of a desired species at regular spacing (Thifault and Roy, 2014). Its main objective is to restore the forest cover and fully utilize the production capacity of the degraded area. Artificial or uniform plantations can regenerate the vegetation cover higher than those of the natural forest. This technique allows the management the composition and distribution of trees of the future stand and require regular monitoring and maintenance at low ages. This results to a lower quality of wood than wood from a natural stand (Thifault and Roy, 2014). For the forester, the essential concept is forest regeneration, which designates all the spontaneous natural processes and silvicultural strategies and techniques for restoring a forest cover. CELLUCAM (cellulose from Cameroon) is a paper pulp production company located 15 km

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from Edéa, capital of Sanaga maritime (coastal region of the Republic of Cameroon) from 1979 to 1982. The production of paper pulp lasted only 4 years (1979-1982). For pulp production, the company's forest department has adopted a method of cutting all woody species for pulp production. This is the clear cut dune/cut forest breed. A bulldozer then passes to bare the ground. As the block is mined, reforestation is carried out using exotic species adapted to paper pulp. The species planted are *Pinus caribeae* M. 1851, *Eucalyptus deglupta* B. 1863 and *Gmelina arborea* R., 1814. About 100 ha of forest have been cleared but only about 30 ha (30%) of plantations have been installed.. The artificial plantations are not maintained and abandoned in the middle of dense forest. In this present study it is a spontaneous natural regeneration under an abandoned artificial plantation. The installation of an artificial plantation matches to the destruction of the natural ecosystem, therefore, the destruction of local plant species (Aubréville, 1948). The main objective of this study is to asses, through the main parameters of floristic diversity, the level of natural regeneration under the uniform plantations abandoned after the destruction of a part of the dense forest.

MATERIALS AND METHODS

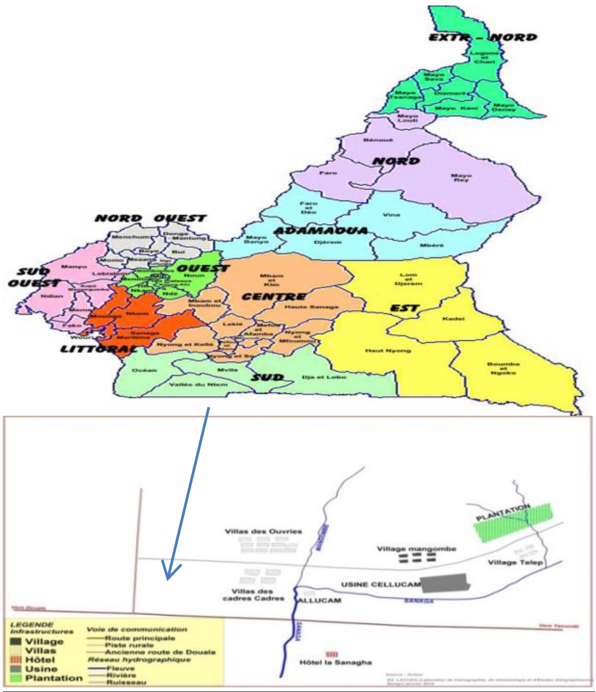

Figure 1. Administrative division of the Cameroon and map of the study zone

Study area

The CELLUCAM plantation (30° 50 N and 10° 10 E; Figure 1) is located about 15 km north east of the town of Edéa in the Cameroonian coastal zone (Central Africa). The original vegetation is a rain forest. The most common species are *Lophira alata*, *Saccroglotis gabonenecis*, *Cynometra hankei* harms and *Coula edulis*. The forest is rich in paper species with a potential greater than 300 m^3/ha. The plantation is located at an altitude of about 30 m. Runoff water has eroded the site, which has a slight slope towards the rivers that cross the plantations. Exotic species planted in uniform blocks are *Pinus caribeae*, *Eucalyptus deglupta* and *Gmelina arborea*. The choice of these three exotic species is based on the quality of their paste and their adaptation to the environment at the experimental site of the Mangombe town near Edéa. The demographic growth of the villages around the plantations exerts various pressures characterized by the extension of agricultural plots whose system is itinerant slash and burn and the harvesting of forest products (Ngueguim et al., 2010). However, the plantation is protected against these demographic pressures.

Experimental device

Three uniform plantations corresponding to the three species (*Pinus caribeae*, *Eucalyptus deglupta* and *Gmelina arborea)* were chosen for this study. In each plantation, 4 rectangular strips (100 m x 50 m) have been established and each strip were divided into two sounding units of 50 m by 50 m. In each survey unit, regenerated local species with stem diameters greater than 10 cm were identified, measured and counted. In total, 2 ha of area are surveyed each of the three plantations.

Counting and calculation of the floristic diversity **parameters**

In the analysis of the collected data, Several indices were used to highlight the specific diversity of the plant communities. The **Absolute abundance (A)** allows to determine the total number of stems, the number of genera and the number of families identified per hectare in a plantation.

The **Specific richness (SR)** is the total number of local species in each plantation. It is determined by The **Shannon diversity index** (1949) (J. R. Ngueguim et al., 2010) is calculated as follow:

$ISH = - \sum (Ni/N) \log2 (Ni/N)$ is expressed in bits where Ni = number of the species i; N = total number of species.

The **Piélou fairness index** (1966) (J. R. Ngueguim et al., 2010) is the ratio of the diversity of a stand or a sample to the number N of species present in the plot. It expresses regularity, the equitable distribution of individuals within species and is calculated as follow:

$EQ=ISH/\log2(N)$

The **Simpson diversity index (J. R.** Ngueguim et al., 2010) represents the probability that two individuals randomly taken from the studied stand belong to the same species. It measures the way in which individuals are distributed between the species of a community and is calculated as follow:

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

Regularity Index Biodiversity (Ref) is greatest when the total number of individuals at a site is evenly distributed among taxa. The regularity index provides information on the proportion of the total abundance of individuals controlled by a proportion of the dominant species. It is the inequality of abundance between species. Let S be the number of taxa, we deduced the maximum biodiversity Hmax :

$H_{max}=\log_2 S$ $\quad$ $R=H/(\log_2 S)$

The Regularity Index R is the ratio between the observed diversity H and the maximum diversity Hmax. A regularity index is between 0 and 1. In nature, this index is commonly around 0.8 or 0.9. Thus, the biodiversity index H can be seen as the product of the specific richness S

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expressed in logarithm and the regularity of the different taxa. This formulation has the advantage of simultaneously quantifying the taxonomic richness and distribution of taxa in a community.

The **Sorensen similarity coefficient** (J. R. Ngueguim et al., 2010) allows to know whether two plots a and b compared on the floristic level belong to the same plant community. This is the percentage of common species in two plots. For a value of K greater than 50%, it can be concluded that the species of the two compared plots belong to the same plant community. It is calculated as follow:
K=(2C/A+B)x100 (A= number of species in plot a, B= number of species in plot b and C= total number of species in plots a and b).

Statistic
Parameters (absolute abundance and specific richness) were compared between the plantations (*Eucalyptus deglupta*, *Pinus caribeae* and *Gmelina arborea*) using a One-way ANOVA following by Tukey's Post hoc test under R software.

RESULTS AND DISCUSSION

Abundance of recruits in the three plantations
The number of stems per hectare in *Eucalyptus deglupta* (480±198 stems) was significantly higher compared to those recorded in *Pinus caribeae* (330±156 stems per hectare) and in *Gmelina arborea (293±115 stems per hectare) where no difference was observed (*One-way ANOVA followed by Tukey's Post hoc test, P<0.005; *Figure 2).* Abundance of recruits in the surrounding forest was 10-fold higher (3654±900 stems *per hectare*) than those in the experimental plantations. The same results were obtained in the study of undergrowth floristic diversity with a closed canopy in the Mangombe village near Edea (J. R. Ngueguim et al., 2010). In this study, the floristic density is also low in the open plots compared to the closed forest. In the Kala massif in Cameroon, it was found that the density of natural regeneration is low in the degraded site compared to the slopes of the massif which are not affected by human activities (Stéphane N., Madiapevo et al., 2017).. The low rate of regeneration may be linked to the brutal method of exploitation of the forest. a. Excessive exposure of an environment to light promotes the development of species (such as ferns) which slow down natural regeneration.

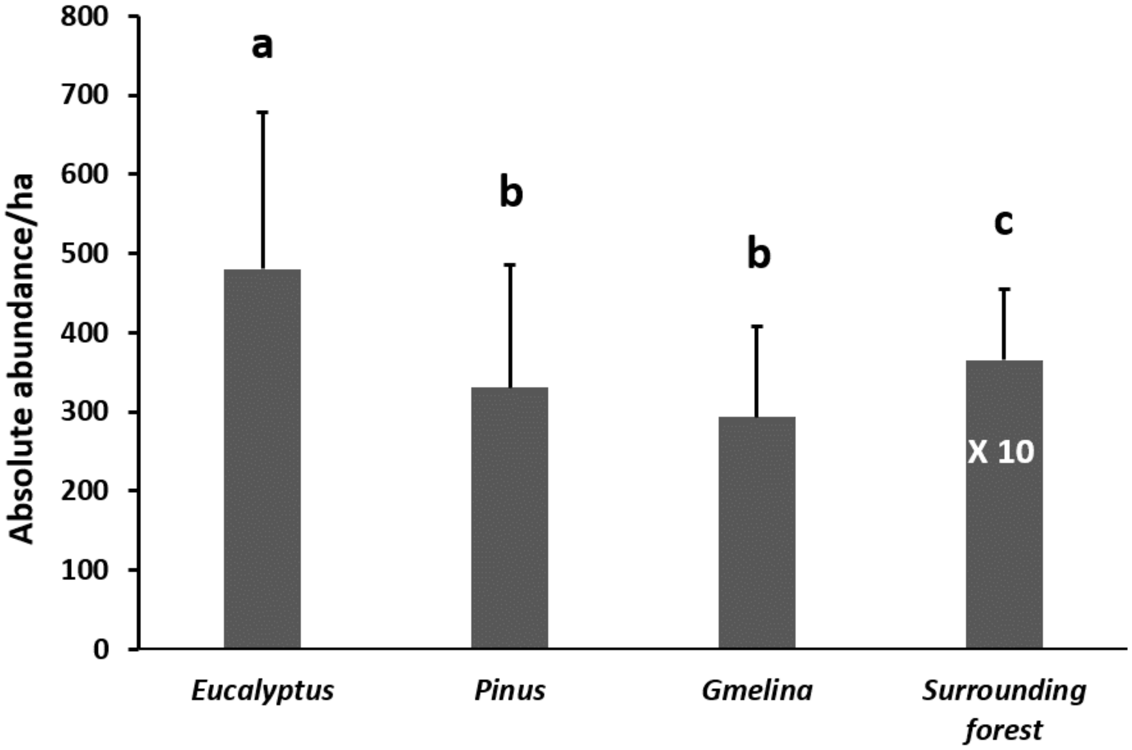

Figure 2. Absolute abundance of the species in the different plantations (*Eucalyptus deglupta, Pinus caribeae* and *Gmelina arborea*) and in the surrounding forest (value to be multiplied by 10). The histograms accompanied by the different letters are significantly different (One-way ANOVA followed by Tukey's Post hoc test, P<0.005).

Species richness

Species richness is the number of local species per hectare regenerated in the plantations. The specific richness presented the same pattern as the absolute abundance, with a significantly higher specific richness from *Eucalyptus deglupta* (73±22 species per hectare) than those from *Pinus caribeae* and *Gmelina arborea* (53±17 species per hectare and 53±18.5 species per hectare, respectively; Figure 3). This situation could be explained by the density of exotic species planted and their canopies likely to inhibit the dissemination of the diaspores responsible for recruitment. The slope of the relief would also be favourable to water runoff, resulting in a rapid variation in the fertility gradient. Several families are characterized by their abundance of stems, in decreasing order of importance: *Apocynaceae* (32.26%), *Ebenaceae* (6.8%), *Burseraceae* (6.4%), *Meliaceae* (6.2%) and *Euphorbiaceae* (5.8%). We noticed the presence of *Cecropiaceae* is abundantly represented by *Musanga cecropioides*, a species that quickly colonizes secondary forests and forest gaps. The presence of gaps in the canopy plays a fundamental role. This is characterized by a pioneer stage where adult individuals that will make up the stand are pioneer or heliophilous species, likely to germinate only in good light conditions. This group of species is distinguished by very rapid growth, early maturity, high fertility and low life expectancy. Similar results were obtained following the study of the intrinsic ecological characteristics of taxa in the Nouragues nature reserve in French Guiana (Riera, 1983; Riera et al., 1990; Randall and Walters, 2011; Trouillon, 2006). In arid environments, natural regeneration is favoured by cattle grazing (which limits the invasion of the environment by ferns and gorse which are often asphyxiating for seedlings) whose hoof marks in the sand generate conditions conducive to the emergence of seeds (Pie-Smith c., 2013; Reij C; Tapan G; Smale M., 2009). According to Ponge et al., 1998, regeneration can be slowed down or prevented by soil degradation (a clear-cut logging site or skidders) but also by the over-density of animals such as rabbits, deer, wild boars (favoured by their feeding and the disappearance of their natural predator) but also by the lack of animals involved in zoochory (Lobova et al., 2003; Inza Koné Joanna E. Lambert, Johannes Refisch, Adama Bakayoko 2016). The conditions necessary for good natural regeneration, such as seed sources, the minimum amount of water available all year round (Nicoll and Coutts, 1998), the possibility of natural seed dispersal (whether by water, wind or animals), conditions allowing seed dormancy to break, pressure from herbivores (Lobova et al., 2003; Debreyne, 1965; Randall and Walters, 2011) and poachers (d'Oliveira and Ribas, 2011), light, humidity (well-drained soil) (Nicoll and Coutts, 1998), humus with high earthworm activity (Ponge et al., 1998) may be the cause of the low result of the stem density of recruits in plantations (Thiffault and Roy, 2011). Depending on the environment concerned, the degree of degradation or anthropization, the time required for complete regeneration can vary greatly. This is the case in the studied plantations with a lifespan of 35 years: Concepts in the field of regeneration previously shown that a meadow degraded by intensive use (excessive export of herbage, excessive use of fertilizer, etc.) can be regenerated in a few years insofar as the seed bank of the soil is not depleted (van Ulft, 2004). A heath burnt by a fire also regenerates in a few years, even in a few months if the fires were only superficial and the fires are not recurrent (Davies et al., 2010). But on the other hand, after a major disturbance (cutting, hurricane, fire, landslide, flood, etc.) it will probably take several thousand years for a tropical rainforest to regain the composition and structure of the previous forest (van Ulft, 2004; Comita and al., 2009). The planting site is 'primary forest', thus due to the dispersal of large-seeded trees typical of mature forest, but the area concerned and the intensity of the disturbances strongly determine the speed and intensity of regeneration (van Ulft, 2004; Comita et al., 2009).

The specific richness is quite high and close to the values of 199 species and 65 species respectively obtained (Guedje et al., 2002) in forests at West *Garcinia lucida* of southern Cameroon (Central Africa) and in the forest plantations of Bilik in semi-deciduous forest-(Stéphane, N. Mandjapevo, 2017). Some authors maintain that the specific diversity of plant groups is very high during the early stages of succession with a reduction in the number of individuals towards the climate stage; for others, the structure of the stand is set up from the first years of succession and the maturation of the forest only leads to a notable drop in specific richness (Sonke, 1998). The tendency to increase in species richness, density and diversity of stands constitutes a general law for all ecological successions (Sonke, 1998). The high specific richness of certain stands can be explained by ecological conditions that would be favourable to the regeneration of the present species.

Presenting the complex structure of a community only by its species richness or an index of diversity gives incomplete information. The statistical study of the abundance of species in a plant community is of great importance. Indeed, it makes it possible to better interpret the nature of the interactions between species and to highlight the factors which determine their relative frequency. To enrich the forest, the role of the silviculturist consists in promoting the development of useful species to the detriment of others. Two methods are possible, each based on a different conception. I can consider that the natural environment has little value except for its soil and its climate and that the existing vegetation there is not capable of evolving towards a state economically profitable and in any case, the efforts of the silviculturist would then be to move towards a method of enrichment by planting. Otherwise, when the different stands in the secondary forest represent, in the form of seedlings, saplings, poles, small or medium-sized trees of useful species, a potential wealth of timber that should not be neglected. An enrichment method based on the existing vegetation and its natural regeneration (assisted natural regeneration) is then considered. This method of naturally assisted regeneration could rapidly increase the rate of useful local species in plantations. This assisted enrichment method has been implemented since 1947 in Cameroon in the Mbalmayo state forest (Stéphane N. Madiapevo et al, 2017). Counts made in 1950 on 1,570 ha show a survival rate of 48.5% out of an initial total of 105,359 stems planted in strips (Morellet, 1952). We also noted that 23,866 seedlings resulting from natural regeneration and belonging to a dozen useful species had taken place on these inventoried strips. This raises to 75.5% the percentage of existing plants compared to those originally planted. It should be noted that the proportion of natural seedlings is certainly higher. The existing natural seedlings between the lines were not counted. This incidental natural regeneration has therefore constituted a valuable supplement for plantations in strips. In some plots, the number of seedlings from natural seedlings is even greater than the number of trees planted (Morellet, 1952).

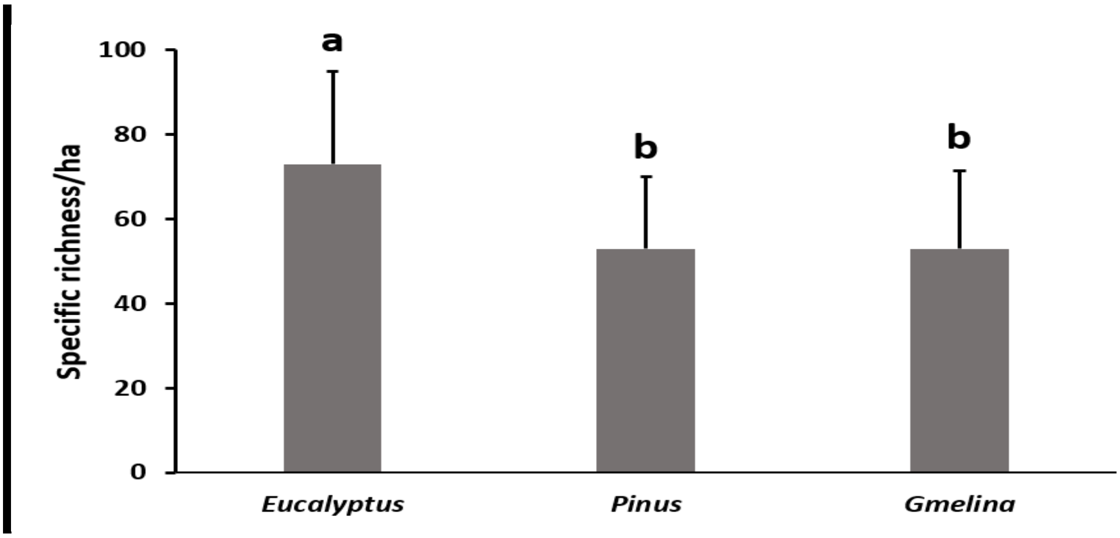

Figure 3. Species richness (SR) values of species in the different plantations (*Eucalyptus deglupta*, *Pinus caribeae* and *Gmelina arborea*).

The histograms accompanied by the different letters are significantly different (ANOVA followed by Tukey's Post hoc test, P<0.005). The others parameters of the floristic diversity
Floristic diversity was assessed in the three plantations through five fundamental indices. These are the Shannon index, Simpson index, Hill indices, Regularity indices and generic diversity. The Shannon indices vary from one plantation to another. Shannon indices were 2.365, 3.259 and 2.265 bits, respectively for *Eucalyptus deglupta*, *Pinus caribeae*and *Gmelina arborea* (Table 1). These high values reflect an equitable distribution of species in the plantations and an equitable evolution of the ecosystem. In the same plantations, the lowest value obtained was 2.74 bits (J. R. Ngueguim et al., 2010). These high values show a great diversity and a good

reconstitution of the floristic diversity in the plantations, undoubtedly due to the favourable conditions of the environment. These values are lower than the average (4.95 - 4.80 bits) in a similar plot of Bilik. For all the stands studied, the values of the Shannon index found are low compared to those obtained in the Biafran Atlantic forests with *Caesalpiniaceae* (Guedje, 2002) and in the forest of the Dja Biosphere Reserve in Cameroon (Sonke, 1998). Simpson's index is very sensitive to the distribution of individuals between species. The Simpson D heterogeneity index was 0.27 for the lowest value (Table 1). This is how the transformation which is 1-D=0.73 gave a very high measure of diversity. This index shows that there is a 73% probability that two (2) trees chosen at random do not belong to the same species (Stéphane N. Madiapevo et al., 2017). The values of this index express a good organization of the ecological system and correspond to environmental conditions favourable to the establishment of many species (Ponge et al., 1998). Low values of the Shannon index are characteristic of stands where one species is dominant as in Guyana where a structure typical of tropical forests in a reserve, with a large number of species and represented by a small number. Hill's diversity index was 0.027 in the plantation of *Eucalyptus deglupta*, 0.041 in the plantation of *Pinus caribeae* and 0.060 in the plantation of *Gmelina arborea* (Table 1). The difference 1 -Hill reaches the value 0.97 or 97% for the plantation of *Eucalyptus deglupta*, 0.94 or 94% for the plantation of *Gmelina arborea* and 95.9% in the plantation *of Pinus caribeae* which are values very close to 1. This means that the diversity of recruits is very high in these plantations. The regularity index (R) is generally between 0 and 1. In nature, this index is commonly around 0.8 or 0.9. R was 0.634, 0.656 and 0.945, respectively in the plantation of *Eucalyptus deglupta*, *Gmelina arborea* and *Pinus caribeae* (Table 1). These results show that the taxa of communities of the recruits are not regularly distributed in the plantations of *Eucalyptus deglupta* and *Gmelina arborea* and also show a low taxonomic richness in these plantations (Stéphane N. Madiapevo et al., 2017). In the *Pinus caribeae* plantation, R was included in the range of two normal values of nature (0.8 and 0.9). The result in this plantation shows that the taxa in this plantation are regularly distributed and at the same time proves a fairly significant taxonomic richness. Similar results were obtained following the study of the intrinsic ecological characteristics of taxa in the Nouragues nature reserve in French Guiana (Riera, 1983; Riera et al., 1990; Trouillon, 2006). The lowest value of the generic diversity indices is 1.07. The 1-G difference is less than 1. This result shows that generic diversity is low in the three plantations. These taxa which require light for their germination grow rapidly, their flowering and fruiting are early and abundant but their life expectancy is relatively short (Trouillon, 2006).

Table1. Shannon's Diversity, Index, Simpson's Index, Hill's Index, Regularity Index and Generic Diversity.

Plantation	ISH	Simpson index (D)	HILL index (Hill)	Regularity index (R)	Generic diversity (GI)
Eucalyptus deglupta	2,365	0,368	0,027	0,634	1,07
Pinus caribeae	3,259	0,27	0,041	0,945	1,08
Gmelina arborea	2,265	0,27	0,060	0,656	1,08

The floristic composition of species in plantations

In the study of the species composition in the three plantations, the similarity coefficient test of Sorensen was used. The Sorensen similarity coefficient between the three plantations compared two by two by the Sorensen similarity index is presented in Table 2. The floristic

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affinities between the 3 plantations are all greater than 50%. It is 61.90% between plantation of *Eucalyptus deglupta* and *Pinus caribeae*, 61.90% between the plantations *Eucalyptus deglupta* and *Gmelina arborea* and 60.97% between the plantations of *Gmelina arborea* and *Pinus caribeae*. The floristic affinities between the 3 plantations are greater than 50%. According to Sørensen (1998), these indices show that the three plantations have the same floristic composition and constitute the same biological unit. The values of the results of the coefficient of similarity of Sorensen also show the same origin of the diaspores which gave rise to local species regenerated in the three plantations. Natural regeneration is a spontaneous seeding that allows us to understand the forest dynamics marked by the existence of gaps and the role of the "initial floristic" composition or floristic potential. Population dynamics refers to all the changes that occur during the life of a population. This set includes recruitment and growth, senility, mortality, seasonal fluctuations in biomass (Svoboda et al., 2010). The stability of each age class and its relative importance, plus the effects that one or more of these factors have on the population. It is an ecological succession, that is to say a set of processes by which an ecosystem naturally or artificially altered or destroyed, spontaneously undertakes to reconstitute itself to recover a state which is in some way similar to the initial state (Blondel, 1979). These conceptions of dynamics seem well indicated for this study. The reconstitution of the forest undergrowth varies from one stand to another. It is important in the plantation of *Eucalyptus deglupta* (480 stems per ha), 330 stems/ha in the plantation of *Pinus caribeae* followed by 293 stems per hectare in the plantation *of Gmelina arborea* and natural forest (3654 stems per ha; Figure 1). This strong inequality of forest regeneration in plantations can be explained by the difference between the exotic species that make up the undergrowth and their effects as well as the ecological conditions in each plantation. Studies from the same series confirm that recruitment in wind throw is greater than that found in closed forests (Hubbell et al., 1999). This phenomenon, called wind throw, is considered to be one of the drivers of silvigenesis because it favours the arrival of light on the ground and therefore the regeneration of new individuals (Riera, 1983).

Table 2. Sorensen's similarity coefficient in the 3 plantations.

Parcelles	Plantation of *Eucalyptus deglupta*	Plantation of *Pinus caribeae*	Plantation of *Gmelina arborea*
Plantation of *Eucalyptus deglupta*	100	61,90%	61,90%
Plantation of *Pinus caribeae*		100	
Plantation of *Gmelina arborea*		60,97%	100

CONCLUSION

The CELLUCAL plantations are little known to researchers in Cameroon. This is surely due to the lack of archives and information on the history of the plantations. The only studies carried out were those of Stéphane Romain Ngueguim et al (2010). This study revealed significant plant biodiversity in the plantations studied. It is characterized by specific, generic and family diversity. The floristic study of the recruits made it possible to identify 34 families, 76 genera and 78 species. The heterogeneity observed in the spatial distribution of species follows the concept of mosaic (Aubréville, 1948). The forest plantations studied, due to the value of their fairness, can be assimilated to evolving and little disturbed ecosystems. The Meliaceae and Apocynaceae form the floristic background. A single species, *R. vomitoria*, is common to all plots. This species represents 7% of the total number of flora inventoried. The Apocynaceae are the most important floristic group with a proportion of 32.06% of the flora. The dynamics of natural regeneration depend on the nature of the disturbance (clearcutting, etc.), including the mechanisms of dissemination of diaspores. These structural changes maintain the dynamics and specific diversity of ecosystems. In general, the natural regeneration in the undergrowth is not negligible; the parameters measured indicate a gradual reconstitution of the flora. This is how forest plantations can, through their diversity and their flexibility of implementation, effectively contribute to the establishment of plant biodiversity. In their diversity, plantations are one of the tools serving the objective of sustainable management of forests in tropical regions (Marien and Mallet, 2004). In Gabon (Central Africa), very encouraging results offer relatively simple and inexpensive techniques to assist the natural regeneration of Okoumé (Doucet et al., 2004). Natural regeneration is advantageous in cost because it does not require the purchase of plants and lends itself to inaccessible land. Natural regeneration is quite simple, although difficult to implement. It is especially important for the forester to ensure that these small plants are protected from predators but also from excessive light and drought (den Herder et al., 2009). It is moreover more difficult to protect a natural regeneration from attack by rodents and game than plants planted by foresters and immediately protected. Natural regeneration allows little introduction of a new species. Even if it is recognized that natural regeneration can give technically unsatisfactory results, especially with certain invasive species and under certain environmental conditions, some authors nevertheless prefer the artificial regeneration which he considers to be a technically safe and more profitable method in the future (Touzet, 1996). Given the importance of natural regeneration in the undergrowth of the plantations studied, it would be interesting to consider polycyclic exploitation with a view to sustaining wood production. To do this, it is necessary to; practice selective upkeep of the understory that spares well-formed new growth of commercial species, with a view to creating a varied and larger genetic pool; exploit trees (exotic and local species) having reached the average diameter of exploitation, this reduces competition with the species of the lower level, especially the sciaphites species which have a slow growth.

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