International Journal of Advanced Research in Biological Sciences
ISSN: 2348-8069
www.ijarbs.com
DOI: 10.22192/ijarbs Coden: IJARQG(USA) Volume 5, Issue 3 - 2018

**Research Article**


**DOI:** http://dx.doi.org/10.22192/ijarbs.2018.05.03.010

# Dynamic and ecological characteristics of rewooded sites of the Sudano -Sahelian zone (Far North, Cameroun)

**Baïyabe Il-Mataï[1], Tchobsala[2], Dongock Nguemo Delphine[1.], Mapongmetsem Pierre Marie[1.]**

[1]University of Ngaoundere, Faculty of Sciences, Department of Biological Sciences, Laboratory of Biodiversity and Sustainable Development, Cameroon P.O BOX 454
[2]University of MAROUA, Faculty of Sciences, Department of Biological Sciences, Cameroon P.O BOX 814
*Corresponding author: *ilmataibaiyabe@yahoo.fr*

## Abstract

The study was carried out in the Far-North region of Cameroon, where two departments (Mayo Kani and Mayo Dany) were chose like one sample. In this one, four rewooded sites have been chosen. The objective of this work is to study the dynamic and ecological characteristics of rewooded sites, in sight of response to the problem of deforestation. The different sites where chose according to their reafforestation year. In the Mayo Kani division, the study sites are those of Goussor (2009) and Boboyo (2012); while in the Mayo Danay, they are those of Ouro-Dabang (2010) and Tcherféké (2011). Data collection has been done according to the FAO method in 2009. The statistical analysis have been done by Excel and Statgraphic+5.0. These analysis bring out that, the mains anthropic factors in the different sites are wood cutting (71.43 % in 2011 and 54.08 % in 2009), fire bush (35.42% in 2009 and 30% in 2011), pasture (22% in 2011, 14.28% in 2010) and pruning (8% in 2011). The density of ligneous species doesn't increase with the year. In 2009, 295 indiv/ha have been met, 305 indiv/ha in 2010; 266 indivi/ha in 2011 and 312 indivi/ha in 2012. The dendometrics parameters reveal that, the species which have 1.30>H≤5 m; 5>DBH≤10 cm and 1.30>DH≤5 m are dominant in the all sites. The Shannon index shows that the sites of 2012 and 2009 are very varied in terms of species with 1.07 and 1.04 respectively. The important value index shows the great number at *Piliostigma reticulatum* (35.48%) and *Anogeissus leiocarpus* (27.38%) in 2009; *Sterculia setigera* (104.08%) and *Guiera senegalensis* (61.17) in 2010; *Guiera senegalensis* (66.76) and *Securida longipedunculata* (46.07%) in 2011; *Acacia gerrardii* (29.75%) and *Combretum glutinosum* (20.13%) in 2012. These species present a good growth in their different sites.

**Keywords:** reafforestation, ligneous species, anthropic factors, ecological characteristics

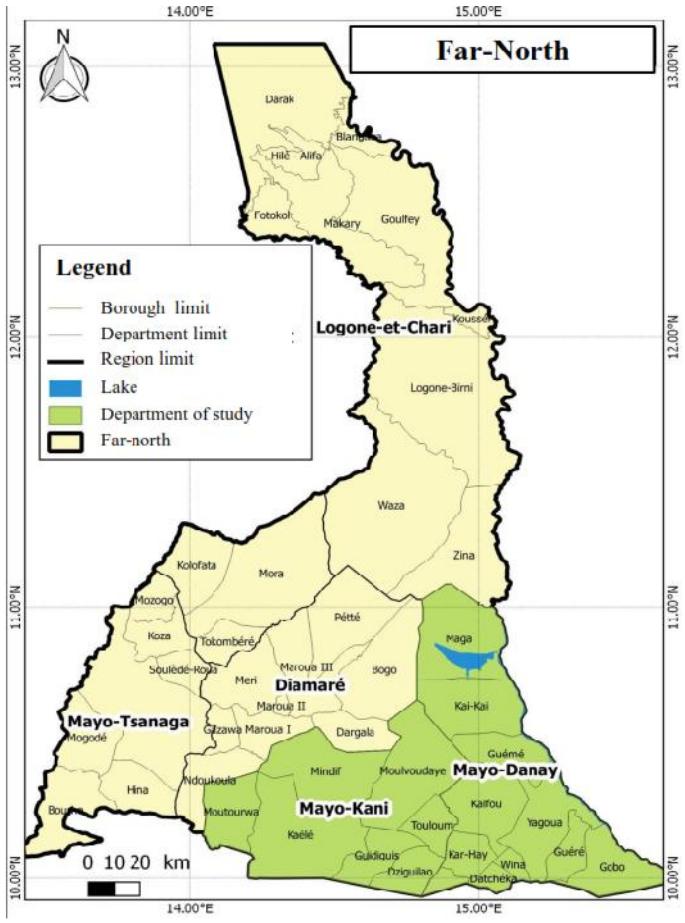
## Introduction

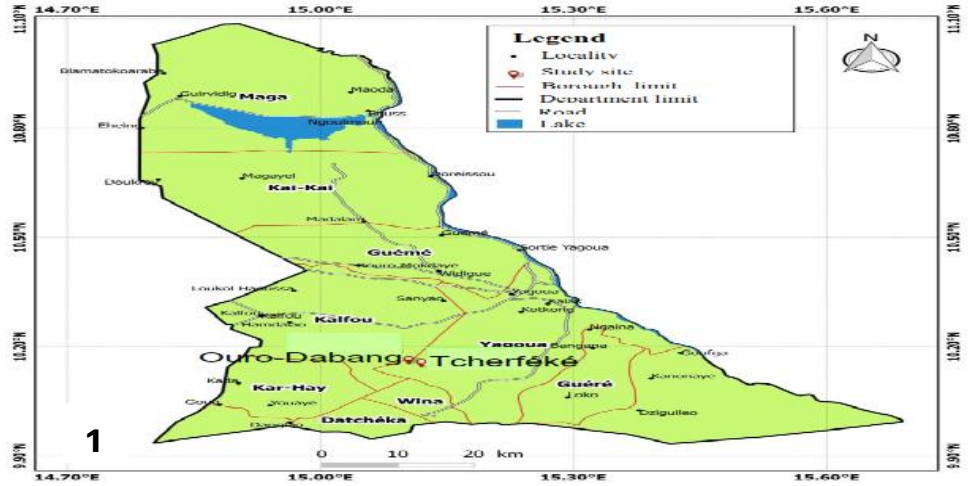
Cameroon, like other Congo basin countries, undergo the environmental, social and economical-devastating effect of climate change. These ones are generally cause by deforestation, degradation and fragmentation of forests; that make our country vulnerable to climate change, whose the alarming situation is more pronounce in the ecoregion of coastal, forest and sahelian zone (UICN, 2013). The principal problem encounter in the sahelian zones, in terms of environmental matter and socio-economic development, are overgrazing, deforestation, poaching and fire bush (P.EVA, 2015).Otherwise, it is necessary to note that, the Far-North region is particularly treats by drought and desertification because of many parameters. Between these ones, one notes a forte proportion of arid, semi-arid and sub-humid zones, affected by periods of important drought; to that, is add demographics and bio-physics parameters with heavy number of inhabitants, farmers, shepherds at the rural and urban level (Saleh *et al*., 2014). In the aim to give and answers to the present and serious ecological problems (climate change, deforestation, soil degradation etc.) in this region, some reafforestation projects as Opération "Sahel Vert" (MINEP, 2008) have been found for the second time since 2006 (Saleh *et al.*, 2014) and recently, it was question to grow green again (Cécile, 2014). In the same way, Action for Biodiversity and Soil Management (ABIOGeT) had executed a project to adjust and turning to profit the green sahel sites in this region. In the context of this research, it concern mainly to study the dynamic and ecological characteristics of the rewooded sites in the Sudano-sahelian zone, in sight of gather the information on phytodiversity, usable in development of REED+ information. For this matter, studies have been stretch on two departments those of Mayo kani and Mayo Dany. The aim of the present subject is to answer to the following questions: are rewooded sites favour a good plants dynamic? Are they the efficient solution to the preceding problems? Palou *et al.* (2015) have realized some works on multi-resources inventory report in the sites of green sahel of Massinkou-Léra-Bippaing (Kaele township) and Bidere (Doukoula township), in the Far-Nord Cameroon but, no works related to our study have been done. The present research has to bring a fill to this blank.

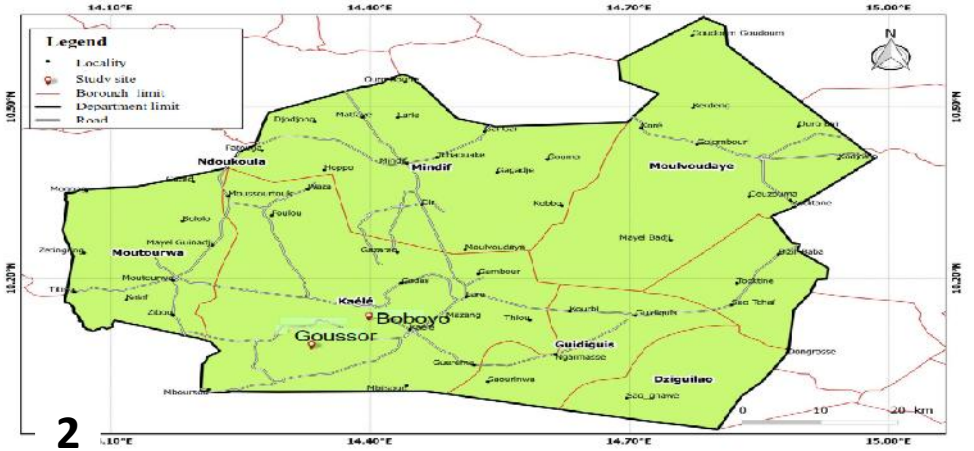
## Materials and Methods

### Presentation of different study zones

The departments of Mayo Kani and Mayo Danay situated at the Far-North of Cameroon, have respectively the county-town of Kaele and Yagoua. The Kaele Township cover an area of 205 $km^2$ with about 12.373 peoples. In the Kaele division, once met the ethnical groups like Moundang which are predominant, Guidar, Toupouri, and Bororo. The soils are constituted of discordant or alkaline granites and alluvium with a sandy to loamy texture and sometime loamy-sandy or sandy-loamy. The climate is the sudano-sahelian type. The average rainfall amplitude is around 809 mm/year. The vegetation is the savannah type to thorny steppe characterise by the presence of species like *Acacia albida* (winter thorn*)*, *Balanites aegyptiaca* (soapberry*)*, *Acacia spp.* and *Azadiratcha indica* (Neem). The Yagoua Township as to it, cover area of 950 $km^2$ with about 170.000 persons composed by Massa in majority. One meet also Toupouri, Kanuri, and Bororo. Three principals types of soil exist like luvisoils, characterize by accumulation of S loam, fluvisoil favourable for rice culture and planosoils characterize by muddy soils. The climate is the Sudano-sahelian type. The precipitation are weak with on average 800 mm/year. The vegetation is an arboreous steppe sprinkle with dwarfish thorny plants and parasitical herbaceous. The main species found in the Mayo Danay division are *Balanites aegyptiaca*, *Tamaridus indica*, and *Guiera senegalensis*. One meets other species like *Acacia spp.* and African fan palm.




**1 : Mayo Danay 2 : Mayo Kani**

## Sites choice

The rewooded sites of the sahel-vert operation, for the second time, have been implement from 2008 to nowadays. For this study, the sites have been chosen in departments of Mayo Kani and Mayo Danay following their rewooded year. The site criterion choice has been base on introduced and common plants to the different sites. There is Goussor 2009 (Mayo Kani); Oura-Dabang 2010 (Mayo Danay); Tcherféké 2011 (Mayo Danay); and Boboyo 2012 (Mayo Kani). These departments bind together represent one sample.

## Method of data collection

Data collection on the field has been done following the FAO (2009) method. The sample unite is a square of 1km×1km. Within this square, four rectangular small squares of 250m of long and 20m of broad have been measured. They go from each angle of a central square measuring 500m of side. This square has the same centre that the one of the sample unite. The small square are numbered from 1 to 4 following the watch needle direction. The first one is situated at South-west of square. Two types of underneath small square corresponding to the different levels of data collection have been measured within the principal small square: three rectangular underneath squares (SPR), of 20m x 10 m (200 $m^2$) constitute the first level; three circular underneath squares (SPC), of 3.99 radius (50 $m^2$) constitute the second level which is in the left half of SPR. Within the SPR, the floristics parameters of plants having at least 1.30m of height have been recorded. The height (H) has been measured with a graduated pole for the trees of 2m long and by visual estimation for the trees of more than 2m. The diameter of bunch (DH), was measured by a ribbon meter and the diameter of the chest height (DBH) with the help of decametre. The height and the diameter of the stump have been measured with a ribbon meter. In the second level, the counting of regeneration has been done systematically. Are consider as regeneration, plants with a height <1.30m and a DBH<10cm. Anthropic factors such as fire bush, woody cutting, overgrazing have been recorded by observation in the field according to Ouédraogo *et al.*(2003). The experimental design is a randomize blocs (figure 2).

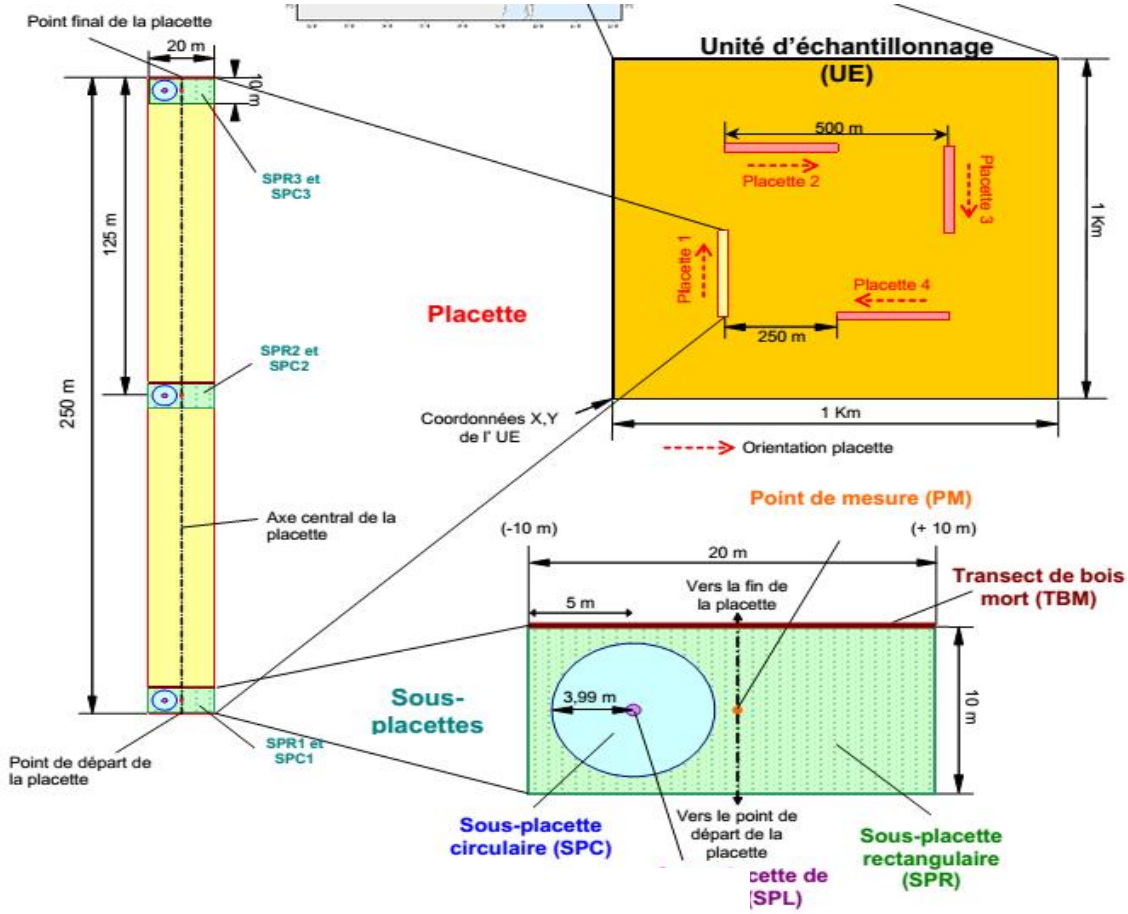



**Figure 2:** Sample method used for data collection

## Data analysis and ecological characteristics

The calculation of ecological parameter has been done according to standard method of (Curtis and McIntosh, 1950; Dagnelie, 1981).

## Frequencies

The absolute frequency (F) of species i is the number of statement containing this species, while the relative frequency is the number of statements containing this species divided by the total number of statements multiplied by 100 (Braun-Blanquet ,1932).

$$FRe = (A/B)*100$$

Where FRe= relative frequency, A=Number of statement containing one specie and B=total number of statement

## Relative density

The relative density represent the relation between the individuals of one specie divided by the total number of individual of all species in one sample.

$$Dre= (C/D)*100$$

Where Dre = relative density; C= Number of individuals of one specie; D= total number of individual of all species in one sample.

## Relative dominance

It represents the recovery area per specie of one population. It is given by the follow formula:

$$DR= \pi D^2 /4$$

DR = relative dominance; D= diameter of the chest height; π=3.14

## Important value index of Curtis

It determines the importance of one specie in one statement.

IVI= relative density + relative frequency + relative dominance

## Important family value index

It is given by the relation

FIV= relative density of families + relative frequency + relative dominance

## Floristic diversity and equitability

The specific diversity has been done with an extensive number of index (Magurran, 1988; Kent and Coker, 1992). Indeed, some mathematics formula help to calculate these index. Among these, four, regularly used have been selected for this work:

## Shannon diversity (Magaurran, 1988):

This index permit to quantify the heterogeneity of biodiversity of one study area (Peet, 1977; Benchrick, 2002), this to observe the evolution during the time.

$$ISH = -\Sigma Ni /N Log2 (Ni /N)$$

Ni= Number of individuals of one specie i, N= total number of individuals

The Shannon index has to be associate to Simpson index.

## Simpson index (Begon *et al.*,1987).

It represents the formula helping to calculate the probability, either the probability that two individuals selected randomly in one area belong to the same species. This index varies from 0 to 1. When the index is near from 0, the chance to obtain the different species is high.

$$D = \sum Ni (Ni-1)/N (N-1)$$

Ni= number of individuals of one speciei, N= total number of individuals.

## Equitability of Pielou (1966) :

It corresponds to the relation between the observed diversity and the maximal number of diversity of one specie.

$$EQ = ISH/log2N.$$

ISH = Shannon index

## Statistical analysis

Analyse of variance (ANOVA) realised by statgraphic+5.0, has to permit to do the comparison between the different sites. The excel software helped to lay the different histograms.

## Results and Discussion

### Horizontal structure of vegetation in the rewooded sites

The species with DBH<5 cm are dominant in the site of 2010 (278 indiv/ha) and 2009 (199 indiv/ha) and weak in 2012 (38 indiv/ha). The last one as, to it, is dominates by the species with 5>dbh≤10 cm (245 indivi/ha) (Figure 3a). Concerning the bunch, the Fig. 3b shows that, in all the studies sites, the species with 1,30>Diameter of the bunch (DH) ≤5 m are majorities while those with DH≥10 m are weakly met.

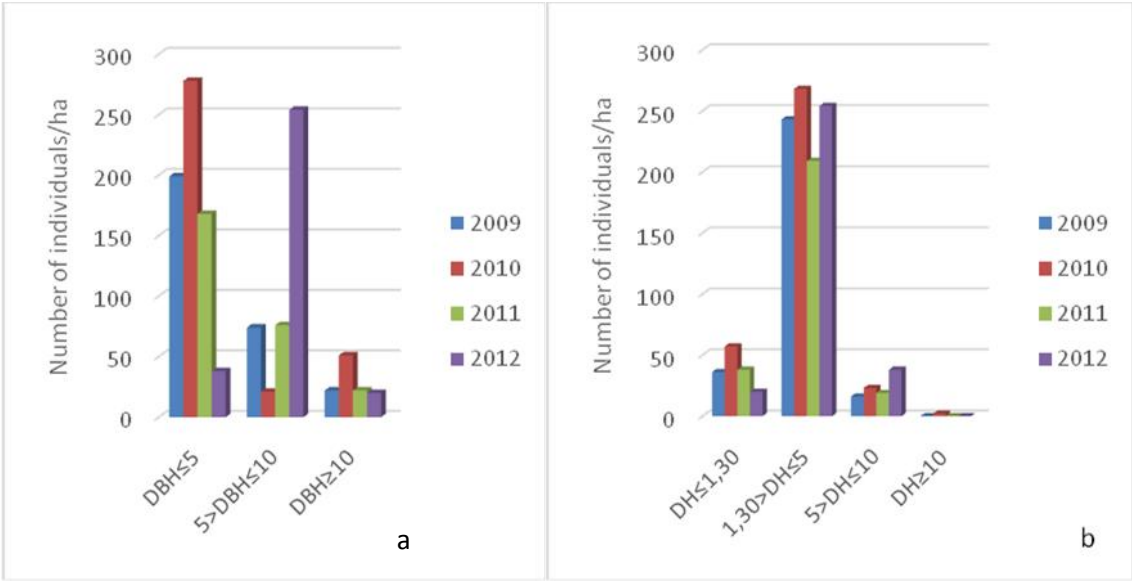



**Figure 3.** Plants structure of rewooded sites according to Diameter of the chest (a) and Diameter at the pick of trees (b).DBH =Diameter of the chest, DH = Diameter of the bunch.

### Vertical structure

The size of trees has been measured on plants with at least 1.30m of height by the help of graduated pole for the shrubs and via visual estimation for the great trees. In the rewoode site of 2010, 322 indiv/ha have the height include between 1.30 and 5m against 232 indiv/ha met in 2011 (Fig.4). In all the sites, species with 1.30>H≤5m are dominants. Nevertheless, those with 5>H≤10m are most present in 2009. The species surpassing 10m of height are very weak in the studies areas. The perfect illustration is gives by 02 indiv/ha in 2011 and 01 Indiv/ha in 2010. The plants in these areas are mostly the shrubs such as *Guiera senegalensis*, *Combretum collinum* and some species of *Acacia* kind doesn't present an important stem volume. This can explains the results of previous paragraph. The climatic and anthropic factors can also stress the plant, slowing down his horizontal and vertical development. These results are agree with those of Tchobsala *et al.*(2016). In the same way, Mapongmetsem *et al.* (2011) working on the impact of soils utilization systems on conservation of *Vitellaria paradoxa* Gaerten. F.(Sapotaceae) in the sudano-guinean savannahs assert that, the diameter and the height of trees in the product ecosystem can be influent by anthropic activities. Likewise, the reforestation campaign has been done from 2009 that justifies the height of trees.

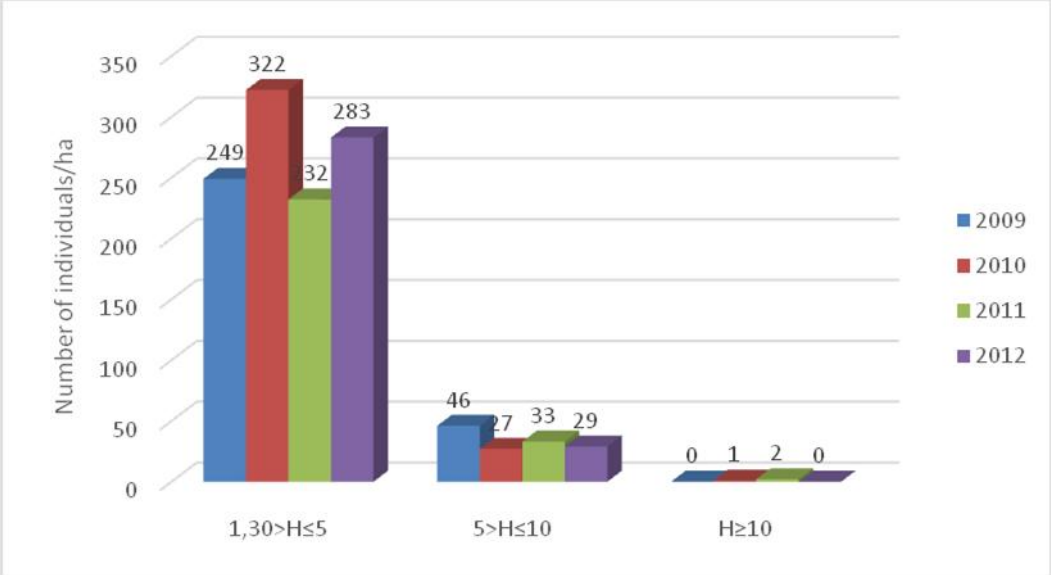



**Figure 4:** vertical structure of sites according to the rewooded years.

## Regeneration rate met in the rewooded sites

Are considered as regeneration plants having less than 1.30 m of height. The number of regeneration in the rewooded sites of 2010 and 2011 (Mayo Danay) is raises in relation to other sites with 97 and 91 regenerations respectively (Fig. 5). The higher rate of regeneration in these sites can be explains by the fact that, the sandy soil nature helps to a good and fast germination. It is the case of *Guiera senegalensis* and *Combretum collinum* which are strongly represented. The zoochorious can also favours a great number of rejection also, humans who cut trees, pick the fruits etc. re-hang the seed. On the other hand, in site of 2009 and 2012 present a weak number of regeneration, the seed germination can be slowing down or destroyed by the hardness of the soil which are most loamy.

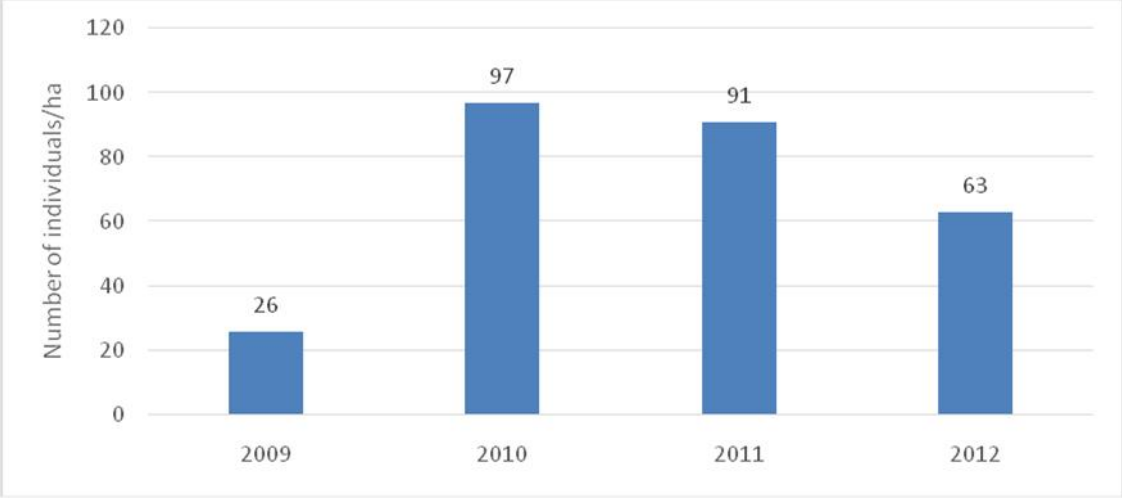



**Figure 5:** Number of regeneration according to the rewooded year.

## Anthropic index met in the different sites

The phenomena of woody cutting is the alone anthropic activities met in 2012. In 2010, this phenomena is presents at 71.42% and 52.08% in 2009. The second anthropic index is the fire bush with 35.41% in 2009, 30% in 2011. The pasture is observed at 22% in 2011, 14.28% in 2010 and 10.41% in 2009. The pruning is small observes with only 8% in 2011 and 2.08% in 2009. The uprooting is not observed. In fact of poverty, populations appeals to environment to supply their need (agriculture, stock farming, wood service, heating wood etc.). In the same way, MINEP (2008); Sonwa *et al.* (2011); Dkamela (2011) and De Wasseige (2009) affirm that, the energy-wood stay one of the energy type mostly used by Cameroonians. The using of fire wood as source of energy closed to housekeeping is widely spread, not only in rural but also in urban surrounding (UICN, 2013). Many investigations have proved that more than 80% of housekeeping of the Far-North region are dependent on fire wood (PAN/LCD, 2006). Some authors as Ntoupka (1998) and Tchobsala (2011) attested that the savannahs of sahelian zone are confronted with combined actions of bush fires, the wood cutting and grazing that influence the wellbeing of ecosystem of the Far North and the Adamawa regions respectively.

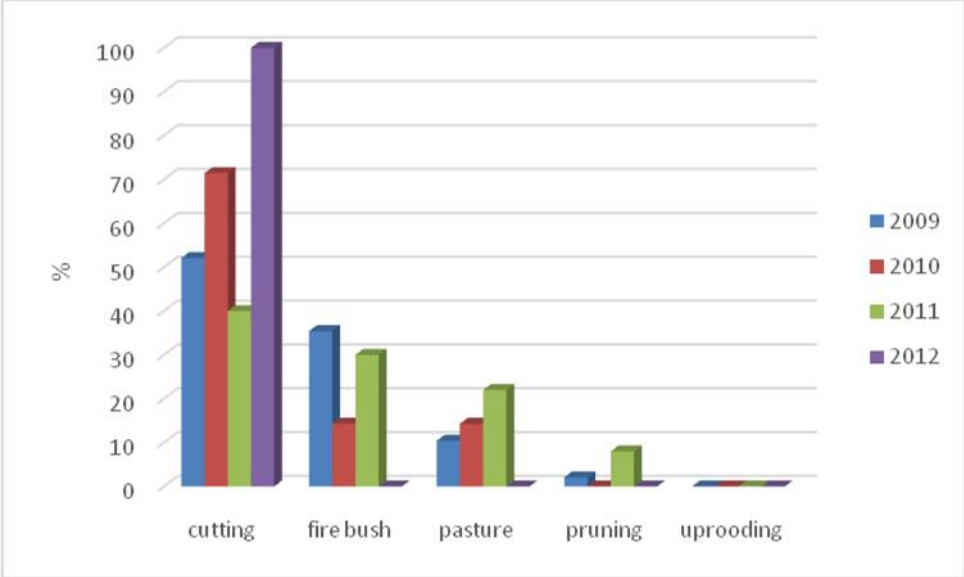



**Figure 6:** Anthropic factor of the rewooded sites

## Vitality and mortality of plants

The number of death and living plants in the rewooded sites is presented in Fig. 5. It presents that, in all studies sites, the number of living plants is important. The site of 2010, present enough important quantity of living plants with 338 indiv/ha, follows by the site of 2011 with 267 indiv/ha. The mortality of plants is enough raise in 2011 with 128indiv/ha and weak in 2012 with indiv/ha. The raise number of living plants in 2010 and 2011 can be explain by the forte dominance of *Guiera senegalensis* and *Combretum collinum* which is specify the Mayo Danay division, these plants are found also on sandy soils which favour their regeneration, their good growth and their survey. The presence of termites in the same sites explain the higher number of death plants because, these plants doesn't receive continually the treatment against termites. The analysis doesn't show the statistical different to the doorway of 5% between the sites (0,05<0,7).

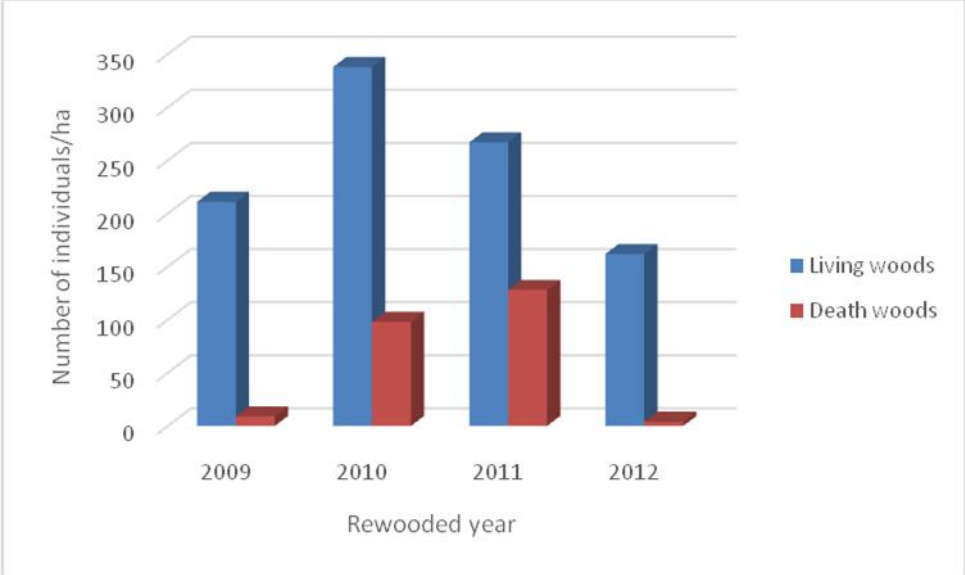



**Figure 7:** Number of living and death plants according to the rewooded years

## Counting of living and death stumps in the rewooded sites

The living stump are most represented in 2011 (10 stumps). This number is weak in all other sites. The death stumps are very met in 2009 (4stumps) and 2010 (5 stumps). They are weakly represented in 2011 and doesn't exist in 2012 (Fig. 7). The wood cutting is originally of stump met in the rewooded sites. The death one are met in great number in 2009 and 2010 because of fact that, the felling of plants are done at short, the plants are also submitted to the action of fire and termites. These factors, cause also the slow downing regeneration of some species such as *Prosopis africana* which are very desired by the waterside populations.

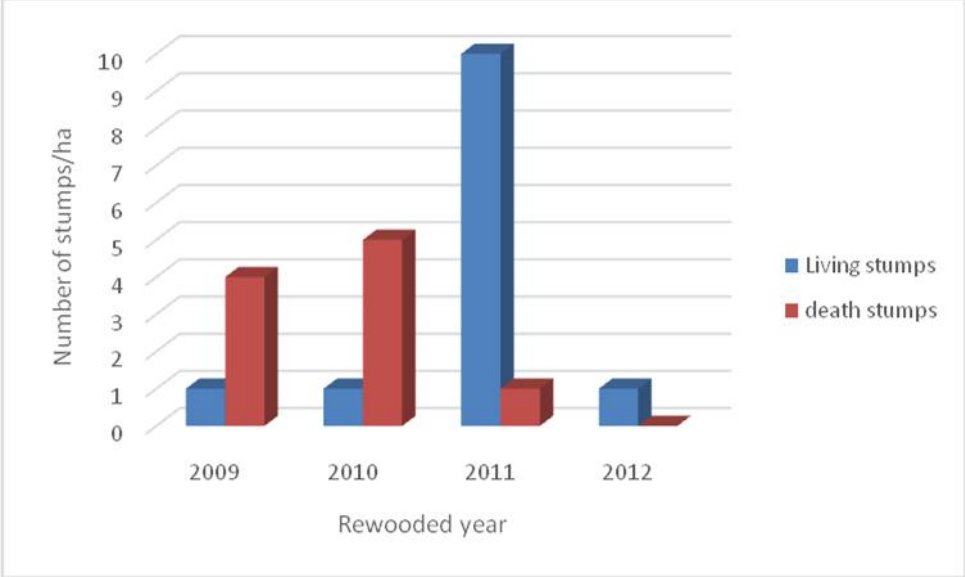



**Figure 8:** Number of living and death stumps met in the different sites

## Number of restock per site

The restock are the plants having less than one year, which have been put underground in replacement of those which are dry or died. It belong to the Fig. 8 that, the rate of restocks is raise in 2012 (28), the younger site of the Mayo Kani division. Those one have been weakly met in 2009 and 2011 with 1 plant each one. The restock campaign in the rewooded sites would normally be done each year, this activity is no more practise since a certain time, mostly in the sites of 2009, 2010 and 2011. The weak rate can also be justify by the lack of watering after the putting of plant underground, the plant can't support the drought because of dry climate. These one drying out and die. The fire cause also the death of young plants. For the restocks, the is the statistical different between the sites (0,03< 0,05).

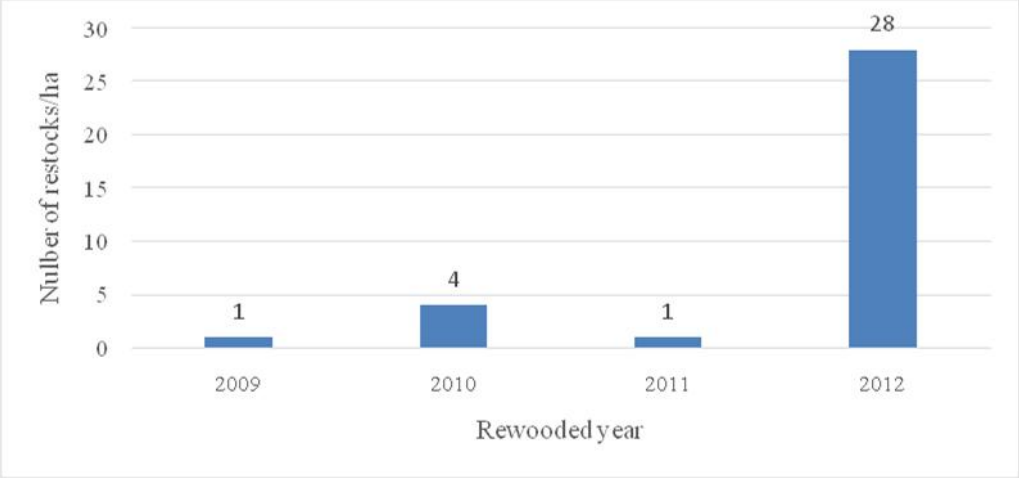



**Figure 9:** Number of restocks according to the rewooded years

## Individuals distribution per ha in the different sites

The number of plant per ha is most important in 2010 and 2012 with 350 and 312 individuals respectively (Fig. 9). The reafforestation in Mayo Kani and Mayo Danay divisions are an asset because, the rewooded sites contain a raise number of species that can be a solution to palliate to the multiple problems of deforestation and soils degradation in these zones. The number of species would be crescent following the rewooded years but it clips. In general manner, the wave evolution of the species density in the rewooded site can be explain by the anthropic factors cites above. Many factors such as cutting, precipitation, fire bush can play an important role in the plant dynamic of savannah (Séghièri, 1990). The site belong also to two zones which can different by their soil. The protection of these sites is not the same everywhere. The deliquescence, the non-respect of law, the displeasure of population can also influent negatively the success of the Sahel-vert sites.

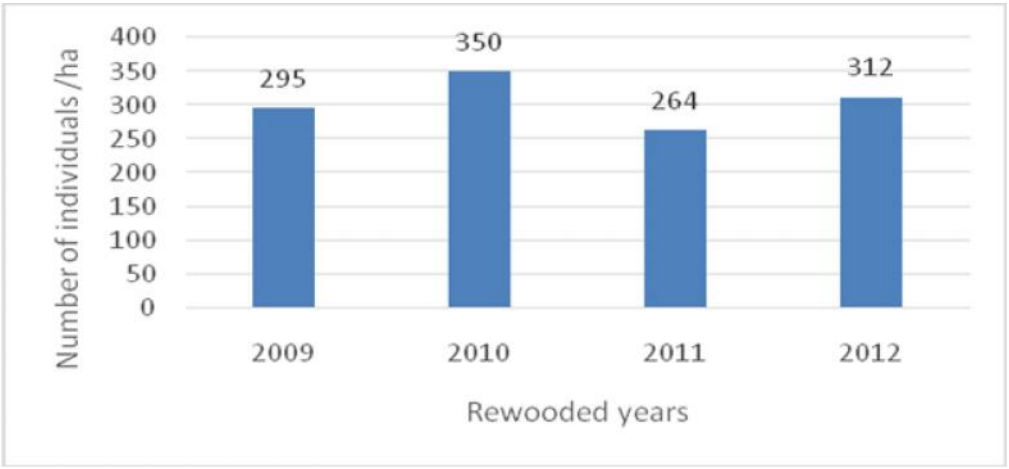



**Figure 10:** Number of individuals per ha according to different sites.

## Ecological characteristics

### Floristical diversity and composition of studies sites

The inventory shows hat, the total number of individuals is 1223 divided in 62 species, 48 genera and 27 families. The site of 2010 (350 indiv/ha) is the most important in terms of density, follows by the site of 2012 (312 indiv/ha). This can be explain by the forte presence of species with a fast regeneration such as *Guiera senegalensis* and *Anogeissus leiocarpus* respectively. However, the number of species is raise in 2009 and 2012, both belonging to Mayo Kani division (37 species). The diversity of genera is great in 2011 (27 genera) and in 2009 and 2011 (26 genera). According to families, this diversity is most pronounced in 2009 and 2011 with 18 families each one. The dominate families in all the sites are Combretaceae and Mimosoceae with the dominance of genera *Acacia*. This result is in accordance with those of Kemeuze *et al.*, 2015, who said that, in the semi-arid zones of Cameroon, Combretaceae are recognized as the most dominant family. Therefore, Sahel-vert operation help to have a great diversity in terms of individuals, species, genera and families this, due to the introduction of different species and because of the protection of different sites.

**Table 1:**Density and floristic diversity of vegetation in the rewooded sites

| | 2009 | 2010 | 2011 | 2012 | Total |
|---|---|---|---|---|---|
| Density | 295 | 350 | 266 | 312 | 1223 |
| Species | 37 | 25 | 31 | 37 | 130 |
| Genera | 26 | 21 | 27 | 26 | 100 |
| Familly | 18 | 13 | 18 | 15 | 64 |

### Diversity index

The diversity of species in the different sites is presented in the table 3. The Shannon index diversity varies according the reafforestation year. It is raised in 2012 and 2009 with 1.07 and 1.04 respectively. On the other hand, this index is weak in 2010 and 2011 with 0.78 et 0.74 respectively. The met anthropic factors would be at the origin of this weak diversity. These lasts sites are strongly dominated by *Guiera senegalensis* and *Combretum collinum* the other species are fairly represented. The Simpson index confirmed this explication because the probability for that, two species selected randomly be the same species is raise in 2011 and 2010 with respectively 0.4 and 0.33.

**Table 2:** Diversity index in the different studied sites

| Reafforestation year/ Diversity index | 2009 | 2010 | 2011 | 2012 | Means |
|---|---|---|---|---|---|
| ISH | 1,04 | 0,78 | 0,74 | 1,07 | 0,90±0,21 |
| EQ | 0,35 | 0,26 | 0,25 | 0,36 | 0,305±0,07 |
| D | 0,15 | 0,33 | 0,40 | 0,12 | 0,25±0,75 |
| 1-D | 0,85 | 0,67 | 0,60 | 0,88 | 0,75±0,15 |
| Means | 0,60±0,13 | 0,51±0,08 | 0,50±0,10 | 0,61±0,13 | 0,55±0,07 |

H'= Shannon Index; E: Equitability of Piélou; D= Simpson index;

### Ecological importance of species

The species showing an ecological importance based on IVI vary according to the reafforestation year. In 2009, the species presenting a great IVI are *Piliostigma reticulatum* (35.48), *Anogeissus leiocarpus* (27.38%), *Balanites aegyptiaca* (25.52%). The site of 2010 is marked by species such as *Sterculia setigera* (104.08%), *Guiera senegalensis* (61.17), *Combretum collinum* (14.65%). The site of 2011 as far as it concern, abound in species like *Guiera senegalensis* (66.76%), *Securidaca longepedontula* (46.07), *Combretumcollinum* (15.62%). Species with a raise IVI in 2012 are *Sterculia setigera* (79.96%), *Acacia gerrardii* (29.75%), *Combretum glutinosum* (20.13), *Piliostigma reticulatum* (18.82%). These species are in the majority characteristic of the study zone. *Sterculia setigera* is marked by his height and his voluminous diameter.

. **Table 3:** Important Value of Curtis of species in the studied sites (%).

| Année/Espèces | 2009 | 2010 | 2011 | 2012 |
|---|---|---|---|---|
| *Acacia ataxacantha* | *5,95* | 0,00 | 0,00 | 0,00 |
| *Acacia gerrardii* | *1,69* | 0,00 | 0,00 | 29,75 |
| *Acacia laeta* | *0,00* | 0,00 | 3,15 | 0,00 |
| *Acacia nilotica* | *13,27* | 4,40 | 7,54 | 9,23 |
| *Acacia polyacantha* | *0,00* | 2,25 | 0,87 | 0,00 |
| *Acacia senegal* | *12,94* | 6,16 | 6,82 | 8,81 |
| *Acacia seyal* | *11,90* | 0,00 | 0,00 | 3,44 |
| *Acacia* sp. | *0,00* | 0,00 | 0,00 | 1,56 |
| *Adansonia digitata* | *0,00* | 0,00 | 7,85 | 0,00 |
| *Afzelia africana* | *1,46* | 0,00 | 0,00 | 0,00 |
| *Albizya lebbeck* | *0,00* | 0,00 | 0,00 | 2,08 |
| *Annona senegalensis* | *0,00* | 0,00 | 0,00 | 0,00 |
| *Anogeissus leocarpus* | *27,38* | 4,40 | 5,03 | 17,86 |
| *Azadirachta indica* | *17,57* | 8,12 | 10,51 | 4,82 |
| *Balanites aegyptiaca* | *25,52* | 4,97 | 9,57 | 16,25 |
| *Borassus aethiopum* | *0,00* | 0,00 | 1,97 | 0,00 |
| *Bosciasa liformis* | *0,00* | 0,00 | 0,00 | 1,56 |
| *Boswelia dalzielii* | *0,00* | 0,00 | 0,00 | 3,71 |
| *Cadaba farinosa* | *3,75* | 0,00 | 0,00 | 4,61 |
| *Capparis fascicularis* | *7,00* | 2,06 | 0,00 | 1,98 |
| *Capparis sepiaria* | *2,98* | 0,00 | 0,00 | 0,00 |
| *Cassia siamea* | *9,18* | 9,07 | 8,20 | 0,00 |
| *Combretum aculeatum* | *4,60* | 0,00 | 0,00 | 1,69 |
| *Combretum collinum* | *7,65* | 14,65 | 15,62 | 3,01 |
| *Combretum glutinosum* | *14,77* | 12,75 | 11,22 | 20,13 |
| *Combretum molle* | *4,85* | 4,11 | 3,51 | 6,48 |
| *Combretum nigricans* | *1,46* | 0,00 | 0,00 | 0,00 |
| *Combretum* sp. | *0,00* | 0,00 | 0,00 | 1,77 |
| *Commiphora africana* | *8,30* | 0,00 | 0,00 | 4,64 |
| *Commiphora pedunculata* | *0,00* | 0,00 | 4,18 | 1,56 |
| *Cresenstia cujete* | *1,46* | 0,00 | 3,75 | 0,00 |
| *Dalbergia melanoxylon* | *5,29* | 2,06 | 0,00 | 3,33 |
| *Daniellia oliveri* | *0,00* | 0,00 | 7,04 | 0,00 |
| *Dichrostachys cinerea* | *2,46* | 9,36 | 4,86 | 8,67 |
| *Diospyros mespiliformis* | *6,03* | 0,00 | 0,00 | 0,00 |
| *Faidherbia albida* | *2,04* | 0,00 | 0,00 | 0,00 |
| *Ficus cordaba* | *1,95* | 0,00 | 0,00 | 0,00 |
| *Gardenia aqualla* | *0,00* | 0,00 | 4,30 | 0,00 |
| *Grewia flavescens* | *8,31* | 0,00 | 0,00 | 0,00 |
| *Guiera senegalensis* | *11,29* | 61,17 | 66,76 | 7,03 |
| *Hexalobus monopetalus* | *4,79* | 6,45 | 7,24 | 1,56 |
| *Hymmenocardia acida* | *0,00* | 0,00 | 2,10 | 0,00 |

| | | | | |
|---|---|---|---|---|
| *Khaya senegalensis* | *0,00* | 2,73 | 8,34 | 0,00 |
| *Lannea barteri* | *0,00* | 0,00 | 0,00 | 1,77 |
| *Maytenus senegalensis* | *6,11* | 0,00 | 0,00 | 7,58 |
| *Opilia celtidifolia* | *1,46* | 0,00 | 0,00 | 0,00 |
| *Parkia biglobosa* | *0,00* | 2,06 | 2,90 | 1,56 |
| *Piliostigma reticulatum* | *35,48* | 6,74 | 5,87 | 18,82 |
| *Piliostigma thonningii* | *2,92* | 0,00 | 0,00 | 3,19 |
| *Prosopis africana* | *0,00* | 4,78 | 16,17 | 0,00 |
| *Pterocarpus lucens* | *7,52* | 0,00 | 0,00 | 1,69 |
| *Sclerocaria birrea* | *8,90* | 7,60 | 3,94 | 5,63 |
| *Securitada longipedunculata* | *0,00* | 0,00 | 46,07 | 0,00 |
| *Sterculia setigera* | *0,00* | 104,08 | 4,27 | 79,96 |
| *Strychnos spinosa* | *0,00* | 7,69 | 6,57 | 0,00 |
| *Tamarindus indica* | *0,00* | 4,02 | 3,21 | 0,00 |
| *Terminalia macoptera* | *0,00* | 0,00 | 0,00 | 2,30 |
| *Vitellaria paradoxa* | *0,00* | 0,00 | 0,00 | 2,49 |
| *Vitex doniana* | *0,00* | 0,00 | 3,20 | 0,00 |
| *Vitex madiensis* | *0,00* | 0,00 | 0,00 | 1,56* |
| *Vitex simplifolia* | *0,00* | 0,00 | 0,00 | 1,56 |
| *Ximenia americana* | *3,04* | 2,15 | 1,85 | 0,00 |
| *Ziziphus mauritiana* | *3,17* | 0,00 | 0,99 | 6,08 |
| *Ziziphus mucronata* | *4,05* | 6,17 | 4,31 | 0,00 |
| *Ziziphus spina-christi* | *1,46* | 0,00 | 0,00 | 0,00 |
| Total | 300,00 | 300,00 | 300,00 | 300,00 |

## Conclusion

The works conducted on the dynamic and ecological characteristic of reafforested sites chose in Mayo Kani and Mayo Danay divisions have permit to evaluate the dynamic of vegetation in four sites 2009, 2010, 2011 and 2012. The density of species is very important in these sites. Families of Combretaceae are the most represented with a dominance of *Acacia* genera which is characteristic of arid zones. The site of 2012 presents a good floristic diversity comparative to the other sites. The quantitative analysis of vegetation has shown that, *Piliostigma reticulatum* (35.48%) and *Anogeissus leiocarpus* (27.38%) in 2009; *Sterculia setigera* (104.08%) and *Guiera senegalensis* (61.17%) in 2010 ; *Securida longipedunculata* (46.07%) and *Guiera senegalensis* (66.76%) in 2011 ; *Acacia gerrardii* (29.75%) and *Combretum glutinosum* (20.13%) in 2012 are ecologically important. The anthropic frequency in the reafforested sites are the wood cutting, fire bush and grazing. This activities modify the horizontal as well as vertical structure of vegetation. The reafforestation, in general manner, is a good solution to palliate to the problem of deforestation and soil degradation in the Sudano-sahelian zone. In the aim to deepen this researches, the works will be focus on the evaluation of biomass and carbon stock of some wood species belonging to these sites.

## Acknowledgments

This work would not be realized without the financing of CARN. Our gratitude go to ABIOGeT for his support and his encouragement. We cannot forget those who have helped and supported us during the work in the field. The population of the riparian village of the reafforested studied sites have been for us an invaluable help.

## References


Begon, M., Harper, L., Towsend, C.R., 1987. Ecology: Individuals, Populations and Communities: 876 p. Oxford, London, Edinburgh, Boston, Palo Alto, Melbourne; *Blackwels scientific publications*.

Benchrik M., SAYEH, L., 2002. « Indice de diversité et équitabilité » [archive], sur https://sites.google.com/site/pastoraldz [archive], ( consulté le27 juillet2014)

Braun-blanquet, 1932. The study of plant communities. *Plant sociology*. New-york, Londres, Mcgray Hill. p. 439.

Cécile, D., Laurent, K., Pierre, H., Manuela, G., Eric, M., Philippe, C. and Cam-Chi, N., 2014. Rain-Use-Efficiency: What it tells us about the Conflicting Sahel Greening and Sahelian Paradox. Remote sensing, 6: 3446-3474.

Curtis, J.T., McIntosh, R.P., 1950. The interrelation of certain analytic and synthetic phytosociological characters. *Ecology*. 31(3), 434-455.

Dagnelie, P., 1981. Statistic Theory and Methods. Vol. 2. *The Gembloux Agronomic Press*, Gembloux. 463p.

De Wasseige, C., Devers, D., De Marcken, P., Eba'aAtyi, R., Nasi, R., Mayaux, P., 2009. Les forêts du bassin du Congo. Etat des forêts 2008. *Office des publications de l'Union Européenne*. Luxembourg.v

Dkamela, G.P., 2011. Le contexte de la REDD+ au Cameroun : causes, agents et institutions. Papier Occasionnel 57, CIFOR, Bogor, Indonésie.

FAO, 2009. Manuel pour le relevé intégré de données sur le terrain. Version 2.3 (Deuxième édition). pp : 1-18.

Kemeuze, V.A., Mapongmetsem, P.M., Sonwa, D.J., Fongnzossie E., Nkongmeneck, B.A., 2015. Plant diversity and carbon stock in sacred groves of semi-arid areas of Cameroon: case study of Mandara mountains. *International Journal of Environment*,; 4(2):308-318.

Kent, M. et Coker, P. 1992. Vegetation description and analysis: a practical approach. John and Wiley & sons, England, 363p.

Magaurran, A.E., 1988. Ecological Diversity and its Measurement. Princeton University Press. Princeton, New Jersey, 179 p.

Mapongmetsem P.M., Nkongmeneck, B.A., Rongoumi, G., Dongock, D.N., et Dongmo, B., 2011. Impact des systèmes d'utilisation des terres sur la conservation de VitellariaparadoxaGaerten. F. (Sapotaceae) dans la région des savanes soudano-guinéennes, *International Journal of Environmental Studies*, 68:6, 851-872, DOI:10.1080/00207233.2011.587259.

Ntoupka, M., 1998. Production utile de bois sous perturbation anthropique (pâturages et feux) dans la région soudano-sahélienne du Nord Cameroun. Actes du colloque. La foresterie des zones sèches. Ouagadougou de Novembre 1998.12p.

Palou, M.O., Balna, J., Sofalne, C., Tchonbay, D.J., 2015. Rapport d'inventaire multi-ressource réalisé dans les sites du SahelVert de Massinkou-Léra-Bippaing (Commune de Kaélé) et de Bidéré (Commune de Doukoula), Extrême-Nord du Cameroun. Projet pilote de mise en valeur des sites du Sahel-Vert dans les départements du Mayo-Danay et du Mayo-Kani (Sahel Vert-HIMO). IRAD/CRRA MRA/SECTION FORET, ABIOGeT. pp. 1-46.

Peet, R.K., 1974.The measurement of species diversity. Annual Reviews of Ecology and Systematics. 5:285-307

P-EVA (Programme Economie Verte en Afrique), 2015. Energie et reboisement pour l'aménagement durable de l'exploitation des forêts : Cameroun. MINFOF.

Pielou, 1994. Biodiversity versus old-style diversity: measuring biodiversity for conservation. In T. J. B. boyle and boontaweeéds. Measuring and monitoring biodiversity in tropical and temperate forest. CIFOR Bogor, Indonesia pp. 5-17.

Plan d'Action National pour la Lutte Contre la Désertification (PAN/LCD). 2006.

Saleh, A., Djingui, T., Okenye, M., 2014. Evaluation du reboisement à grande échelle dans la Région de l'Extrême-Nord : quelles leçons tirées. Rapport final. pp. 1-74

Sonwa, D., Walker, S., Nasi, R., Kanninen, M., 2011. Potential synergies of the main current forestry efforts and climate change mitigation in Central Africa. *SustainSci*6:59–67.

Tchobsala, Djallo, D., Adamou, I., Konsala, S., Clément, S., 2016. State, ecological characterization and strategies of sustainable management of plant formations in the Mayo-Kani Division (Far North Region, Cameroon). *Int. J. Curr. Res. Biosci*. Plant Bio 3(9), 97-113.

Tchobsala, 2011. Impact des coupes de bois sur la végétation naturelle de la zone périurbaine de Ngaoundere (Adamaoua). Thèse de Doctorat PhD, Université de Yaoundé I, Cameroun 204p.

Tchobsala, Amougou A., and Mbolo M., (2010). Impact of wood cuts on the structure and floristic diversity of vegetation in the peri-urban zone of Ngaoundere, Cameroon. *Journal of Ecology and the Natural Environment* Vol.2 (11), pp. 235-258, http://www.academicjournals.org/jene.

| Access this Article in Online | |
|---|---|
| | Website: www.ijarbs.com |
| Quick Response Code | Subject: Biodiversity |
| DOI:10.22192/ijarbs.2018.05.03.010 | |

How to cite this article:
Baïyabe Il-Mataï, Tchobsala, Dongock Nguemo Delphine, Mapongmetsem Pierre Marie. (2018). Dynamic and ecological characteristics of rewooded sites of the Sudano -Sahelian zone (Far North, Cameroun). Int. J. Adv. Res. Biol. Sci. 5(3): 88-102.
DOI: http://dx.doi.org/10.22192/ijarbs.2018.05.03.010