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Influence of anthropic activities on the structural changes of plants species of mount Ngaoundal

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Abstract
The strong pressure exerted by inhabitants on natural resources through agro-pastoral and military activities are among others the main causes of phyto-diversity degradation of Mount Ngaoundal. As a prelude to the exploitation of minerals founds in the Mount, the overall objective of this research was to investigate on how the resources of the Mount have being used. The research approach consisted of using the MARP tools and the floristic records sheets of vegetation to evaluate the different potentials of the Mount. Results indicate that, although the mining exploitation works are still to really start, the Mount is already subject to zoo-anthropogenic activities such as agriculture (13.94%), botanical healthy (12.98%). %), or ecotourism (11.50%). The floristic surveys enabled the identification of 6773 plants belonging to 62 species, 45 genera and 32 families. The Mount is found to be very diversified, with the ecologically dominant and important species recognized as *Daniellia oliveri* (21.65%), *Piliostigma thonningii* (21.03%), *Terminalia glaucescens* (18.24%), and *Hymenocardia acida* (14.23%). Species such as *Dombeya quinquesete* var. *Senegalensis* and *Xylopia parviflor* are rarely found, whereas others like *Daniellia oliveri, Piliostigma thonningii* are preferential. The South slope was the most densified, unlike the East, which was the most diversified. The structure of species in height along the slopes was the "L" shape, which indicated a very highly significant difference ($p < 0.005$) between the height classes per slope. Depending on the altitude, 37.58% of species had heights ranged between [0 - 0.5[m, while only 8.21% of species had height comprised between] - ∞, 8[. Altitudes 200m and 600m showed vertical structures oft the "L" shape, whilst vertical structures in inverted "U" shape were found at 400m altitude.

Keywords: Mount Ngaoundal, anthropic activities, plant structures

Introduction
Mining production and agriculture are primary and very old important industries [1]. At the beginning of the millennium, the issue of supplying mineral resources has become critical for the North and emerging countries, mainly in China, which accounts for 40% and 44.9% of the world basic metals and charcoal consumption respectively [2].
In Cameroon, the discovery of minerals before Independence has enabled the building up of the mining projects currently being under finalization. Hence, bauxite and sapphire were discovered at Ngaoundal subdivision and was estimated to around 200 million tones and 1 million tones respectively. Mount Ngaoundal is considered as a touristic military training site, where economic activities based on animal husbandry, agriculture, beekeeping and ecotourism are also practiced. These activities are factors that reduce and degrade the biodiversity of the Mount, thus leading to their disappearance [3]. Considering the estimated bauxite from Mount Ngaoundal, which is averagely 200 million tones, our question is what would become the biodiversity of the mount when the exploitation takes place? Several studies have been carried out on methods of management, conservation and development of the savannahs and territories of Adamawa [4, 5]. Similar work on the impact of human activities was carried out in North Cameroon [6,7], on the hills of Yaounde in the Center [8], in the South of Cameroon [9], in the Sudano-Guinean zone of Cameroon [10], and in the peri-urban savannahs of Ngaoundere [11]. Despite these extensive researches, no scientific has yet investigated on the impact of the exploitation of natural resources on the dynamics of the vegetation of Mount Ngaoundal. Therefore, the overall objective of this work was to assess

the impact of activities exerted on Mount Ngaoundal on the phytodiversity, through determination of vegetation structure and identification of ecological important species.

Description of the study area

The study area was located in the Ngaoundal district, Department of Djerem, region of Adamawa. This department is located between 12°856-13°020 East longitude, and 6 °037-7°020 North latitude [12]. It covers a surface area of 4,500 km^2 inhabited by approximately 70,000 peoples [13]. The average annual rainfall is 1500 mm with an average temperature is 22°C. The climate is Sudano-Guinean with a long rainy season which runs from april to october and a short dry season which runs from November to March.

2. Material and Methods

The study area was preliminary prospected with guides to identify types of agro-pastoral, agroforestry, and anthropization activities, as well as the sustainable management of natural resources types. The surveys were carried out within nine villages (Camp Fara, Zimbabwe, Bottom Mount, Tapare, Sansi, Mbalonga, Mandal, Belaka and Cinema Mount) according to whether they were at the vicinity of the mountain or not. In each village, 30 people were interviewed at random without taking into account the gender, ethnic and religion. A total of two hundred and seventy (270) people were interviewed.

2.1. Experimental design and treatments

The experimental set-up was a two factors split-plot in which the slopes (North, South, East and West) represent the main factor and the altitudes the secondary factors (400-600m, 200-400m, 0-200m). On each slope, two linear transects were carried out without interruption from the bottom to the top of the Mount with a sequence of 200 m. Different altitudes were not separated from each other along the same transect.

2.2. Inventory of woody species

Plots of (20 x 200) m^2 established, arranged according to altitude gradients and slopes. In these plots, each plant species was identified *in situ* by its scientific and local language names. A standard ecological descriptor sheet was completed as the floristic surveys were carried out. Hence, the following dendrometric parameters were measured in each plot: species height using a graduated slat; crown diameter using a graduated slat at the base of each tree; DBH (1.30m from the ground) uses a tape measure. For multi-stemmed species, the circumference of the main stem was measured using a tape measure.

2.3. Assessment of the vegetation structures

The ecological profile was produced using parameters for quantifying

ecological important species. The tree stand structure was assessed using the species Importance Value Index (IIVIE), through the formula developed [14]:

$$IVIE = 100 * \left[\left(\frac{Ni}{\sum N_i}\right) + \left(\frac{G_i}{\sum G_i}\right) + \left(\frac{F_i}{\sum F_i}\right) \right]$$

Where, Ni = number of individuals species i, Gi = basal species i area; Fi = frequency of species i. Species with IVIE ≥ 10 are considered as ecologically important.

2.4. Statistical data analysis

Socio-economic surveys and floristic surveys were subjected to statistical analyses of variables. ANOVA was carried out to compare slopes and altitudes each other. These analyses were followed by comparison of means using the Ducan Multiple Range tests at a given level of significance. Obtained data were treated through Excel using Office 2010 program.

3. Results and Discussion

3.1. Socio-economic responses

Respondents of the ethnic groups Fulani (33.8%), Gbaya (23.94%) and Mboum (21.12%) were the most represented (78.86%) as indicated on Figure 1, to similar what was previously reported [15]. The Fulani group always come in large numbers from Nigeria in search of pasture land to settled down and exert their trading activities. This result is in line with that of CDV [13], which showed that Peuls are the ethnic group holding trade in the Ngaoundal sub-division, while the Gbaya, Mboum and Dii groups are excellent hunters or farmers. Conversely, Mbororos and Fulani, who also came from Nigeria are nomade who practice livestock and/or agriculture and represent only 5.65% of the farmers. In addition, foreigners such as Guidar, Bamileke, Massa, English speakers, Mafa, Moudang are also represented (15.49%).

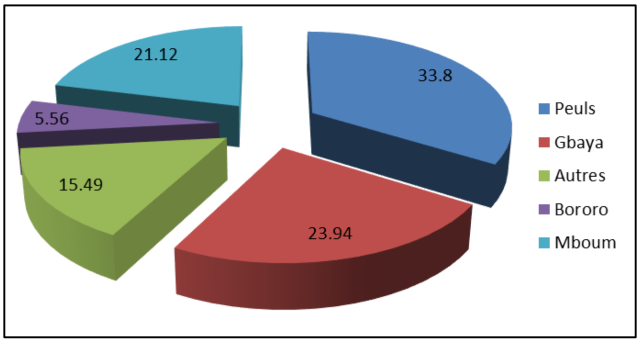

Fig 1: Repartition of respondants according to ethnic (%)

3.2. Socio-economic practiced on Mount Ngaoundal

In addition to these activities carried out on Mount Ngaoundal, there was a significant collection of food products from plants (70.21%), animals (19.35%) and other origin (10.42%). Animal products found were honey (6.91%), caterpillars (7.19%) and termites (5.93%) (Figure 2). Honey comes from traditional beekeeping, *Terminalia laxiflora* being the plant species that most attracted bees on the Mount for its leaves (Photo 10). Products of plant origin include bark (11.90%), leaves (8.47%), mushrooms (8.19%), roots (7.23%), seeds (1.10%) %), flowers (1.94%) and fruits (6.64%). This result is in agreement with that of Laouali [16], who showed that plants are used much more in households.

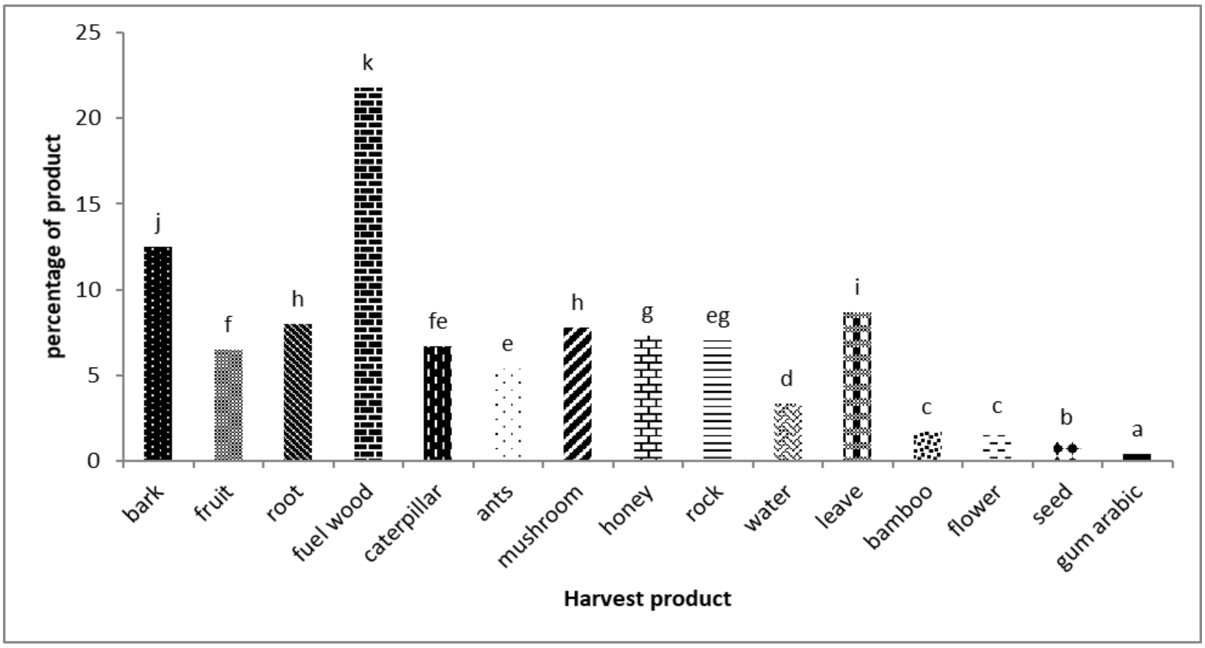

Fig 2: Harvest product in Mont Ngaoundal Bars affected with the same letter are not significantly different at the indicated level of probabily

3.3. The traditional botanical treatments

The traditional phyto-medication is the most popular because pharmaceutical products are not always within the reach of the majority of the population. Hence, they look for different plant organs to prepare decoctions or products depending on the health problem they are exposed to. This pressure is exerted on adult medicinal plants, affecting their development, in agreement with findings of Agca *et al.* [17], Tabuti and Mugula [18], on *Albizia coriaria* and *Pyrenacantha sylvestris* which are medicinal plants from western Uganda. According to the same authors, the overexploitation of these resources has an influence on the species. The most important plant organs under stress were barks, roots, leaves and flowers, accounting respectively for 11.90%, 7.23%, 8.7% and 1.92%. This result is in line with that of Guimbo *et al.* [19], who showed that local populations use plants for healing. Others, commonly use the medicinal plants such as *Piliostigma thonningii*, *Ficus vogelii*, *Cussonia arborea* and *Maytenus senegalensis* to seek for spiritual magical powers. This is confirmed previous results different parts of plants are used in traditional pharmacopoeia [20]. These activities are considered as serious threat to the biodiversity of Mount Ngaoudal.

Table 2 shows some plant species collected from Mount Ngaoundal and used in traditional medicine by the population. The plants parts used are leaves, barks, roots and seeds according to their importance, the most often use being tree barks. These results agree with otherbfindings, which identified several species (*Uapaca togoensis*, *Tamarendus indica*, *Strychnos pinosa*), in use in traditional medicine [16, 21, 22]. In some cases, the mixtures of combination of bark, leaves and roots are very effective in curing certain diseases. The most indicated species in traditional medicine are *Senna alata*, *Tamarindus indica*, *Annona senegalensis*, *Terminalia glaucescens*, *Sterculia setigera and Uapaga togoensis*. They suffer fom anthropogenic pressure, since populations on the daily basis harvest parts of trees to cure malaria, toothache, typhoid, Sexual Transmitted Diseasess (STD), stomach aches, flu, wounds). These results corroborate with those obtained in Cameroon [23], in Niger [16, 22], which have revealed the use of medicinal plants in the management of certain diseases.

Tableau 2: Plants with therapeutic harvested Mount Ngaoundal

Local names	Scientific names	Plant part used	Sickness cured
Sore (Gbgaya)	*Annona senegalensis*	Bar	wound
Domoo (Gbgaya)	*Piliostigma thonningii*	Bar/roo	Varicella
Goup (Dii)	*Bridelia scleroneura*	Bar/roo,/fru	Influenza
Ndia+ ndobo (Gbaya)	*Aframamum latifolia+Pseudarthria hookeri*	Bar/roo,/fru	Hernie
Zerphoro (Gbgaya)	*Uapaca togoensis*	Rac	STD
Goup+fleur de marguerite	*Bridelia scleroneura +Tithonia diversifolia*	fru	Filaria
Djabbé (Fufulde))	*Tamarindus indica*	roo,/fru	Intestinal pains
Mbouré (Gbgaya)	*Psorospermum febrifugum*	fru	wounds
Ndoumba (fruit jaune)	*Strychnos pinosa*	Bar,/fru	wooms diorrhea
Nérédjé (Fulfuldé)	*Parkia biglobosa*	Bar/roo,/fru	Stomac ache
Ngalbidjé (Fulfulde)	*Vitex doniana*	Bar	Itch
kinkeleba,	*Senna alata*	fru	Typhoïd
Zawaya (Gbgaya) (white wood)	*Ficus* sp.	roo,/fru	Malaria
Mbi (Gbaya)	*Ximenia Americana*	roo,/fru	Influenza
Ecalyptus	*Eucalyptus camaldulensis*	fru	Colg
Gueté (Gbaya)	*Combretum molle*	Bar/roo,/fru	Scabies
Mbordon (Gbaya)	*Erythrina sigmoidea*	Bar/roo,/fru	Stomac ache, appendicitis

Bar = bark; roo = roots; fru = fruits; lea = leaves

3.4. Overexploited plant species of Mount Ngaoundal

Some plant species of the Mount Ngaoundal are highly endangered because of their high therapeutic, energy or timber value (Table 3), that significantly differred from one species to another. Such plants with their percentage uses are *Daniellia oliveri* (75, 48%), *Piliostigma thonningii* (71.59%), *Hymenocardia acida* (66.28), *Terminalia glausecens* (62.45), *Securidaca longepedunculata* (57.5%). *Sterculia setigera* (23.41%), *Ficus* sp.(14.32%). *Senna alata* (19.42%), *Parkia biglobosa* (31.18%), *Millicia exelsa* or Iroko (46.98%) and *Entandrophragma cylindricum* (Sapili)(50.63%). Some of these plants originated from the Sahelian zone of Cameroon were reported difficult to be found due to their overexploitation [21, 22, 24].

Table 3: Average number of plant species overexploited within villages nearby Mount Ngaoundal

Overexploited	Camp Fara	Zimba bwe	Cinéma le Mont	Pied du Mont	Tapare	Mbah longa	Sansi	Mandal	Mbelaka	Averages
Daniellia oliveri	92.35	75.21	88.36	98.65	65.21	70.55	69.35	61.32	58.35	75.48±14.35[m]
Piliostigma thonningii	90.15	69.15	79.45	96.16	63.14	65.32	65.32	59.95	55.65	71.59±13.94[lm]
Hyminocardia acida	88.35	58.85	75.24	95.34	52.12	60.27	60.35	53.67	52.35	66.28±15,24[klm]
Terminali glausecens	85.19	52.26	73.16	89.19	45.21	58.45	59.65	48.65	50.32	62.45±16.23[jklm]
Securidata longepedonculata	78.12	43.31	70.24	85.75	35.26	55.65	55.31	45.55	48.34	57.5±17.01[ijkl]
Cussonia arborea	78.21	40,.7	69.32	80.27	25.31	50.31	50.13	40.32	45.35	53,27±18.74[hijk]
Entandrophragma cylindricum	75.63	41.28	65.26	78.25	21.23	45.38	48.65	39.65	40.32	50.63±18.74[ghij]
Millicia exelsa	74.33	38.34	58.34	75.55	15.45	40.35	45,55	35.35	39.58	46.98±19.35[fghi]
Pterocarpus lucens	68.29	37.5	55.34	72,.6	12.9	35.24	40.32	31.25	35.39	43.12±18.86[efghi]
Steganotaenia araliacea	65.19	35.26	52.32	68.45	11.03	30.16	35.15	29.55	30.25	39,71±18.64[defgh]
Terminalia macroptera	55.14	32.21	50.16	65.24	10.05	28.85	30.34	25.33	28.65	36.22±17.17[cdefg]
Sarcocephalus latifolius	55.84	30.16	48.34	62.15	9.57	26.34	27.75	22.37	25.35	34.21±17.29[bcdef]
Parkia biglobosa	45.68	28.15	45.12	60.24	8.02	27.33	25,65	20.15	20.31	31.18±16.12[bcde]
Ximenia americana	43.67	25.31	44.32	59.12	7.15	25.15	23.34	19.35	18.85	29.58±16.15[bcde]
Annona senegalensis	26.42	23.25	41.28	55.13	8.35	20.12	18.85	15.67	15.65	24.97±14.53[abcd]
Sterculia setigera	25.34	21.33	41.03	53.24	7.24	18.95	15.85	13.35	14.45	23.42±14.49[abc]
Senna alata	15.37	20.34	39.47	45.24	6.15	15.32	12.32	10.24	10.32	19.42±13.67[ab]
Ficus sp.	12.54	12.79	35.15	23.15	5.16	12.25	8.32	9.65	9.85	14.32±9.24[a]
P-value										< 0.0001

Means affected with the same letter are not significantly different at the indicated level of probabily

3.5. Changes in woody plants diameter according to altitude

Depending on the altitude, the distribution of the diameter classes was of "L" shape. The study site was dominated by a group of 6644individuals with a diameter less than or equal to 0.25 m, representing 33.22% of the plant population, whereas only 2126 individuals woody plants with a diameter greater than 1 m represented 10.63% of the total population (Figure 3). Similar results were reported on the population of *Albizia coriaria* in Uganda [18], where individuals with large-diameter at low mountain altitudes were under the disappearance process due to its overexploitation. Similarly, large-diameter population of *Parkia biglobosa* has been reported in the Sudano-Guinean zone of Cameroon as a result of overexploitation and overgrazing [25]. In the same agro-ecological zone, it was clearly indicated the impact of land use systems on the depletion of adult individuals of *Vitellaria paradoxa* population [26].

Individuals with a diameter ranged 0.25m to 0.5m represented 23.25% of the woody population. This diameter range confirms the presence of young individuals, which act as a relay between the youngest and the adult population. Their presence increases the percentage of small-diameter individuals on the Mount. Similar findings were revealed at Tandjile in the eastern Chad [27], or in the Kilum-Ijim communal forest of the north-western Cameroon [28]. For trees with a diameter comprised between 0.5-0.75m, or 0.75-1m, only 17.60% and 15.28% of tree population were concerned. At between 200m and 600m altitudes, many individuals with a small diameter were encountered. This could be explained by the fact that the bottom of the mountain constitute the cultivation areas, while at the top is less accessible to population. Numerous individuals with a diameter greater than 1m (10.63%) were found above 600m altitude, although high altitudes do not offer favorable environment for the development of species. These ensure the sustainability of species. This results differ from those obtained on the Bolivarian Andes mountains, which use the low temperatures and poor soil at the top of the mountain to support the absence of large-diameter individuals [29].

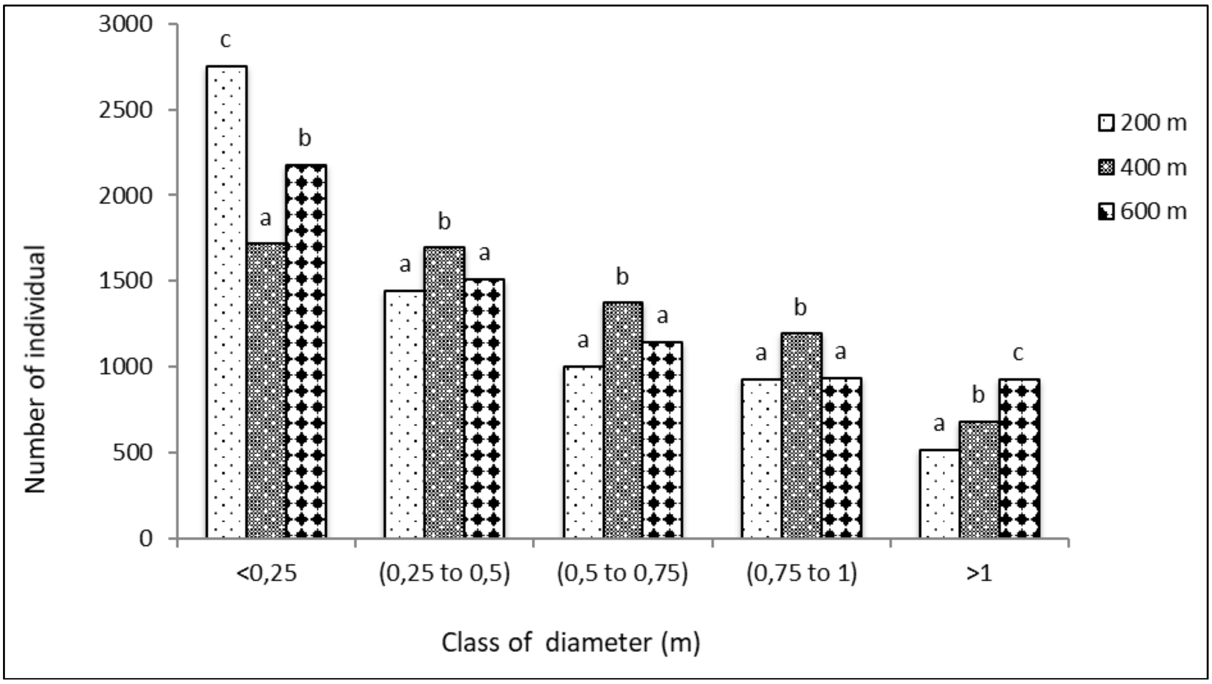

Fig 3: Diametral structure of tree species at the Mount as affected by altitude

Bars affected with the same letter for each diameter class are not significantly different at the indicated level of probability

3.6. Diametrical distribution of ligneous plants species as affected by slopes

The distribution of diameter classes varied with the slopes, giving a "L" shaped but more pronounced in the north and east (Figure 4). These results suggest that anthropogenic pressure is more efficient on large trees in the eastern and northern slopes, resulting in the regeneration of and abundance of young individuals on these slopes. For the southern and western slopes, anthropogenic pressure and regeneration are weak due to the presence of large diameter trees unlike the eastern and northern slopes. On average, 12,193 individuals (46.09%) had a diameter between [0-0.25[, against 1998 of individuals with a diameter > 1m, thus 7.55% of the total number of individuals. A similar distribution of woody vegetation was reported on the mountains in the Sudano-Sahelian zone of Cameroon [30]. The youngest population was dominant on all slopes of Mount Ngaoundal, reflecting a gradual growth of the vegetation, despite the activities observed. This result differs from findings in Senegal indicating the predominance of adult populations in *Acacia senegal* plantations in the Dahra zone [31].

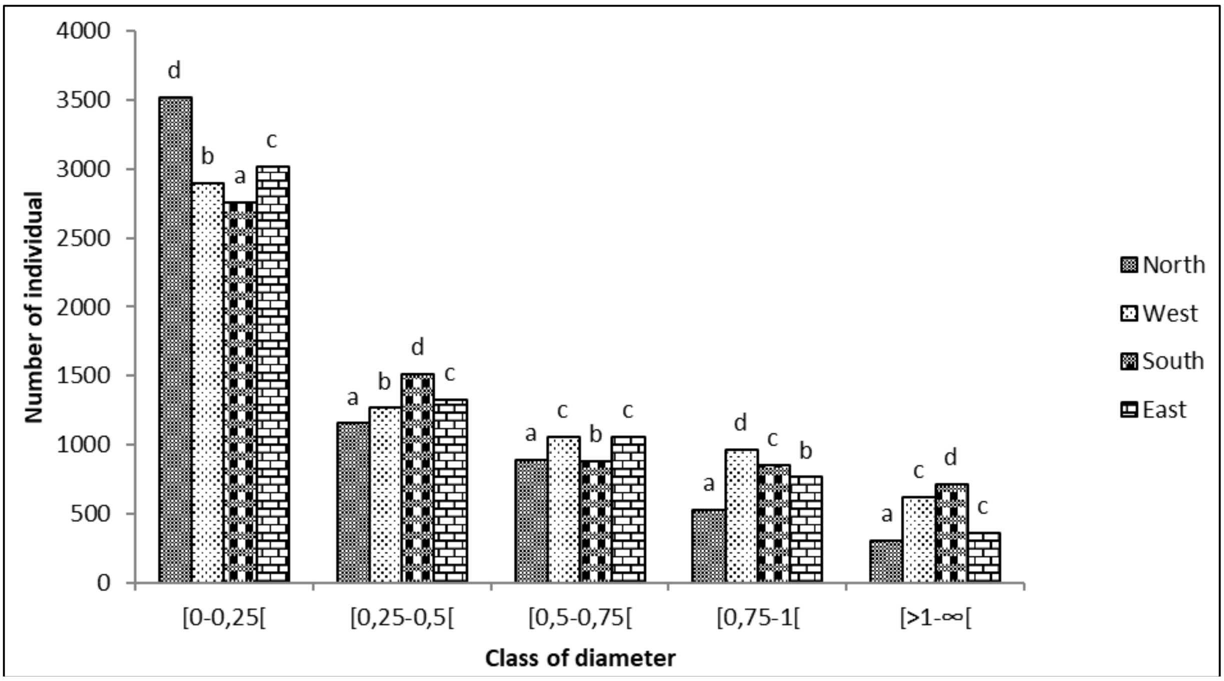

Fig 4: Variation of tree diameters between the mount Ngaoundal slopes

Bars affected with the same letter for each diameter class are not significantly different at the indicated level of probability

3.7. Distribution of height classes of tree species according to altitude

The heights of woody species of Mount Ngaoundal varied with altitude (Figure 5), expressing a "L" shaped distribution. Individuals belonging to the height classes between [0-0.5[and [0.5-2.5[, were dominant, respectively with 7864 and 7753 individuals, 2577 d 'individuals with a height between [∞, 8.5[. The low number of large individuals was generally explained by anthropogenic activities on large woody species at a low altitude (200m).

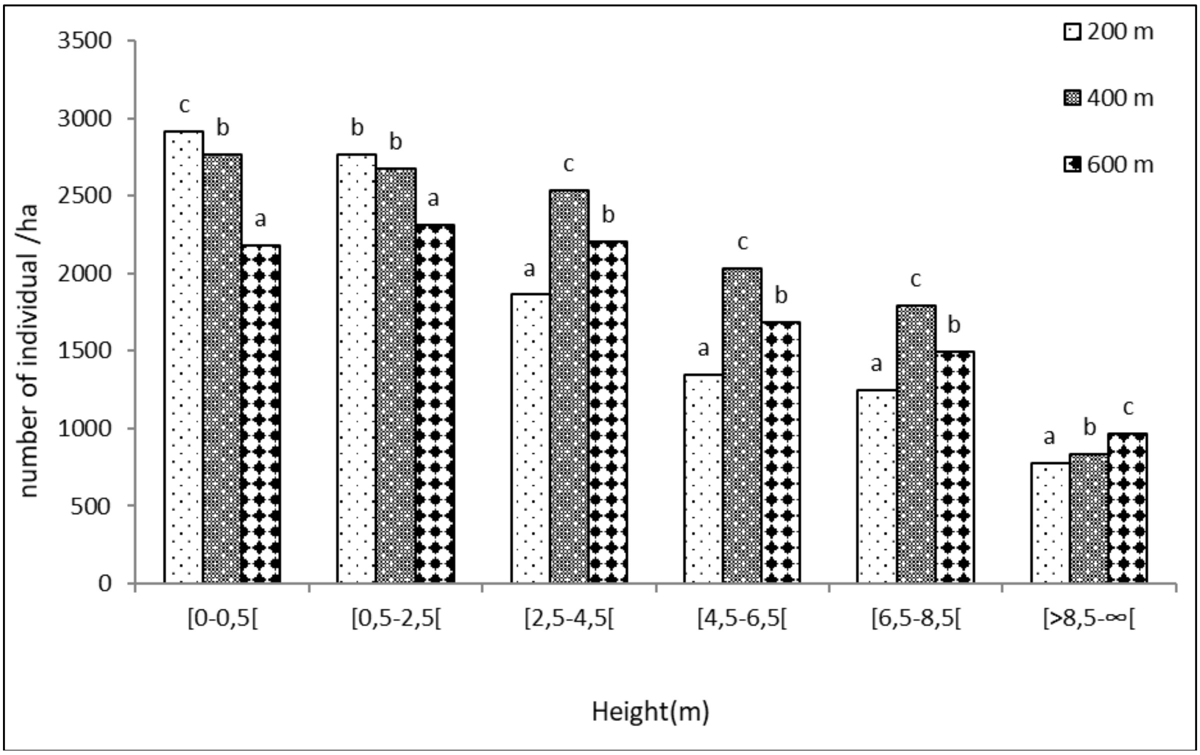

Fig 5: Variation of tree heights of the mount as affected by

Bars affected with the same letter for each diameter class are not significantly different at the indicated level of probability.

On the overall sites, the height of species decreased with increased altitude, with young individuals at 200m than large individuals. This result corroborates with similar results on certain mountains in the Sudano-Guinean region of North Cameroon [30]. This finding could be explained by the disturbance of the physiology of tree species at high altitudes lower temperature. At elevated altitude, environmental conditions (temperature, wind speed and relative humidity) change, become unsuitable to the establishment and development of species, thus negatively affects their sizes, as early revealed by other authors [32, 33]. In similar researches in tropical regions the size of species of the genus *Polylepis* (*P. australis*, *P. tarapacana*, *P. pepei*) was reported to decrease with increased altitude [34, 35, 36]. During the study of altitude gradient on the specific richness of woody flora native to Reunion Island, it was noticed that the dominant height of species decreased with altitude [37].

3.8. Changes in of height classes as affected by slopes

The height of woody species indicated a "L shape (Figure 6), based on the slopes, the number of short individuals (10,190) being the greatest (33.37%), against 1448 individuals with a height between]-∞, 8.5[, and representing only 5.30%. The western and southern slopes were distinguished by species with heights of large sizes]-∞, 8.5[, respectively 5.74% and 7.56% unlike the northern and eastern slopes with respectively have 3.9 % and 4.5% of the plant population which have a size between]-∞, 8.5[. In fact, the density of the species in the southern and western slopes was high, enabling the competition for light, thus forcing the plants to grow in length. A similar result was obtained on certain northern Cameroon hills [30]. The northern and eastern slopes had a large number of shorter individuals because human activities negatively impacted the height of species through cuttings for agricultural purposes. This finding agrees with other reported results in the Sudano-Sahelian zone of Cameroon [10, 38].

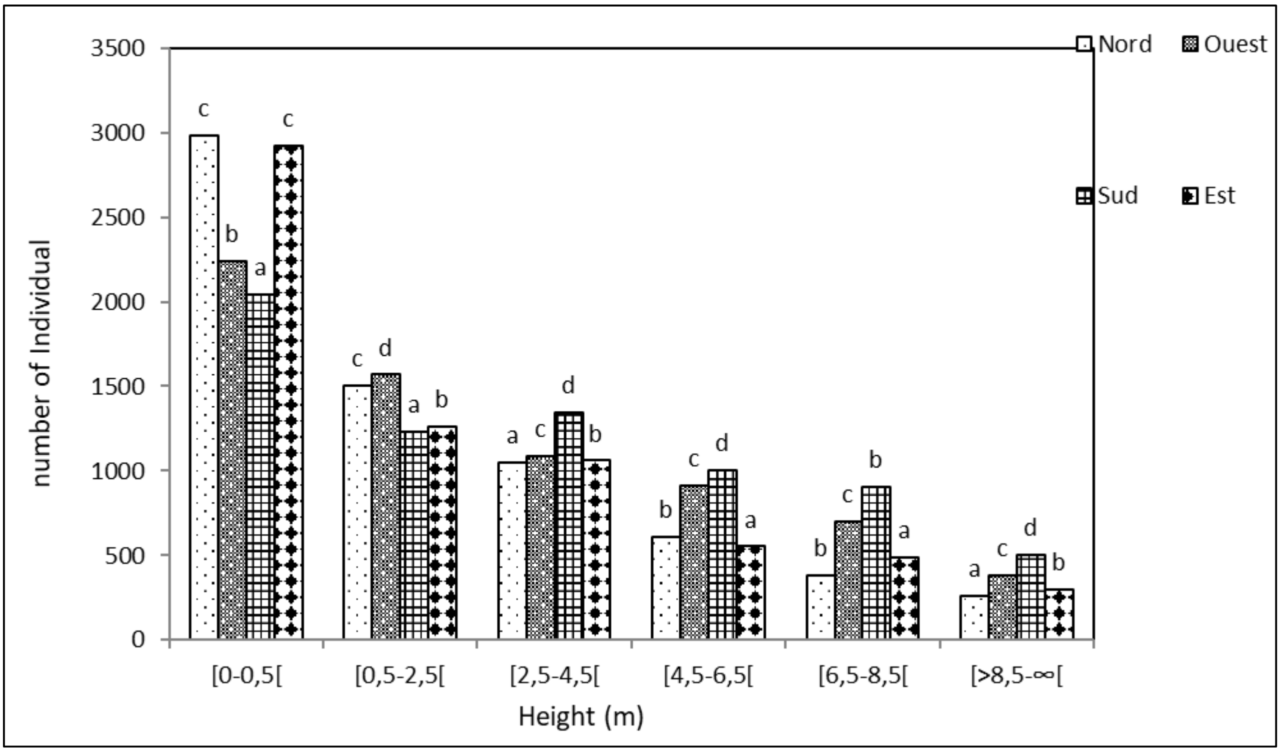

Fig 6: Differences in tree height according to slopes

Bars affected with the same letter for each diameter class are not significantly different at the indicated level of probability

3.9. Horizontal structure of species as affected by altitude

The height structure presented as an inverted "U" shape expressed the dominance of species of medium diameter classes compared to small diameter [0-0.5[, and large diameters]-∞, 8.5[classes (Figure 7). These are characteristics of savannah ecosystems that comprise individuals of relatively small sizes [39]. There was a significant difference between the different crown diameter classes ($p < 0.05$). At different altitudes, species with crown diameter of between [0.5-2.5[and [2.5-4.5[were dominant and represented respectively 24.58% and 23.19% of the plant populations against 7.09% of individuals with a crown between]-∞, 8.5[. These percentages reflect an evolutionary growth of vegetation. The 600m altitude differed from the others by a significant disparity between the different classes.

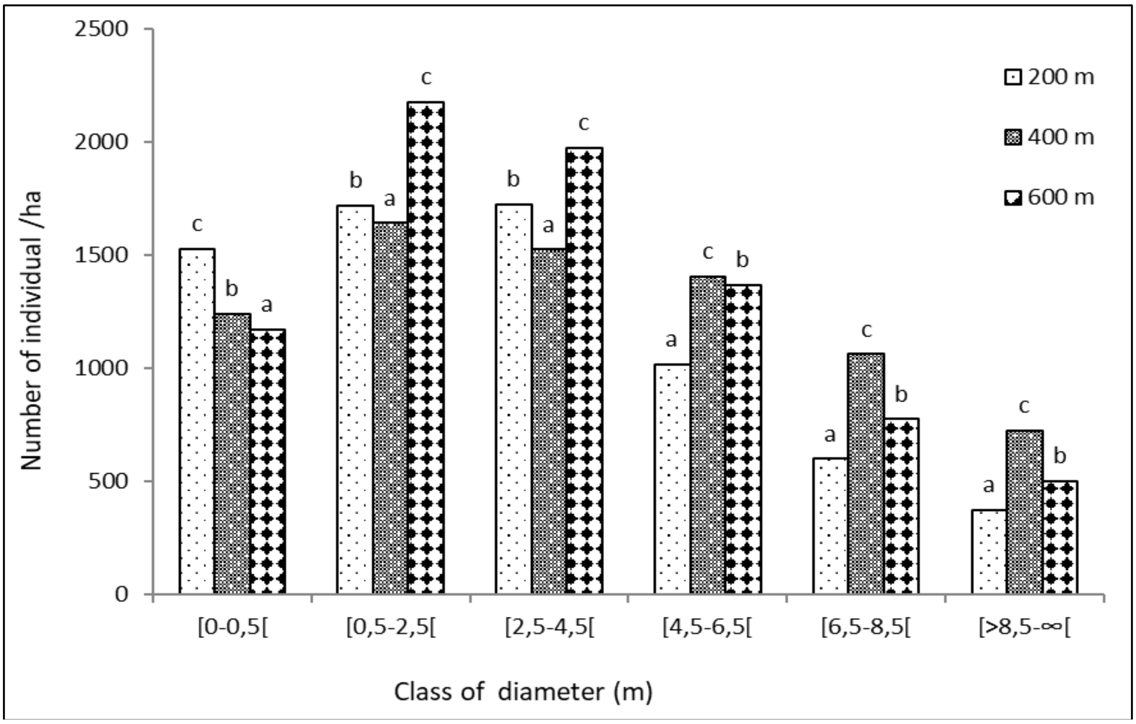

Fig 7: Changes in the horizontal structure of species between altitudes

Bars affected with the same letter for each diameter class are not significantly different at the indicated level of probability

3.10. Horizontal structure of species according to slopes

Whatever was the slope, the crown diameter distribution had an inverted "U" shape (Figure 8), and indicated significant difference ($p < 0.05$). The crown diameter of species individuals ranged between [0.5-2.5[and [2.5-4.5[classes were important and represented respectively 27.09% and 25.91% of the total number of individuals. The southern and western slopes were charcterised by a high number of individuals with a crown diameter of between]-∞, 8.5[, thus representing 7.5% and 8.7% respectively compared to those of northern and eastern slopes. The explanation could be that adult and juvenile population were not large enough due as the result of human activities. Identical structural shapes were found in the peri-urban vegetation of Ngaoundere [40]. Slopes therefore, might play an important role in the structure of the canopy.

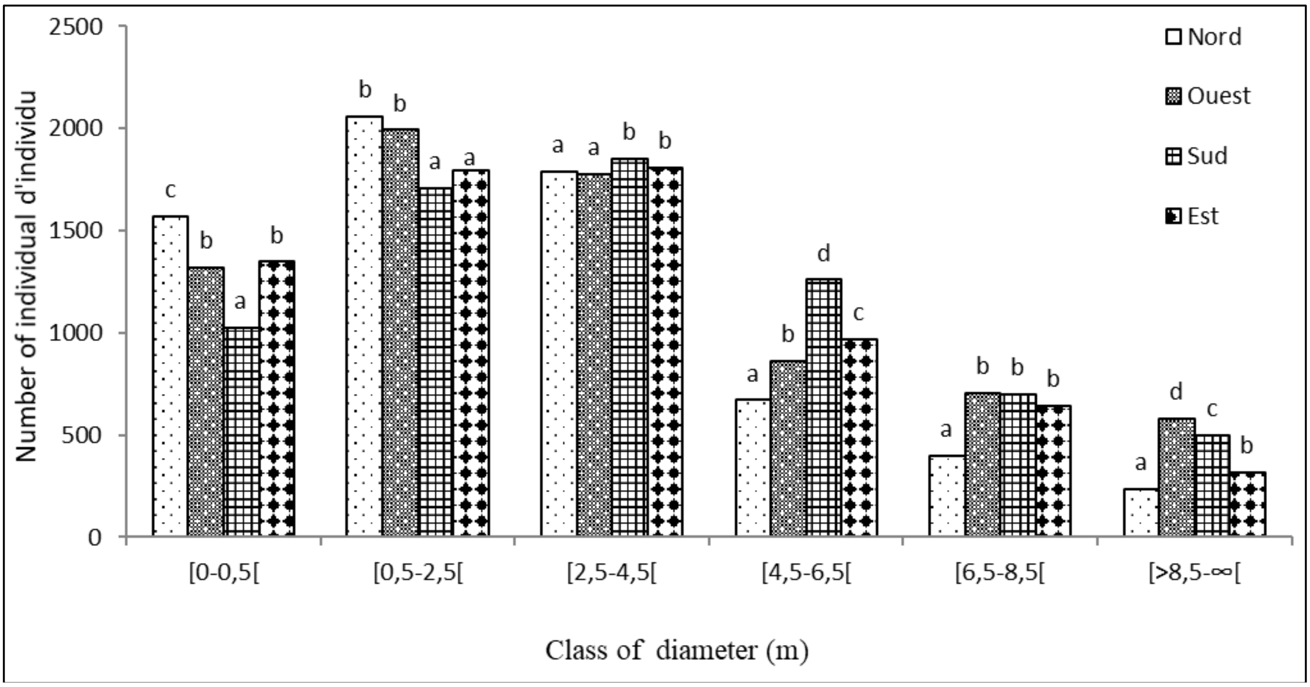

Fig 8: Horizontal structures of tree species as affected by slopes

Bars affected with the same letter for each diameter class are not significantly different at the indicated level of probability

3.11. Ecological importance of the species of Mount Ngaoundal

Of the 62 tree species identified, only six (6) were ecologically important and represented 3.72% of the population. These include species in great demand by local residents such as *Daniellia oliveri* (21.65%), *Piliostigma thonningii* (21.03%), *Terminalia glaucescens* (18.24%), *Hymenocardia acida* (14.23%), *Cussonia arborea* (13.87%), and *Steganotaenia araliacea* (10.78%), similar to reported results in the natural forests of Benin [41]. Some ecologically important species on the Lebialem Highlands were revealed in the southwestern Cameroon [42]. Species of low ecological importance were *Anacardium* sp. (0.663%), *Dombeya quinqueseta* var. *senegalensis* (0.14%), *Ficus platyphylla* (0.447%), *Gardenia aqualla* (0.914%). Depending on the slopes, the species with the highest importance value indexes were known as *Cussonia arborea* (11.12%), *Daniellia oliveri* (25.1%), *Entada Africana* (10.22%), *Hymenocardia acida* (18.32%), *Lannea schimperi* (14.13%), *Piliostigma thonningii* (21.48%) *Protea madiensis* (11.28%), *Steganotaenia araliacea* (11.84%), *Terminalia glaucescens* (18.75%). When considering the altitude, the species with indexes of high ecological importance value were *Piliostigma thonningii* (index value 26.4%) at 200m altitude on the western slope, *Terminalia glaucescens* with an importance index value of 26.5% at 400m altitude in the eastern slope, and *Cussonia arborea* (index value 18.4%) at 400m altitude in the southern slope.

Conclusion

This work was investigated to evaluate the impact of the activities carried out on Mount Ngaoundal on the dynamics of phytodiversity. Bauxite mining activities were limited to a few exploratory activities, which are visible through opened pits. Products collected were of plant and animal origin, firewood being the most used (21.85%) among many of the identified products. Activities such as agriculture (13.94%), traditional medicine (12.98%) were also practiced on the Mount, but implies like the disappearance of animal and plant diversity, erosion, climate change and the loss of cultural values. A total of 6773 individuals were identified, belonging to 62 species, 54 genera and 32 families, with the dominant species such as *Piliostima thonningii, Daniellia oliveri, Terminalia glaucescens, Hymenocardia acida.* The structure of the vegetation was of "L" shaped when the vertical and diametrical structure were considered. The horizontal structure was an inverted "U" shape. The eastern and northern slopes of Mount Ngaoundal were severely degraded as the result of human activities. The vegetation was poorly represented at 200m (2038 individuals), while at 400 m altitude the density of plant was elevated (2449 individuals). At 200m altitude plant species remained the most diverse with 59 species compared to other altitudes. The most densified slope in species was the Southern (1863 individuals), whereas the Northern was the least densified with only 1381 individuals. It is concluded that slopes and altitude may play an important role in the distribution, diversity and density of species. Of the 63 species identified, the most dominant were the most appreciated by population for their activities, but were also the most ecologically important.

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