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Plant Diversity and Ecological Characteristics Along an Altitudinal Gradient in the Mount Maroua, Far North Cameroon

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ABSTRACT

Background and Objective: Environmental filters and functional adjustments of species to local conditions are major determinants of plant communities in stressing habitats. This study aimed to compare floristic characteristics and functional traits in the lower and upper zone of Mount Maroua. **Materials and Methods:** This study was conducted in the Mount Maroua Savannahs from July to October, 2021. The floristic data were collected on 100 m^2 sampling plots for the woody stratum and 25 m^2 plots for the herbaceous stratum, using a random stratified sampling technique. Plant species identified were characterized using floristic diversity and life traits parameters (growth habit, life forms and phytogeographical affinities). **Results:** A total of 60 surveys were conducted, from which we identified 132 species belonging to 99 genera and 34 families (99 herbaceous and 33 woody species) from the study site. From the lower zone, 101 species belonging to 87 genera and 28 families (76 herbaceous and 25 woody species) were identified, while 71 species belonging to 57 genera and 25 families (60 herbaceous and 11 woody species) were recorded in the upper zone. The richest families in the two zones were Fabaceae, Poaceae and Malvaceae. Trees and shrubs' proportions decreased with an increasein altitude. The most predominant life form was Therophytes followed by Phanerophytes and Chamaephytes and their proportions decreased with an increase in altitude. The geographical distribution of plant species showed a high proportion of the Pantropical, Tropical Africa and Sudano-Sahelian species in the different zones. **Conclusion:** The lower zone was found to be rich and more diversified as compared with the upper zone. The vegetation pattern in the Mount Maroua could result from interactions between altitude, fire, grazing and climate.

KEYWORDS

Altitude, floristic diversity, functional traits, life forms, Mount Maroua, phytogeographical affinities

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INTRODUCTION

Mount Maroua is part of the Sudano-Sahelian Highlands of the Far North Region of Cameroon, where high-elevation habitats are represented by a few isolated peaks. This area is considerably being modified by anthropogenic activities (pastures and firewood collection). However, climate change and its associated effects and anthropogenic activities are increasingly modifying natural biodiversity. The interaction between anthropogenic, abiotic and biotic factors makes it difficult to identify and quantify the main determinants of plant association[1]. This characteristic is the most important challenge for understanding their functioning.

The floristic diversity and functional traits are among the most significant ecological attributes of a particular ecosystem showing variations in response to environmental and anthropogenic factors. In addition, elucidating how these factors drive the assemblage of plant communities remains an important challenge in ecological research[2-4]. The biological forms of plants are dependent on the genetic feature as well as environmental factors because the environment can have undeniable effects on the formation of different critical forms of plants. In the Sudano-Sahelian zone, the distribution, composition and structure of vegetation depend on climate (low rainfall) and local factors such as soil surface condition and texture, topography, anthropogenic activities, herbivores and fire[5,6]. The heterogeneity of these environments, due to a pronounced low rainfall, influences the structure, composition and distribution of the characteristic species. The study carried out by Osborne *et al*.[6] indicated that the unique combinations of functional characteristics of plants characterizing the main associations of African savannahs make them differentially vulnerable and resilient to anthropogenic factors of ecosystem change.

Previous studies on floristic diversity and functional traits have been conducted in the Sudano-Guinean mountains savannahs of Cameroon[3,4,7]. In the Sudano-Sahelian zone of Cameroon, most studies carried out investigations mainly on woody vegetation[8,9]. Very few studies have focused on the variations drivers of floristic composition and functional traits of plant communities in the Sudano-Sahelian mountain savannahs. Therefore, there is a need for investigations to source such information as it is useful for understanding the impact of changed environmental conditions on plant community structure. Moreover, it will provide insight into the environmental requirements of the species needed for successful ecological restoration and biodiversity protection of this mountain. This study aimed at comparing the floristic diversity and ecological characteristics of the Sudano-Sahelian savannahs of the Mount Maroua along an altitudinal gradient.

MATERIALS AND METHODS

Study site: The study was carried out at the Mount Maroua, in the Sudano-Sahelian Highlands of the Far North Region of Cameroon. The study area is located between 10°36'10.1"-10°37'46.2"N and 14°17'52.5"-14°19'04.9"E. This mountain has a maximum height of 742 m. The study site was subdivided in to the lower zone (Lowland Savannah <500 m altitudes) and upper zone (Highland Savannah >500 m). The climate was defined as Sudano-Sahelian type, with a long dry season (October-May) and a short rainy season (June-September). The annual average rainfall was 867 mm. The annual average temperature was 27°C with a maximum of 38-40°C from March-April. The soils are mostly sandy, clay, vertisols and lateritic. The natural landscape is a savannah where scattered trees and shrubs grow in a matrix of a continuous herbaceous/grass species layer that thrives during the rainy season. Most woody species of this Sahelian-Savannah ecosystem are thorny. Harvesting of trees and shrubs, grazing, cropping and rainfall contribute to shaping the vegetation.

Data collection: The fieldwork was conducted during the rainy season from July to October 2021. A total of 60 plots of 10×10 m were marked randomly to sample the floristic data of vascular plants within the two altitudinal zones (30 in each zone). The trees and shrubs were inventoried within quadrats of 100 m^2 and herbs within a sub-quadrats of size 5×5 m placed within 100 m^2 quadrats. Phytosociological data were collected using the Tomaselli method[3]. Most plant species were identified directly in the field using

monograph, for other species, specimens were collected and compared to those available in the National Herbarium of Cameroon. The habit of the plant species was determined in the field by observation. Raunkiaer life forms (based on the nature of perennating buds of plant species) were recorded. Phytogeographical distribution types were characterized by the distribution pattern of vegetation and the level of endemism of communities. This would likely provide information about phytogeographic affinities, maturity and stability of the flora which were determined and classified according to the White method[4].

Data processing and analysis: Data related to relative frequency and abundance, Shannon-Weaver diversity and Pielou evenness indices and Floristic similarity coefficient of Sorensen were subject to descriptive statistical analysis using Microsoft Excel 2017 software.

RESULTS

Floristic composition and diversity: A total number of 132 species (99 herbaceous and 33 woody) (Table 1), belonging to 98 genera and 34 families (APG IV) were recorded in the study area (Table 2). A total of 101 species (81 herbaceous and 25 woody) and 71 species (57 herbaceous and 11 woody) were recorded in the lower zone and the upper zone, respectively (Table 2). A set of 61 species were encountered only in the lower zone (Table 1). Conversely, 31 species appear to be restricted to the upper zone.

The most frequent species in the study site were *Spermacoce chaetocephala* (60.86%), *Calopogonium mucunoides* (52.17%) and *Cassia occidentalis* (52.17%). The following species *Hygrophila schulli* (69.23%), *Cassia obtusifolia* (63.63%) and *Calopogonium mucunoides* (54.54%) were the most frequent in the lower zone while *Aspilia helianthoides* (61.11%), *Calopogonium mucunoides* (61.11%), *Cassia occidentalis* (50%) and *Loudetia togoensis* (50%) were the most frequent in the upper zone. The most abundant species in the study site were *Spermacoce chaetocephala* (8.57%) and *Aspilia helianthoides* (5.32%). The most abundant species in the lower zone were *Aristida hordeacea* (10.47%), *Hygrophila schulli* (10.21%) and *Spermacoce chaetocephala* (7.93%) while *Loudetia togoensis* (10.32%), *Spermacoce chaetocephala* (9.14%) and *Aspilia helianthoides* (8.19%) were the most abundant in the upper zone.

A total of 1652 individuals belonging to 33 woody species were recorded at the study site with 25 and 11 species, respectively for lower and upper altitudes (Table 2). The most frequent species were *Azadirachta indica* (53.84%) and *Cassia occidentalis* (53.84%) in the lower zone and *Annona senegalensis* (50%) and *Cassia occidentalis* (50%) in the upper zone. The most abundance woody species in the study site were *Cassia occidentalis* (17.74%), *Azadirachta indica* (16.39%), *Guiera senegalensis* (11.37%). *Azadirachta indica* (20.95%) and *Acacia hockii* (16.32%), *Guiera senegalensis* (15.37%) in the lower zone and *Cassia occidentalis* (44.45%), *Azadirachta indica* (15.34%) in the upper zone.

The richest families in the lower zone were Fabaceae (22 species), Poaceae (20 species), Malvaceae (8 species) and Asteraceae (7 species) whereas, in the upper zone, the richest families were Fabaceae (18 species), Poaceae (16 species) and Malvaceae (5 species). At the study site, the richest families were Fabaceae (30 species), Poaceae (25 species), Malvaceae (11 species) and Asteraceae (7 species).

Table 1: Plant lists are recorded in the lower zone and the upper zone

Species	Lower zone	Upper zone
Acacia ehrenbergiana Hayne	+	-
Acacia hockii de Wild.	+	+
Acacia nilotica (L.) Willd. ex Delile	-	+
Acacia seyal Delile	+	-
Achyranthes aspera L.	+	+
Ageratum conyzoides L.	+	+
Amaranthus viridis L.	+	-
Andropogon chinensis (Nees) Merr.	-	+
Andropogon fastigiatus Sw.	+	+

Table 1: Continue

Species	Lower zone	Upper zone
Andropogon pseudapricus Stapf	-	+
Aneilema lanceolatum Benth.	-	+
Annona senegalensis Pers.	+	+
Aristida hordeacea Kunth	+	-
Aristida kerstinguii Pilg.	+	+
Aspilia africana (Pers.) C.D. Adams	+	+
Aspilia helianthoides (Schumach. and Thonn.) Oliv. and Hiern	+	+
Azadirachta indica A. Juss.	+	+
Balanites aegyptiaca (L.) Del.	+	-
Bauhinia rufescens Lam.	+	-
Bidens pilosa L.	+	-
Borassus aethiopum Mart.	+	-
Brachiaria jubata (Fig. and de Not.) Stapf	+	+
Calopogonium mucunoides Dev.	+	+
Calotropis procera (Ait.) Ait. f.	+	+
Cardiospermum halicacabum L.	+	-
Cassia absus L.	-	+
Cassia mimosoides L.	+	+
Cassia nigricans Vahl	+	-
Cassia obtusifolia L.	+	+
Cassia occidentalis L.	+	+
Cassia singueana Delile	+	-
Cenchrus ciliaris L.	+	+
Centaurea cf. *pungens* Pomel	+	-
Chloris lamproparia Stapf	+	-
Chloris prieurii Kunth	+	-
Cienfuegosia digitata Cav.	+	+
Cissus quadrangularis L.	+	-
Cleome brachycarpa Vahl ex DC	+	-
Cleome monophylla L.	+	-
Cleome viscosa L.	-	+
Combretum aculeatum Vent.	+	-
Combretum collinum Fresen.	+	-
Combretum sericeum G. Don	+	-
Conyza bonariensis (L.) Cronquist	+	-
Crotalaria naragutensis Hutch.	+	-
Crotalaria retusa L.	-	+
Crotalaria senegalensis (Pers.) Bacle ex DC	-	+
Croton lobatus L.	-	+
Cucumis cf. *maderaspatanus* L.	+	-
Cymbopogon schoenanthus (L.) Spreng.	-	+
Cynodon dactylon (L.) Pers.	+	-
Cyperus rotundus L.	-	+
Datura stramonium L.	+	-
Dichrostachys cinerea (L.) Wight and Am.	-	+
Eleusine indica (L.) Gaertn.	+	-
Entada africana Guill. and Perr.	+	-
Eragrostis pilosa (L.) P. Beauv.	+	-
Euphorbia maculata L.	-	+
Faidherbia albida (Delile) A. Chev.	+	-
Flueggea virosa (Roxb. ex Willd.) Voigt.	+	+
Geigeria alata (Hochst. and Steud. ex DC.) Oliv. and Hiern	+	-
Gomphrena celosioides Mart.	+	-
Guiera senegalensis J.F. Gmel.	+	+
Helleborus sp.	+	+
Heteropogon contortus (L.) Roem. and Schult.	+	+
Hygrophila schulli (Buch.-Ham.) M.R. Almeida and S.M. Almeida	+	+
Hyparrhenia rufa (Nees) Stapf	-	+
Hyphaene thebaica (L.) Mart.	+	-
Hyptis spicigera Lam.	+	-
Hyptis suaveolens Poit.	-	+
Indigofera dendroides Jacq.	+	-

Table 1: Continue

Species	Lower zone	Upper zone
Indigofera hirsuta L.	-	+
Indigofera stenophylla Guill. and Perr.	+	+
Indigofera strobilifera (Hochst.) Hochst. ex Baker	+	+
Ipomoea carnea Jacq.	+	-
Ipomoea eriocarpa R. Br.	+	-
Ipomoea involucrata P. Beauv.	+	-
Jatropha gossypiifolia L.	+	-
Laportea aestuans (L.) Chew	+	+
Ledebouria sudanica (A. Chev.) Burg	-	+
Leonotis nepetifolia (L.) R. Br.	-	+
Lepidagathis collina (Endl.) Milne-Redh.	+	+
Leptadenia hastata (Pers.) Decne	+	+
Leucas martinicensis (Jacq.) R. Br.	+	-
Loudetia togoensis (Pilger) C.E. Hubbard	+	+
Microchloa indica (L. f.) P. Beauv.	+	+
Mitracarpus hirtus (L.) DC.	+	-
Momordica charantia L.	+	-
Monechma ciliatum (Jacq.) Milne-Redh.	+	+
Panicum laetum Kunth	+	-
Paspalum scrobiculatum L.	+	+
Passiflora sp.	-	+
Pennisetum pedicellatum Trin.	+	+
Phyllanthus maderaspatensis L.	+	-
Physalis lagascae Roem. and Schult.	+	-
Piliostigma thonningii (Schumach.) Milne-Redh.	+	-
Platostoma africanum P. Beauv.	+	-
Pterocarpus erinaceus Poir.	+	-
Pupalea lappacea (L.) A. Juss.	-	+
Rogeria adenophylla J. Gay	+	-
Schizachyrium sanguineum (Retz.) Alston	+	-
Schoenefeldia gracilis Kunth	+	-
Senna italica Mill.	+	-
Sesbania pachycarpa DC.	+	+
Sida acuta Burm. f.	+	-
Sida alba L.	+	-
Sida cordifolia L.	+	-
Sida ovata Forssk.	-	+
Sida rhombifolia L.	+	-
Solanum incanum L.	+	-
Spermacoce chaetocephala de Candolle	+	+
Spermacoce stachydea DC.	-	+
Stachytarpheta indica (L.) Vahl	-	+
Sterculia setigera Del.	-	+
Stipagrostis pungens (Desf.) de winter	+	+
Striga aspera (Willd.) Benth.	-	+
Striga gesnerioides (Wild.) Vatke	-	+
Striga hermonthica (Del.) Benth.	+	-
Stylochaeton hypogaeus Lepr.	+	-
Stylosanthes erecta P. Beauv.	+	+
Tephrosia bracteolata Guill. and Perr.	-	+
Tephrosia linearis (Willd.) Pers.	+	+
Tephrosia purpurea (L.) Pers.	-	+
Tetrapogon cenchriformis (A. Rich.) Clayton	-	+
Thespesia garckeana F. Hoffm.	+	-
Tinospora bakis (A. Rich.) Miers	-	+
Triumfetta pentandra A. Rich.	+	+
Vetiveria nigritana (Benth.) Stapf	+	+
Walteria indica L.	-	+
Wissadula rostrata (Schumach.) Hook. f	+	-
Ziziphus mauritiana Lam.	+	+
Ziziphus spina-christi (L.) Desf.	+	-

+: Present and -: Absent

Table 2: Taxonomic richness of plant species in the different zones of Mount Maroua

Taxonomic richness	Lower zone	Upper zone	Study site
Species richness	101	71	132
Genera number	81	57	98
Family number	28	25	34
Woody species	25	11	33
Herbaceous species	76	60	99

Table 3: Growth habits of plant species were recorded in different zones of the study site

	Study site		Lower zone		Upper zone	
Growth habits	Species number	Proportion	Species number	Proportion	Species number	Proportion
Trees	10	7.57	8	7.92	3	4.22
Shrubs	23	17.42	21	20.79	10	14.08
Herbs	95	71.97	69	68.32	56	78.87
Lianas	4	3.03	3	2.97	2	2.82

Table 4: Distribution of plant species in the various life forms spectra in different zones of the study site

	Study site		Lower zone		Upper zone	
Life forms	Species number	Proportion	Species number	Proportion	Species number	Proportion
Chamaephytes	32	24.24	22	21.78	20	28.17
Geophytes	6	4.54	2	1.98	5	7.04
Hemicryptophytes	4	3.03	2	1.98	3	4.22
Microphanerophytes	20	15.15	17	16.83	8	11.26
Mesophanerophytes	12	9.09	11	10.89	3	4.22
Nanophanerophytes	8	6.06	7	6.93	6	8.45
Therophytes	50	37.88	40	39.60	26	36.62

Diversity and similarity indices of the two altitudinal zones: The species richness of the plots varies from 9-23 species. The average number of species per plot was higher in the lower zone (14.69±2.46) than in the upper zone (13.30±2.94). The Shannon-Weaver diversity index value was 4.90 and 4.80 bits for the herbaceous species, 3.53 and 2.18 bits for the woody species, respectively in the lower zone and the upper zone. However, for the overall study, the Shannon value was 5.36 and 3.44 bits, respectively for herbaceous and woody species. The Pielou's evenness index was 0.45 and 0.43 for the herbaceous species, 0.37 and 0.29 for the woody species, respectively in the lower zone and the upper zone whereas, in the study this was 0.45 and 0.35, respectively for herbaceous and woody species. The Floristic similarity coefficient of Sorensen was less than 50% for all the two altitudinal zones (46.51). Forty plant species belong to these two altitudinal zones indicating a certain similarity between these zones.

Ecological characteristics

Growth habits: Different plant taxa growth habits demonstrated that the most common species were herbs with 71.97, 68.32 and 78.87%, respectively in the study site, for the lower and upper zone. Herbs proportion was higher in the upper zone than lower zone whereas trees, shrubs and lianas proportions were higher in the lower zone than upper zone (Table 3).

Life forms spectrum: The most dominated life forms were Therophytes with 37.88, 39.60 and 36.62%, respectively in the study site, lower and upper zone. The Phanerophytes represented by Microphanerophytes, Nanophanerophytes and Mesophanerophytes were the second most dominated life forms in the lower zone while Chamaephytes were dominant in the upper zone (Table 4). The least represented life forms were the Geophytes and Hemicryptophytes with (4.06 and 3.03%), (1.98 and 1.983%) and (7.04 and 4.22%), respectively in the lower and upper zone.

Phytogeographical affinities: Investigation of the geographical distribution of plant species indicated that the total flora was composed mostly of pantropical species with 32.57, 29.70 and 33.80%, respectively in the study site, lower and upper zone. Tropical-Africa species were the second most important

Table 5: Geographical distribution of plants showing several species and proportions in each chorotype in different zones of the study site

	Study site		Lower zone		Upper zone	
Phytogeographical affinities	Species number	Proportion (%)	Species number	Proportion (%)	Species number	Proportion (%)
Tropical Africa	23	17.42	17	16.83	13	18.30
Africa-Malgaches	3	2.27	3	2.97	0	0.00
Cosmopolitan	8	6.06	7	6.93	3	4.22
Paleotropical	9	6.82	7	6.93	5	7.04
Pantropical	43	32.57	30	29.70	24	33.80
Pluriregional African	3	2.27	3	2.97	3	4.22
Sudano-Guinean	1	0.76	1	0.99	0	0.00
Sahelo-Saharian	17	12.88	14	13.86	11	15.49
Sudano-Zambezian	19	14.39	15	14.85	8	11.26
Sudano-Zambezian-Sahelo-Saharian	4	3.03	3	2.97	2	2.81
Underminated	2	1.51	1	0.99	2	2.81

phytochoria with 17.42, 16.83 and 18.30%, respectively in the study site, lower and upper zone (Table 5). Sahelo-Saharian and Sudano-Zambezian species were highly represented withthe proportion (13.86 and 14.85%) and (15.49 and 11.26%), respectively in the lower and upper zone.

DISCUSSION

Spermacoce chaetocephala, *Hygrophila schulli* and *Calopogonium mucunoides* were the most frequent and most abundant herbaceous species. The importance of these species could be explained by ecological, geomorphological (slopes zones), edaphic (soil types and inselbergs) and climatic conditions of various plots. The large number of plant species recorded in the lower zone compared to the upper zone could be related to disturbance and the pronounced dry period in the upper zone. Species richness along an altitudinal gradient could be in uenced by the factors such as altitude, grazing, soil characteristics, wood collection and climate. This altitudinal variation of the flora is in agreement with the works of several authors on Cameroonian mountains[7]. Soil characteristics, grazing, bush fires and climate can also modulate the variation of the flora. The number of species recorded in the woody vegetation of the study site was 33 species. This number is small compared to 86 woody specie recorded in the Kalfou Forest Reserve (Far North, Cameroon)[9] and 80 species recorded in the woody vegetation of Larmanaye (Chad)[10]. The differences observed in these studies could be attributed to the difference in the level of anthropogenic pressures such as wood collection, overgrazing, population growth and bush fires.

The high values of the Shannon diversity index in the different zones can be associated with the high number of plant species and the high species/area and the diversity of the observed biotope (lowland, hilltop, slope zone and roads boundary). According to Wouokoue *et al.*[7], each topographic position corresponds to a type of ground and specific type of drainage, which can constitute niches for various plant species. The low equitability values recorded in the different zones seem to indicate that these are disturbed environments. These environments are often crossed by anthropogenic fires at the beginning of the dry season and grazing during the rainy season. On the other hand, the equitability values observed in this study were low and all below 0.5. This means that the numbers of the species recorded are not in equilibrium. A comparison of the two altitudinal zones by Sorensen's floristic similarity coefficient showed a value of less than 50% and confirmed that the two zones belong to different plant communities. These results suggest that the topographical position and the stony fraction of the soils can be considered important factors modulating the oristic composition and the abundance of species in the savannah vegetation[11].

The most frequent, abundant and richest families in the two altitudinal zones of the study sitewere Fabaceae and Poaceae. A similar floristic pattern was found in the Western Highlands savannahs of Cameroon by scientists[3,7]. High richness in Poaceae could be since the study area is occupied by the

pastures and crossed each year by bush fires[3,7]. Moreover, Poaceae taxa have a high tilling potential and a high regrowth rate after grazing if environmental conditions are favourable[7,12]. The study revealed that most woody species were found in the lower zone than the upper zone. The high richness of woody species in the lower zone could be explained by the lack of bush fire in some plots and the proximity of some plots to residential plots and roads (shade trees). Generally, woody species are more affected by fires than grasses and frequent burning over a long time leads to the reduction or elimination of the tree layer.

The high proportion of herbs might be explained by climatic factors (dry climate) and anthropogenic pressures (bush fire, overgrazing and fuelwood collection). Most tropical savannahs are highly resilient to and even dependent on frequent res and mega-herbivores, which maintain savannah plant diversity and vegetation structure i.e., low tree cover[13]. The dominance of herbaceous species in savannahs communities is in line with previous studies in Cameroon[4,8] and in in the Gran Sabana, Venezuela[12]. The spatial distribution of plant species richness increased with altitude, especially for herb species whereas, trees and shrubs decreased with altitude.

The dominance of therophytes and chamaephytes in all zones over other life forms might be a response to the hot climate, topographic variations and anthropogenic pressures. The high proportion of therophytes testifies to the xericity of the study area[14]. This is confirmed by the low representativeness of hemicryptophytes and geophytes. Similar conclusions were also reported in Niger[5], Djona, Benin[15] and Bandipora (India)[16], where therophytes were known to be the major life form in dryland ecosystems such as Sahelian savannahs. Therophytes life form indicates disturbed environmental conditions in the study area and biotic pressure on vegetation which increase the short live species, higher occurrence of this life form indicates some anthropogenic and overgrazing effects in the study area. The preponderance of therophytes can also be related to their high reproductive capacity and ecological, morphological and genetic plasticity under a higher degree of disturbance[4]. Most therophytic plants in this study were found in the family of Poaceae. The dominancy of life forms in the study area shows adaptation to arid and harsh climatic conditions (low rainfall) which are capable to tolerate the unfavourable conditions. Chamaephytes having perennating buds within 25 cm of the ground surface was the second dominant life form in the two altitudinal zones and increase with altitude. The high representation of micro-phanerophytes shows a preponderance of shrubby formations in different zones.

The high proportion of species with broad distribution (Pantropical) and with continental distribution (Tropical Africa) found in the different zones of the study area followed by the proportion of Sahelo-Saharian and Sudano-Zambezian species indicates that the study area belongs to the disturbed Sudanian domain[5]. This disturbance could be due to the grazing, bush fire and agricultural activities which highly modify the original Sudanian flora with the appearance of the Sahelian ones. The combination of rainfall and floristic data makes it possible to classify our area in the Sudano Sahelian sector. These species are generally ruderary or species of disturbed mediums can be used as an indicator of degraded ecosystem[4]. Most of the pantropical species are weedy annuals. These results are similar to those of previous investigations as African distribution species constitute a remarkable proportion of the studied flora[4].

CONCLUSION

A total of 132 species belonging to 99 genera and 34 families have been recorded in the Mount Maroua with 101 species in the lower zone and 71 species in the upper zone. It was revealed that the flora was dominated by Fabaceae, Poaceae and Asteraceae families. Herbs and shrubs were the most dominant growth habits in different altitudinal zones. The factors that could in uence species richness along the altitudinal gradient studied were altitude, fire, grazing, soil characteristics and climate. Therophytes and Chamaephytes were the most frequent life forms. Chronological types revealed that the pantropical species was the most dominant chorotype followed by the Tropical African species.

SIGNIFICANCE STATEMENT

This study examined the rich floristic potential and their functional traits in two altitudinal zones of Mount Maroua. That was an important and necessary investigation to carry out because it has been noticed that species richness and diversity are under serious threats from anthropogenic and climate change, especially in the mountain areas. Studying the overall ecological scenario and biodiversity might be helpful as a reference study for the protection and manageable utilization of plants.

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