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Floristic composition, diversity and ecological importance of woody plants in eastern part of National Park of Sena Oura, Chad

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Abstract

Scientific research on plant biodiversity is the only one to identify and develop the potential for innovations derived from plant richness, particularly those of the developing countries. In order to valorize the wild phytogenetic resources for the efficient conservation and sustainable use in sudano-zambezian, a study was carried out in eastern part of National Park of Sena Oura (Chad) assessing the floristic composition, specific abundances and assessing the stand diversity. The systematic inventory of all trees and shrubs (diameter ≥ 5 cm) was done in 10 linear transects (1000 m × 20 m = 20 ha). In total, 84 species grouped in 58 genera and 29 families were found. Combretaceae was the most diverse family (16 species) and the most diverse genus was *Terminalia* (9 species). The most abundant species was *Isoberlinia doka* (pi*100 = 12.13% and D = 23 stems/ha) followed by *Burkea africana* (pi*100 = 7.91% and D = 15 stems/ha). The Simpson index (E= 0.95), the Shannon index (H= 3.41) and the equitability index of Pielou (J= 0.76) indicated that there was moderate stand diversity with more or less equitable species in the Park. The values of diversity and equitability were sufficient for sudanian vegetation. Combretaceae, Caesalpiniaceae, Fabaceae, Meliaceae, Anacardiaceae, Mimosaceae, Rubiaceae were most dominant families according to the Family Importance Value index (FIV). These results contribute to the valorization of the wild phytogenetic resources for efficient *in situ* conservation and sustainable use.

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Introduction

According the Earth Summit in Rio in 1992, the World Summit in Johannesburg in 2002, the Parks Summit of IUCN in Durban in 2003, and recently the COP21 and COP22 summits in Paris and in Marrakech , it is learned that it is imperative to conserve plant biodiversity for the goods and services it provides to humanity. This biodiversity provides, among other things, food, the basis of medicine, building materials and contributes effectively to the reduction of famine and poverty (Eissing *et al.*, 2007) Plant diversity could bring together all the primary ecological values and regulates the global climate (air purification through photosynthesis). Scientific research on plant diversity is among the best ways for identification and development of the potential for innovations derived from plant richness, particularly that of the developing countries. Protected areas since several decades, have been recognized for their great role in biodiversity conservation. They are therefore suitable for conducting such type of research because they are rich in species and ecosystems (Galindo, 2010). Nevertheless, they are facing a lot of pressure from human as well as natural phenomenon to ensure sustainable improvement of the resources (Aubertin and Vivien, 1998). These factors dangerously threat the preservation and management; subsequently, strongly cause the regression of the size of protected areas (Brunner *et al.,* 2001). And even, in sudano-zambezian region, few studies on plant biodiversity are carried out.

The National Park of Sena Oura (NPSO) is one of the mainly protected areas in Chad. It covers about 10% of all Chad territory. It is characterized by its fauna richness shown by several studies (UICN/PACO, 2008; Worgue Yemye, 2012; Bémadjim, 2014), but there are shortage of floristic and plant diversity data to have broad knowledge of the potential of this Park. However, there are ecosystems submitted to human disturbances such as the cutting down of flora for fuel, construction materials, medicines, pasture and bush fires as for most protected areas in tropical Africa (Akpagana and Bouchet, 1995). These factors can contribute for degradation of flora, leading to their scarcity and the alteration of the ecosystems as well as a significant loss of biodiversity (Khresat *et al.,* 1998; Darkoh, 2003). It is urgent to know its phytogenetic potential for a good conservation and a good valorization of its richness in biodiversity. The main objective of this study was to valorize the sudano-zambezian wild plant resources for the efficient conservation and sustainable use. Specifically the study was carried out in eastern part of National Park of Sena Oura, it was to (i) determine the floristic composition and specific abundance, (ii) assess the stand diversity indexes and (iii) assess ecological importance of plants.

Materials and Methods

Study area

National Park of Sena Oura is located in the Department of Mayo-Dallah, Mayo-Kebbi West Region. It is located between 8°25'43'' and 9°13' 06'' north latitude and 13°58'47'' and 15°30'09'' east longitude. It is located at an altitude of between 350 and 671 m. The NPSO is the third National Park in Chad. It covers an area of 73520 ha and it is cross-border with the National Park of Bouba-Ndjidda (NPBN) in Cameroon (Fig. 1).

This study was carried out in the eastern part of the Park, limited to the western part by the river 'mayo sena oura'. The Park is located in the Sudanian domain (sudano-zambezian region) according to the phytogeographic subdivision of Letouzey (1985). It is created by Law N° 011/PR/2010 of 10 June 2010 on the initiation of the local communities of the cantons Dari and Goumadji. One of the main objectives of which is to propagate, protect and conserve wild animal and plant species. The climate is of the tropical sudano-guinean type with a dry season which extends from October to April and a rainy season from May to September. Annual cumulative rainfall is about 900 to 1200 mm per year. The hydrographic network consists of rivers flowing between July and September (Bemadjim, 2014). The vegetation is a wooded savanna identical to that of the National Park of Bouba-Ndjidda but with the particularity of sheltering in the zone of confluence of the streams, vegetation of guineo-sudanian type and forests gallery along the rivers.

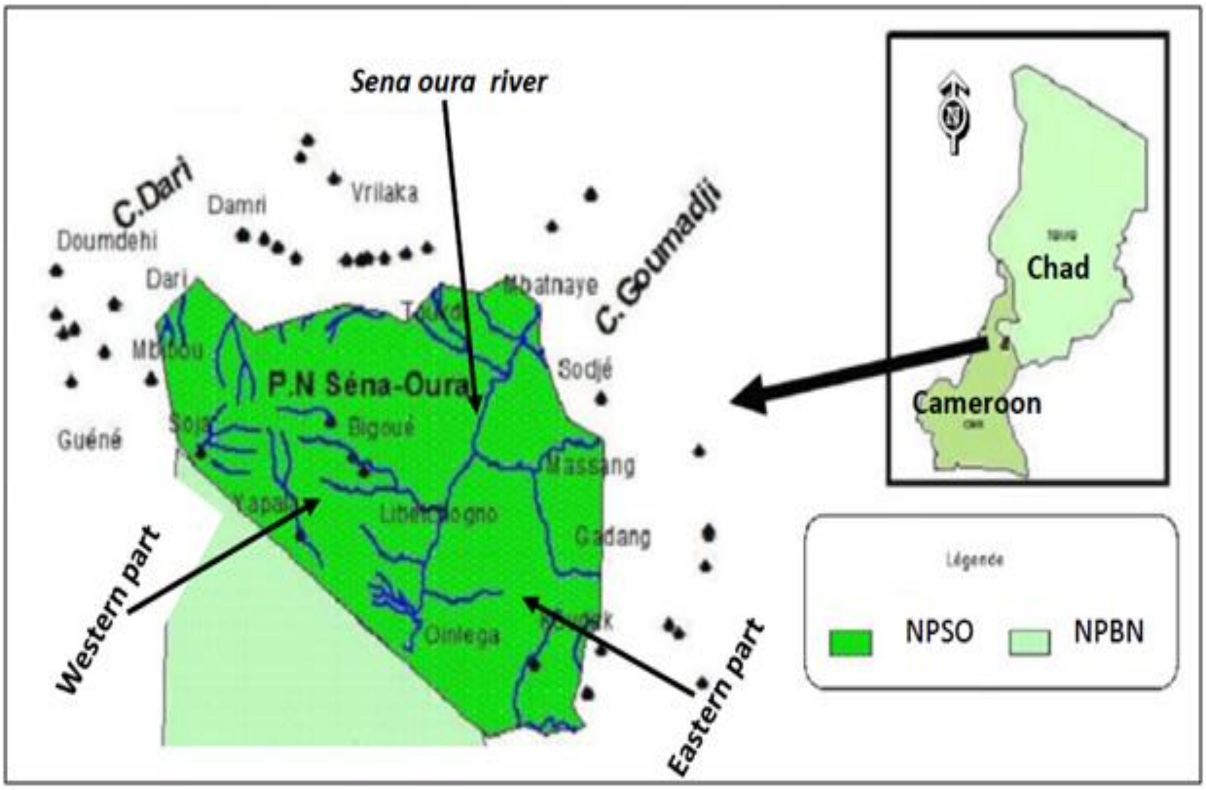

Fig. 1. Location map of study site.

Data collection

The data collection was done at the beginning of the rainy season corresponding to the peak of flowering of plants (April-May-June-July 2016), using the transect method to inventory woody plants. The developed method was recommended by Lejoly (1993) and Hall and Bawa (1993) and recently used by Todou *et al.* (2016). Ten linear transects (1000 m × 20 m) were established about more than 500 m one away from each other in order to cover the eastern part of the Park and to represent the maximum of species. In total, 20 ha were surveyed. Transects were recorded with a global positioning system (GPS) (Garmin Map 62S). Within each transect, all trees and shrubs (diameter ≥ 5 cm) were systematically recorded. Diameters were measured *at breast height (dbh)* for plants upper than 2 m high and at 0.33 m aboveground for those with diameters less than 2 m high. For multi-stem plants, the mean diameter was calculated according the following formula (Kabore *et al.*, 2013):

$$Dq = \sqrt{\sum_{i=1}^{n}(di^2)}$$

di is the diameter of the stem *i*.

Scientific names of the most common species was done directly in the field whenever possible. Some specimens were collected in order to authenticate scientific names in laboratory of Agriculture and Development Research Institute (IRAD) in Maroua.

Data analysis

Floristic composition

All recorded data of each transect were pooled and the total number of species and individuals were tallied. Using the pooled data, number of plants, number of species, number of genera and number of families were calculated. Richness of genera and family were also evaluated.

The relative specific abundances of each species were calculated according to Curtis and McIntosh (1950) formula:

$$RA = \frac{Ni}{Nt} * 100$$

Ni is the number of individuals belonging to species I and Nt is the total individuals number of all species.

The densities (D, stems/ha) of each species were calculated according this formula:

$$\mathrm{Di} = \frac{\mathrm{Ni}}{\mathrm{Sa}}$$

Ni is the number of individuals belonging to species i and Sa is the surveyed area in hectare.

Stand diversity

The stand diversity was described using the widely employed indexes to measure biological diversity (Magurran, 2004).

The Simpson's index was calculated according to formula:

$$E = 1 - \sum_{S=1}^{S} \mathrm{Pi}$$

S is the number of collected species. This index is dominance index because it focuses on common species. It is the probability that two individuals belong to two different species. It ranges between 0 and 1.

The Shannon Weaver index was calculated according to formula:

$$H = -\sum_{S=1}^{S} (Pi * \ln(Pi))$$

The diversity is low if H < 3; the diversity is moderate if 3 ≥ H > 4 and the diversity is high if H ≥ 4 (Yédomonhan, 2009).

The equitability index of Pielou was calculated using the formula:

$$J = \frac{H}{\mathrm{Hmax}} = \frac{H}{\ln(S)}$$

J ranges between 0 and 1. One species is present in the site if J = 0 and all species have same probability if J = 1. This index means that the degree of diversity reaches the possible maximum ratio.

Ecological importance of plants

Family Importance Values (FIV) was computed as the average of the relative basal area, density and frequency (Mori *et al.*, 1983).

Importance Value Index (IVI) was determined as the sum of relative frequency, relative density and relative dominance (Curtis and McIntosh, 1950; Sultana *et al.*, 2014).

The values of FIV and IVI determine vegetation status and importance of component species and families in a stratum stand. Theoretically the relative dominance, relative density, relative frequency and relative diversity range from 0 to 100%, thus the IVI and The FIV should vary from 0 to 300%.

Table 1. Genera/species ratio of the families with more than one species.

Families	G	S	G/S
Anacardiaceae	1	4	0.25
Annonaceae	2	2	1
Burseraceae	2	2	1
Caesalpiniaceae	9	10	0.9
Capparaceae	2	2	1
Combretaceae	3	16	0.18
Euphorbiaceae	3	3	1
Fabaceae	4	5	0.8
Loganiaceae	1	2	0.5
Meliaceae	3	3	1
Mimosaceae	6	10	0.6
Moraceae	1	3	0.33
Myrtaceae	1	2	0.5
Rubiaceae	4	6	0.66

Results and Discussion

Floristic richness

A total of 3792 invidious grouped in 84 species, 58 genera and 29 families, were identified in National Park of Sena Oura (Chad). The families/species ratio was 0.34, the families/genera ratio was 0.5 and the genera/species ratio was 0.69. These results were similar to the ones of Kalfou Forest Reserve where 28 families, 58 genera and 86 species were recorded (Froumsia *et al.*, 2012) and the ones of non-cultivated plain of Moutourwa where 28 families, 54 genera and 75 species were recorded (Todou *et al.* 2016).There were similar numbers of taxa may be because these sites are located in the same phytogegraphical region, sudano-zambezian region.

The species accumulation curve is a measure for the floristic representativeness of a botanical survey. It indicates how many new species are found when a surveyed area becomes enlarged. In this study, the curve became flatter and it was almost reaching an asymptote at 15 ha (Fig. 2). From this point onwards a further enlargement of the survey area would not increase the tree species spectrum. The trend of the species accumulation curve followed a natural logarithmic function ($y = 23.93\ln(x) + 13.16$; $R^2 = 0.97$). Species accumulation curve proved that the surveyed area is representative of the floristic assessment of the tree species composition. An almost complete tree species survey was carried out. According Lamprecht (1989) and Williamson (2001), the minimum representing area has been reached, when the increase in the number of species per unit area remains below 10% while the sample plot is enlarged in size by 10%.

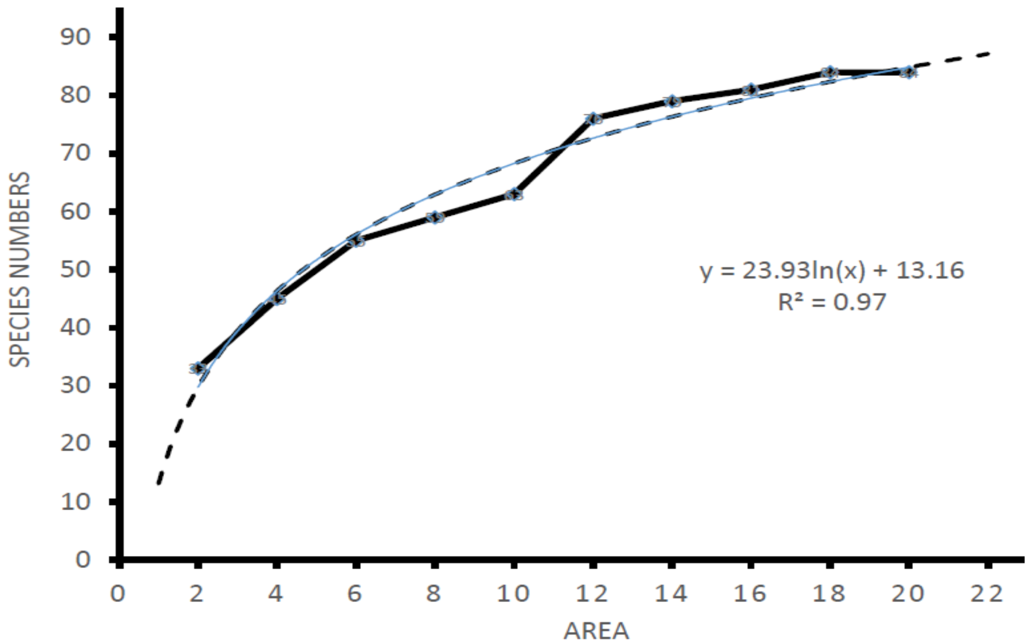

Fig. 2. Species accumulation curve.

Families' richness

In total, 29 families were inventoried. For the best visibility, richness of 14 families was indicated in Fig. 3. They were represented by more than one species. About 15 species were represented each by only one species. These were grouped in "Others". Combretaceae was the richer family with 16 species followed by Ceasalpinaceae and Mimosaceae (10 species each other). Rubiaceae and Fabaceae had respectively six and five species. Annonaceae, Burceraceae, Capparaceae, Loganiacea and Myrtaceae were represented by two species. In sahelo-sudanian zone in Cameroon, Todou *et al.* (2016) found Caesalpinaceae as the richer family in non-cultivated plain of Moutourwa and Froumsia *et al.* (2012) found Combretaceae as the richer family in the Kalfou Forest Reserve. In dry woodland sites of northeastern Botswana, Neelo *et al.* (2015) found that Fabaceae was the most diverse Family followed by Combretaceae. The genera/species ratio of families (Table 1) showed the lower value in Combretaceae (G/S = 0.18) followed by Anacardiaceae (G/S = 0.25) and Moraceae (G/S = 0.33). In addition to families with one only species, the most equitable families are Annonaceaea (G/S = 1), Burseraceae (G/S = 1), Capparaceae (G/S = 1), Ephorbiaceae (G/S = 1), Meliaceae (G/S = 1) and Caesalpinaceae (G/S = 0.99).

Table 2. List of all species and their ecological importance.

Familles	Species	Ni	RA	D	IVI
Anacardiaceae	*Lannea acida* A. Rich.	7	0.18	0.35	24.80
	Lannea barteri (Oliv.) Engl.	2	0.05	0.1	12.06
	Lannea velutina A. Rich.	74	1.95	3.7	103.31
	Lannea schimperi (Hochst. ex A. Rich.) Engl.	10	0.26	0.5	51.28
Annonaceae	*Annona senegalensis* Pers.	14	0.37	0.7	50.53
	Hexalobus monopetalus (A. Rich.) Engl. & Diels	4	0.11	0.2	20.42
Bignoniaceae	*Stereospermum kunthianum* Cham.	10	0.26	0.5	50.63
Bombacaceae	*Bombax costatum* Pellegr. & Vuillet	5	0.13	0.25	21.44
Burseraceae	*Commiphora pedonculata* (Kotschy & Peyr.) Engl.	11	0.29	0.55	20.87
	Boswellia alzielii Hutch.	1	0.03	0.05	10.26
Caesalpiniaceae	*Afzelia africana* Smith ex Pers.	19	0.50	0.95	75.17
	Burkea africana Hook. f.	300	7.91	15	98.69
	Piliostigma reticulatum (DC.) Hochst.	79	2.08	3.95	102.34
	Piliostigma thonningii (Schumach.) Milne-Redh.	52	1.37	2.6	71.77
	Tamarindus indica L.	45	1.19	2.25	103.27
	Cassia sieberiana DC.	7	0.18	0.35	51.57
	Daniellia oliveri (Rolfe) Hutch. &Dalz.	282	7.44	14.1	101.50
	Detarium microcarpum Guill. &Perr.	236	6.22	11.8	97.09
	Isoberlinia doka Craib & Stapf.	460	12.13	23	94.70
	Swartzia madagascariensis Desv.	45	1.19	2.25	61.50
Capparaceae	*Crateva adansonii* DC.	2	0.05	0.1	10.35
	Maerua angolensis DC.	1	0.03	0.05	10.65
Chrysobalanaceae	*Parinari curatellifolia* Planch. ex Benth.	10	0.26	0.5	20.68
Combretaceae	*Combretum collinum* Fresen.	107	2.82	5.35	73.09
	Combretum micranthum G. Don	5	0.13	0.25	10.72
	Combretum molle R. Br. ex G. Don	53	1.40	2.65	71.82
	Combretum paniculatum Vent.	22	0.58	1.1	10.98
	Anogeissus leiocarpus (DC.) Guill. &Perr.	206	5.43	10.3	107.09
	Combretum adenogonium Steud. ex. A. Rich.	81	2.14	4.05	73.19
	Combretum glutinosum Perr. ex DC.	175	4.61	8.75	95.06
	Terminalia albida Sc. Elliot	103	2.72	5.15	103.23
	Terminalia avicennioides Guill. &Perr.	59	1.56	2.95	82.19
	Terminalia brownii Fresen.	9	0.24	0.45	32.09
	Terminalia catappa L.	35	0.92	1.75	11.42
	Terminalia laxiflora Engl.	248	6.54	12.4	97.05

	Terminalia macroptera Guill. &Perr.	38	1.00	1.9	53.10
	Terminalia mantaly H. Perrier	3	0.08	0.15	15.34
	Terminalia mollis Laws.	9	0.24	0.45	10.71
	Terminalia schimperiana Hochst.	12	0.32	0.6	40.98
Dipterocarpaceae	*Monotes kerstingii* Gilg	212	5.59	10.6	75.90
Ebenaceae	*Diospyros mespiliformis* Hochst. ex A. Rich.	6	0.16	0.3	31.35
Euphorbiaceae	*Croton macrostachyus* Hochst. ex Del.	7	0.18	0.35	10.41
	Antidesma venosum Tul.	2	0.05	0.1	10.33
	Bridelia ferruginea Benth.	16	0.42	0.8	60.67
Fabaceae	*Erythrina sigmoidea* Hua	2	0.05	0.1	20.82
	Pericopsis laxiflora (Benth.) van Meeuwen	34	0.90	1.7	51.57
	Pterocarpus lucens Guill. &Perr.	175	4.61	8.75	106.37
	Lonchocarpus laxiflorus Guill. & Perr.	22	0.58	1.1	61.52
	Pterocarpus erinaceus Poir.	7	0.18	0.35	51.28
Hymenocardiaceae	*Hymenocardia acidaTul.*	40	1.05	2	82.29
Loganiaceae	*Strychnos innocua* Del.	48	1.27	2.4	41.68
	Strychnos spinosa Lam.	27	0.71	1.35	51.12
Meliaceae	*Ekebergia senegalensis* A. Juss.	1	0.03	0.05	11.39
	Khaya senegalensis (Desr.) A. Juss.	5	0.13	0.25	38.49
	Pseudocedra lakotschyi (Schweinf.) Harms	41	1.08	2.05	82.00
Mimosaceae	*Acacia erythrocalyx* Brenan	1	0.03	0.05	10.14
	Acacia gerrardii Benth.	2	0.05	0.1	10.63
	Acacia macrostachya Reichenb. ex DC.	22	0.58	1.1	31.57
	Acacia polyacantha (Hochst. ex A. Rich.) Brenan	6	0.16	0.3	22.18
	Acacia tortilis (Savi) Brenan	3	0.08	0.15	20.35
	Albizia zygia (DC.) J.F. Macbr.	1	0.03	0.05	14.38
	Parkia biglobosa (Jacq.) R. Br. ex G. Don	1	0.03	0.05	16.18
	Prosopis africana (Guill. & Perr.) Taub.	33	0.87	1.65	92.08
	Dichrostachys cinerea (L.) Wight & Arn.	1	0.03	0.05	10.18
	Entanda africana Guill. & Perr.	9	0.24	0.45	60.69
Moraceae	*Ficus sur* Forssk.	1	0.03	0.05	10.48
	Ficus thonningii Blume	1	0.03	0.05	10.34
	Ficus ingens (Miq.) Miq.	3	0.08	0.15	32.56
Myrtaceae	*Syzygium guineense* var. *macrocarpum* (Engl.) F. White	3	0.08	0.15	10.44
Olacaceae	*Ximenia americana* L.	58	1.53	2.9	81.77
Opiliaceae	*Opilia celtidifolia* (Guill. & Perr.) Endl. ex Walp.	6	0.16	0.3	30.95
Polygalaceae	*Securidaca longepedunculata* Fres.	1	0.03	0.05	10.20
Rhamnaceae	*Ziziphus mauritiana* Lam.	1	0.03	0.05	11.17
Rubiaceae	*Crossopteryx febrifuga* (Afzel. ex G. Don) Benth.	79	2.08	3.95	82.19
	Gardenia aqualla Stapf & Hutch.	12	0.32	0.6	50.51
	Gardenia ternifolia Schumach. & Thonn.	11	0.29	0.55	40.50
	Morelia senegalensis A. Rich. ex DC.	1	0.03	0.05	10.48
	Sarcocephalus latifolius (Smith) Bruce	28	0.74	1.4	101.79
	Feretia apodanthera Del.	3	0.08	0.15	10.21

Sapotaceae	*Vitellaria paradoxa* Gaertn. f.	4	0.11	0.2	31.01
Sterculiaceae	*Sterculia segitera* Del.	7	0.18	0.35	41.42
Tilliaceae	*Grewia lasiodiscus* K. Schum.	2	0.05	0.1	10.28
Ulmaceae	*Celtis integrifolia* Lam.	5	0.13	0.25	11.03
Verbenaceae	*Vitex doniana* Sweet	1	0.03	0.05	13.28

Ni = number of individuals belonging to species i; RA = relative abundance; D = density ; IVI Importance Value Index.

Generic richness

In total, 58 genera were inventoried in the Park. Richness of only 10 genera was indicated in Fig. 4 for the best visibility. They were represented by more than one species. About 48 genera were represented each by one species. They were grouped in "Others". The most diverse genus was *Terminalia* with nine species followed by *Combretum* (six species) and *Acacia* (five species). *Gardenia*, *Strychnos*, *Piliostigma, Pterocarpus* and *Zyzygium*had each two species. In degraded land of Ngaoundere (Adamawa, Cameroon), *Hymenocardia, Annona, Piliostigma* were the most abundant genera (Tchobsala and Mbollo, 2013).

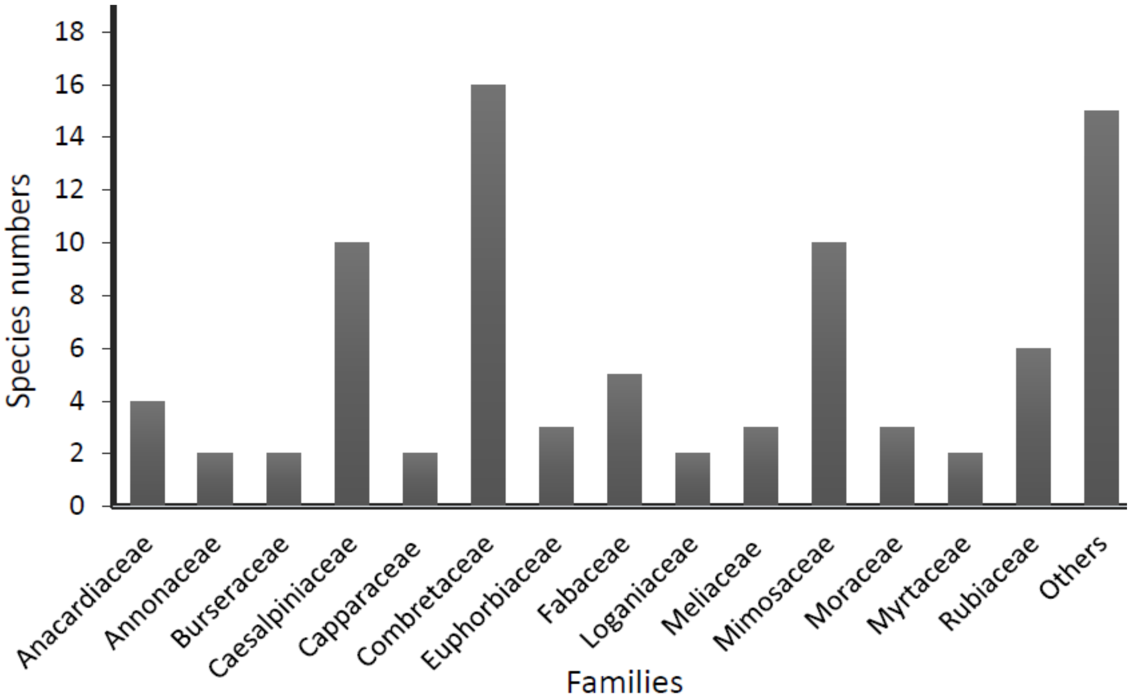

Fig. 3. Richness of most representative families.

Specific density and relative abundances

In total, 3792 plants grouped into S = 84 species were recorded in 20 ha (Table 2). Total plants density was 189.6 stems/ha. This density was slightly superior to the ones of non-cultivated plain of Moutourwa in Cameroon (D = 181.6 stems/ha; Todou *et al.*, 2016).

The most represented species was *Isoberlinia doka* (RA = 12.13%; D = 23 stems/ha) followed by *Burkea Africana* (RA = 7.91%; D = 15 stems/ha), *Daniellia oliveri* (RA = 7.43%; D = 14.1 stems/ha), *Terminalia laxiflora* (RA = 6.54%; D = 12.4 stems/ha), *Datarium microcarpum* (RA = 6.22%; D = 11.8 stems/ha), *Monotes kerstingii* (RA = 5.59%; D = 10.6 stems/ha) and *Anogeissus leocarpus* (RA = 5.43%; D = 10.3 stems/ha). The leftover stocks of species had density inferior to 10 stems/ha.

Fourteen species were least represented (RA = 0.02% and D = 0.05 stems/ha) because they were represented by only one individual (Table 1). Some fruits as *Parkia biglobosa, Vitex doniana and Ziziphus mauritiana* were among the rare species in National Park of Sena Oura.The results appeared to be similar to those of Letouzey (1985) because according to him, the medio-sudanian sector in Cameroon is essentially composed of *Isoberlinia doka* accompanied by *Anogeissus leiocarpus, Monotes kerstingii, Parinari curatifollia, Uapaca togoensis, Burkea africana* and other non-characteristic species. NPSO is located in similar ecological secteor. On the Adamawa plateau (altitude sudano-guinean sector), *Daniella oliveri*, *Lophira lanceolata, Albizia zygia, Vitex doniana* and *Sterculia sp.* were quoted as the most characteristic species (Letouzey, 1985; Tchotsoua and Gonne, 2010).

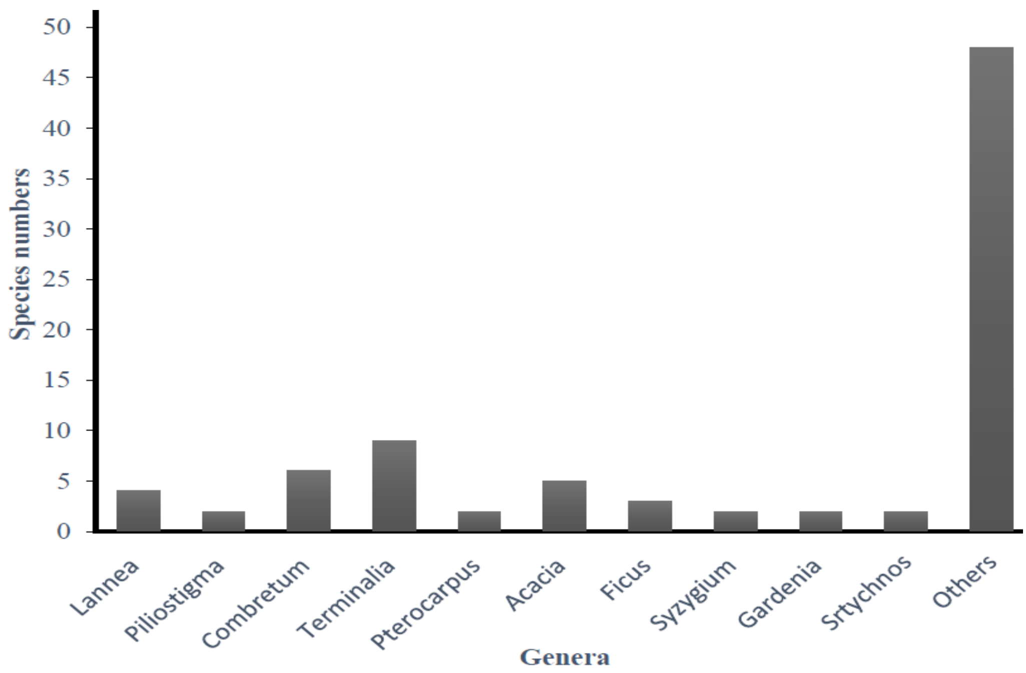

Fig. 4. Richness of most representative genera.

Table 3. Diversity characteristics in the stand

Parameters	Values
Number of individuals	3792
Specific richness	84
Number of genera	58
Nomber of families	29
Density (stems/ha)	189.6
Simpson index	0.95
Shannon Weaver index	3.41
Pielou equitability index	0.76

Stand diversity

According the Simpson index (0.95), the Shannon Weaver index (3.41) and the equitability index of Pielou (0.76), there was moderate diversity of woody plants in National Park of Sena Oura with more or least equitable species (Table 3). The systematic record of all trees and shrubs (diameter ≥ 5 cm) enabled to check off quasi-totality of woody plants in transects. The specific richness and the Shannon index showed moderate diversified flora (S = 84 species, $3 < H = 3.41 < 4$) but sufficient for sudanian landscape. The Shannon-Wiener index was usually found to fall between 1.5 and 3.5 and is rarely above 5.0 (Magurran, 2004). The found value in this inventory fall within the expected range.

Richard *et al.* (2011) similarly reported Simpson's index of diversity as D = 0.957 for the Miombo woodland of Bereku Forest Reserve, in Tanzania. But Zhigila *et al.* (2015) reported that Simpson's index of diversity was 0.526 in West Tangaza Forest Reserve, Sokoto State, Nigeria.

The species was more equitable and more diverse in eastern part of National Park of Sena Oura (located in sudanian domain) than in sites located in sahelian domain (plain of Moutourwa, Todou *et al.*, 2016 and Kalfou Forest Reserve, Froumsia *et al.*, 2012).

Table 4. List of all families and their ecological importance.

Familles	Nf	D	RD (%)	FIV
Combretaceae	1160	58	48.30	178.93
Caesalpiniaceae	1525	76.25	2.67	142.94
Fabaceae	240	12	1.92	108.26
Meliaceae	47	2.35	5.30	106.54
Anacardiaceae	93	4.65	3.90	106.36
Mimosaceae	79	3.95	2.20	104.28
Rubiaceae	134	6.7	0.72	104.26
Loganiaceae	75	3.75	0.78	92.76
Olacaceae	58	2.9	0.46	81.99
Hymenocardiaceae	40	2	0.44	81.50
Euphorbiaceae	25	1.25	0.48	81.14
Dipterocarpaceae	212	10.9	0.57	76.17
Annonaceae	18	0.9	0.44	70.92
Moraceae	5	0.25	1.66	51.79
Bignoniaceae	10	0.5	0.68	50.95
Sterculiaceae	7	0.35	2.34	42.53
Sapotaceae	4	0.2	6.17	36.27
Ebenaceae	6	0.3	2.26	32.42
Opiliaceae	6	0.3	1.50	31.65
Burseraceae	11	0.55	0.73	31.05
Bombacaceae	5	0.13	2.49	22.62
Myrtaceae	3	0.08	1.54	21.62
Chrysobalanaceae	10	0.26	0.79	21.06
Capparaceae	3	0.08	0.85	20.92
Verbenaceae	1	0.03	6.17	16.19
Rhamnaceae	1	0.03	2.17	12.20
Ulmaceae	5	0.13	1.70	11.83
Tilliaceae	2	0.05	0.44	10.49
Polygalaceae	1	0.03	0.32	10.35

Nf = number of individuals of Family; D = density (stems/ha) ; RD = Relative dominance ; FIV= Family Importance Values

Ecological importances

The most dominant tree species based on IVI scorewere *Anogeissus leiocarpus* (107.09), *Pterocarpus lucens* (106.37), *Lannea velutina* (103.31), *Tamarindus indica* (103.27), *Terminalia albida* (103.23), *Piliostigma reticulatum* (102.34), *Sarcocephalius latifolius* (101.79), *Daniellia oliveri* (101.50). Their IVI were superior to 100 (Table 2). The least dominant species was *Acacia erythrocalyx* (10.14). The most dominant families based on FIV score were Combretaceae (178.93 %), Caesalpiniaceae (142.94%), Fabaceae (108.26 %), Meliaceae (106.54 %), Anacardiaceae (106.36 %), Mimosaceae (104.28 %) and Rubiaceae (104.26 %). Their FIV were superior to 100 (Table 4). The least dominant family was Polygalaceae (10.35).

In the biosphere reserve, *Pterocarpus lucens, Guiera senegalensis and Combretum glutinosum* were the dominant species, but with the values of IVI equal to 18.1; 16,09 and 13,4 respectively (Ngom *et al*., 2013). In the periphery of Mbam and Djerem National Park in Cameroon, *Uapaca guineensis, Xylopia aethiopica, Maprounea membranacea, Berlinia grandiflora* and *Trilepisium madagascariense* were most dominant; Euphorbiaceae, Caesalpiniaceae and Annonaceae were most dominant (Souare *et al.,* 2012). The difference with the present study would be due to the fact that Mbam and Djerem National Park is located in a rainforest-savanna transition zone.

According to the importance values, *Anogeissus leiocarpus, Pterocarpus lucens*, *Lannea velutina*, *Tamarindus indica*, *Terminalia albida*, *Piliostigma reticulatum*, *Sarcocephalius latifolius*, *Daniellia oliveri*were the dominant species that IVI were superior to 100. Combretaceae, Caesalpiniaceae, Fabaceae, Meliaceae, Anacardiaceae, Mimosaceae, Rubiaceae were the dominant families.

Conclusion

The present study revealed a high diversity in species composition in eastern part of National Park of Sena Oura. Combretaceae, Ceasalpinaceae, Mimosaceae were the most abundant families but Annonaceae, Burceraceae, Capparaceae, Loganiacea and Myrtaceae were the least abundant with only two species. *Terminalia*, *Combretum* and *Acacia* were the most abundant genera. The present study showed that the eastern part of National Park of Sena Oura is the wooded savanna to *Isoberlinia doka*, *Burkea africana*, *Daniellia oliveri*, *Terminalia laxiflora*, *Datarium microcarpum*, *Monotes kerstingii*, *Anogeissus leocarpus.*

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