Floristic diversity and carbon stock of woody stands in some sacred forests in the West Cameroon region

Abstract

The vegetation of West Cameroon has been almost entirely destroyed, and the only remaining forests are mostly so-called "sacred" forests, which play a role in regulating the climate.The aim of this study was to assess the wood diversity and carbon sequestered by sacred forests in the Ndédivision. The inventories were carried out on 34 plots of 900 m2 each.To do this, all woody individuals with a diameter ≥ 10 cm at 1.30 m above ground level were counted. Floristic diversity was assessed using diversity indices. Allometric equations were used to estimate biomass in order to deduce the carbon stored by these forests.At the end of the surveys, 77 species belonging to 57 genera and 32 families were recorded. *Dracaena arborea* and *Cola* sp. were the most common species (64.71% and 94.12% respectively). The density of individuals varied from 299 stems/ha to 341 stems/ha in the forests studied.Basal area varied from 42.19 m²/ha to 53.28 m²/ha. Shannon index values are low in both forests (around 2±0.38 bit), indicating low specific diversity at the sites studied. Carbon values ranged from 286.89 tC/ha to 215.67 tC/ha in these sacred forests.*Cola* sp. and *Dracaena arborea* recorded the highest carbon values. Of the species recorded, 05 are vulnerable. This study reveals the importance of sacred forests for the conservation of biodiversity and their capacity to store carbon in order to contribute to the mitigation of greenhouse gases.

Key words: Sacred forests, Diversity, Carbon stock, West Cameroon, Greenhouse gases

Introduction

Forest ecosystems cover 31% of the planet's land area, equivalent to around 4 billion hectares (Fao, 2011). The largest fraction is in the tropical zone (1.8 billion hectares). Tropical forests are major reservoirs of biological diversity (Thatchou*et al*., 2015).They play a major role in regulating the climate and conserving biodiversity throughout the world. They provide a wide range of ecosystem services to humans, such as firewood, timber, medicines and fruit.However, these tropical forests are under human pressure not only for agricultural needs, but also for industrial timber exploitation, to the point where they are experiencing annual deforestation rates of 0.17% (Thatchou*et al*., 2015). This leads to massive losses in biodiversity, reduced ecosystem services and greenhouse gas emissions (Molto, 2012).In addition, some of these forests are called "sacred" and seem to be less influenced by human activities; they also contribute to the management of natural resources and the conservation of biodiversity (Wild and Mcleod, 2012). These sacred forests are found in South and South-East Asia, Latin America and Africa (Fode, 2019; Garcia*et al*., 2006). They are the site of traditional and religious rituals.The sacred forests of sub-Saharan African countries are characterized by very high biological diversity due to their position in the intertropical zone (Hounto*et al*., 2016). They provide non-timber forest products for food, medicinal and ritual needs, as well as regulating services (Tiokeng*et al*., 2019; Ngougni, 2017). The natural forests of the western highlands have been almost totally destroyed in favor of agriculture.Most of the existing relic forests are sacred forests. These play a significant role in the management and conservation of biological diversity. They have long been protected by prohibitions handed down from generation to generation (Tiokeng, 2007; Kitoko*et al*., 2020).

In Cameroon, several studies have been carried out in the sacred forests of the western highlands. For example, the work of Noumiand Tiam (2016) in the Oku sacred forest showed that *Piptadeniastrumafricanum* is the most dominant species; that of Ngougni (2017) reveals that the biodiversity of the sacred forests of Bafou, Baleveng and Bamendou is dominated by species such as *Albizia* sp. and *Aleurites moluccana*. Frederic*et al*. (2021) studied the woody diversity and carbon storage rate of the sacred forests of Kouoghap in Batoufam; their study showed that the value of carbon stored by this forest is 6.40 tC. ha-1 and the most abundant species are *Autranellacongolensis*, *Dacryodesbuttnerii*, *Vitex grandifolia* and *Polyscias fulva*. Very few studies have been carried out in the Ndé department.This is the case of the work by Mounmemi (2021), which revealed the presence of the endemic species *Dacryodesigaganga* in the sacred forests of the village of Bazou. However, eucalyptus forestry, bush fires, agrarian pressure and non-compliance with prohibitions have been identified as the main threats to certain sacred sites. All this previous work is still fragmentary and does not give a more complete picture of the vegetation of the sacred forests of the Western Highlands. Furthermore, no study has yet been carried out on the biomass and carbon sequestered by the sacred forests of Bangangté and Balengou.

It is with this in mind that this study was initiated in the sacred forests of Bangangté and Balengou in order to contribute to knowledge of the floristic diversity and carbon stock sequestered by the sacred forests of these two localities. More specifically, the aim is to assess the diversity and structure of the woody stands in these sacred forests and to estimate the quantities of carbon sequestered by these sacred forests.

Study area

The Western Highlands of Cameroon cover an area of 13,890 km² and reach an altitude of over 2,669 m (Kuete and Dikoume, 2000). The sacred forests selected are located in the Ndé department. The Bangangté group includes the sacred forests of Mandja (5° 9'49.27 "N, 10°32'34.41 "E, altitude 1271 m) and Banekane (5° 7'23.62 "N, 10°34'15. 85 "E, Alt: 1273 m), while the Balengou area has the sacred forests of Ndepla (5° 6'4.10 "N, 10°25'9.21 "E, Alt 1298 m) and Ndiop (5° 4'48.00 "N, 10°24'32.02 "E, Alt: 1379m) (Figure 1).The climate in this department is monsoonal and sheltered in the locality of Bazou, while in the localities of Bangangté it is sub-equatorial and not very humid. Annual rainfall fluctuates around 1,600 mm in Bazou and between 1,400 and 2,500 mm in Bangangté (PCD Bangangté, 2015; PCD Bazou, 2013).

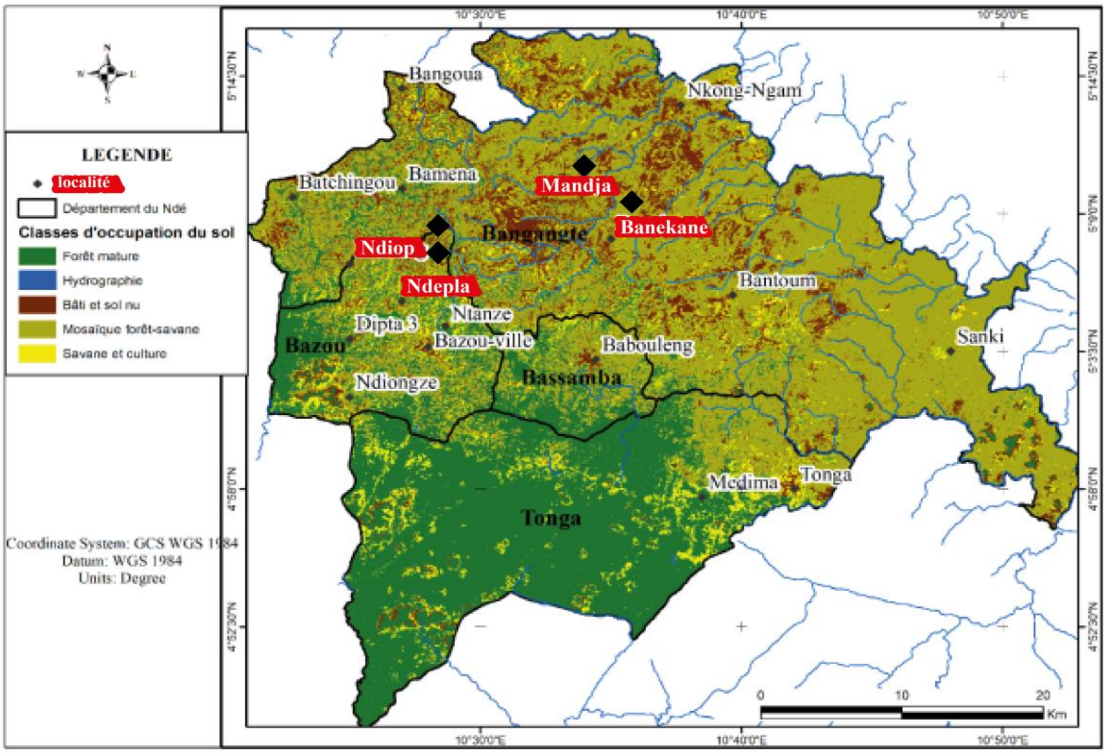

Figure 1: Location of study sites in the department of Ndé (Esther, 2020)

Vegetation sampling and floristic inventory

Thirty-four 30 m x 30 m (900 m²) plots were established in the sacred forests located between 1264 m and 1327 m altitude. The plots were positioned so as to cover all the different habitats present. In order to better assess the variation of species in the study sites, the plots were paired by grouping. Thus, 17 plots each were sampled in the Bangangté group (1264 m) and the Balengou group (1327 m) respectively. Only trees and shrubs with a diameter at breast height (1.30 m) greater than or equal to 10 cm were considered.

Any stem bifurcated before 1.30 m above the ground was treated as a secondary stem and also counted. For species with buttresses, diameters were taken at 0.30 m above the buttresses. Some species were identified on site using well-known vegetative characters and field guides such as Letouzey's Manuel de botaniqueforestièred'Afriquetropicale (1982). Unidentified species were collected and brought back to the Yaoundé Herbarium for identification by comparison with the herbarium samples.

Data analysis

The data were analyzed for parameters such as species richness, Shannon-Weaver index (H'), Piélou equitability index, Simpson index, basal area, density, importance value index (IVI), Sorensen index and biomass.

- Species richness (S) is the total number of species present in the population considered in a given ecosystem (Ramade, 2003). It is mainly expressed by the total number of species observed per unit area.

- Shannon-Weaver index (H'): This quantifies specific diversity, taking into account the proportions of each species (Shannon, 1948). The higher the value of this index, the greater the diversity. A value greater than 3.5 bits indicates high floristic diversity (Kent & Cooker, 1992; Ngougni, 2017). In a community of S species, the Shannon-Weaver index (H') is calculated according to the following formula:

$$H' = -\sum_{i-1}^{s} \frac{N_i}{N} \log_2 \left(\frac{N_i}{N}\right)$$

In this formula, H' is the Shannon diversity index,
Ni: the number of individuals of a species i with i ranging from 1 to S (total number of species),
N: the total number of individuals of all species combined in the environment,
S: the species richness of the plot or biotope under consideration
Log: the logarithm to base 2.
H' = 0 if all the individuals in the stand are represented by one and the same species, or if each species in a stand is represented by a single individual; H' will be at its maximum when all the individuals are equally distributed over all the species.

-The Piélou Equitability Index (EQ): This is the ratio between the observed diversity and the maximum possible diversity, given the total number of species N. It is used to compare the diversity of two quadrats with different diversity indices (Smith & Smith, 2001).

$$EQ = \frac{H'}{\log_2 N}$$

With H': Shannon's diversity index, $\log_2$ the logarithm to base 2

- Simpson's diversity index (1-D)

This gives the probability that two individuals selected at random from a population belong to the same species. The formula used to calculate it is :

$$D = \sum_{i=1}^{s} \frac{N_i(N_i-1)}{N(N-1)}$$

It is a diversity index that varies between 0 and 1. It tends towards a value of 0 to indicate minimum diversity, and a value of 1 to indicate maximum diversity (Schlaepfer, 2002).

stand structure was determined by parameters such as density, basal area and the distribution of individuals by diameter classes.

The **density** of individuals is the number of stems counted per hectare.

The **basal area** corresponds to the sum of the cross-sections at 1.30 m from the ground of the individuals in the stand. It is calculated per hectare and expressed in m²/ha. It is calculated using the following formula: $S = \pi D^2/4$, where S is the basal area of plot i, D: the diameter of the individual measured at 1.30 m from the ground and $\pi = 3.1416$.

Importance value (IVI) of Curtis and McIntosh (1950) which corresponds to the sum of the relative density (Dr), relative dominance (Gr) and relative frequency (Fr) of each species. It is calculated by the formula: IVI = Dr + Gr + Fr. It is used to characterise plant communities. The IVI provides information on the position that each taxonomic group occupies in relation to all the species within a plant community.

The conservation status of each species has been determined using the International Union for Conservation of Nature (IUCN) Red List. This is an essential indicator of the health of the world's biodiversity; it is a tool for informing and catalysing action to conserve biodiversity.The diversity indices were calculated using past 4.03 software.

The allometric equation of Djomo et al (2011) was used to estimate above-ground biomass: $AGB = \exp(-2{,}436 + 0{,}139 \times (\ln D)^2 + 0{,}737 \times \ln(D^2H) + 0{,}279 \times \ln(\rho))$

With: AGB = Above-ground biomass; ρ=Specific density; DBH =Diameter at Breast Height.

Below-ground biomass was calculated using the allometric equation of Cairns et al (1997), which is a function of above-ground biomass:

$$BGB = \exp(-1{,}0587 + 0{,}8836 \text{ x } \ln(ABG))36x\ln(ABG))836 \text{ x } \ln(ABG))$$

ABG: Above-ground biomass BGB: Below-ground biomass

The total biomass was evaluated by adding the above-ground biomass to the below-ground biomass: TB = AGB + BGB

The carbon stock is obtained from the recommendations of the IPCC guidelines (IPCC, 2006) by multiplying the above-ground biomass obtained by the default value of 0.47.

Results

Floristic composition and species diversity of the sacred forests

The inventories enabled 980 individuals to be counted in 77 species, 56 genera and 32 families. The number of individuals varied from 522 to 458 (490±45.3) per zone.Shannon diversity indices ranged from 2.03±0.26 bits in the Balengou sacred forest to 2±0.38 bits in the Bangangté sacred forest (Table 3). The Piélou equitability index is 0.88±0.07 in Bangangté and 0.85±0.05 in Balengou.) Basal area was 53.28 m².ha-1 in the Balengou forest and 42.19 m².ha-1 in the Bangangté forest.

Table 1: number of individuals, species, genera, land areas and diversity indices recorded at the study sites.

	Ni	Ne	Ng	D(tiges/ha)	ST (m^2/ha)	H'(bit)	Eq	D'
Bangangté	458	55	38	299	42,19	2±0,38	0,88±0,07	0,82±0,08
Balengou	522	48	41	341	53,28	2,03±0,26	0,85±0,05	0,82±0,06

Ni: number of individuals, Ne: number of species, Ng: number of genera, H': Shannon index, D': Simpson index, ST: basal area

Family importance values

The most important families according to family importance value (FIV) in the Bangangté sacred forest are Asparagaceae (FIV = 42.88%), Burseraceae (31.98) and Euphorbiaceae (31.88%), whereas in Balengou, Malvaceae (FIV = 66.12%), Burseraceae (34.50%) and Olacaceae (30.99%) (Table 2).

Table 2: Most important families (IVI ≥ 8%) in the two forests

	Families	Dr	Fr	Do	IVI
Bangangté	Asparagaceae	12,23	7,27	23,38	42,88
	Burseraceae	6,77	7,27	17,93	31,98
	Euphorbiaceae	12,88	12,73	6,27	31,88
	Moraceae	9,39	8,48	6,89	24,77
	Malvaceae	8,08	9,09	6,57	23,74
	Anacardiaceae	6,77	6,67	8,74	22,18
	Fabaceae	6,11	5,45	5,32	16,88
	Ericaceae	4,15	2,42	5,26	11,83
	Arécaceae	4,15	3,64	2,74	10,53
	Araliaceae	3,28	4,85	1,88	10,00
Balengou	Malvaceae	19,35	8,51	38,26	66,12
	Burseraceae	11,30	6,91	16,29	34,50
	Olacaceae	13,60	7,98	9,41	30,99
	Moraceae	9,00	13,30	6,17	28,47
	Fabaceae	4,41	7,98	5,91	18,30
	Bignoniaceae	6,70	7,45	3,09	17,24
	Magnoliaceae	7,66	5,32	3,30	16,28
	Euphorbiaceae	5,17	7,98	1,97	15,12
	Calophyllaceae	3,83	4,26	2,23	10,31
	Araliaceae	3,45	4,79	1,40	9,64

Dr: relative density; Fr: relative frequency; Do: relative dominance; IVI: species importance value.

The most common families are Euphorbiaceae (12.73%) in Bangangté and Moraceae (13.30%) in Balengou, while the most dominant are Asparagaceae (23.38) in Bangangté and Malvaceae (38.26) in Balengou.

Importance Value Index

Analysis of table 3 shows that relative density, relative frequency, relative dominance and Importance Value Index vary from one species to another.

Table 3: Importance value (IVI ≥8%) of the ten most important species in the two forests.

	Species	**Dr**	**Fr**	**Do**	**IVI**
Bangangté	*Dracaena arborea*C. Koch	12,01	6,67	23,35	42,03
	*Canariumschweinfurthii*Engl.	5,68	5,45	17,51	28,64
	*Brideliaferruginea*Benth.	6,11	4,24	4,87	15,23
	Agauriasalicifolia(Lam.) Oliv	4,15	2,42	5,26	11,83
	Ficus sp.	4,37	3,03	4,20	11,60
	*Elaeis guineensis*Jacq.	4,15	3,64	2,74	10,53
	Polysciasfulva(Hiern) Harms	3,28	4,85	1,88	10,00
	*Acacia albida*Delile	4,59	3,03	1,98	9,60
	*Macaranga spinosa*Mûll.Aeg.	3,71	4,85	0,81	9,37
	Vitex doniana Sweet	2,84	2,42	2,77	8,03
Balengou	*Cola spp.*	19,35	38,26	8,51	66,12
	*Strombosiaglaucescens*Engl.	8,24	6,42	4,79	19,45
	*Canariumschweinfurthii*Engl.	6,32	7,48	4,79	18,59
	*Magnolia macrophylla*Michx.	7,66	3,30	5,32	16,28
	*Aucoumea klaineana*Pierre	4,98	8,81	2,13	15,92
	Markhamia lutea (Benth.) K.Schum.	6,13	2,66	6,38	15,18
	Albizia zygia(D.C.) .J. F.Macbr.	3,07	4,65	4,79	12,51
	*Strombosiopsistetrandra*Engl.	5,36	2,98	3,19	11,54
	*Mammeaafricana*Sabine	3,83	2,23	4,26	10,31

Polysciasfulva(Hiern) Harms	3,45	1,40	4,79	9,64

Dr: relative density, Fr: relative frequency, Do: relative dominance, IVI: species importance value.

Among the most important species are Dracaena arborea (42.03%), *Canarium schweinfurthii* (28.64%) and *Brideliaferruginea* (15.23%) in the Bangangté sacred forest, while in the Balengou sacred forest we find Cola spp. (66.12%), *Strombosiaglaucescens* (19.45%) and *Canarium schweinfurthii* (18.59%). Generally speaking, the species with the highest relative importance values also have significant relative abundance and relative dominance values. The most frequent species are *Dracaena arborea*, *Canarium schweinfurthii* and *Polyscias fulva* in the Banganté sacred forest and *Cola*spp, *Aucoumeaklaineana* and *Canarium schweinfurthii* in Balengou.

Diameter classes

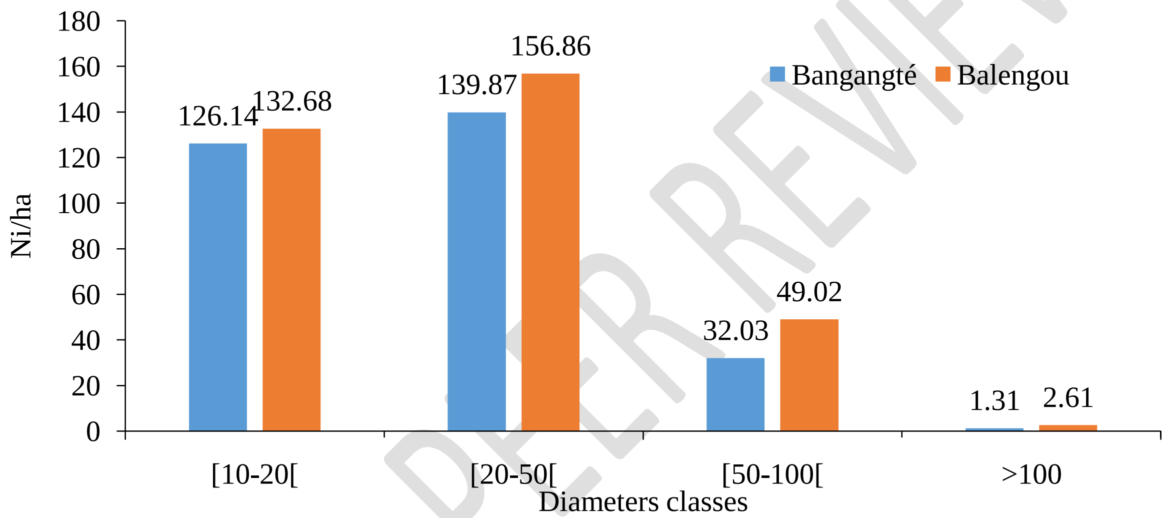

Figure 2: Distribution of individuals (Ni) by diameter class in the two localities

Figure 2 shows the distribution of individuals by diameter class. The distribution is bell-shaped, with a peak in the 20 to 50 cm diameter class and a reduction in individuals with diameters greater than 50 cm.

Floristic similarity between sites

Comparison of the stands gives a Sorensen coefficient value of less than 50% (table 4). This result shows that, from a floristic point of view, the stands compared do not belong to the same plant community (K being less than 50) (Sorensen = 47.79%).

Table 4: Floristic similarity between the two localities

	Bangangté	Balengou
Bangangté	1	47,79
Balengou	47,79	1

Biomass and carbon stock estimates across the study area

The highest biomass values were observed in the Balengou sacred forest, with a high carbon stock of 286 TC/ha. The lowest value was obtained in the Bangangté sacred forest (Table 5).

Table 5: Total biomass and carbon stock recorded in each forest.

	ABG (tMS/ha)	BGB (tMS/ha)	BT (tMS/ha)	ST (t c/ha)
Bangangté	348,84	110,03	458,87	215,67
Balengou	463,70	146,70	610,40	286,89

ABG: above-ground biomass, BGB: below-ground biomass, BT: total biomass, ST: carbon stock.

Certain species showed the highest carbon values. these include:*Cola* spp. (123,1 tC/ha), *Aucoumeaklaineana* (27,61 tC/ha), *Albizia zygia* (15,94tC/ha), *Strombosiaglaucescens* (15,016 tC/ha) à Balengou; puis de *Dracaena arborea* (56,12tC/ha), *Canarium scheinfurthii* (45,75tC/ha), *Agauriasalicifolia* (13,03tC/ha), *Erbromaoblongum*(11,95tC/ha) à Bangangté.Globally, the species showing the highest carbon values differ from one forest to another.

Special-status species recorded in the forests studied

The general list of species recorded reveals the presence of 5 species of special status (Table 6). This table shows that 3 species are vulnerable. These are species such as *Khayaivorensis*, *Lophiraalata* and *Eribromaoblongum* and near-threatened (NT) species such as *Magnolia macrophylla* and *Milicia excelsa*. The rest of the species do not yet appear to have been reviewed by the International Union for Conservation of Nature.

Table 6: Species with special status

Famille	Espèces	**UICN**
Magnoliaceae	*Magnolia macrophylla*Michx.	NT
Malvaceae	*Eribromaoblongum*Mast.	VU
Méliaceae	*Khayaivorensis* A. Chev.	VU
Ochnaceae	*Lophiraalata* Banks ex C.F.Gaertn	VU
Urticaceae	*Milicia excelsa* (Welw.) Beth. &Hook.f.	NT

VU = Vulnerable; NT = Near Threatened

Discussion

Species richness

The results of the inventories carried out within the stands of the Bangangté and Balengou sacred forests revealed an almost equal number of species, ranging from 48 species in Balengou to 55 species in Bangangté; this reflects the low species richness of the sites.

These values could be explained by the presence of these two forests in the same geographical area, with very little variation in altitude (1264 m and 1327 m respectively in Bangangté and Balengou). This species richness is higher than that obtained by Tiokeng*et al*. (2020), which varied between 21 and 26 species in certain sacred forests of the West Cameroon Highlands, and Noumi and Tagne (2016) in the sacred forests of Mount Oku (31 species).However, these species richnesses are lower than those found in the Benin sacred forest (89 species) by Hounto*et al*. (2016).

The most diverse botanical families within the two forest patches in terms of species are Moraceae (6 species), Euphorbiaceae (5 species) and Malvaceae (4 species). The high diversity within these families would indicate good regeneration of species from these different families in the study area. Similar results were recorded by Ngougni (2017) and Tiokeng (2008) in the sacred forests of Menoua and Bamboutos. The Burseraceae are also among the most important families; their presence in these sacred forests is a sign that they are the result of dense Atlantic forests (Gonmadje*et al*., 2011;Tiokeng*et al*., 2019). There is also a relative abundance of the Cola genus in Balengou. The trees in Balengou are dominated by the *Cola* sp. genus, which in ancient times would have been a species with high financial returns for the village.

Individual density

The densities obtained at the different study sites were 341 stems/ha at Balengou and 299 stems/ha at Bangangté. The difference between the two could be explained by the low anthropogenic influence noted in the sacred forest of Balengou compared with that of Bangangté. These values are lower than those of Fréderic*et al*. (2018) in the Batoufam sacred forest (429 stems/ha); then of Tiokeng*et al*.,2019 in the MbingMekoup sacred forest (926 individuals/ha), in the Bamendou sacred forest (878 individuals/ha) by Tiokeng*et al*. (2020) and of Ali*et al*. (2014) in the sacred forests of south-east Benin (103 individuals/ha).

Basal area

The basal area values were 53.28m²/ha and 42.19m²/ha respectively in the sacred forests of Balengou and Bangangté. The difference in basal area between the two sites suggests that the size of the diameter of the individuals and even the densities varied from one sacred forest to another. These values are close to those obtained by Mounmeni (2021) in the sacred forests of Bazou (30.35 m2/ha); then by Tiokeng*et al*. (2020) in the sacred forest of MbingMekoup and Bamendou (45 m2/ha and 39 respectively), Djomo (2015) found in the east of Cameroon in the unexploited area of the Yokadouma communal forest (35.30 m2/ha) and Tajeukem *et al*. (2014) in the Gribe community forest in south-east Cameroon (49.70 m2/ha). However, these values are lower than those of Noumiand Tiam (2016) in the sacred forest of Mont Oku (205.02 m2 /ha) and Noumi (2012) in the sacred forest of Kouoghap (90.36 m2 /ha).

Diversity

The mean values of the Shannon index obtained in the Bangangté (2±0.38 bits) and Balengou (2.03±0.26 bits) sacred forests are low. This would indicate low specific diversity in the sacred forests studied. According to Kent and Coker (1992), rich communities have Shannon diversity values greater than or equal to 3.5 bits. This may be due to the low specific variation regularly observed in high-altitude zones such as the case of the present study, but also to the surface area of these forests, which is sometimes very small. These results are close to those obtained by Fredericet *al*. (2018) in the Batoufam sacred forest (2.98 bits) and by Ngougni (2017) in the Bafou sacred forest (2.53 bits).

The Piélou equitability index is 0.88 and 0.85 at Bangangté and Balengou respectively. These values are said to be optimal according to Odum (1976) because they are between 0.6 and 0.8. They reflect the stability of these plant communities. These results are comparable to those of Tiokenget *al*. (2015) in the forests of the Lebialem Highlands (West Cameroon) (0.52 and 0.96) and those of Kengneet *al*. (2018) in the logged Kompia and Nkolenyeng Community Forests in East Cameroon. The Simpson diversity index values recorded in these sacred forests are 0.82 in Bangangté and 0.82 in Balengou. These results are average and reflect the average diversity of these sites. The results of this study are similar to those recorded by Mounmemi (2021) in the sacred forests of Bazou (0.94).

Vegetation structure

The diametric structures showed a high density of individuals in the 20-50 cm diameter class, which would indicate unstable regeneration over time and relative disturbance of the stand. This type of vegetation distribution was also observed by Ngounni (2017) in the sacred forests of Bafou. However, work carried out by other researchers in the sacred forests of Cameroon and Benin has instead shown an inverted J-shaped structure, where the number of individuals decreases as the diameter class increases (Tiokenget *al*., 2020; Fredericet *al*., 2018; Noumi and Tagne, 2016; Agbaniet *al*., 2018).

Carbon stock

The carbon stocks obtained are higher in the Balengou sacred forest (286.89 tC/ha) than in the Bangangté sacred forest (215.67 t C/ha). These differences are thought to be linked to the abundance of large-diameter trees in Balengou compared with Bangangté. The carbon values recorded in this study are lower than those of Ngougni (2017), which are respectively 207.46 t C/ha in the Bafou sacred forest and 168.58 t C/ha in the Baleveng sacred forest. However, they are higher than those found by Tsalefacket *al*. (2016) in the Baleng forest reserve (West Cameroon) (120 t C/ha), by Fréderic et al. (2018) in the sacred forests of Batoufam (128 t C/ha) and by Ngomeni et al. (2021) in robusta coffee (*Coffea canephora* var. *robusta*) agroforests in Ayos (67.84±45.41 t C/ ha) and Nkongsamba (41.94±15.50 t C/ ha). In general, the differences observed in these values could be due to the methodological approach adopted by each author, but also to the structure of each stand studied.

Conclusion

This study, carried out in the sacred forests of Balengou and Banganté, shows a low species richness in both sites. The most predominant species and families are sometimes different from one sacred forest to another. The distribution of individuals by diameter class is characteristic of a stand disturbed by human activity. The carbon stocks sequestered by these forests vary from one forest to another. These quantities also differ from one species to another. According to the International Union for Conservation of Nature (IUCN) red list of species, there are 5 species in a vulnerable situation in these sacred forests, which calls for even greater attention to be paid to them. This work shows that the sacred forests of West Cameroon, despite their relatively small surface area, are of great importance in the fight against climate change and in maintaining phytodiversity. Management strategies for these relic forests should be strengthened in order to optimize their stewardship.

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