DIVERSITY OF WOODY PLANT SPECIES IN THE GALLERY FORESTS OF BABESSI SUB DIVISION, NORTH-WEST REGION OF CAMEROON

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ABSTRACT: This study aimed at documenting and comparing the floristic diversity and forest structure of woody plant species in the four villages in Babessi subdivision, Ngo-ketunjia Division. Systematic sampling was used to collect data from 8 main plots (50 m×50 m each). Two main plots were selected from each of the four villages. Each main plot was then subdivided into five subplots of 10 m×10 m. By moving through these subplots all the woody plant species with diameter at breast height (DBH) superior or equal to 5 cm (1.3 m above the ground) were individually measured and recorded. The parameters of floristic diversity such as species richness, basal area, Pielou's evenness index, Sorensen similarity coefficient, Simpson's index of dominance, the Shannon-Wiener index, and frequency were calculated using Microsoft Excel 2016. A total of 105 woody plant species distributed in 80 genera and 37 families were inventoried. The 3 most important families in terms of similarity, diversity and dominance were Rubiaceae (13), Euphorbiaceae (12) and Fabaceae (10). Five species were of high conservation priority. Bangolan had the highest number of woody plant species diversity (49) and abundance followed by Baba I (45), Babessi (37) and Babungo (25) respectively. Anthropogenic activities, unsustainable means of exploitation coupled with urban growth were major threats to the gallery forests of this locality. Therefore, it is recommended that appropriate timely measures should be taken by all stakeholders to sustain utilization of vegetation of the study area so as to maintain its biodiversity and provision of ecosystem services.

Keywords: Biodiversity, Gallery Forest, species diversity, and woody plants.

INTRODUCTION

Gallery forests are part of tropical savannas and mostly found in narrow forest patches in proximity to streams and rivers (González-Abella et al., 2021). Gallery forests in savannas represent one of the few examples of naturally fragmented tropical forests (Ajonina et al., 2020). They are generally rich in woody plant species like, *Ficus* spp, *Vitex doniana*, *Polyscias fulva*, which form a ridge of forests and are postulated

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to have provided refugee for tropical forest species in areas deforested during the Pleistocene drought (Ajonina et al., 2020).

Forests are important to humans as humans depend directly or indirectly on forest products like firewood, food, medicine and other non-timber forest products (Megeyand, 2013) as well as other ecosystem services (regulatory, supporting and cultural) (González-Abella et al., 2021). Thus, there is a rapid and increasing change in land use for local subsistence in the Western Highland regions of Cameroon which has resulted to an unprecedented destruction and fragmentation of riparian areas of gallery forests resulting in a few scattered forest patches on the landscape (Solefack et al., 2018).

There has been a growing interest of ecological research in ascertaining the processes underlying the assembly, dynamics, and structure of ecological communities. Such information is useful not only in understanding plant community structure and species distribution variability at a spatial scale (Solefack et al., 2018) but also in providing insight into the environmental requirements of the tree species needed for successful ecological restoration and biodiversity conservation.

This ecosystem has been under serious pressure from the local people. Despite the rich biodiversity of this ecosystem, there exists very little documentation on the species composition and vegetation structure in the Western Highlands of Cameroon. There are very few studies on the potentials of this ecosystem in the world (González-Abella et al., 2021; González-Rivas et al., 2006) and in Cameroon (Ajonina et al., 2020; Zeh et al., 2019). A threat on this ecosystem could lead to the local extinction of some globally threatened plant species, disturbance of watershed and affect livelihoods. These studies have not given enough information on the diversity of woody plants and vegetation structure in the Western Highlands of Cameroon. Furthermore, no research work has been done on the diversity of woody plant species in the gallery forests of Babessi subdivision. This work therefore aims to contribute to the documentation of biodiversity focusing on the diversity, forest structure and distribution of woody plants species in the gallery forests of the four villages of Babessi subdivision in Cameroon.

MATERIALS AND METHODS

Description of the study area

Babessi subdivision is located in Ngo-ketunjia division in the North West Region of Cameroon between latitude $6^{0}01'00''$ to $6^{0}8'00''$ N and longitude $10^{0}34'00''$ to $10^{0}24'00''$ E (Njoya, 2016). It consists four villages: Babungo, Baba I1, Babessi and Bangolan (Figure 1). The climate of this Subdivision is made of two distinct seasons: dry season starting from November to February and the rainy season from March to October. The average rainfall in this area varies from 1270mm to 1778mm. The maximum annual temperature varies from 27.2 to 33^{0}C and the minimum range between 7.8 and 15.0^{0}C. The main vegetation type is savannah with short stunted trees. Natural gallery forests are found in some valleys alongside man planted vegetation like palm trees and raffia palms (Njoya, 2016).

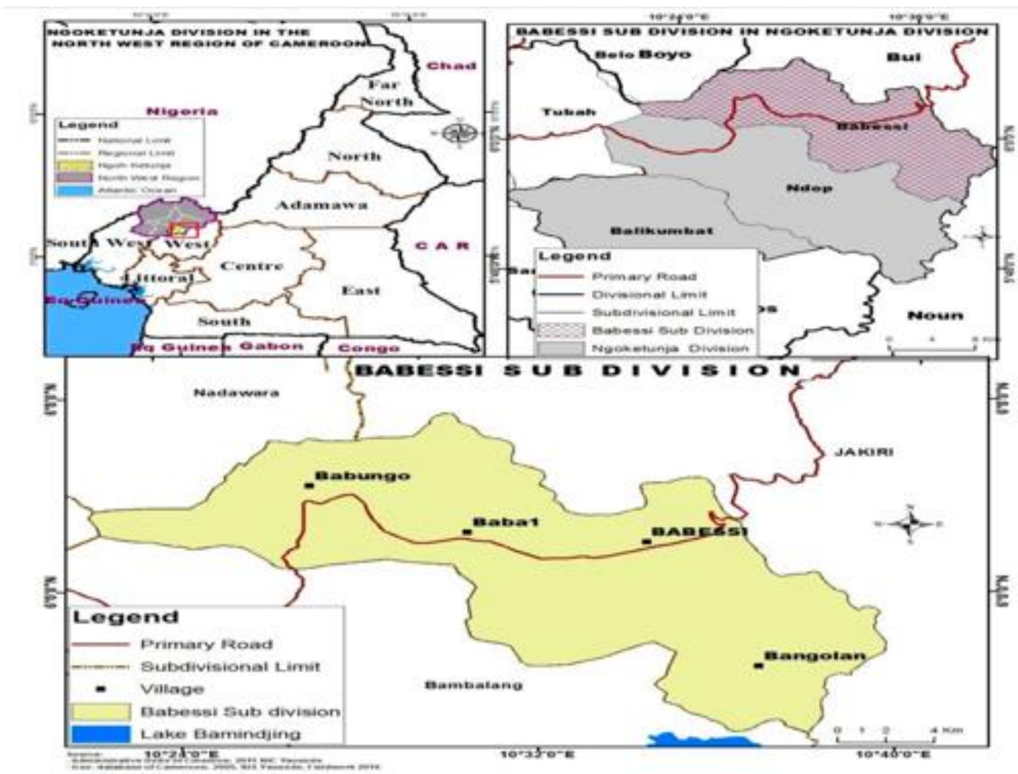

Figure 1. Map of Babessi subdivision showing the study site.

Source: Administrative units of Cameroon 2011. NIC Yaounde Geo-data base of Cameroon 2005 NIS Yaounde, field work 2016.

Sample collection

Data were collected in the four villages that constitute Babessi subdivision that is Bangolan, Babessi, Baba I and Babungo from March to May 2018. In each village, two gallery forests were selected for the study based on information gathered from villagers on the state of conservation, and the potential diversity. In each gallery forest, 2 main plots of 50 m × 50 m (2500 m^2) were mapped out using a decameter in the most conserved part of the gallery forest at a distance of 100 m apart. After taking the coordinates using a global positioning system (GPS Garmin etrex 10), each plot was subdivided into 10 m ×10 m subplots. A botanic walk was made through all the subplots and all the woody plant species of diameter DBH ≥ 5 cm at 1.3 m above the ground were identified, individually measured, and the number of individual trees in each subplot was counted for all the villages in the subdivision and recorded. The DBH of the woody plant species at 1.3 m above the ground were measured using a diameter tape. Trees were identified to species level where possible by an experienced taxonomist and the use of vegetative characters and field guides such as Manuel de Botaniques forsetiere d'Afrique (Letouzey, 1982) and samples of unidentified trees were collected and added to those already identified for proper identification at the Cameroon National Herbarium Yaoundé (YA). This permitted the establishment of a preliminary checklist of woody plant species in the gallery forest of the Subdivision. The conservation status of each species was investigated using the Red data book of the flowering plants of Cameroon (Onana et al., 2011).

Data analysis

All data were analyzed using Microsoft Excel 2016 of Microsoft office software package version 2.

Comparison of woody plant species diversity

To assess and compare the plant diversity in the Sub-Division and among the villages, some parameters were evaluated, these included: taxonomic richness, Shannon diversity index (H'), Pielou's evenness index (J), Simpson diversity index (D'), Sorensen similarity coefficient (Ss), and Frequency.

Taxonomic richness was evaluated by taking into consideration the number of taxa at the rank of species, genera and families.

The Shannon-Weaver Diversity Index (H') is a measure of the potential for interaction between the species that make up a community. This index takes into account the number of species present and the distribution of individuals within those species. It was calculated using the following formula:

$$H' = -\sum (\mathrm{ni}/\mathrm{N}) \ln (\mathrm{ni}/\mathrm{N})$$

Where, ni is the number of individuals of a given species i, and N the total number of individuals within the plot.

Pielou's evenness index (J') was calculated using the formula:

$$J' = \mathrm{H}'/\ln \mathrm{S}$$

Where, ln S = H' max (the maximum value of Shannon diversity) is what H' would be if all the species in the community had an equal number of individuals; S is the number of species. When J=1, it indicates little variation within species and J=0 indicates high variation between species.

The Simpson's diversity index (D') is the probability that two randomly selected individuals are of different species. It was calculated using the formula below. The maximum diversity is represented by the value 1 and the minimum diversity by the value 0.

$$D' = 1/\ \Sigma \mathrm{Pi2}$$

Where, Pi = the proportional abundance of species.

Sorensen similarity coefficient (Ss) is an index used for comparing the similarity of two samples in a community. It is calculated using the following formula:

$$Ss = 2\mathrm{C}/\mathrm{A} + \mathrm{B}\ \times\ 100$$

(where A= number of species found only in site I; B = number of species found only in site II and C = number of species found in both sites).

The relative frequency of species occurrence was calculated using the formula below according to Raunkiaer (1934).

$$F = \mathrm{n}/\mathrm{N}$$

In the equation, “F” represents the frequency, “n” the number of villages where the species was found and “N” the total number of villages involved in the study.

As the degree of presence allows to appreciate the floristic homogeneity of plant communities (Dajet, 1976), the species were classified in four classes since the study was done in four villages. Hence, the follows were adapted Class A: 25% (species present only in one village, considered as rare species), Class B: 50% (species present only in two villages, considered as fairly common species), Class C: 75% (species present only in three villages, considered as common species) and Class D: 100% (species present in the four villages, considered as ubiquitous or very common species).

Assessment of the vegetation structure of the gallery forests

Vegetation structure was determined by parameters such as density, basal area and distribution of individuals by diameter classes (DBH). For density (D), the number of individuals per hectare was calculated by converting the total number of individuals encountered in all plots to equivalent number per hectare, following the formula below where D is the density (stems ha-1), N is the number of stems present on the considered surface and S the area considered.

$$D = \mathrm{N}/S$$

For diameter classes, the trees were grouped into 7 DBH classes of class size 20 grouped as follows: 5 - 25 cm, 26-45 cm, 46-65cm, 66-85cm, 86-105cm, 106-125 cm and 126-145.

Concerning the basal area (BA) that provides information on the area occupied by tree sections at 1.30 m from the ground, the formula used was:

$$BA = \pi/4 \sum (\mathrm{Di}^2)$$

Where, BA is basal area (m^2 ha-1) and Di is diameter (m) for each measured tree section (i).

RESULTS

Woody plant diversity and distribution in gallery forests of Babessi subdivision

Preliminary check list of species

A total of 105 woody plant species were identified in the subdivision. The preliminary check list of woody plant species in the gallery forests of this subdivision are presented in Appendix 1. Among these species, five were found to be of conservation priority. These included *Polyscias fulva, Khaya senegalensis, Mitragyna stipulosa, Allophylus hematus* and *Vitellaria paradoxa*.

Taxonomic richness

The distribution of the 105 species identified in the subdivision ranged from 49 in Bangolan to 25 in Babungo. A similar trend followed for the genera with 42 for Bangolan to 22 in Babungo but for the family with 26 in Bangolan to 15 in Babungo (Figure 2).

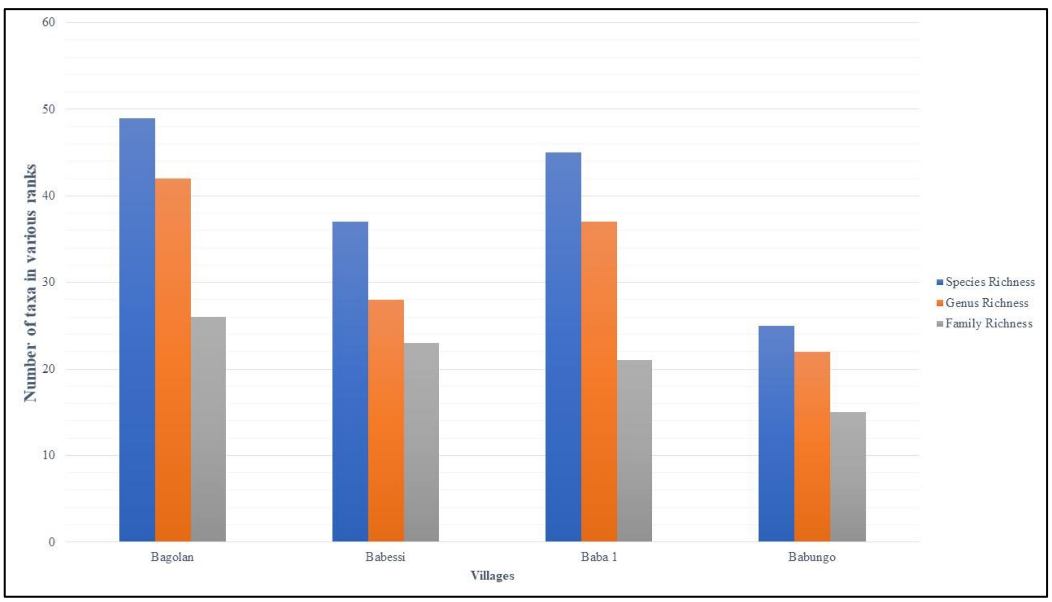

Figure 2. Bar charts showing species, genera and family richness per village.

The distribution of the dominant families in the subdivision varies from one village to another (Figure 3), with families Moraceae, Rubiaceae, Eurpobiaceae and Fabaceae having the highest number of species in the area.

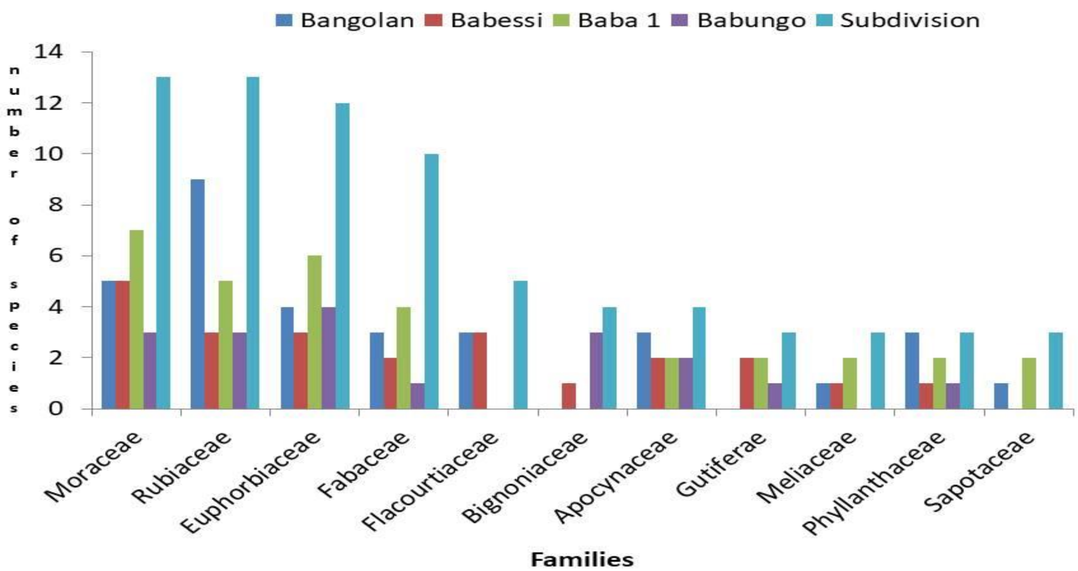

Figure 3. Dominant families and distribution in Babessi Sub-division

Floristic diversity of the different study sites

The floristic diversity of the Subdivision is poor. The Shannon-Weiner diversity index ranged from 3.371 in Baba I to 2.688 in Babungo. Simpson dominance index value ranged between 0.042 - 0.091. The Pielou's evenness index values ranged from 0.538 in Bangolan to 0.705 in Babessi (Table 1).

Table 1. The Shannon-Weiner diversity index (H'), Pielou's evenness index (E), and Simpson's index of dominance (D) of the different study sites.

	No. of Species	H'	D	E
Babungo	25	2.688	0.091	0.589
Babessi	37	3.296	0.047	0.705
Baba I	45	3.371	0.042	0.636
Bangolan	49	2.994	0.083	0.538

Sorenson similarity index

The similarity index values varied from 0.0 652 between Bangolan and Baba I to 0.0949 between Baba I and Babungo being the highest in the subdivision (Table 2).

Table 2. Similarity indices between the four villages.

	Babungo	Babessi	Baba I	Babungo
Babungo	1			
Babessi	0.0677	1		
Baba I	0.0949	0.085	1	
Bangolan	0.0672	0.0815	0.0652	1

Frequency

The histogram below (Figure 4) shows a reversed J-shape. This implies that the species of low frequency (Class A species or rare species) are dominant with 76 species. Those of class B (fairly common species) follow with 12 species. The Common species (Class C) with 6 species have the lowest number of species. These species include among others *Schefflera hierniana*, *Vernonia cinerea*, *Cordia platythyrsa*, *Combretum molle*. The very common species (Class D) include 8 species of which among others are *Voacanga thouarsii*, *Polyscias fulva*, *Canariun schweinfurthii*, *Macaranga occidentalis*

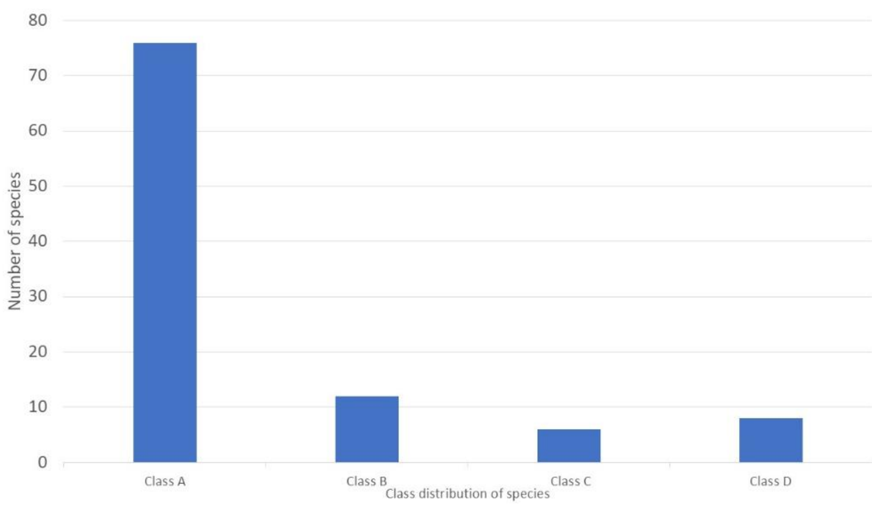

Figure 4. A bar graph of number of occurrence of species according to classes

Assessment of the vegetation structure of the gallery forests

Density of individual trees

The density of trees in the subdivision varies from 254 individuals per hectare (ind/ ha) in Babessi to 500 individuals per hectare in Bangolan. Averagely the density of individual trees is 357 individuals per hectare in the subdivision (Table 3).

Table 3. Density of individual trees per village in hectares

	P1	P2	Total no. of ind / 500 m2	Total no. of ind / ha.
Bangolan	171	79	250	500
Baba I	97	82	179	358
Babessi	72	55	127	254
Babungo	114	44	158	316
Average for the subdivision			178.8	357

Basal area (BA)

The basal area of trees in the subdivision was averagely 38.2 m^2/ha. It varies from 32 m^2/ha in Bangolan to 42.1m^2/ha in Baba I. (Figure 5). The highest BA value of the subdivision was contributed by *Pseudospondias microcarpa* (13.9 m^2 /ha). In Babungo the highest BA was contributed by *Pseudospondias microcarpa* (23.6%), followed by *Vitex doniana* (16.7%), and then *Ficus asperifolia* (14.5%). In Baba I the highest BA was contributed by *Ficus asperifolia* (24.2%), followed by *Pseudospondias microcarpa* (19.9%) then *Vitex doniana*. In Babessi the highest BA was from *Pseudospondias microcarpa* (25.2%) followed by *Ficus asperifolia* (19.9%) and then *Canarium schweinfurthii* (11.7%). In Bangolan the highest BA was contributed by *Olea hostchsteteri* (36.9%) followed by *Polyscias fulva* (6.6%) and then *Macaranga occidentalis* (6.5%).

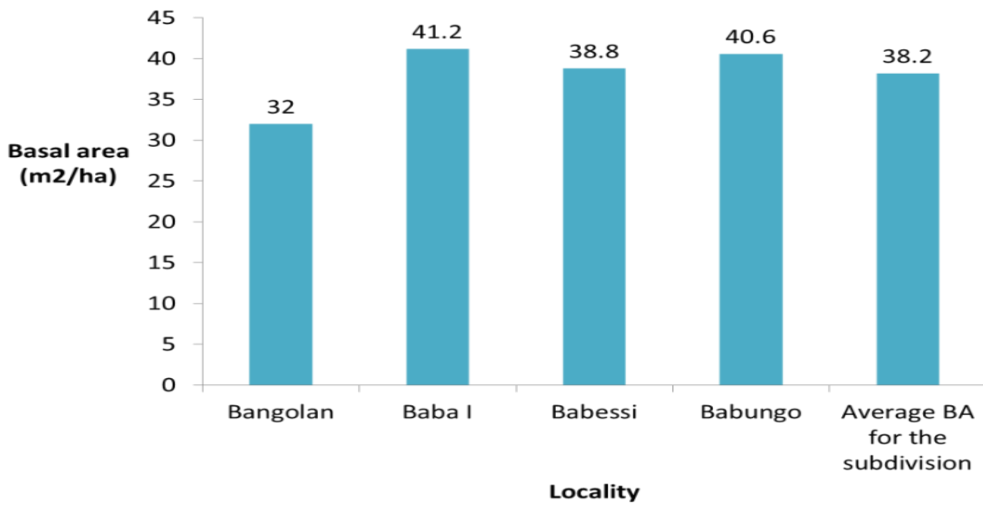

Figure 5. Basal area of woody plants in the subdivision and the different study sites

Diameter size class (DBH)

The distribution of individual trees in different DBH classes showed the highest number of individuals (414) in the lowest DBH size class 5 - 25 cm (53.07 %) and the lowest number of individuals (6) in the highest DBH size class 126-145 (0.77%). The number of individual woody plants decreased with increasing DBH size class, such that the general pattern of DBH class size distribution forms an inverted J-shape for each village and for the subdivision (Figure 6).

The biggest trees in Babessi were represented by *Ficus asperifolia*, *Canarium schweinfurthii* and *Pseudospondias microcarpa* with DBH of 210, 170, and 150 cm respectively. In Bangolan, the biggest trees were represented by *Olea hostchsteteri, Ficus estrangulaire* and *Polyscias fulva* with DBH of 160,110 and 75 cm respectively. In Baba I, we had *Ficus mucuso*, *Pseudospondias microcarpa* and *Ficus asperifolia* with DBH of 130,120 and 110 cm respectively while in Babungo the largest trees were represented by *Hallea stipulosa*, *Ficus asperifolia* and *Pseudospondias microcarpa* with DBH of 150,150 and 110cm respectively.

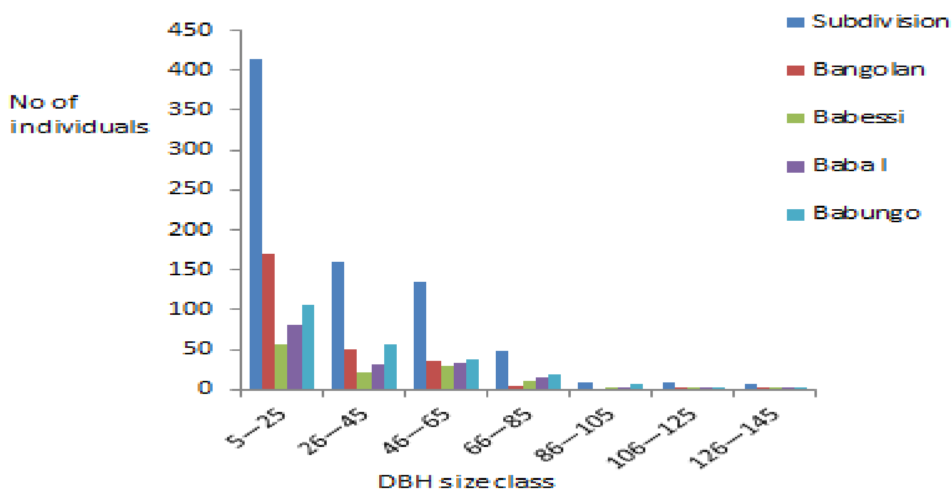

Figure 6. DBH size class distribution of plant species in the different study sites (Bangolan, Babessi, Baba I, Babungo) of the subdivision.

DISCUSSION

Woody tree composition of the subdivision is comprised of at least 105 woody plant species of DBH ≥ 5 cm recorded in the four villages of the subdivision ranging from 25-49 species, 22-42 genera, and 15-26 families. Species richness of woody plants at DBH ≥ 5cm in this area differs from one village to another. This difference is as a result of geographical location and method of exploitation and or protection of the gallery forests by the people over a long period of time (Moutoni, 2019).

The number of woody species found in this study is higher than that of 25 species as was found in Ijim Rigde gallery forest of Bamenda highlands (Ndamason, 2016) and also greater than 60 species found in the Koupa Matapit gallery forest (Soléfack et al., 2018). Also 61 tree species were identified in a gallery forest in the Sudanian savannah ecosystem of Togo (Fousseni et al., 2014). In this study species richness was more in Bangolan (49). This is due to the position of the village at the boundary with Bangourain in the West Region which hinders or reduces the pressure of over exploitation of the forests. As the neighboring village, Bangourain is located in a subdivision of another region with language and sociocultural differences, this reduces the rate of interaction and exploitation of the gallery forests in Bangolan (Moutoni, 2019). The culture of the people through myth and religion reduces the exploitation of the forest to a certain degree of sustainability (Tiokeng et al., 2024). Agriculture and livestock which are major activities here alongside collection of fuel wood go a long way to reduce the richness of gallery forest of this subdivision. This observation was also made during the study of the diversity and uses of woody resources of Koupa Matapit (Atoupka, 2016). The other reasons for differences in diversity of woody plants from one location to another may be related to the intensity and frequency of floods, variation in topography, variations in climate and disturbances regimes imposed on the riparian forest by upland environment (Naiman et al., 2008).

Baba I is second in species richness. This trend is same in all the villages and similar to the findings made in the study of floristic composition, diversity and analysis of forest cover change in the Kedjom-Keku community forest, N.W. Cameroon (Tsitoh, 2018). A similar observation was made in the study of floristic diversity and carbon stock of woody stands in some sacred forests in the West Cameroon Region (Tiokeng et al., 2024). This is probably due to the fact that the gallery forests are often flooded, inaccessible and many resource users here are located far away from the forests. In addition, women and children only visit the gallery forests occasionally. Also, the presence of *Spondianthus preussii* which is poisonous to cattle scares away many grazers from getting close to the gallery forest (Barikpoa et al., 2021).

In Babessi village many gallery forests are being destroyed for agriculture and construction. The gallery forests are also exploited for timber and non-timber forest products. Very little or no conservation method is in place.

Babungo has the lowest species richness. This is because of over exploitation in order to obtain wood for carving. The Babungo palace museum and the Prince Handicraft center are exerting a lot of pressure on the gallery forests in this village even though very powerful traditional conservation methods are in place. Also, the forests are very accessible and fertile favoring agriculture around and within it. The forests are also exploited by neighboring villages like Oku, Baba I and Bamunka for medicine, timber, fuel wood and other non-timber forests products, this explains the low species richness. In the study of the swamp forests there is almost daily human presence within the forests (Dan et al., 2012). The search and harvesting of non-timber forest products alongside habitat destruction are at the origin of the loss or disappearance of species in Babungo in particular and the subdivision in general.

Floristic diversity

The mean Shannon-Weiner diversity index (H') obtained in the gallery forests of the Babessi subdivision is low. Species diversity is an important attribute of a natural community that influences functioning of an ecosystem. A forest community is said to be diverse if it has a Shannon-Weiner diversity value greater than or equal to 3.5 (Kent and Coker, 1992). All the four villages of the subdivision had Shannon-Weiner Diversity index values below 3.5 making these forests poor in diversity. These values are greater than those obtained in the study carried out in some sacred forests in West Region of Cameroon (Tiokeng et al., 2024). The reason for the difference in species diversity in Baba I and Babessi villages more than Bangolan and Babungo is due to community held beliefs and myths that forbids children and women from frequenting the forests, coupled with control by traditional authorities, social and religious purposes. A similar conclusion was made concerning the management of sacred forests and trees in the study of cultural and biological interactions in the savanna woodlands of Northern Ghana (Blench, 2004). The poor diversity here is also due to numerous intense human activities by traditional healers, pastoralists or livestock farmers, fuel wood sellers, carpentry, agriculture, carving and deforestation. This observation is similar to that obtained during the study on the diversity and uses of woody resources in the Koupa-Matapit area (Atoupka, 2016). This finding is also in line with that observed among the rural folks in Northern Ghana who also heavily depend on the vegetation around them for food, fuel wood, income, medicine, spiritual protection and a host of ecosystem services which often lead to loss of tree species in particular and biodiversity in general (Ziblim et al., 2013).

Pielou’s evenness index (E) values obtained in this study fall within the optimal range of 0.6 to 0.8 (Odum, 1976). These values indicate that there is equitable distribution of individuals across species in the gallery forests of some villages of Babessi Subdivision. These results are similar to those observed in the study of Woody species diversity and ecological characteristics of the Mawouon forest, in the Western highlands of Cameroon (Ngnignindiwou et al., 2021).

The Simpson index of dominance was low in all the villages of the subdivision (0.042 to 0.091). The Simpson's index of dominance (D) maximum value is 1, which is obtained in the case of a single species dominating implying no diversity. Low values are obtained when numerous species are present (no dominance), such that each species represents only a small fraction of the total value (Simpson, 1949). The low Simpson value implies each species represented only a fraction of the total due to a high level of heterogeneity of the species in the forests. Thus, in this study the probability that two individuals selected at random belong to the same species is slow. The results obtained from this study is similar to that obtained in the study of floristic diversity of Western Highlands savannas of Cameroon (Wouokoue et al., 2017).

The Sorenson similarity index values were low indicating that the woody plant species were not similar in the subdivision. A total of 8 species were found to be common in all the villages. The low level of similarity index was due to the fact that the forests are conserved, exploited as well as managed differently in these villages coupled with the differences in the density of the population and consequent pressure on this forest. This finding is similar to that observed in the study of floristic diversity in two villages of the South region of Cameroon (Nganwa, 2003).

Rubiaceae, Moraceae, Euphorbiaceae, Fabaceae, Apocynaceae and Phyllantaceae are the most dominant families in this subdivision with at least a representative in all the 4 villages. This finding is similar to the one recorded in the study of the diversity and the structure of the woody plant of the submountain forest of the Kala mount region of Yaoundé (Madiapevo, 2008). Also, this finding falls in line with that observed in the study of floristic inventory of woody Species in the Manengouba Mountain Forest, Cameroon (Noumi, 2013). Flacourtiaceae, Bignoniaceae, Gutiferae, Sapotaceae and Meliaceae are represented in at least two villages.

The highest numbers of species occur in class A. Even with the absence of class E, the study still reveals a reversed J-shape characteristic of law of frequency (Raunkiaer, 1934). According to the law, species poorly distributed or dispersed in an area are likely to be presented more than those with more dispersion. In other words, A is greater than B, and B is greater than C, and C less than D. This pattern is probably due to human pressures in the gallery forests principally on woody resources for energy, medicine, handicraft, fuel wood and food. This finding is in corroboration with the observation noted that human activities (e.g. changes in disturbance regimes, such as wood cutting) may directly or indirectly affect the regeneration of species and therefore the low frequency in the study area may be due to over harvesting of its fruits, bark and roots for use in rural diets, for medicine, fuel wood and raw materials for processed goods (Stephenne and Lambi, 2004).

Vegetation structure

This study revealed that highest density of woody individual trees was found in the lowest DBH size class. This is because the lowest diameter classes include most of the species which are not big enough for many uses and the highest diameter class includes only few species since most of them are exploitable. This observation is similar to the one viewed in the study of plant species composition and structure in South Eastern Ethiopia (Lulekal et al., 2008). The number of individuals decreased with increase in diameter in all the villages but for Babessi where there is a higher density in 46-65 DBH size class which would indicate unstable regeneration as time passes. This type of vegetation distribution is very close to the findings in the sacred forests of Bafou (Ngougni, 2017). However, the number of individuals decreases as the diameter class increases showing an inverted J-shaped structure. This observation is in conformity with the observation made in the study of flora composition, structure and diversity in the Kimbi Fungom National Park (Zeh et al., 2019).

The Basal area observed in this study ranged from 32 to 41.2 m^2 ha-1 which are typical of a forest in good state of conservation. These values are similar to those found in the study of floristic diversity and stand structural analysis of gallery forests in Ajei highland watershed community forest, North West Cameroon (Ajonina et al., 2020). Baba I has the largest BA value in the subdivision. It is characterized by trees of large DBH such as *Pseudospondias microcarpa, Vitex doniana* and *Ficus asperifolia*. This large BA is accounted for by the physical factors and the richness of these species alongside proper management. Similar values were obtained in the study of sacred forests of Bazou in the Western region of Cameroon (Mounmeni, 2021 and in the study of soil, site and management component of variation in species composition of Agricultural Grasslands in Western Norway (Myklestad, 2004). In the subdivision of Babessi, trees with the largest DBH and BA were *Ficus asperifolia* and *Canarium schweinfurthii* with 210 cm and 170 cm respectively. The relatively large values for *Ficus asperifolia* is probably due to the fact that it is not used by the indigenes while for *Canarium schweinfurthii* is because its highly conserved for its fruits as food coupled with its many category of uses. The same conclusion was arrived at in the study of what controls the distribution of tropical forest and savanna (Murphy and Bowman, 2012).

The DBH size class with the highest number of individuals was found in the lowest DBH class (5 -25) where the trees were not mature enough for many uses. The least number of trees was found in class 126-145 cm probably because they were mature and large enough for exploitation for a wider variety of uses. This suggests a good reproduction and healthy regeneration potential of the woody species in the gallery forest. This observation is in concomitance with the findings obtained the study of effects of wild coffee management on species diversity in the Afromontane rainforests of Ethiopia (Senbeta, 2006). Trees were present in all the DBH classes except in Bangolan where there was no tree in the 86-105 class. Babungo had the highest number of large exploitable trees, followed by Baba I, Babessi and then Bangolan. This variation is probably due to the different methods of conservation, intensity of use and reasons for exploitation. The same findings were made in the study conducted in Wotagisho forest in Ethiopia (Dikaso and Tesema, 2016).

CONCLUSION AND RECOMMENDATION

This study on the diversity of woody plant species in the four villages of Babessi Subdivision revealed a low species richness in all the four villages. The most predominant species and families are different from one village to another. The distribution of individuals by diameter class is characteristic of a forest disturbed by human activity but with a high potential of regeneration if there is proper management. According to the International Union for Conservation of Nature (IUCN) red data list of species, there are five species in conservation priority in the gallery forests, which calls for even greater attention to be paid to them. This study showed that the gallery forests of Babessi subdivision and Western High lands of Cameroon in general, despite their relatively small surface area, they are of great importance in maintaining woody plant diversity. Management strategies for these relic forests should be strengthened by including all the stakeholders in this area in a bottom - up approach in order to optimize their stewardship in a sustainable manner.

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Appendix 1. Preliminary check list of woody plant species, distribution in gallery forests and conservation priority of Babessi subdivision

No	Botanical name	IUCN red list status	Locality
Anacardiaceae			
1	*Pseudospondias microcarpa* A. (Rich.) Engl.		BGN, BBA, BBS
Apocynaceae			
2	*Funtumia africana* (Benth.) Stapf		BGN
3	*Voacanga thouarsii* Roem. & Schult.		BGN, BBS, BBA, BBN
4	*Rauwolfia macrocarpa*		BGN
5	*Voacanga africana* (Scott-Elliot) Stapf.		BBS, BBN
Araliaceae			
6	*Polyscias fulva* (Hiern) Harms	NT	BGN, BBS, BBA, BBN
7	*Schefflera hierniana Harms*		BBA
	Arecaceae		
8	*Pheonix reclinata* Jacq		BBA
Asteraceae			
9	*Vernonia cinerea* (L.) Less		BBN
Bignoniaceae			
10	*Stereospermum personatum*		BBS
11	*Markhamiatomentosa* (Benth.) K.Schum. ex Engl.		BBN
12	*Spathodeacampanulata* P. Beauv.	en	BBN
Boraginaceae			
13	*Cordia platythyrsa* Bak.		BBS
Burseraceae			
14	*Canarium scheinfurthii* Eng.		BGN, BBS, BBA, BBN
Clusiaceae			
15	*Garcinia smeathmanii* (Planch. & Triana) Oliv.		BBS
Combretaceae			
16	*Terminalia glaucescens* Planch. ex Benth.		BBS
17	*Combretum molle* R.Br. ex G.Don		BBS
Euphorbiaceae			
18	*Antidesma chevalieri* Beille		BGN
19	*Macarangaoccidentalis* (Müll.Arg.) Müll.Arg.		BGN, BBS, BBA, BBN
20	*Macaranga spinosa* Müll.Arg.		BGN
21	*Bridelia ferruginea* Benth		BGN
22	*Spondianthus preussii* Engl.		BBA
23	*Neobourtonia glabescence* Prain.		BBA, BBN

24	*Bridelia micrantha* (Hochst.) Baill.	BBA
25	*Croton macrostachyus* Hochst. ex Del.	BBS
26	*Jatropha podagirca* Hook.	BBA, BBN
27	*Margaritaria discoidea* (Baill.) G.L.Webster	BBS
28	*Tragia benthamii* Baker	BBN
Fabaceae		
29	*Dalbergia sissoo* Roxb. ex DC.	BGN
30	*Pericopsis laxiflora* Benth Meeuwen	BGN
31	*Pterocarpus erinaceus* Poir.	BGN
32	*Entanda abyssinica* A. Rich.	BBA
33	Unidentified	BBA
34	*Albiziaadianthifolia* (Schumach.) W.F. Wight	BBA
35	*Sesbania sesban* (L.) merr.	BBA
36	*Albizia coriaria* Welw. ex Oliv.	BBS
37	*Xeroderris stuhlmannii* (Taub.) Mendonca & E.P.Sousa	BBS
38	*Albizia zygia* (DC.) J.F.Macbr.	BBS, BBN
Flacourtiaceae		
39	*Caloncoba glauca* (P. Beauv.) Gilg	BGN
40	*Flacourtia flavescens* Willd.	BGN
41	*Flacourtia indica* (Burm.f.) Merr.	BBS
42	*Oncoba spinosa* Forssk.	BBS
Gentianaceae		
43	*Anthocliestia djalonensis* A.Chevy	BGN, BBA, BBN
44	*Anthocleista procera* Lepr. ex Bureau	BBS
Gutiferae		
45	*Allanblackia floribunda* Oliv.	BBA, BBS
46	*Psorospermum senegalense* Spach	BBA
47	*Garcinia ovalifolia* Oliv.	BBS, BBN
Hymenocardiaceae		
48	*Hymenocardia heudelotii* Planch. ex Müll.Arg.	BBA
Hypericaceae		
49	*Harungana madagascariensis* Lam ex.Poir	BGN
Lamiaceae		
50	*Vitex doniana* Sweet	BGN, BBS, BBA, BBN
51	*Vitex welwitschii* Gurke	BBS
Lauraceae		
52	*Beilschmiedia tarairi* (A.Cunn.) Benth. & Hook.f. ex Kirk	BGN, BBS

Malpighiaceae			
53	*Alicia anisopetala*(A.Juss.)W.R.Anderson		BBA
Malvaceae			
54	*Cola acuminata - (P.Beauv.) Schott & Endl*		BGN
55	*Cola nitida* (Vent.) Schott & Endl.		BBA
Melastomaceae			
56	*Erythroxylum abyssinica*		BGN, BBS
Meliaceae			
57	*Khaya senegalensis* (Desr.) A.Juss.	VU	BGN
58	*Trichilia emetica* Vahl		BBA, BBS
59	*Swietenia mahogani* (L) Jacq.		BBA
Menispermaceae			
60	*Penianthus camerunensis*		BGN
Moraceae			
61	*Ficus vallis-choudae* Del.		BGN
62	*Ficus extrangulaire*		BGN, BBA
63	*Ficus elastica* Roxb. ex Hornem		BGN
64	*Ficus asperifolia* Miq		BGN, BBS, BBA, BBN
65	*Ficus lutea* Vahl		BBA
66	*Ficus exasperata* Vahl.		BBA
67	*Ficus mucuso* Welw. ex Ficalho		BBA
68	*Milicia excelsa* Welw.C.C.Berg		BBA
69	*Ficus thonninjii* Blume		BBS
70	*Ficus platyphylla* Del.		BBS
71	*Ficus aurea* Nutt.		BGN, BBS, BBA, BBN
72	*Ficus ingens* (Miq.) Miq.		BBS
73	*Ficus trichopoda* Baker		BBN
Mytaceae			
74	*Syzygium guineense* Var. macrocarpa (Eng)		BGN
Myristicaceae			
75	*Pycnanthus angolensis* (Welw.) Warb		BGN
Myrsinaceae			
76	*Maesa lanceolata* Forssk.		BBS
Olacaceae			
77	*Olax sp* indet. null		BGN
Oleaceae			
78	*Olea hochstetteri* Bak.		BGN
Phyllanthaceae			
79	*Uapaca guineensis* Mull. Arg.		BGN

80	*Fluggea virosa* (Roxb.exWilld) voight		BGN, BBS, BBA
81	*Bridelia micrantha* (Hochst.) Baill.		BGN, BBA, BBS
Proteaceae			
82	*Protea madiensis* Olive.		BGN
Rhamnaceae			
83	*Ziziphus abyssinica* Hochst		BGN
Rubiaceae			
84	*Mitragyna stipulosa* (DC.) O. Ktze	NT	BGN
85	*Macrosphyra longistyla* (DC.) Hook.f.		BGN
86	*Keetia cornelia* (Cham. & Schltdl.) Bridson		BGN
87	*Pavetta crassipes* K. Schum.		BGN
88	*Sarcocephalus latifolius* (Sm.) E.A.Bruce		BGN
89	*Hallea stipulosa* (D.C) Le Roy		BGN, BBS, BBA, BBN
90	*Canthium subcordatum* D.C.		BGN, BBA, BBN
91	*Psychotria djumaensis* De Wild.		BGN, BBA, BBS
92	*Craterispermum laurinum* (Poir.) Benth.		BGN
93	*Alchornea cordifolia* (Schumach. & Thonn.) Müll.Arg		BBA
94	*Psychotria peduncularis* (Salisb.) Steyerm.		BBA
95	*Breonadia salicina* (*Vahl*) Hepper et Wood		BGN
96	*Cremaspora triflora* (Thonn.) K Schum.		BBS
97	*Sericanthe chevalieri* (K Krause) Robbrecht		BBN
Rutaceae			
98	*Vepris heterophylla* (Engl.) Letouzey		BGN
Sapindaceae			
99	*Allophylus africanus* P. Beauv.		BGN, BBA
100	*Allophylus bullatus* Radlk.	VU	BBN
Sapotaceae			
101	*Vitellaria paradoxa* C.F.Gaertn.	VU	BGN
102	*Pachystela brevis*		BBA
103	*Afrosersalisia cerasifera* (Welw) Aubrev.		BBA
Sterculiaceae			
104	*Sterculia tragacantha* Lindl		BBS
Ulmaceae			
105	*Trema orientalis* Linn. Blume		BBA, BBN

BGN: Bangolan; BBS: Babessi; BBA: Baba I; BBN: Babungo; VU: Vulnerable; NT: Near threatened