Original Research Article

FLORISTIC CHARACTERIZATION AND PHYTOSOCIOLOGY OF A VEGETATION IN A CAATINGA AREA in Brazil

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ABSTRACT

The present study aimed to characterizes the floristic and phytosociological characters in the paraibano semiarid Caatinga area in the paraibano semiarid in Brazil. For the phytosociological survey of the area, was used 25 sample units with dimensions of 20 m x 20 m (400 m²), which were distributed randomly were used in order to collect the name of the species, the circumference at ground level (CFL), the circumference at breast height (CBH), the total height of the individuals and the state trees. The total surface of the area was 323.65 he and 255.85 he of shrub by arboreal vegetation what represent 79% of the area with vegetation, the remaining 21%, were classified as clean field, reservoirs, courses of water and highways, totaling 67.8 hectares. To the floristic composition 2.362 individuals were observed, which ones, 22 species belonging to 14 families. Considering the habit of the found species, 68% can be considered as arboreal and 32% as shrubby. The vegetation can be classified as a closed shrub-arboreal Caatinga. The most representative species in the area were *Poincianella pyramidalis*, *Mimosa tenuiflora*, *Aspidosperma pyrifolium* and *Anadenanthera colubrina*.

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Keywords: Measurement; forest inventory; forest management; steppic savannah biome

1. INTRODUCTION

The Caatinga biome is found in semiarid region of northeastern states of Brazil, extending to the northeast of the state of Minas Gerais. It is estimated that the total area covered by this Biome is about 1000.000 km^2 [1]. The annual precipitation in the region is less to 1000 mm a year, with rains distributed irregularly. Moreover, the solar radiation is extremely high, as the annual average temperature, while the relative levels of moisture and cloudiness are the lowest in the region of Brazil [2].

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The Caatinga has an inappropriate usage history of their land, with the transformation of native forests in arable fields, large areas for livestock, among other uses. Due to this fact, 45% of the Caatinga has been modified by human activities [3]. However, studies indicate that this value is underestimated [4]. Despite the immense lack of knowledge about the Biome [5], the Caatinga has been systematically devastated.

Thus, this type of exploration on such a complex and unknown environment may take even an irreversible process of degradation and consequent desertification. The native forest remnants, is located almost exclusively within semiarid, playing an important role in the state's socio-economy [6]. However, the forest cover of the semiarid region has been drastically reduced by the lack of proper management and the type of exploration adopted.

As seen, the Caatinga lost part of its native vegetation as a result of inadequate management. Due to this fact, there is damage to the soil and water bodies of the region [7].

Much of the environmental degradation problems is related to the absence of a proper planning of the occupation of the land, respecting the characteristics of the various ecosystems, particularly its richness and diversity. Environmental degradation always had the impulse to economic enterprises that do not consider the environmental changes in costs [2].

Despite the existence of some phytosociological work of the Caatinga vegetation composition, there is still much to knowledge of this Biome as a whole, determining their distribution patterns, abundance and relationship with environmental factors, to be established based on quantitative data, the different faces of the Caatinga and its floristic connections [8].

In this sense, the aim of this study was to characterize and elaborate a phytosociological and floristic diagnosis of an area located in a representative Caatinga Biome.

2. MATERIAL AND METHODS

2.1 Characterization of the study area

The area where were developed the research is part of Tamandua Farm, owned by the Moco Agropecuaria Ltda. company, located in Santa Terezinha (PB). The area is located in the micro-region of low Hinterland Piranhas, with altitude ranging between 250 and 310 meters, in the coordinates 07º 00 'S and 37º 23' W.

According to the Köppen climate classification, the region of the study is characterized as having type climate Bsh, semiarid region, marked by rainy and dry season [9].

The area is part of a geomorphology unit Country Depression, an extended low plain, smooth-rolling predominant relief, sometimes wavy, with residual elevations scattered in the landscape, in which the granite rock shows exposed or minimal soil capping and vegetation [10]. The vegetation in which the study was conducted is characterized as Steppic savannah [11].

2.2 Environmental characterization of the area

The first step to characterize the environmental area was conducting a topographic survey using a GPS navigation. In this phase were used an aerial photograph with high resolution of the whole farm, provided by the owner. This procedure defined the perimeter of the studied area. For making the maps was used the computer program TrackMaker® professional version 4.7.

After defining the perimeter, it was raised areas with vegetation, grassland, water reservoirs, waterways and roads. The representation of terrain elevation through colors, i.e. the hypsometry area was made using the computer program Surfer® version 10.

The assessment of the ground truth was done through several visits to the area during the various surveys.

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2.3 Floristic survey

The floristic survey of the shrub-tree layer was carried out through periodic campaigns of field, in order to go through the greatest extensions of the study area, with a view to observe the greatest possible number of established plant species. In addition to the campaigns, they were held collections in the plots used for phytosociological. To collect the plant material was used pruning shears. The collected material was properly prepared and forwarded to the Herbarium of the Academic Unit of Forestry (CSTR-UFCG) for identification.

For the classification of the species adopted the [12]. As for the floristic comparisons, we used different work carried out in Caatinga vegetation.

2.4 Phytosociological survey

For the phytosociological survey of the area, was used sample units with dimensions of 20 m x 20 m (400 m²), which were distributed randomly. In each unit has been noted, the common name, the circumference at ground level (CFL), the circumference at breast height (CBH), the total height of the individuals and the state trees, alive or dead. Were considered for data collection purposes, all living or dead, still standing, and as inclusion criteria, total height greater than 1.0 meters, and the largest circumference at chest level or equal to 6.0 cm, following the recommendation of the Forest Management Network Measurement Protocol of Caatinga [13].

Circumferences were measured with the aid of tape and to the heights was used retractable metal rod, graduated in meters with divisions of 50 cm.

3. RESULTS AND DISCUSSION

3.1 Characterization of the study area

The total area of the studied was 323.65 he. It was also found that the total study area, 255.85 he showed shrub and tree vegetation, which represents 79% of the area with vegetation. After the 25 sampling units used in the characterization of vegetation in the experimental area the definition of areas with vegetation were distributed. The remaining 21% after aerial photography analysis, were classified as areas of grassland, reservoirs, water ways and roads, totaling 67.8 he (Fig. 1).

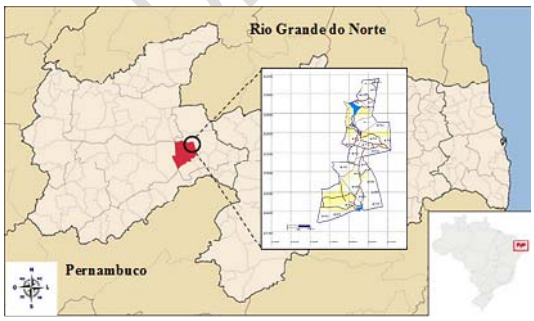

Fig. 1. Map of the study area with vegetation (white), Grassland (yellow), bodies of water (blue) and distribution of sample units.

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The hypsometric chart (Fig. 2) shows that the altitude, ranging from 230 m to 320 m. It can be observed that these altitudes are commonly found throughout the region.

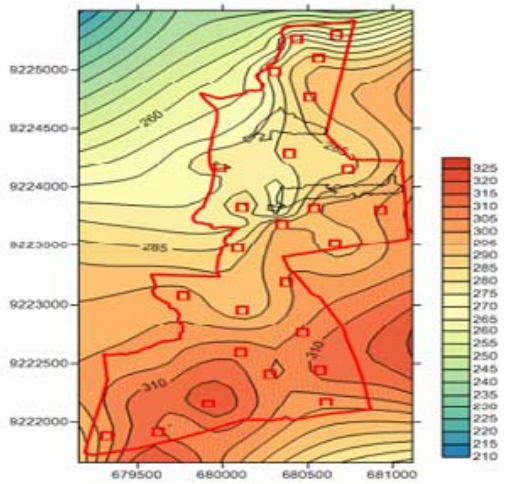

Fig. 2. Hypsometric chart map of the study area.

The sampling sufficiency was verified by the collector curve (Fig. 3). There was an initial increase of trend and, to the extent that the sampled area increased, tended to stabilize indicating that sampling of the species in the experimental area was enough. The curve tended to stabilize with 9600-10000 m^2 of area sampled, indicating that sampling was satisfactory for the species in the study area.

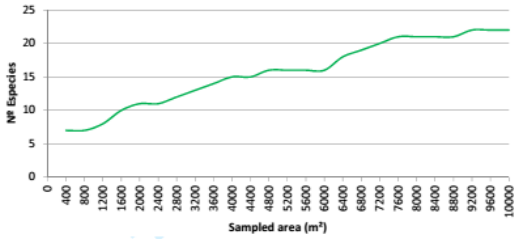

Fig. 3. Adequate sampling of the species in the study area.

Regarding the floristic composition, were found a total of 2.362 individuals, including 22 species belonging to 14 families (Table 1). However, one of the observed species was not identified botanically, and that at the time of collection of botanical material, it had no fertile material. The percentage of dead individuals was 4%. Whereas the habit of the species found, 68% can be considered as a tree and shrub 32%.

Comment [u23]: What species sampled...only trees ? trees and shrubs ? Herb/lianas included ? if not why ? small sample size ?/

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Table 1. Floristic ratio of woody species in the study area.

Family/Specie	Common name	Habit
Anacardiaceae		
Myracrodrum urundeuva	Aroeira	Arboreal
Apocynaceae		
Aspidosperma pyrifolium	Pereiro	Arboreal
Bignoniaceae		
Tabebeuia impetiginosa	Pau d´arco	Arboreal
Bombacaceae		
Pseudobombax marginatum	Embiratanha	Arboreal
Burseraceae		
Commiphora leptophloeos	Imburana	Arboreal
Capparaceae		
Capparis flexuosa	Feijao bravo	Shrub
Combretaceae		
Combretum leprosum	Mofumbo	Shrub
Erythroxylaceae		
Erythroxylum pungens	Rompe gibao	Shrub
Indeterminada		
Indeterminada	Cipo de vaqueiro	Shrub
Fabaceae		
Amburana cearensis	Cumaru	Arboreal
Bauhinia cheilantha	Mororo	Arboreal
Poincianella pyramidalis	Catingueira	Arboreal
Libidibia ferrea	Pau ferro	Arboreal
Senna macranthera	Sao Joao	Shrub
Mimosaceae		
Anadenanthera colubrina	Angico	Arboreal
Mimosa tenuiflora	Jurema preta	Arboreal
Piptadenia stipulacea	Jurema branca	Arboreal
Rhamnaceae		
Ziziphus joazeiro	Juazeiro	Arboreal

Among the ten species that stood out in relation to the importance value, we can highlight the catingueira (*Poincianella pyramidales*), in which it had the highest importance value (Fig. 4), which was mainly due to the high number of individuals of species in the experimental area [14-15].

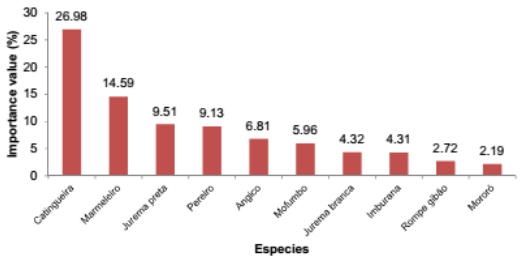

Fig. 4. Importance value (IV) of the ten species that showed the highest.

Considering the horizontal structure, it was observed that once again the *Poincianella pyramidalis* specie stands when comparing phytosociological parameters with other species (Table 2).

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Table 2. Values of phytosociological parameters for the species sampled.

Cientific name	DR	FA	FR	DoR	VI
Amburana cearensis	0.08	8.00	0.87	0.04	0.33
Anadenanthera colubrina	3.30	64.00	6.99	10.14	6.81
Aspidosperma pyrifolium	8.98	76.00	8.30	10.11	9.13
Bauhinia cheilantha	2.03	36.00	3.93	0.59	2.19
Capparis flexuosa	0.08	8.00	0.87	0.03	0.33
Cnidoscolus quercifolius	0.68	32.00	3.49	1.40	1.86
Combretum leprosum	7.11	76.00	8.30	2.47	5.96
Commiphora leptophloeos	2.24	52.00	5.68	5.02	4.31
Croton blanchetianus	26.7	96.00	10.5	6.58	14.5
Croton cf. alagoensis	0.55	12.00	1.31	0.15	0.67
Erythroxylum pungens	1.65	44.00	4.80	1.70	2.72
Indeterminada	0.34	12.00	1.31	0.13	059
Libidibia ferrea	0.34	4.00	0.44	0.15	0.31
Mimosa tenuiflora	8.93	76.00	8.30	11.29	9.51
Morta	4.02	84.00	9.17	4.97	6.05
Myracrodrum urundeuva	0.13	8.00	0.87	0.12	0.37
Piptadenia stipulacea	2.92	76.00	8.30	1.73	4.32
Poincianella pyramidalis	29.1	100.0	10.9	40.89	26.9
Pseudobombax marginatum	0.25	24.00	2.62	0.85	1.24
Sebastiana sp.	0.08	4.00	0.44	0.05	0.19
Senna macranthera	0.17	8.00	0.87	0.02	0.36
Tabebeuia impetiginosa	0.08	8.00	0.87	0.19	0.38
Ziziphus joazeiro	0.17	8.00	0.87	1.38	0.81

DR = relative density (%); FR = relative frequency; DoR = relative dominance (%); VI = importance value (%). **FA + ??**

It was observed that the ordering of the 22 sampled species by their importance values followed, mainly, the relative dominance (Table 2), indicating that the basal area of the individuals was essential to the determination of IV of the species, as was the case *Poincianella pyramidalis*, *Mimosa tenuiflora*, *Anadenanthera colubrina* and *Aspidosperma pyrifolium* decreasingly.

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Of the 2.362 sampled individuals, 2.232 individuals are distributed in the first three classes, representing approximately 94.5% of all samples with diameters less than 15 cm. (Table 3). The estimated cylindrical volume was approximately 52.1 m^3/he.

Table 3. Diametric distribution of individuals (N), percentage of individuals, basal area (BA) and volume per hectare (V/he), according to the DAB (diameter at the base).

Class (cm)	N	%	BA m^3/he	V/he
0.0 – 5.0	1148	48.60	1.2327	3.5908
5.0 – 10.0	844	35.73	3.2361	11.997

10.0 – 15.0	240	10.16	2.8042	12.169
15.0 – 20.0	82	3.47	1.8899	9.6911
20.0 – 25.0	31	1.31	1.2252	6.2648
25.0 – 30.0	11	0.47	0.6681	3.9533
30.0 – 35.0	3	0.13	0.2519	1.7177
35.0 – 40.0	2	0.08	0.2274	1.6271
40.0 – 45.0	1	0.04	0.1450	1.0877
Total	2362	100	11.680	52.099

The basal area average was found to be 11.68 m²/ha and is considered a low value in relation to other studies conducted in semiarid region. The species that had higher basal area were *Poincianella pyramidalis, Mimosa tenuiflora, Anadenanthera colubrina* and *Aspidosperma pyrifolium* (Fig. 5).

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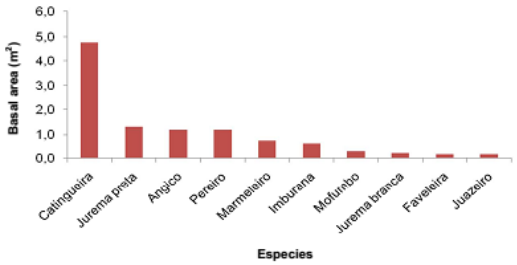

Fig. 5. Relation of the ten species that showed higher basal area (m²).

Structurally, the following vegetation characteristics were evident: the majority of individuals in the class 3.0 to 4.5 m high, with some emerging species, reaching about 10 m or more, with relevant importance in community structure, as equal among the most IV, as *Poincianella pyramidalis, Mimosa tenuiflora and Anadenanthera colubrin*a due to significant numbers of individuals and basal area (Fig. 6). It was also clearly visible two strata, one tree and other shrubs. In the tree layer, with a predominance of individuals with height greater than 4.5 m.

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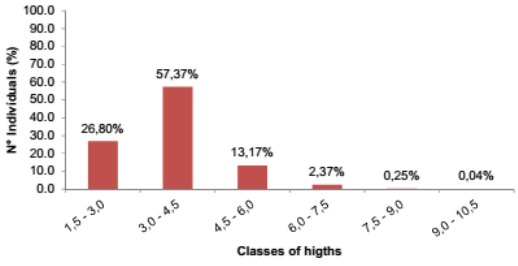

Fig. 6. Percentage of individuals in classes (cm).

4. DISCUSSION

The results of this study show that there is considerable species richness in the area, even if compared with inventories in other areas of Caatinga [15-17].

In the arboreal component occurred 15 species, distributed in nine families, especially Mimosaceae, Fabaceae and Euphorbiaceae, the first family with four species and the last two with three and two species, respectively, and the other families with only one specie.

In the shrub component occurred seven species, distributed in six families. Euphorbiaceae, with two species of shrubs, being considered the most family wealth in this component.

Comment [u29]: •Sample small ...inadequate data ? ?? 63 species of trees in in the semi-arid region of Paraba, Brazil DOI: •10.5897/AJAR2016.11662 Many statements are out of poportions....?

Without considering the habit of the species is observed that families with highest species richness were Fabaceae with five species, followed by Euphorbiaceae families with four species and Mimosaceae with three species. The other families had only one specie. Similar results were obtained in studies performed in the Caatinga of the Serido region [18-19]. Other research carried out within the same farm was noted that families with the highest number of species were Euphorbiaceae, Caesalpinaceae and Mimosaceae [20].

The high species richness of Fabaceae in the study area indicates their status as the main family [21]. Leguminous are constantly seen in inventories in areas of savannah, as in crystalline soffits [22,16], sandy soils of sedimentary basins [23], or in areas with a predominance of rocky outcrops [24], or surveys restricted to the woody component [25] which include other habits [15].

The species that have held the highest number of individuals sampled were *Poincianella pyramidalis*, *Croton blanchetianus* and *Aspidosperma pyrifolium*. The *Poincianella pyramidalis* species and *Croton sonderianus* are considered those that stood out most in the number of individuals in several works in areas of Caatinga [26-27].

The five species that had higher relative density were *Poincianella pyramidalis*, *Croton blanchetianus*, *Aspidosperma pyrifolium*, *Mimosa tenuiflora* and *Combretum leprosum*. The forest specie *Poincianella pyramidalis* showed higher relative dominance. Other studies, find in an area of Caatinga in good condition, the *P. pyramidalis* has the second highest importance value [28]. The prevalence of *P. pyramidalis* on other species is due to the large number of individuals (688) and also by the way these individuals are distributed throughout the sampled area. The species were present in 100% of sampled plots, thus affecting substantially the highest importance value.

With regard to the relative frequency, the five species that stood out were: *Poincianella pyramidalis*, dead trees, *Aspidosperma pyrifolium*, *Mimosa tenuiflora* and *Combretum leprosum*, and the last three species showed similar percentages (8.3%).

It can be seen that the majority of individuals (94%) were positioned in the first three diameter classes, numerically decreasing with increasing the diameter, to form a graphic format of inverted "J". Thus, in the event of a disturbance on vegetation, older individuals (larger diameter class), in a less quantity, may die younger individuals, along with regenerating quickly repopulate the disturbed area. The presence of many individuals with stem diameter in the initial diameter classes shows an initial stage of secondary feature by the studied vegetation [29].

The high diversity of species found in the study area may have several causes, such as the presence of large flagstones, microhabitats in the region, numerous banks of rivers and streams. Furthermore, several studies indicate that these environments serve as refuges, and to minimize the effects of drought, it enables a higher probability of survival of various

species. Moreover, the vegetation conservation state may have contributed to the high richness [26, 30].

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5. CONCLUSIONS

The most representative species in the area were *Poincianella pyramidalis*, *Mimosa tenuiflora*, *Aspidosperma pyrifolium* and *Anadenanthera colubrina*.

The most important families with the number of species sampled were Mimosaceae, Fabaceae and Euphorbiaceae.

The species *Poincianella pyramidalis* showed the highest rates recorded for the horizontal structure, vertical, basal area and volume.

Regarding the characterization of vegetation, it is clear that it can be classified as a closed shrub-arboreal Caatinga.

Comment [u31]: How this conclusion has been reached ??

COMPETING INTERESTS

Authors declare that is no competing interests.

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