Nativa, Sinop, v.4, n.6, p.360-367, nov./dez. 2016.
Pesquisas Agrárias e Ambientais
DOI: 10.14583/2318-7670.v04n06a03
http://www.ufmt.br/nativa

ISSN: 2318-7670

Floristic, phytosociology and diametric distribution of a fragment of ciliary area in a Cerrado area in Piauí, Brazil

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Recebido em maio/2016; Aceito em agosto/2016.

ABSTRACT: The objective was to perform a floristic and phytosociological study and adjust probability density functions to express the diameter distribution in a Cerrado area on the banks of the Uruçuí-Preto River. The study was carried out in the municipality of Baixa Grande do Ribeiro, Piauí, where 10 sample units of 20 x 20 m (400 m²) were placed. Living and dead individuals with CHC ≥ 10 cm were measured. To verify the sample adequacy, a method of the species-area curve was used and the horizontal structure was analyzed through phytosociological estimators. For the diametrical distribution, the functions of 2 and 3-parameters Weibull, type I and II Meyer, were adjusted. There were 621 individuals distributed in 31 species belonging to 19 families. The diametric distributions were presented in decreasing order, and the 3-parameter Weibull distribution was significant for all species analyzed and for those of higher importance value (IV), according to the Kolmogorov-Smirnov (K-S) test. The species *Vochysia pyramidalis*, *Mauritia flexuosa*, *Alchornea discolor* and *Tapirira obtuse* presented high density and frequency in the studied area with the highest IV. The 3-parameter Weibull distribution presented adequate adjustment for both data and may be indicated to describe the diametric distribution of the species.

Keywords: riparian forest, horizontal structure, probability distributions.

Florística, fitossociologia e distribuição diamétrica de fragmento de área ciliar em uma área de Cerrado no Piauí

RESUMO: Objetivou-se realizar um estudo florístico e fitossociológico e ajustar funções densidade de probabilidade para expressar a distribuição diamétrica em um fragmento de Cerrado as margens do Rio Uruçuí-Preto. O estudo foi realizado no município de Baixa Grande do Ribeiro, Piauí, onde foram alocadas 10 unidades amostrais de 20 x 20 m (400 m²). Os indivíduos vivos e mortos com CAP ≥ 10 cm foram mensurados. Para verificar a suficiência amostral, utilizou-se método da curva espécie-área e a estrutura horizontal foi analisada por meio dos estimadores fitossociológicos. Para a distribuição diamétrica foram ajustadas as funções de Weibull com 2 e 3 parâmetros, Meyer tipo I e II. Foram registrados 621 indivíduos, distribuídos em 31 espécies pertencentes a 19 famílias. As distribuições diamétricas apresentaram-se de forma decrescente, sendo a distribuição de Weibull 3P significativa para todas as espécies analisadas e para aquelas de maior valor de importância (VI), segundo o teste de Kolmogorov-Smirnov (K-S). As espécies, *Vochysia pyramidalis*, *Mauritia flexuosa*, *Alchornea discolor* e *Tapirira obtusa*, apresentaram alta densidade e frequência na área estudada com os maiores valores de VI. A distribuição Weibull 3P apresentou ajuste adequado para ambos os dados e pode ser indicada para descrever a distribuição diamétrica das espécies.

Palavras-chave: mata ciliar, estrutura horizontal, distribuições de probabilidade.

1. INTRODUCTION

In the Piauí state, as in other states, the biome's native vegetation has been suppressed by deforestation due to the expansion of agricultural crops. According to Olimpio and Monteiro (2013), it is estimated that about 4 million hectares of the Piauí Cerrado are suitable for agriculture, especially in the Uruçuí-Preto and Gurguéia rivers basins. This process began between the 1970s and 1980s and intensified in 1990 through the implementation of large projects for grain production, mainly soybeans (AGUIAR E MONTEIRO, 2005).

The plains and valleys of the Southwest region of the state of Piauí are of great importance for the conservation of the Cerrado Biome and its water resources, since they are areas that shelter the sources of the main tributaries of the Parnaíba river, among them the Uruçuí-Preto river, which is one of its main tributaries (BASTOS, 2008).

The plains of the Uruçuí-Preto river basin are used for grain production, as the conditions of cultivation are more favorable for the use of high technology agricultural implements. The edges and the interior of the valleys are occupied by traditional communities, whose main activity is subsistence agriculture (BASTOS, 2008).

In order to maintain the water quality of the Uruçuí-Preto river, it is necessary to systematically monitor the water, as well as for the preservation of its banks against deforestation, by avoiding siltation and controlling the arrival of nutrients, sediments and erosion of the riverbanks (DELLITI, 1989). For this, it becomes necessary to know the vegetation, both in floristic and phytosociological terms, since there is great ignorance of the flora of the region as a whole.

Studies of the floristic and phytosociology of a forest are the initial step for knowing it, because, associated with its structure and dynamics, one can build the theoretical basis that supports the conservation of genetic resources, the conservation of similar areas and the recovery of areas or degraded forest fragments, contributing substantially to its management or to the entire conservation of its fragments without using its products (ARRUDA, 2005).

The characterization on the floristic composition and structure of the different phytophysiognomies of the Cerrado of Piauí has been incipient, object of little or no study, with some works recently developed in transition areas between the Cerrado and Caatinga biomes, among them, those of Amaral (2012) and Silva et al. (2015).

In view of the above, the objective was to carry out a floristic and phytosociological study and adjust probability density functions to express the diametric distribution in a cerrado fragment along the banks of the Uruçuí-preto river, aiming to indicate the use of species for the recovery of degraded environments.

2. MATERIAL AND METHODS

2.1. Location and description of the study area

The present study was conducted in an area of riparian forest of the Uruçuí-preto river in the rural community of Formosa in the Olho D'água farm, in the geographic coordinates 044°53'11,0"W and 08°43'27,9" S at 044°53'12,6" W and 08°43'41,5" S (Datum SIRGAS 2000), located in the Southwest of the state of Piauí in the municipality of Baixa Grande do Ribeiro with a territorial area of 7,967.73km² (Figure 1). The Uruçuí-Preto River Valley is a region composed of a great diversity of environments, presenting various types of soils, red yellow latosols, plinthsols, and, to a lesser extent, the planosols and quartzaenic neosols, rainy tropical climate and smooth undulated relief. The predominant vegetation is the Cerrado, and the predominant phytophysiognomies are: Cerrado *senso-stricto*, Veredas, Rocky fields, Riparian woods, and Gallery woods (CPRM, 1973).

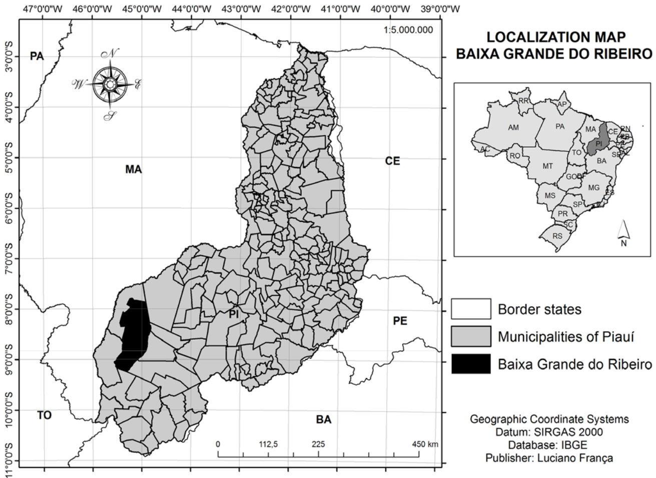

Figure 1. Location of the municipality of Baixa Grande do Ribeiro, Piauí.
Figura 1. Localização do município de Baixa Grande do Ribeiro, Piauí.

2.2. Sampling

For the accomplishment of the present study, the fixed area method was used. Ten sample units with dimensions of 20 x 20 m (400 m²) were allocated, totaling a sample area of 4,000 m². In order to control the measurements, the sample units were divided into subplots of 10 x 10 m².

The sample units were allocated by the systematic sampling process, considering a distance of 20 m from the river bank for the units, and 50 m between plots.

All live and dead trees, standing, with chest height circumference (CHC), taken at 1.30 m from soil, equal to or greater than 10 cm were measured (CHC and total height), identified and numbered with Aluminum plates.

Sampling sufficiency in terms of richness (number of species) was analyzed using the species-area curve.

2.3. Phytosociological analyzes

The registered species were identified at the family, genus and species level according to the classification system Angiosperm Phylogeny Group (APG IV, 2016). Identification occurred through observations of the dendrological characteristics recognized in the field and by the collected botanical material. All the botanical material collected was herborized and the exsicates were verified by a specialist in the botanical laboratory of the Federal University of Piauí (UFPI).

As for the unidentified species (U.I.) in the botanical laboratory of UFPI, vegetative and reproductive material was sent to the Herbariums of the Federal Rural University of Pernambuco (UFRPE) and Federal University of Rio Grande do Norte (UFRN).

The phytosociological, absolute and relative parameters of density, dominance and frequency were evaluated, as well as the importance value and coverage value. To evaluate the diversity of communities, the Shannon-Wienner index (*H*') was used.

2.4. Diametric distribution

The evaluation of the diametric distribution was held through the adjustment of probability density functions. In this study, authors adjusted the functions of 2 and 3-parameters Weibull and type I and II Meyer. In forest science, the Weibull probability distribution function has been widely used to describe the diameters distribution, both in equal and unequal populations (SCOLFORO, 2006).

The probability density function can be presented with 2 (Eq. 1) and 3 parameters (Eq. 2). The Meyer probability density function was adjusted by using the linear regression method, after the logarithmization of type I Meyer (Eq. 3) and type II Meyer (Eq. 4).

$$f(x)=\frac{c}{b}\left(\frac{x}{b}\right)^{c-1} e^{-\left(\frac{x}{b}\right)^{c}} \quad (1)$$

$$f(x)=\frac{c}{b}\left(\frac{x-a}{b}\right)^{c-1} e^{-\left(\frac{x-a}{b}\right)^{c}} \quad (2)$$

$$Ni = K \cdot e^{-\beta \cdot di} \quad (3)$$

$$Ni = K \cdot e^{-\beta \cdot di^2} \quad (4)$$

Where: *a* = Location parameter; *b* = Scale parameter; *c* = Shape parameter; x = Center of diameter class; Ni = Number of trees in class i; K and β = Parameters to be estimated; *di* = Central value of the diameter class; *e* = Basis of the Neperian logarithm.

In order to evaluate the effect of the methods of adjustment of the probability density functions to describe the diametric distribution of the forest, the diameters of all the trees of the sampled area and the species of greater importance value (IV) were used to adjust the probability density functions. The diameters were grouped in classes with diametric amplitude of 10 cm for the set of all species, 7 cm for *Vochysia pyramidalis (*Mart*)* and 2 cm for *Alchornea discolor Hook. F.*, thus generating the estimates in each diameter class for each method of adjustment of the probability density functions used. The adherences of the distributions were performed by using the Kolmogorov-Smirnov test (K-S).

3. RESULTS AND DISCUSSION

3.1. Floristic composition

A total of 621 individuals were surveyed, 591 of whom were alive and 30 were dead, but still standing, representing 1,553 $ind.ha^{-1}$. It was found that the area has a large number of individuals when compared to the study conducted by Battilani et al. (2005), who sampled 661 individuals in an area of 9,000 m² of the riparian forest of the Prata River, located on the banks of the Serra da Bodoquena, in the municipality of Jardim (MS).

A total of 30 species were found, belonging to 19 families, according to Table 1. The families with the highest number of species, in descending order, were: Fabaceae, with 4 species, Annonaceae, Chrysobalanaceae, Myrtaceae, with three species each.

The set of edaphoclimatic and ecological factors existing in the river banks may contribute to this difference on the dominance of some families and species, since the environmental conditions have a direct influence on the

Table 1. Floristic composition, of a riparian forest fragment of Uruçuí-Preto River.
Tabela 1. Composição florística, de um fragmento de mata ciliar do rio Uruçuí-Preto.

Popular name	Family	Scientific name
Canjarana	Vochysiaceae	*Vochysia pyramidalis* Mart.
Pau Loro	Euphorbiaceae	*Alchornea discolor* Hook. F.
Tapirira	Anacardiaceae	*Tapirira obtusa* (Benth.) J.D. Mitch.
Buriti	Arecaceae	*Mauritia flexuosa* L.
Indivíduo Morto	I.M.	I.M.
Desconhecida	Chrysobalanaceae	*Licania aff. sclerophylla* (Hook. F.) Fritsch.
Marmeldada	Rubiaceae	*Alibertia edulis* (L. Rich.) A. Rich
Murici	Malpighiaceae	*Byrsonima crispa* A.Juss.
Buritirana	Arecaceae	*Mauritiella armata* (Mart.) Burret.
Embaúba	Urticaceae	*Cecropia* sp.
Cachimbeira	Lecythidaceae	*Cariniana rubra* Gardner ex Miers
Sambaiba	Dillenidae	*Curatela americana* L.
Pau Loro	Chrysobalanaceae	*Hirtella gracilipes* (Hook. F.) Prance
Ingarana	Fabaceae	*Inga vera* Willd.
Desconhecida	Phyllantaceae	*Richeria grandis* Vahl
Pau Sangue	Myrtaceae	*Calyptrantes* sp.
Almesca de Brejo	Burseraceae	*Protium heptaphyllum* (Aubl.) Marchand
Angelim	Fabaceae (Faboideae)	*Andira* sp.
Ata Braba	Annonaceae	*Duguetia echinophoraR*.E.Fr.
Mestiço	Vochysiaceae	*Qualea cf. paraenses* Ducke
Desconhecida	Sapindaceae	*Matayba* sp.
Copaíba	Fabaceae	*Copaifera langsdorffii* Desf.
Desconhecida	Lauraceae	*Ocotea* sp.
Desconhecida	Fabaceae	NI
Goiaba Braba	Myrtaceae	*Psidium* sp.
Maria Preta	Ebenaceae	*Diospyros sericea* A. DC.
Cafuringa	Myrtaceae	*Myrcia splendens* (Sw.) DC.
Desconhecida	Humiriaceae	NI
Desconhecida	Hypericaceae	*Vismia guianensis* Pers.
Pata de Vaca	Fabaceae	*Bauhinia cupulata* Benth
Pindaiba de Macaco	Annonaceae	*Xylopia aromatica* (Lam.) Mart.

growth and establishment of a plant community, influenced by a set of factors, of which the flora, the species' ability to reach a particular site, the ecological properties of the species, the habitat and the time elapsed after an event that culminated in the invasion of the vegetation or changes in the environment at different scales (PILLAR, 1994).

Through the sampling adequacy curve, which relates the species to the sample area (Figure 2), it was possible to express that the sampling for the floristic variability representation was satisfactory, since there was a stabilization tendency (curve inflection) from the sampling of an area of 4,000 m². The stabilization of the curve indicates that sampling was sufficient in terms of number of species. Thus, the sampling adequacy for the sampled area of 4,000 m² can be fully accepted in order to correctly interpret the sampling coverage regarding the number of species.

The Shannon-Wiener diversity index found for the total area was *H*'= 2.561 nats.ind^{-1}. Considering the size of the sampled area (0.4 ha) and the minimum diameter established (DCH = 3.18 cm), authors expected to find a larger number of species in this site, since the riparian forest of Uruçuí-Preto river is in a fair stage of conservation. This result was lower than that found in studies carried out by Matos and Felfili (2010) in gallery forests in the national park of Sete Cidades, PI (3.53 nats.ind^{-1}), and by Gomes et al. (2014) in a fragment of riparian forest of Carinhanha river, Bahia (3.62 nats.ind^{-1}).

The values of the Shannon-Wiener diversity index (H') generally found for galleries and ciliary forests in Brazil are among 3.6 and 4.2 nats.ind^{-1} (ROMAGNOLO; SOUZA, 2000; GUARINO; WALTER, 2004). Probably, this lower value in terms of diversity obtained in the study area has occurred due to the dominance of some species and due to anthropic interference by cattle breeding and forest fires observed in previous years. The lower floristic richness found in this study, when compared to other surveys conducted in the Cerrado Biome, may be related to local physical factors and to processes of fragmentation and perturbations that provided conditions for the dominance of some species in the studied fragment.

The processes of fragmentation and disturbance may be related to the presence of fires in previous years and to the frequent grazing of cattle on the farm, since this is a frequent practice in the Piauí State, that is, using the silvopastoral system, that is, cattle breeding in association with native forests.

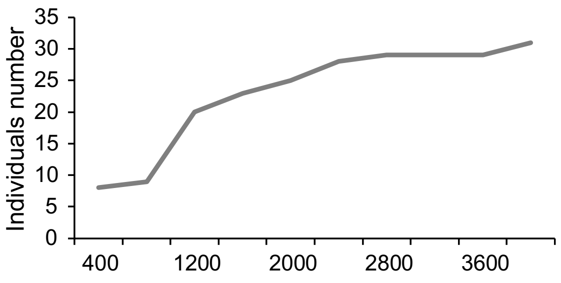

Figure 2. Sampling adequacy curve of a fragment of riparian forest of the Uruçuí-Preto river.

Figura 2. Curva de suficiência amostral de um trecho de mata ciliar do rio Uruçuí-Preto.

3.2. Phytosociology

The evaluated phytosociological parameters are presented in Table 2. The species with the highest absolute density was *Vochysia pyramidalis* (Mart), with 169 individuals, comprising 27.1% of the total number of individuals (621). The second species in terms of abundance was *Alchornea discolor, w*ith 89 individuals, representing 14.3% of the total. The following three species were *Tapirira obtusa*. (n 80; 12.8%), *Mauritia flexuosa* L. (n 42; 6.7%) and *Alibertia edulis* (n 29; 4.6%).

In relation to the absolute density, the site presented 1,553 individuals per hectare. The species that presented higher density, that is, greater number of individuals per unit of area was the *Vochysia pyramidalis* (canjarana), approximately 423 individuals per hectare, followed by the species *Alchornea discolor* (pau loro), with 223 individuals per hectare and *Tapirira obtusa*, with 200 individuals per hectare. On the other hand, the species with the lowest density were *Myrcia* sp.*, Vismia cavennensis, Bauhinia cupulata and Xylopia aromatica.*

For absolute dominance and relative dominance, the species that obtained the highest values were: *Vochysia pyramidalis* and *Mauritia flexuosa,* totaling more than 60% of the total. This difference was also observed for the coverage value index (CV), which represented 25.14 for *Vochysia pyramidalis,* 22.50 for *Mauritia flexuosa* and 8.81 for *Alchornea discolor.*

Regarding the relative frequency, the species that presented the highest percentage were *Vochysia pyramidalis, Mauritia flexuosa*, *Alchornea discolor*, *Tapirira obtusa*, representing more than 30% of the total value, which indicates a wide distribution of these species in the area. The species that presented the highest importance values (IV) were *Vochysia pyramidalis* (19.85), followed by *Mauritia flexuosa* (17.78), *Alchornea discolor* (8.34) and *Tapirira obtusa* (7.58). In general, these species stood out in this community because they present a combination of large number of individuals and high frequency values in the plots, as well as high relative dominance, evidencing that they are numerous and widely distributed in the study area.

3.3. Diameter distribution

The results of the adjustments made for all the studied species and for the species that presented the highest values of IV, such as *Vochysia pyramidalis,* followed by the species *Alchornea discolor*. Tables 2, 3 and 4 show the parameters found in the adjustments of the type I and II Meyer probability density distributions, 3 and 2 parameter Weibull distribution.

Tables 6, 7 and 8 show the values observed and estimated by the distributions. It can be seen that the functions reached at estimated total values different between each other and the real value, and the 3-parameter Weibull distribution was the only one that the values were adherent. It is possible to verify with respect to the observed frequency that a great part of the individuals are among the smaller classes of diameter, which is typical of a native forest.

These results indicate predominance in the lower stratum of low trees and with small diameters in the riparian forest fragment. According to Nunes et al. (2003), areas that had suffered more severe disturbances in the past have higher densities of fine small-height individuals, characterizing the

Table 2. Phytosociological parameters of a riparian forest fragment of the Uruçuí-Preto river.
Tabela 2. Parâmetros fitossociológicos de um fragmento de mata ciliar do rio Uruçuí-Preto.

Scientific name	N	FA	RF (%)	AD	RD (%)	Ado	RDo (%)	IV	CV
Vochysia pyramidalis Mart.	169	1.0	9.26	422.50	27.21	6.61	23.07	19.85	25.14
Alchornea discolor Hook. F.	89	0.8	7.41	222.50	14.33	0.94	3.29	8.34	8.81
Tapirira obtusa (Benth.) J.D. Mitch.	80	0.7	6.48	200.00	12.88	0.97	3.39	7.58	8.14
Mauritia flexuosa L.	42	0.9	8.33	105.00	6.76	10.96	38.23	17.78	22.50
DI	30	0.7	6.48	75.00	4.83	0.89	3.11	4.81	3.97
Licania aff. sclerophylla (Hook. F.) Fritsch.	29	0.3	2.78	72.50	4.67	0.76	2.67	3.37	3.67
Alibertia edulis (L. Rich.) A. Rich	29	0.5	4.63	72.50	4.67	0.31	1.08	3.46	2.87
Byrsonima crispa A.Juss.	18	0.4	3.70	45.00	2.90	0.10	0.33	2.31	1.62
Mauritiella armata (Mart.) Burret.	16	0.4	3.70	40.00	2.58	0.37	1.28	2.52	1.93
Cecropia sp.	16	0.4	3.70	40.00	2.58	0.11	0.40	2.23	1.49
Cariniana rubra Gardner ex Miers	15	0.4	3.70	37.50	2.42	0.68	2.39	2.84	2.40
Curatela americana L.	14	0.3	2.78	35.00	2.25	0.12	0.42	1.82	1.34
Hirtella gracilipes (Hook. F.) Prance	11	0.3	2.78	27.50	1.77	0.03	0.12	1.56	0.95
Inga vera Willd.	11	0.4	3.70	27.50	1.77	0.12	0.42	1.96	1.10
Richeria grandis Vahl	9	0.3	2.78	22.50	1.45	0.35	1.23	1.82	1.34
Calyptrantes sp.	6	0.5	4.63	15.00	0.97	0.08	0.28	1.96	0.62
Protium heptaphyllum (Aubl.) Marchand	5	0.2	1.85	12.50	0.81	2.12	7.39	3.35	4.10
Andira sp.	5	0.4	3.70	12.50	0.81	1.81	6.30	3.60	3.55
Duguetia echinophora R.E.Fr.	5	0.2	1.85	12.50	0.81	1.21	4.23	2.29	2.52
Qualea cf. paraenses Ducke	4	0.3	2.78	10.00	0.64	0.01	0.04	1.15	0.34
Matayba sp.	3	0.2	1.85	7.50	0.48	0.03	0.11	0.81	0.29
Copaifera langsdorffii Desf.	2	0.1	0.93	5.00	0.32	0.00	0.01	0.42	0.17
Ocotea sp.	2	0.1	0.93	5.00	0.32	0.01	0.02	0.42	0.17
UI	2	0.1	0.93	5.00	0.32	0.01	0.03	0.43	0.17
Psidium sp.	2	0.2	1.85	5.00	0.32	0.01	0.04	0.74	0.18
Diospyros sericea A. DC.	2	0.2	1.85	5.00	0.32	0.00	0.02	0.73	0.17
Myrcia splendens (Sw.) DC.	1	0.1	0.93	2.50	0.16	0.00	0.01	0.37	0.09
UI	1	0.1	0.93	2.50	0.16	0.00	0.01	0.37	0.09
Vismia guianensis Pers.	1	0.1	0.93	2.50	0.16	0.01	0.02	0.37	0.09
Bauhinia cupulata Benth	1	0.1	0.93	2.50	0.16	0.01	0.04	0.38	0.10
Xylopia aromatica (Lam.) Mart.	1	0.1	0.93	2.50	0.16	0.01	0.04	0.38	0.10
Sum	621	10.8	100.00	1552.50	100.00	28.67	100.00	100.00	100.00

Where: N = Number of Individuals; UI = Unidentified species; DI = dead individual; AD: Absolute density (ind ha^{-1}); RD = Relative density (%), RF = Relative Frequency (%); ADo = Absolute Dominance; RDo = Relative Dominance (%); IV = Importance Value (%); CV = Coverage Value (%).

Table 3. Parameters of probability density distributions for all species.
Tabela 3. Parâmetro das distribuições de densidade de probabilidade para todas as espécies.

Model	Coefficient	Kolmogorov-Smirnov	
		Tab. 95%	Calculated
Meyer type I	b0 = 4.9055798 b1 = -0.050579	0.05457	0.41424
Meyer type II	b0 = 4.3915342 b1 = -0.000622	0.05457	0.4236
Weibull 2P	a = 2.283 b = 7.774	0.054575	0.14813
Weibull 3P	a = 4.196 b = 3.537 c = 0.6364	0.054575	0.05454

Table 4. Parameters of probability density distributions for the species *Vochysia pyramidalis* (Mart).
Tabela 4. Parâmetros das distribuições de densidade de probabilidade para espécie *Vochysia pyramidalis* (Mart).

Model	Coefficient	Kolmogorov-Smirnov	
		Tab. 95%	Calculated
Meyer type I	b0 = 4.39343 b1 = -0.083692	0.10462	0.21523
Meyer type II	b0 = 3.074488 b1 = -0.000534	0.10462	0.3747
Weibull 2P	a = 1.85 b = 8.189	0.104615	0.16322
Weibull 3P	a = 5.103 b = 5.792 c = 0.5787	0.104615	0.01938

stage of initial regeneration, since the sites that had suffered milder disorders in the past present higher density of tall and larger-diameters individuals, which indicates more advanced regenerative stage.

Although the riparian forest fragment under study showed predominance of low and fine individuals, high-height and diameter species and individuals stood out, such as *Vochysia magnifica, Copaifera langsdorfii* and *Mauritia flexuosa.*

The values calculated by the Kolmogorov-Smirnov test that were smaller than the table indicate the acceptance of the null hypothesis, that is, it means that the expected and observed frequencies do not differ statistically, that is, the model represented well the set of data. Thus, the adherence of the estimated values occurred in the distributions 3-parameter Weibull distribution and type I and type II Meyer. Also, the function of 3-parameter Weibull distribution was significant for all species analyzed and for those with higher IV. On the other hand, the function of type I and II Meyer were significant only for the species *Alchornea discolor* Hook. F.

Figures 1 to 3 show the estimated and observed diametric distribution curves, and it is possible to observe more clearly the behavior of the adjustments of the models. It is observed

Table 5. Parameters of probability density distributions for the species *Alchornea discolor* Hook. F.
Tabela 5. Parâmetros das distribuições de densidade de probabilidade para espécie *Alchornea discolor* Hook. F.

Model	Coefficient	Kolmogorov-Smirnov	
		Tab. 95%	Calculated
Meyer type I	b0 = 4.6850617 b1 = -0.265331	0.14416	0.03427
Meyer type II	b0 = 3.3882566 b1 = -0.012581	0.14416	0.10855
Weibull 2P	a = 2.437 b = 5.186	0.14416	0.15230
Weibull 3P	a = 3.148 b = 3.49 c = 1.01	0.14416	0.02459

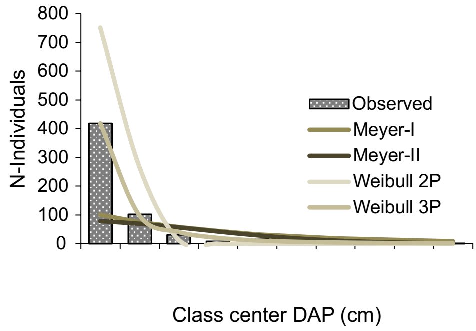

Figure 3. Frequency observed and estimated by the function of type I, II Meyer and 2 and 3-parameter Weibull for all species studied.
Figura 3. Frequência observada e estimada pela função de Meyer I, II e Weibull 2P, 3P para todas espécies estudas.

that the distribution function of type I Meyer was adherent only for the species *Alchornea discolor*, which can also be observed for the function of type II Meyer, in which there was adherence only for the same species mentioned above.

It can be observed in Figures 1 to 3 that the distribution function of 3-parameter Weibull distribution was the one that best adjusted to the set of data in all situations, both for all individuals and for the species with higher IV. Although the function of type I and II Meyer presented an adherent adjustment for the species *Alchornea discolor*, only the 3-parameter Weibull distribution obtained an estimated frequency with a higher degree of approximation of the observed frequency and consequently obtained satisfactory results to estimate the diametric distribution of the set of data.

Some studies that used the Weibull distribution to estimate the diametric distribution in native forests obtained good results

Table 6. Frequencies observed and estimated by functions for all species.
Tabela 6. Frequências observadas e estimadas pelas funções para todas as espécies.

Class center	Actual frequency (ha)	Frequencies estimated by distributions			
		Meyer type I	Meyer type II	Weibull 2p	Weibull 3p
5.95	418	99.95	77.94	751.79	418.19
11.45	103	75.68	69.09	266.37	97.53
16.95	31	57.30	56.24	13.22	40.15
22.45	9	43.38	42.03	0.09	19.74
27.95	16	32.85	28.85	0.00	10.68
33.45	16	24.87	18.18	0.00	6.15
38.95	17	18.83	10.52	0.00	3.70
44.45	5	14.26	5.59	0.00	2.31
49.95	5	10.80	2.73	0.00	1.48
55.45	1	8.17	1.22	0.00	0.97
Total	621	386	312	1031	601

Table 7. Frequencies observed and estimated by functions for the species *Vochysia pyramidalis* (Mart).
Tabela 7. Frequências observadas e estimadas pelas funções para espécie *Vochysia pyramidalis* (Mart).

Class center	Actual frequency (ha)	Frequencies estimated by distributions			
		Meyer type I	Meyer type II	Weibull 2p	Weibull 3p
7	112	46.19	20.87	158.13	111.99
14	27	25.71	17.93	40.60	27.37
21	13	14.31	13.69	2.82	12.85
28	8	7.97	9.30	0.07	7.23
35	6	4.43	5.61	0.00	4.46
42	2	2.47	3.01	0.00	2.92
49	0	1.37	1.44	0.00	1.99
56	1	0.76	0.61	0.00	1.40
Total	169	103.21	72.44	201.62	170.23

Tabela 8. Frequencies observed and estimated by functions for the species *Alchornea discolor* Hook. F.
Tabela 8. Frequências observadas e estimadas pelas funções para espécie *Alchornea discolor* Hook. F.

Class center	Actual frequency (ha)	Frequencies estimated by distributions			
		Meyer type I	Meyer type II	Weibull 2p	Weibull 3p
4	40	35.54	23.72	169.32	39.93
6	22	20.91	18.26	123.83	22.74
8	15	12.30	12.71	43.95	12.81
10	5	7.23	8.00	7.58	7.18
12	4	4.25	4.55	0.62	4.02
14	3	2.50	2.34	0.02	2.24
Total	89	83	70	345	89

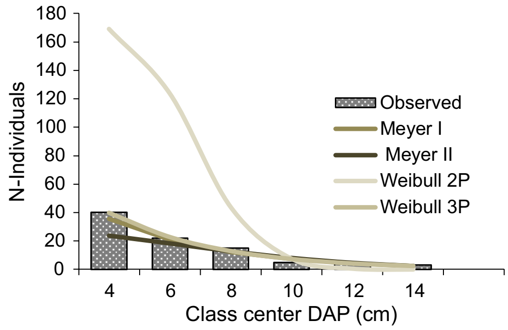

Figure 4. Frequency observed and estimated by the function of type I, II Meyer and 2 and 3-parameter Weibull for the species *Vochysia pyramidalis*.
Figura 4. Frequência observada e estimada pela função de Meyer I e II, Weibull 2P, 3P para espécie *Vochysia pyramidalis*.

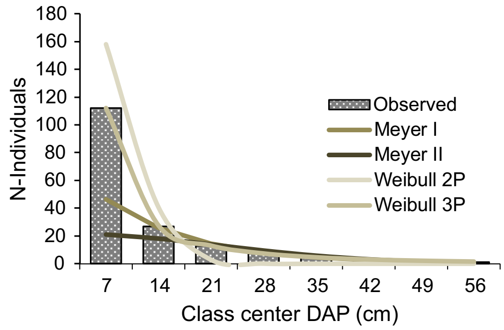

Figure 5. Frequency observed and estimated by the function of type I, II Meyer and 2 and 3-parameter Weibull for the species *Alchornea discolor*.
Figura 5. Frequência observada e estimada pela função de Meyer I, II e Weibull 2P, 3P para espécie *Alchornea discolor*.

with this function. Among these studies, we can mention the studies Orellana et al. (2014), Ebling et al. (2014), Kuchla et al. (2015), among others.

4. CONCLUSIONS

The species *Vochysia pyramidalis, Mauritia flexuosa*, *Alchornea discolor* and *Tapirira obtuse* presented high density and frequency in the studied area, with the highest values of IV, which shows that these species have a wide distribution in the banks of the Uruçuí-Preto river, and this data can help in recovery projects for degraded environments.

The diametric distribution of the studied species was presented in a decreasing manner, that is, negative exponential, with a higher concentration of individuals in the smaller diameter classes and with a lower concentration in the higher classes.

The 3-parameter Weibull distribution presented adequate adjustment for both data and can be indicated to describe the diametric and auxiliary distribution in the decision making on the management and conservation of the species.

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