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TREE COMMUNITY STRUCTURE IN A SEASONALLY DRY TROPICAL FOREST REMNANT, BRAZIL

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ABSTRACT: *Most studies on Seasonally Dry Tropical Forests (SDTFs) investigate phytogeographic patterns and floristic connections of this disjunct biome. However, little is known about the structural characteristics of SDTFs. We aimed to describe the structure of a SDTF in an ecotonal area between the Cerrado and Caatinga domains. In total, 79 tree species were recorded, and high values of Shannon diversity index (3.6 nats/individual) and equability (0.83) were observed. The diameter distribution for the species with higher cover values and for the entire community did not exhibit a reverse-J shaped distribution, which indicates the occurrence of different growth strategies and ecological adaptations to water stress. The results did not indicate the formation of floristic groups, as the high soil fertility in the study area results in a homogeneous environment. The structural characteristics of the study area associated with the soil composition highlight its importance for conservation and emphasize the need for community structure studies in SDTFs.*

Keywords: diameter distribution, Caatinga, phytosociology, conservation.

ESTRUTURA DA COMUNIDADE ARBÓREA DE UM FRAGMENTO DE FLORESTA TROPICAL SAZONALMENTE SECA, BRASIL

RESUMO: A maior parte dos estudos envolvendo as Florestas Tropicais Sazonalmente Secas aborda questões fitogeográficas e conexões florísticas deste bioma disjunto. Porém, pouco se conhece a respeito das características estruturais da FTSS. Devido a esta lacuna existente na literatura, buscamos descrever a estrutura de um fragmento remanescente de FTSS em uma área ecotonal entre domínio do Cerrado e da Caatinga. Ocorreram no estudo grande número de espécies arbóreas, 79, e altos valores para os índices de diversidade e equabilidade (3,6 nats/indivíduos e 0,83, respectivamente). A distribuição diamétrica para os indivíduos que apresentaram maiores valores de cobertura e para a comunidade não resultou em padrão de J-reverso, o que indica adaptações ecológicas ao stress hídrico adotadas em diferentes estratégias de crescimento. Não houve formação de grupos florísticos, já que a alta fertilidade do solo da área de estudo configura um ambiente homogêneo. A característica da área de estudo detectada através da estrutura, associada a dados edáficos, nos permitiu vislumbrar sua importância em termos de conservação e reforçar a importância de estudos com este enfoque nas FTSS.

Palavras-chave: distribuição diamétrica, Caatinga, fitossociologia, conservação.

1 INTRODUCTION

The Seasonally Dry Tropical Forest (SDTF) biome has physiognomic, taxonomic, and structural peculiarities due to a phytogeographical report in which provided its disjunction along South America according to the refuge theory (PENNINGTON et al., 2000, 2006; PRADO; GIBBS, 1993).

The longest continuous extent of SDTFs occurs in the Caatinga domain as a mosaic of "ecoregions" and "floristic units" (SANTOS et al., 2012; VELLOSO; SAMPAIO, 2002). This variability is caused mostly by variations in climate, topography, edaphic conditions, and human intervention among the areas (VELLOSO; SAMPAIO, 2002). Nevertheless, there are few studies of plant communities in dry environments compared to more humid ones in Brazil (LIMA et al., 2007; SILVA; SCARIOT, 2004). Even though several studies have focused on the phytogeography and florisitic connections of SDTFs (OLIVEIRA-FILHO et al., 2006; PENNINGTON et al., 2000; SANTOS et al., 2012), few studies aimed to examine their structural characteristics. Vegetation structure studies are complementary to phytogeographic ones as they help understand the environmental and spatial characteristics of SDTFs.

Vegetation structure varies greatly among SDTF patches, mostly due to the environmental heterogeneity along their distribution. Most vegetation structure studies in the SDTF biome were done in the more xeric part of the Caatinga (PEREIRA et al., 2002; RODAL;

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NASCIMENTO, 2006), whereas few ones investigated the ecotonal area between the Caatinga and Cerrado domains (SANTOS et al., 2011, 2012). However, SDTF patches have differences in tree species composition, abundance, and individual size (SANTOS et al., 2007).

Because SDTFs occur in areas of high soil fertility, they are subjected to disturbance by farming (PENNINGTON et al., 2000, 2006), and only few remnants with primary vegetation can be found in the area. The settlement and development of the region caused the reduction and alteration of natural vegetation, and diversity studies of these communities are fundamental to design conservation strategies for the remaining forests.

This study aimed to investigate the structure of the tree community of a Seasonally Dry Tropical Forest remnant in an ecotonal area between the Cerrado and Caatinga domains in northern Minas Gerais, Brazil.

2 MATERIAL AND METHODS

2.1 Study area

The study was done in a SDTF remnant of approximately 40 ha located in the municipality of Juvenília (14º26'04'' S and 44º10'67'' W). The area has a gentle slope with the soil depth gradient characterized by shallower soils in its lowest part, rocky outcrops in its intermediate section, and deeper soils in its highest part. The average annual rainfall is 1000 mm and the area experiences more rain from November to January (SANTOS et al., 2011).

2.2 Tree community survey

Sixty 20 x 20 m (400 m^2) plots, totaling 2.4 ha, were distributed along three transects 50 m apart from each other, parallel to the largest dimension of the remnant and following the soil depth gradient. At each point of the transect, two plots were established 10 m apart from each other, and the same procedure was repeated every 20 m. All individuals with DBH (diameter at breast height) ≥ 10 cm at 1.30 m from soil were recorded.

The botanical material was herborized and the control collection deposited in the Montes Claros herbarium of Universidade Estadual de Montes Claros (UNIMONTES). The Angiosperm Philogeny Group II (ANGIOSPERM PHYLOGENY GROUP - APG, 2003) classification system was adopted.

2.3 Environmental variables

To determine the relationships between edaphic variables and vegetation, three 0.5 l surface samples (0–20 cm depth) were taken per plot for analysis of particle size distribution and chemical composition of soils. The soil samples were stored in plastic bags and taken to the Federal University of Lavras Soil Analysis Laboratory (Laboratório de Análise de Solos da Universidade Federal de Lavras), where the following variables were measured: pH in water; levels of potassium (K), phosphorus (P), calcium (Ca), magnesium (Mg), and aluminum (Al); potential acidity (H+Al), sum of bases (Sb), effective CEC (t), CEC at pH 7.0 (T), aluminum saturation (m), base saturation (V), carbon (C), organic matter (OM), and sand, silt, and clay fractions. Laboratory procedures followed the Brazilian Agricultural Research Corporation protocols (EMPRESA BRASILEIRA DE PESQUISA AGROPECUÁRIA - EMBRAPA, 2006).

2.4 Tree community descriptive parameters

To describe tree community structure, the traditional quantitative parameters proposed by Mueller-Dombois and Ellenberg (1974) were calculated per species: absolute density (AD, ind/ha); absolute frequency (AF, %); absolute dominance (ADo) expressed by basal area (m^2/ha); and cover value (CV). The Shannon diversity index (H') and Pielou equability (J') measures of diversity (BROWER; ZAR, 1984) were also calculated. Tree density distributions per diameter class were analyzed for the community and for the 11 species of highest cover value. Class intervals with growing ranges were used to compensate for the significant decrease in the number of individuals in larger diameter size classes, typical of a reverse-J shaped negative exponential distribution (BOTREL et al., 2002). The Kruskal-Wallis test was used to assess if the number of individuals in each diameter class was similar among the three transects (ZAR, 2010).

2.5 Analysis of environmental variables

To correlate the environmental variables with vegetation variables, a Canonical correspondence Analysis (CCA) was performed using Pc-ord-5 software (MCCUNE; MEFFORD, 2006). The abundance values were $\log_{10}$ (a+1) transformed to compensate for deviations caused by outliers (TER BRAAK, 1995).

Fifteen soil parameters [P, pH, K, Ca, Mg, H+Al, SB, (t), (T), V, OM, P-rem, sand, silt, and clay] were investigated, but after a preliminary analysis, 10 parameters were removed as they were weakly correlated with the environmental data or redundant, which could result in high collinearity. Thus, only the five variables [K, Ca, (T), OM, and P-rem] most strongly correlated with the ordination axes were analyzed.

3 RESULTS

3.1 Floristics, structure, and diversity

In total, 1828 individuals were sampled in the sixty plots, with a density of 761.67 ind.ha^{-1} and basal area of 40.657 m^{2}ha^{-1}. The individuals were distributed among 79 tree species belonging to 67 genera and 29 families (Table 1). The most representative families were: Fabaceae (22 species); Bignoniaceae, Euphorbiaceae, and Malvaceae (five species each); Anacardiaceae and Rutaceae (four species each); Nyctaginaceae (three); followed by Cordiaceae, Cactaceae, Lamiaceae, Malpighiaceae, Meliaceae, Moraceae, Myrtaceae, Polygonaceae, and Rubiaceae (two species each), representing 55.2% of the sampled species. The other families (44.8%) were represented by a single species. The genus with the highest species richness was *Handroanthus* (four species), followed by *Zanthoxylum* (three species), *Bauhinia*, *Eugenia*, *Guapira*, *Manihot*, *Ptilochaeta*, *Senegalia*, and *Senna* (two species each), corresponding to 26.6% of the sampled species. The 10 species with highest density were *Aspidosperma pyrifolium* Mart., *Commiphora leptophloeus* (Mart.) J.B. Gillet, *Ptilochaeta glabra* Nied., *Combretum duarteanum* Cambess., *Anadenanthera colubrina* (Vell.) Brenan, *Handroanthus impetiginosus* (Mart. ex DC.) Mattos, *Coccoloba schwackeana* Lindau, *Coutarea hexandra* (Jacq.) K.Schum., *Myracrodruon*

Table 1 - Species sampled in the floristic and structural surveys with their respective phytosociologic parameters in a SDTF remnant: (DA) Absolute Density; (FA) Absolute Frequency; Absolute Dominance (DoA); and cover value (VC).

Tabela 1 *- Espécies amostradas nos levantamentos florístico e estrutural, com seus respectivos parâmetros fitossociológicos em um remanescente de FTSS. (DA) Densidade Absoluta; (FA) Frequência Absoluta; (DoA) Dominância Absoluta e (VC).*

FAMILY	SPECIES	NI	DA	FA	DOA	VC
Anacardiaceae	*Cyrtocarpa caatingae* Mitchell & Daly	1	0.42	1.67	0.00	0.03
	Myracrodruon urundeuva Allemão	92	38.33	70.00	2.26	9.19
	Schinopsis brasiliensis Engl.	6	2.50	5.00	0.02	0.23
	Spondias tuberosa Arruda	7	2.92	11.67	0.24	0.90
Annonaceae	*Rollinia leptopetala* R.E.Fr.	10	4.17	13.33	0.02	0.33
Apocynaceae	*Aspidosperma pyrifolium* Mart.	60	25.00	40.00	0.16	2.12
Araliaceae	*Aralia warmingiana* (Marchal) J.Wen	5	2.08	6.67	0.02	0.19
Arecaceae	*Syagrus oleracea* (Mart.) Becc.	51	21.25	46.67	0.49	2.85
Bignoniaceae	*Handroanthus heptaphyllus* (Martius) Mattos	1	0.42	1.67	0.00	0.04
	Handroanthus impetiginosus (Mart. ex DC.) Mattos	80	33.33	40.00	0.59	3.92
	Handroanthus ochraceus (Cham.) Mattos	29	12.08	15.00	0.27	1.60
	Handroanthus spongiosus (Rizzini) S.O.Grose	19	7.92	15.00	0.17	1.02
	Tabebuia roseoalba (Ridl.) Sandwith	45	18.75	38.33	0.10	1.52
Boraginacear	*Auxemma oncocalyx* (Allemão) Taub.	4	1.67	5.00	0.07	0.31
	Patagonula bahiensis Moric.	5	2.08	5.00	0.02	0.21
Burseraceae	*Commiphora leptophloeus* (Mart.) J.B.Gillet	64	26.67	58.33	1.36	5.77
Cactaceae	*Cereus jamacaru* DC.	7	2.92	11.67	0.06	0.35
	Pereskia bahiensis Gürke	45	18.75	43.33	0.46	2.58
Cannabaceae	*Celtis brasiliensis* (Gardn.) Planch.	2	0.83	3.33	0.00	0.06
Celastraceae	*Fraunhofera multiflora* Mart.	33	13.75	35.00	0.24	1.62
Combretaceae	*Combretum duarteanum* Cambess.	72	30.00	35.00	0.16	2.45
Erythroxylaceae	*Erythroxylum caatingae* Plowman	15	6.25	16.67	0.02	0.47
Euphorbiaceae	*Cnidoscolus oligandrus* (Müll.Arg.) Pax	6	2.50	10.00	0.02	0.24
	Jatropha mollissima (Pohl) Baill.	3	1.25	3.33	0.01	0.10
	Manihot anomala Pohl	3	1.25	3.33	0.00	0.09
	Manihot dichotoma Ule	2	0.83	3.33	0.00	0.06
	Sapium glandulosum (L.) Morong	10	4.17	15.00	0.01	0.30

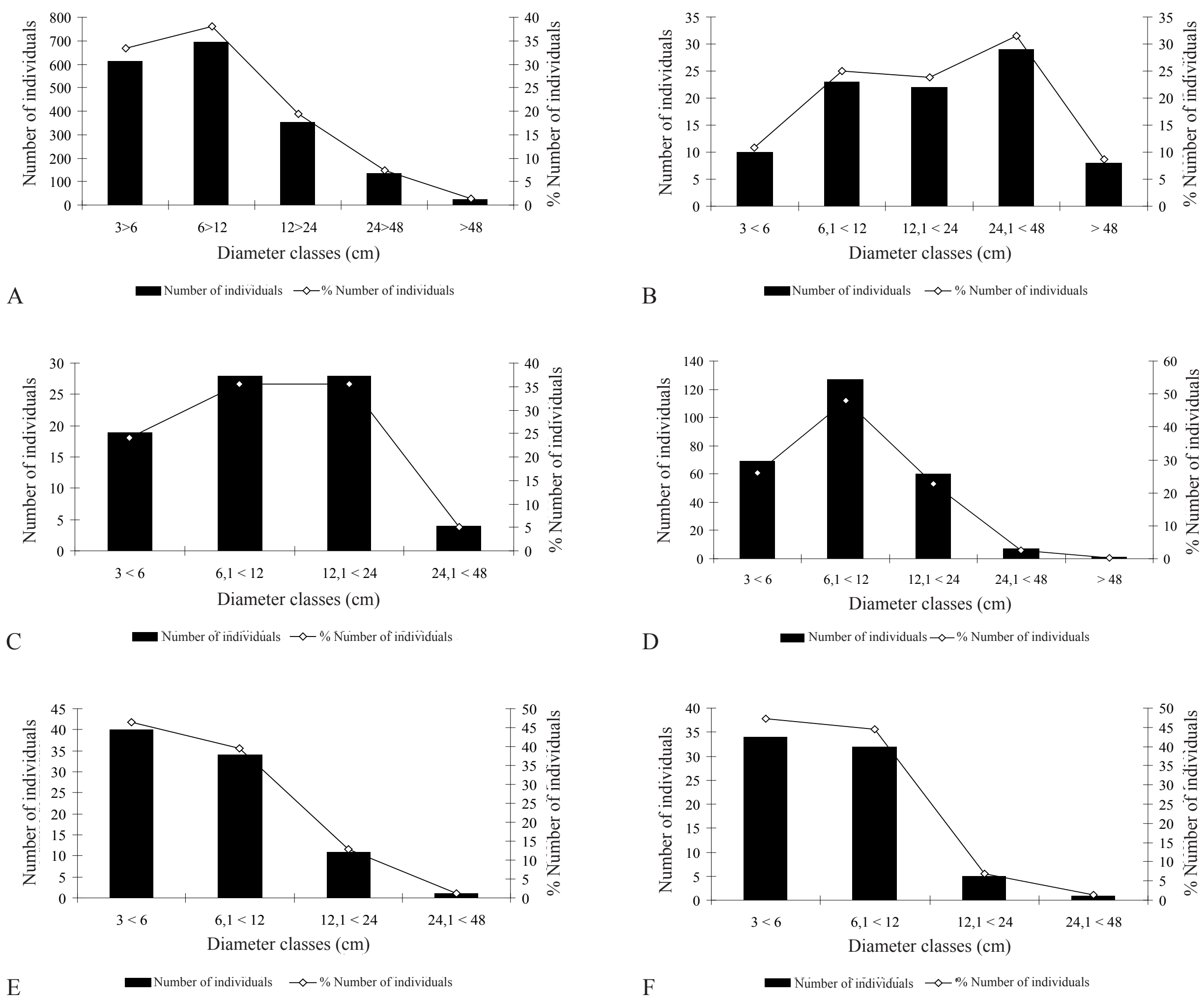
FAMILY	SPECIES	NI	DA	FA	DOA	VC
	Sapium glandulosum (L.) Morong	10	4.17	15.00	0.01	0.30
Fabaceae	*Anadenanthera colubrina* (Vell.) Brenan	79	32.92	48.33	0.45	3.49
	Bauhinia cheilantha (Bong.) Steud.	19	7.92	15.00	0.02	0.56
	Bauhinia forficata Link	31	12.92	35.00	0.03	0.93
	Cassia ferruginea (Schrad.) Schrad. ex DC.	1	0.42	1.67	0.01	0.05
	Chloroleucon dumosum (Benth.) G.P.Lewis	2	0.83	3.33	0.01	0.07
	Dalbergia cearensis Ducke	41	17.08	28.33	0.15	1.56
	Erythrina velutina Willd.	1	0.42	1.67	0.00	0.03
	Holocalyx balansae Micheli	2	0.83	3.33	0.03	0.14
	Lonchocarpus sericeus (Poiret) DC.	1	0.42	1.67	0.00	0.03
	Luetzelburgia auriculata (Allemão) Ducke	12	5.00	11.67	0.02	0.40
	Machaerium acutifolium Vogel	28	11.67	33.33	0.06	0.95
	Mimosa tenuiflora (Willd.) Poir.	10	4.17	11.67	0.02	0.32
	Piptadenia viridiflora (Kunth) Benth.	2	0.83	3.33	0.02	0.13
	Plathymenia reticulata Benth.	3	1.25	3.33	0.02	0.15
	Poincianella pluviosa (DC.) L. P. Queiroz	265	110.4	90.00	1.19	10.8
	Pseudopiptadenia warmingii (Benth.) G.P.Lewis & M.P.Lima	36	15.00	16.67	0.06	1.17
	Pterocarpus villosus (Mart. ex Benth.) Benth.	3	1.25	1.67	0.01	0.10
	Senegalia martii (Benth.) Seigler & Ebinger	11	4.58	16.67	0.03	0.39
	Senegalia polyphylla (DC.) Britton & Rose	6	2.50	8.33	0.02	0.22
	Senna multijuga (L.C.Rich.) H.S.Irwin & Barneby	1	0.42	1.67	0.00	0.03
	Senna spectabilis (DC.) H.S.Irwin & Barneby	1	0.42	1.67	0.00	0.03
	Sweetia fruticosa Spreng.	6	2.50	10.00	0.05	0.30
Lamiaceae	*Aegiphila sellowiana* Cham.	9	3.75	11.67	0.04	0.36
	Vitex laciniosa Turcz.	26	10.83	25.00	0.14	1.13
Lythraceae	*Lafoensia vandelliana* Cham. & Schltdl.	2	0.83	3.33	0.00	0.07
Malpighiaceae	*Ptilochaeta bahiensis* Turcz.	29	12.08	13.33	0.07	1.01
	Ptilochaeta glabra Niedz.	65	27.08	50.00	0.12	2.12
Malvaceae	*Cavanillesia arborea* (Willd.) K.Schum.	23	9.58	35.00	5.37	16.5
	Ceiba pubiflora (A.St.-Hil.) K.Schum.	5	2.08	8.33	0.17	0.62
	Luehea paniculata Mart. & Zucc.	7	2.92	6.67	0.03	0.28
	Pseudobombax marginatum (A.St.-Hil.) A.Robyns	12	5.00	18.33	0.35	1.37
	Sterculia striata A.St.-Hill. & Naudin	29	12.08	31.67	0.54	2.38
Meliaceae	*Cedrela fissilis* Vell.	10	4.17	13.33	0.20	0.86
	Trichilia hirta L.	15	6.25	18.33	0.16	0.89
Moraceae	*Ficus calyptroceras* (Miq.) Miq.	3	1.25	5.00	0.02	0.13
	Maclura tinctoria (L.) D.Don ex Steud.	4	1.67	5.00	0.02	0.18
Myrtaceae	*Eugenia florida* DC.	50	20.83	38.33	0.13	1.76
	Eugenia uniflora L.	33	13.75	31.67	0.04	1.03
Nyctaginaceae	*Bougainvillea praecox* Griseb.	4	1.67	6.67	0.01	0.12
	Guapira hirsuta (Choisy) Lundell	1	0.42	1.67	0.00	0.04
	Guapira opposita (Vell.) Reitz	10	4.17	15.00	0.04	0.40
Polygonaceae	*Coccoloba schwackeana* Lindau	87	36.25	60.00	0.22	3.04
	Ruprechtia laxiflora Meisn.	11	4.58	15.00	0.04	0.42
Rubiaceae	*Coutarea hexandra* (Jacq.) K.Schum.	90	37.50	43.33	0.15	2.91
	Randia armata (Sw.) DC.	21	8.75	25.00	0.02	0.64
Rutaceae	*Balfourodendron molle* (Miquel) Pirani	19	7.92	11.67	0.05	0.66
	Zanthoxylum petiolare A.St.-Hil. & Tul.	4	1.67	6.67	0.01	0.13
	Zanthoxylum riedelianum Engl.	4	1.67	6.67	0.01	0.13
	Zanthoxylum stelligerum Turcz.	2	0.83	3.33	0.00	0.06
Salicaceae	*Casearia selloana* Eichl.	11	4.58	11.67	0.02	0.36
Sapindaceae	*Dilodendron bipinnatum* Radlk.	2	0.83	1.67	0.00	0.07
Solanaceae	*Capsicum parvifolium* Sendtn.	2	0.83	3.33	0.00	0.06
Total		1827	761.6	1428.3	16.94	100

urundeuva Allemão, and *Poincianella pluviosa* (DC.) L.P. Queiroz. The three species with highest basal area values were *Cavanillesia arborea* (Willd.) K.Schum (31.67%), *M. urundeuva* (13.85%), and *C. leptophloeus* (8.03%), representing 53.04% of total basal area. The species with highest cover value were *C. arborea* (16.5%), *P. pluviosa* (10.8%), *M. urundeuva* (9.2%), *C. leptophloeus* (5.8%), and *H. impetiginosus* (3.9%), corresponding to 46.1% of total cover value. The Shannon diversity index (H') for the 79 species sampled was 3.6 nats/individual and equability (J) was 0.83.

Two species included in the official list of endangered species of the Brazilian flora were sampled in the SDTF remnant: *M. urundeuva* (92 individuals, basal area: 5.43 m², AD: 21.25 ind/ha, AF: 70%, CV: 9.19) and *Schinopsis brasiliensis* Engl. (six individuals, basal area: 0.056 m², AD: 2.5 ind/ha, AF: 5%, CV: 0.233). In addition, two species listed as "insufficient information" were sampled: one individual of *Cyrtocarpa caatingae* J.D. Mitch. & Daly (basal area: 0.001 m², AD: 0.417, AF: 1.667, CV: 0.029) and *Handroanthus spongiosus* (19 individuals, basal area: 0.406 m², AD: 7.917, AF: 15%, CV: 1.019).

The diameter distribution of the tree community had a larger percentage of individuals in the second diameter class (6.1–12 cm) (Fig. 1A).

The first diameter class (3–6 cm) corresponded to 33.6% of the individuals, the second class (6.1–12 cm) 38.0%, the third class (12.1–24 cm) 19.4%, and the fourth class (24.1–48 cm) 7.3% of all individuals sampled. The 48.1–96 cm class and those larger than 96.1 cm represented 1.7% and 0.3% of the individuals, respectively. Different diameter distribution patterns were observed in the species with greater cover value. For instance, *M. urundeuva* (Fig. 1B), *A. colubrina* (Fig. 1C), and *P. pluviosa* (Fig. 1D) exhibited a tendency towards the normal distribution, with fewer individuals in the upper and lower diameter classes. Conversely, *C. schwackeana* (Fig. 1E), *C. duarteanum* (Fig.



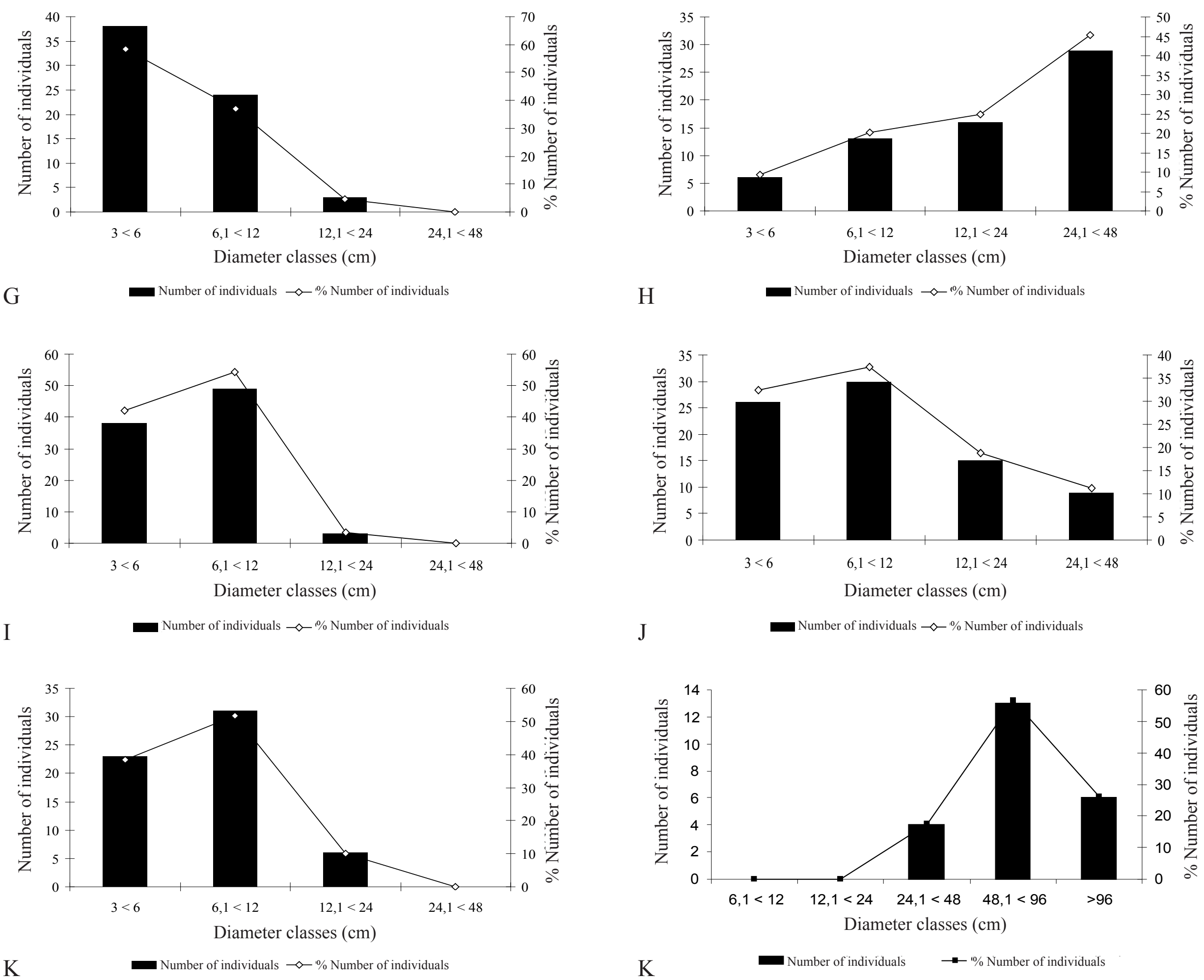


Figure 1- Diameter distribution of the tree community and of the 11 species of greatest cover value in a seasonally dry tropical forest remnant, Minas Gerais, Brazil.

***Figura 1**- Distribuição diamétrica da comunidade arbórea e das 11 espécies de maior valor de cobertura em um fragmento de floresta tropical sazonalmente seca, Minas Gerais, Brasil.*

A) tree community (comunidade arbórea) B) *Myracrodruon urundeuva* Allemão., C) *Anadenanthera colubrina* (Vell.) Brenan., D) *Poincianella pluviosa* DC., E) *Coccoloba schwackeana* Lindau., F) *Combretum duarteanum* Cambess., G) *Ptilochaeta glabra* Niedz., H) *Commiphora leptophloeus* (Mart.) J.B. Gillet., I) *Coutarea hexandra* (Jacq.) K. Schum., J) *Handranthus impetiginosus* (Mart. ex DC.) Standl., K) *Aspidosperma pyrifolium* Mart., and L) *Cavanillesia arborea* (Willd.) K.Schum.

1F), and *P. glabra* (Fig. 1G) exhibited a tendency towards reverse J-shaped distributions, with a higher number of individuals in lower diameter classes, whereas *Commiphora leptophloeus* (Fig. 1H) and *C. arborea* (Fig. 1L) tended towards J-shaped distributions, with the highest percentage of individuals in the largest diameter class. The species *C. hexandra* (Fig. 1J), *H. impetiginosus* (Fig. 1K), *P. pluviosa*, and *A. pyrifolium* (Fig. 1L) had the greatest percentage of individuals in the second diameter class, as observed in the diameter distribution of the entire community.

3.2 Environmental variables

The eigenvalues found in the CCA were 0.182 for the first axis and 0.146 for the second axis. The low eigenvalues found (<0.5) indicate the occurrence of a poor species replacement in the soil gradient. The first axis accounted for 4.3% and the second 3.5% of data total variance (accumulated total 7.8%) resulting in a higher proportion of unexplained variation. However, "noise" data are common in vegetation studies and do not affect the interpretation of species-environment relationships (TER BRAAK, 1987). Therefore, this poor species replacement indicates that soil variables had little impact in explaining the variation in vegetation abundance. Nevertheless, the abundance CCA (Fig. 2) had a high correlation in the two first axes (0.895 and 0.787), indicating the significance of the species-environment relationship.

The Monte Carlo permutation test showed that species abundance correlated significantly with environmental variables in the first two ordination axes (p=0.001). All soil variables correlated positively with the first axis, with the exception of K, which correlated negatively with the first axis. Finally, P-rem correlated negatively with the second axis.

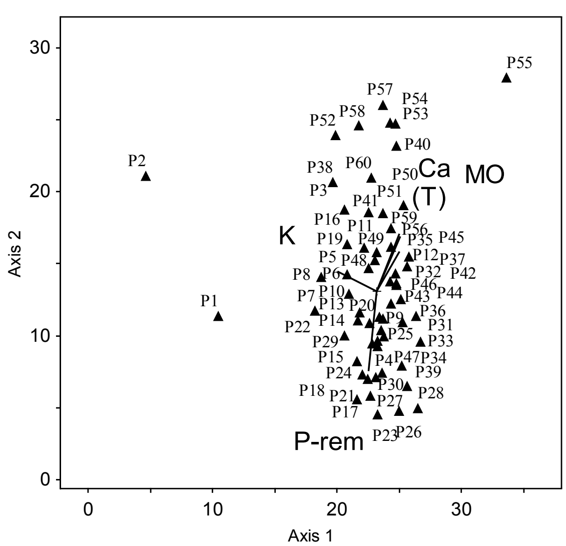


Figure 2 - Canonical correspondence analysis (CCA) diagram of species abundance in a Seasonally Dry Tropical Forest remnant in Minas Gerais, Brazil.

***Figura 2** - Diagrama gerado pela análise de correspondência canônica (CCA) de abundância de espécies em um remanescente de Floresta Tropical Sazonalmente Seca (FTSS) em Minas Gerais, Brasil.*

4 DISCUSSION

4.1 Floristics, structure, and diversity

The number of species recorded in our study (79) was higher than in most studies that investigated the structure of SDTFs, which ranged between 40 and 70 species (ARRUDA et al., 2011; FAGUNDES et al., 2007; FELFILI et al., 2007; SANTOS et al., 2007). The studies that found more than 75 species in SDTF fragments (LIMA et al., 2009; SANTOS et al., 2012) had larger sample sizes or lower inclusion criteria that enabled the inclusion of non-tree species.

The high species richness found in the study site was probably the result of its location in a transitional area between the Cerrado and Caatinga domains, which enables the overlapping of species niches, its association with high fertility soils and good conservation status. Moreover, the species with endangered conservation status and little scientific knowledge highlight the importance of preserving the study area.

Fabaceae had the highest species richness in the study community. In fact, this family is very typical of and predominant in SDTFs, and was the most representative family in most studies on community structure of SDTFs (ARRUDA et al., 2011; NASCIMENTO et al., 2004; SANTOS, 2007). Other families with high species richness in our study such as Bignoniaceae, Malvaceae, and Euphorbiaceae were also representative in other vegetation studies in northern Minas Gerais (SANTOS et al., 2007, 2011). According to Gentry (1995), these families are typical of deciduous communities. Moreover, the study area can be included in the SDTFs great biome (PENNINGTON et al., 2009), and this SDTF patch is being able to be a great species dispersion nucleus into other areas due to the species richness found (SANTOS et al., 2012).

Three of the 10 species with the highest density have also the highest density in the study by Nascimento et al. (2004) in a deciduous slope forest in Monte Alegre, state of Goiás, Brazil: *C. duarteanum*, *H. impetiginosus*, and *M. urundeuva*. In fact, the latter species was recorded in most studies of the Caatinga (NASCIMENTO et al., 2004; SANTOS et al., 2007, 2011; SILVA; SCARIOT, 2004) along with *C. arborea* (FELFILI et al., 2007; NASCIMENTO et al., 2004; SANTOS et al., 2011), which shows the great representativeness of the two species in several areas of the Caatinga domain, their tolerance to environmental heterogeneity, and strong adaptation to the seasonal characteristics of the SDTF biome.

Several species recorded in the study site are cited by Prado and Gibbs (1993) as typical of the Caatinga such as *A. colubrina*, *Piptadenia viridiflora* (Kunth) Benth, *Ruprechtia laxiflora* Meisn., *S. brasiliensis, Sterculia striata* A. St.-Hill. & Naudin, *C. leptophloeus*, *Machaerium acutifolium* Vogel, *Senna spectabilis* (DC.) H.S. Irwin & Barneby, and *A. pyrifolium*. Additionally, the species *Fraunhofera multiflora* Mart. and *Spondias tuberosa* Arruda are endemic to that domain.

According to the classification by Santos et al. (2012), Caatinga species are distributed into five floristic subunits: Caatinga growing on soils derived from crystalline basements, Caatinga on sedimentary sand deposits, rupicolous Caatinga, arboreal Caatinga, and dry forests. The study area is characterized by the presence of species typical of arboreal Caatinga such as *C. arborea*, *Cereus jamacaru* DC., *C. duarteanum*, *M. urundeuva*, *Bauhinia cheilantha* (Bong.) Steud., *Casearia selloana* Eichl., *C. caatingae*, *Pereskia bahiensis* Gürke, *P. pluviosa*, and species typical of dry forests such as *Eugenia florida* DC., *Guapira opposita* (Vell.) Reitz, *Handroanthus ochraceus* (Cham.) Mattos, *H. impetiginosus*, *Zanthoxylum stelligerum* Turcz., *A. colubrina*, and *M. acutifolium* (SANTOS et al., 2007, 2012). Additionally, *S. tuberosa* and *Jatropha mollissima* (Pohl) Baill. were considered by Santos et al. (2012) as restricted to the crystalline Caatinga. The presence of species that occur in different phytophysiognomies reinforces the ecotonal character of the study area and emphasizes its conservation and biological importance.

Cavanillesia arborea had the highest cover value, which can be explained mainly by the large basal area values found in spite of its low RD. *Poincianella pluviosa* had the second highest cover value, but contrarily to *C. arborea* had small basal area and high DR, with several individuals equally distributed in the plots. These results demonstrate the opposite colonization strategies by the most representative species: to allocate resources either in basal area or large numbers of individuals.

We found higher values for the Shannon diversity index (H') and equability (J') than in other SDTF studies (SANTOS et al., 2007; SILVA; SCARIOT, 2004), further highlighting the importance of the study area for conservation.

The diameter distribution of *M. urundeuva* and *A. colubrina* exhibited a tendency towards normality, with a small percentage of individuals in smaller and larger diameter classes. A similar pattern was found by Fagundes et al. (2007) and Santos et al. (2011). In addition, the diameter distribution of *P. pluviosa* also exhibited a tendency towards normality, both in our study and in the one by Santos et al. (2011). Conversely, *C. leptophloeus* exhibited a J-shaped distribution, suggesting the role of seasonality in the recruitment of individuals, as this process is more intense in the recruitment phase than in established individuals, which usually remain stable over the years (CARVALHO; FELFILLI, 2011). Our results indicate that the diameter distribution of SDTF species has a different pattern from most humid forest communities, which exhibit a tendency towards reverse-J shaped distributions, with larger numbers of individuals in smaller diameter classes.

The environmental seasonality results in leaf loss and, consequently, increased incidence of light, during the dry season, affecting ecological processes such as species growth and stem increase, which are higher in the rainy season (CARVALHO; FELFILI, 2011). For instance, by storing water in their stems, some species such as *C. arborea*, *S. tuberosa*, and *C. jamacaru* exhibit higher growth rates in periods of higher water availability and avoid drought in seasonal environments (CARVALHO; FELFILI, 2011; NASCIMENTO et al., 2004).

The study site is well-preserved, and the patterns found cannot be explained by human interference, but by the heterogeneity of the average diameter distribution of SDTF species, as observed in other studies of these communities (FAGUNDES et al., 2007; SANTOS et al., 2011). The seasonal character of the environment results in the seasonality of ecological processes (PENNIGTON et al., 2000), which affect each species differently depending on their ecological adaptive strategies to water stress.

4.2 Environmental variables

The CCA did not indicate the formation of floristic groups in the study site. This result was probably caused by the uniform soil fertility in the area, which results in a homogeneous environment with little species variability among transects.

The ordination graph presented a short gradient due to the great soil fertility in the study area. Even though the homogeneity in soil fertility along the fragment results in little variability in species richness and abundance, the high correlation between the first two axes indicates that this homogeneity is one of the main factors affecting species composition and distribution. In addition to soil, several factors affect species distribution, many of which are not easily perceptible or measurable such as light, water, and dispersal factors.

We detected the species homogeneity composition among the transections through the results obtained by the CCA associated with the diameter classes homogeneity distribution found through the Kruskal-Wallis test which reinforces the study area to be the a peculiar unit of SDTFs for presenting particular characteristics as the great soil fertility, ecotonal composition of species and species behaviors in an advanced successional stage. We performed the first structural work related to edaphic variables in punctual areas of the Caatinga domain and realized the importance to understand this relationship to establish priority areas to conservation, specially due to the complex soil mosaic existing in the domain. According to Prado (2005), soil-plant relationships had not been studied in SDTFs by the year 2005. Our results show that this area should be considered a priority to conservation efforts since it presents tree elements important in maintaining the ecosystem, working as a source of propagules and seeds for other areas as well as keeping the natural cycling of the organic matter and the consequent soil fertility due to the deciduous factor. We stress, at last, the importance of studies in SDTFs remnants, for the possibility of knowing the biodiversity and detecting the priority areas for conservation.

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