Scientia Agraria Paranaensis
Scientia Agraria Paranaensis – Sci. Agrar. Parana.
ISSN: 1983-1471 – Online
DOI: https://doi.org/10.18188/sap.v20i4.29195

TREE COMPONENT ANALYSIS IN A SAVANNA-FOREST ECOTONE AREA OF MINAS GERAIS STATE, BRAZIL

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SAP 29195 Received: 19/09/2021 Accepted: 20/03/2022
Sci. Agrar. Parana., Marechal Cândido Rondon, v. 20, n. 4, oct./dec., p. 405-413, 2021

ABSTRACT - Ecotones are transition areas characterized by environmental complexity and high biodiversity. In this sense, carrying out a floristic survey and characterization of each phytoecological region is necessary. Thus, we analyzed the floristic composition, horizontal and vertical structure, and dispersal syndromes of the woody community in an ecotone of Cerrado *Sensu Stricto* and seasonal deciduous forest. Likewise, we proceeded with the floristic similarity analysis to evaluate the study area's similarities to the vegetation of cerrado *Sensu Stricto* and seasonal deciduous forest. A total of 919 individuals from 19 families, 43 genera, and 49 species were sampled. The tree community has an average height of 4.12 m, a species diversity of 3.03 nats ind^{-1}, and a Pielou equitability index of 0.77. The predominant dispersion syndrome was anemochory. The vegetation formed floristic groups with the Cerrado *Sensu Stricto*. The environmental gradient that determines the occurrence of transition vegetation makes each remnant unique in terms of species and structure, demonstrating the importance of these areas for the biodiversity conservation.
Keywords: Cerrado *Sensu Stricto*, transition forest, tropical dry forest.

ANÁLISE DE COMPONENTES ARBÓREOS EM ÁREA DE ECÓTONO SAVANA-FLORESTA EM MINAS GERAIS, BRASIL

RESUMO - Os ecótonos são áreas de transição caracterizadas pela complexidade ambiental e alta biodiversidade. Nesse sentido é necessário realizar o levantamento florístico e caracterização de cada região fitoecológica. Assim, nós analisamos a composição florística, a estrutura horizontal e vertical e as síndromes de dispersão da comunidade lenhosa em ecótono de *cerrado sensu stricto* e Floresta Estacional Decidual. Ademais, nós realizamos a análise de similaridade florística buscando avaliar as semelhanças da área de estudo com o cerrado *sensu stricto* e a Floresta Estacional Decidual. Foram amostrados 919 indivíduos distribuídos em 19 famílias, 43 gêneros e 49 espécies. A comunidade arbórea tem altura média de 4,12 m, diversidade de espécies de 3,03 nats ind^{-1} e índice de equabilidade de Pielou de 0,77. A síndrome de dispersão predominante para a área foi anemocórica. Além disso, a vegetação formou grupos florísticos com o cerrado *sensu stricto*. O gradiente ambiental que determina a ocorrência de vegetação de transição faz com que cada remanescente seja único em termos de espécies e estrutura, demonstrando a importância dessas áreas para a conservação da biodiversidade.
Palavras-chave: Cerrado *Sensu Stricto*, floresta de transição, mata seca.

INTRODUÇÃO

The tremendous Brazilian biodiversity is not limited to species. It extends to vegetation types, life environments, consequently, biomes. As an example, the Brazilian savanna, also known as Cerrado, is classified as one of the world's biodiversity hotspots due to the high rate of endemism and loss of habitat (STRASSBURG et al., 2017). The main reasons of vegetation losses are continuous degradation of native areas, disorderly occupation, urban expansion, agriculture, and not controlled use of fire (SANO et al., 2019). The Cerrado originally covered about 2 million km^2, of which 46% has already been deforested (STRASSBURG et al., 2017). The Cerrado degradation implies in loss of endemic species and the ones of commercial value (LATRUBESSE et al., 2019). In this sense, protected areas creation is needed to the biome conservation and maintenance. However, less than 6% of the biome area is fully protected in conservation units (FRANÇOSO et al., 2015).

Cerrado boundaries' regions are represented by different vegetations types and Brazilian biomes (BARBOSA et al., 2015), explained by its vast area of occurrence (PEREIRA et al., 2011). Thus, the biome shows a vegetation mosaic that includes grasslands, woodlands, rupestrian grasslands and riparian forests (KLINK; MACHADO, 2005). As an example, at the Northern region of Minas Gerais state is found a transitional vegetation between Cerrado (to the west), Caatinga (to the north), and Atlantic Forest (to the east) (ARRUDA et al., 2013). Also, this region shows typical vegetation of Cerrado *Sensu Stricto*, and seasonal deciduous forest (regionally known as

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tropical dry forest or “Mata Seca”) (ARRUDA et al., 2013; GONZAGA et al., 2013).

Seasonal deciduous forest is usually distributed in patches (LINARES-PALOMINO et al., 2011) with a dominant tree stratum, and more than 50% of deciduous individuals during the dry season (DAMASCENO-JUNIOR et al., 2018). These patches are influenced by different soil classes that implies in a floristic variation (ARRUDA et al., 2013). Also, these forest patches are predominantly yielding on limestone outcrops (ROSSATTO et al., 2015), which are the non-agricultural portions of the landscape (ARRUDA et al., 2011). Deciduous Forests are among the least studied and the most threatened ecosystems on the world, consequence of habitat destruction and disjunct distribution (DUPIN et al., 2018; CLEMENTE et al., 2020).

The contact zones between biomes, the ecotones, such as the Cerrado *Sensu Stricto* and seasonal deciduous forest in Northern Minas Gerais state, show an environmental complexity and hold a significant portion of the local biodiversity. In these environments, no sharp edge separates the different vegetation formations. Instead, the contact between two formations may create a junction of two environments or even a new vegetation formation type (SOUZA et al., 2020). In transitional zones, the separation of vegetation is highly complex, requiring a floristic survey and the characterization of each phytoecological region (IBGE, 2012).

The knowledge of local diversity and biogeographic patterns of plant communities allow to characterize the environments, define the vegetation type and determine the ecological importance of different habitats in maintaining biodiversity at different spatial scales (SCHARDONG et al., 2020). Therefore, our study aimed to characterize the floristic composition, horizontal and vertical structure as well as the woody community dispersal syndromes in a Cerrado *Sensu Stricto* - seasonal deciduous forest ecotone in the municipality of Montes Claros, Minas Gerais state, in order to provide insights for conservation and maintenance of mixed ecosystems.

MATERIAL AND METHODS

Our study covered a protected area (known as “Reserva Legal” according to the Forest Code in Brazil) located in the municipality of Montes Claros, Northern of Minas Gerais State (Figure 1). The region’s climate classification is Aw, characterized by hot and dry winter, with a rainy season between October and March (ALVARES et al., 2013). The mean annual precipitation is 1,060 mm and the mean annual temperature is 24.2ºC (INMET, 2020).

The fragment has 29.6 ha located in a transition area between *Cerrado Sensu Stricto* and seasonal deciduous forest. We sampled a total of 25 plots of 20 m x 20 m (400 m^2), in a continuous way at the area's center, totaling one hectare. In each plot, we measured the diameters and heights of all living individuals with a diameter breast height (DBH) equal to or greater than 3.0 cm. We collected botanical material for all measured individuals. Thus, the species identification was performed using scientific literature, comparing materials from herbaria, and consulting specialists. The classification followed the APG IV (2016) system, and the nomenclature was standardized according to Flora do Brasil (2020).

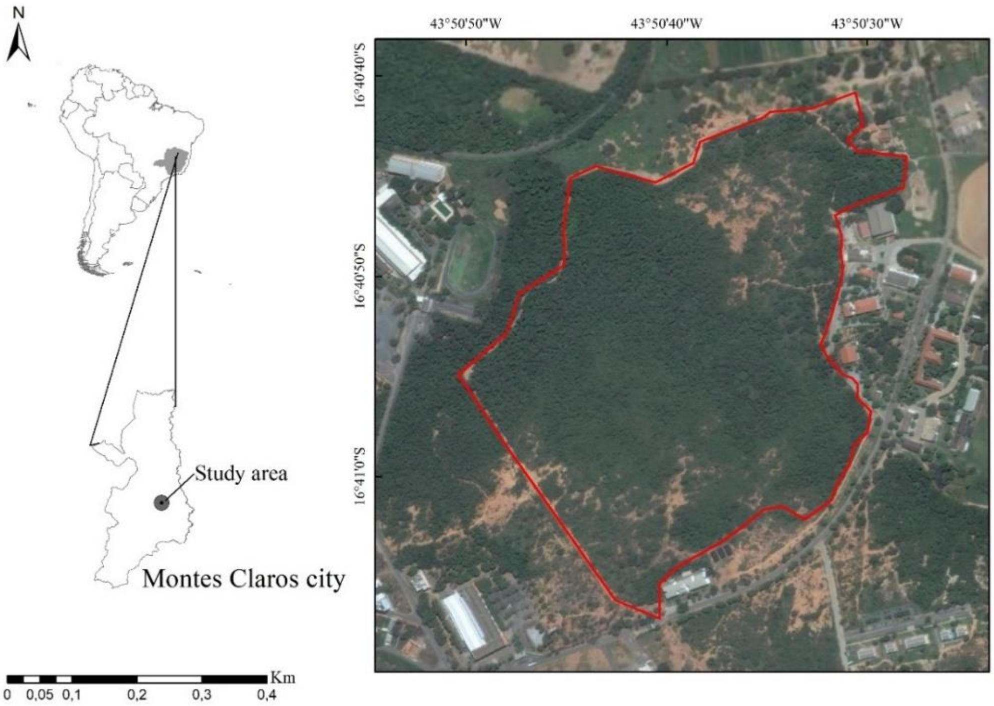

FIGURE 1 - Study area of Cerrado *Sensu Stricto* and seasonal deciduous forest vegetation, located in Montes Claros city, Minas Gerais State, Brazil.

We analyzed the community's horizontal structure using phytosociological parameters: absolute (AF) and relative (RF) frequency, absolute (AD) and relative (RD) density, absolute (ADo) and relative (RDo) dominance, importance value (IV), and coverage value (CV). We verified the vertical structure of the tree community separating the data in three strata that consider as criteria the individual's height (h_i), the average height ($\bar{h}$) and the standard deviation (s): lower stratum (trees with $h_i < \bar{h} - s$), middle stratum (trees with $\bar{h} - s \leq h_i \leq \bar{h} + s$), upper stratum (trees with $h_i > \bar{h} + s$). We used the frequency distribution of height class and sociological position of the sampled individuals to analyze the vertical structure (HACK et al., 2005). The sociological position was calculated using the criteria proposed by Souza and Soares (2013). We calculated Shannon Diversity Index (H') and Pielou equitability index (J') (MAGURRAN, 2011).

The floristic similarities between the study area and fragments of Cerrado *Sensu Stricto* and seasonal deciduous forest in Northern Minas Gerais state were performed by a Cluster Analysis. Thus, we arrange the data in a binary matrix of presence/absence, excluding species classified at the genera level and not identified. Next, we calculated the similarities using the Jaccard index, and constructed a dendrogram through an Unweighted Pair Group Method using the Arithmetic averages (UPGMA) algorithm. Processing was performed using the software R (R CORE TEAM, 2020).

We classified the diaspore dispersal syndromes according to the categories proposed by Van der Pijl (1982) in: anemochorous, autochorous, and zoochorous species. We classified the species as rare following the criteria of the presence one species' individual per hectare (LIM et al., 2012).

RESULTS AND DISCUSSION

Overall, we found a total of 919 individuals belonging to 19 families, 43 genera, and 49 species. The main families, considering the number of individuals, were: Fabaceae (220), Malpighiaceae (184), and Anarcadiaceae (183). These families represent 63.87% of the total individuals sampled. The richest families were: Fabaceae (13), Myrtaceae (5) and Anacardiaceae (4), while 47% of the families were represented by only one species. We found a Shannon diversity index (H') of 3.03 nats.ind^{-1} and Pielou equitability index (J') equal to 0.77.

The mains species sampled in the area were: *Heteropterys byrsonimifolia* A.Juss., *Machaerium opacum* Vogel, *Astronium fraxinifolium* Schott, *Copaifera langsdorffii* Desf., *Tabebuia aurea* (Silva Manso) Benth. & Hook.f. ex S.Moore, *Curatella americana* L., *Astronium urundeuva* (M. Allemão) Engl., *Terminalia fagifolia* Mart., *Schinopsis brasiliensis* Engl. and *Plathymenia reticulata* Benth. These species represent 69% of the sampled individuals, 75% of the basal area, 72% of the coverage value, and 65% of the importance value. In addition, we classified 48 species to the dispersal syndromes, thus, we found 54.5% of anemochorous, 10% autochorous, and 35.5% zoochorous (Table 1).

TABLE 1 - Floristic composition, phytosociological parameters and dispersion syndromes of the species sampled in the transition from cerrado *sensu stricto* and seasonal deciduous forest in Montes Claros, Minas Gerais state, Brazil. In which: N = number of individuals, RD = relative density (%), RF = relative frequency (%), RDo = relative dominance (%), CV = coverage value (%), IV = importance value (%), DS = dispersal syndrome, ane = anemochory, aut = autochory, zoo = zoochory.

Species	N	RD	RF	RDo	CV	IV	DS
Anarcadiaceae							
Astronium fraxinifolium Schott	117	12.73	7.58	10.51	11.62	10.27	ane
Astronium urundeuva (M. Allemão) Engl.	46	5.01	4.85	4.26	4.63	4.71	ane
Lithraea molleoides (Vell.) Engl.	1	0.11	0.30	0.16	0.14	0.19	zoo
Schinopsis brasiliensis Engl.	19	2.07	2.42	4.10	3.08	2.86	ane
Annonaceae							
Annona leptopetala (R.E.Fr.) H.Rainer	8	0.87	1.82	0.27	0.57	0.99	zoo
Bignoniaceae							
Handroanthus ochraceus (Cham.) Mattos	6	0.65	0.61	1.57	1.11	0.94	ane
Jacaranda brasiliana (Lam.) Pers.	23	2.5	2.73	2.4	2.45	2.54	ane
Tabebuia aurea (Silva Manso) Benth. & Hook.f. ex S.Moore	48	5.22	6.06	8.19	6.71	6.49	ane
Celastraceae							
Monteverdia ilicifolia (Mart. ex Reissek) Biral	10	1.09	0.30	0.82	0.95	0.74	zoo
Combretaceae							
Combretum duarteanum Cambess.	1	0.11	0.30	0.03	0.07	0.15	ane
Combretum leprosum Mart.	18	1.96	3.64	0.86	1.41	2.15	ane
Terminalia fagifolia Mart.	38	4.13	6.06	2.74	3.44	4.31	ane
Dilleniaceae							
Curatella americana L.	44	4.79	3.94	6.35	5.57	5.03	zoo
Erytroxylaceae							
Erythroxylum sp.	6	0.65	1.52	0.21	0.43	0.79	zoo
Euphorbiaceae							
Sebastiania brasiliensis Spreng.	26	2.83	1.82	1.58	2.2	2.07	aut

Continuation of Table 1 - Floristic composition,…

Fabaceae							
Amburana cearensis (Allemão) A.C.Sm.	3	0.33	0.61	0.14	0.24	0.36	ane
Copaifera langsdorffii Desf.	40	4.35	5.15	11.03	7.69	6.84	zoo
Dalbergia sp.	2	0.22	0.61	0.07	0.14	0.30	ane
Lachesiodendron viridiflorum (Kunth) P.G.Ribeiro et al.	8	0.87	1.82	1.26	1.06	1.32	aut
Leptolobium dasycarpum Vogel	17	1.85	2.12	1.62	1.73	1.86	ane
Machaerium opacum Vogel	99	10.77	6.36	14.38	12.58	10.51	ane
Machaerium sp.	16	1.74	2.12	1.37	1.55	1.74	ane
Plathymenia reticulata Benth.	12	1.31	2.72	4.50	2.90	2.84	ane
Platypodium elegans Vogel	4	0.44	0.91	1.02	0.73	0.79	ane
Sclerolobium sp.	13	1.41	2.73	1.24	1.33	1.79	ane
Senegalia polyphylla (DC.) Britton & Rose	2	0.22	0.61	0.11	0.17	0.31	aut
Senna sp.	2	0.22	0.61	0.07	0.15	0.3	aut
Senna spectabilis (DC.) H.S.Irwin & Barneby	2	0.22	0.61	0.25	0.23	0.36	aut
Loganiaceae							
Antonia ovata Pohl	2	0.22	0.61	0.11	0.16	0.31	ane
Lytraceae							
Lafoensia pacari A.St.-Hil.	1	0.11	0.30	0.04	0.08	0.15	ane
Malpighiaceae							
Byrsonima crassifolia (L.) Kunth	1	0.11	0.30	0.17	0.14	0.19	zoo
Byrsonima sp.	14	1.52	3.03	0.98	1.25	1.85	zoo
Heteropterys byrsonimifolia A.Juss.	169	18.39	7.27	9.11	13.75	11.59	ane
Malvaceae							
Eriotheca pubescens (Mart.) Schott & Endl.	2	0.22	0.61	0.79	0.51	0.54	ane
Guazuma ulmifolia Lam.	1	0.11	0.30	0.27	0.19	0.23	zoo
Luehea paniculata Mart.	8	0.87	2.12	0.52	0.70	1.17	ane
Myrtaceae							
Eugenia dysenterica (Mart.) DC.	1	0.11	0.30	0.19	0.15	0.20	zoo
Eugenia florida DC.	1	0.11	0.30	0.04	0.08	0.15	zoo
Not identified	1	0.11	0.30	0.03	0.07	0.15	-
Psidium firmum O.Berg	4	0.44	1.21	0.22	0.33	0.62	zoo
Psidium sp.	1	0.11	0.30	0.10	0.11	0.17	zoo
Olacaceae							
Ximenia americana L.	5	0.54	1.21	0.19	0.37	0.65	zoo
Proteaceae							
Roupala montana Aubl.	4	0.44	1.21	0.79	0.61	0.81	ane
Rubiaceae							
Alibertia edulis (Rich.) A.Rich.	13	1.41	2.42	0.56	0.99	1.47	zoo
Tocoyena formosa (Cham. & Schltdl.) K.Schum.	21	2.29	3.64	1.81	2.05	2.58	zoo
Sapindaceae							
Dilodendron bipinnatum Radlk.	2	0.22	0.30	0.37	0.29	0.30	zoo
Magonia pubescens A.St.-Hil.	32	3.48	2.12	2.29	2.89	2.63	ane
Vochysiaceae							
Callisthene major Mart.	2	0.22	0.61	0.17	0.19	0.33	ane
Qualea parviflora Mart.	3	0.33	0.61	0.13	0.23	0.35	ane

The rare species were *Guazuma ulmifolia* Lam., *Eugenia dysenterica* (Mart.) DC., *Lithraea molleoides* (Vell.) Engl., *Byrsonima crassifolia* (L.) Kunth, *Psidium* sp., *Eugenia florida* DC., *Lafoensia pacari* A.St.-Hil., and *Combretum duarteanum* Cambess. The Cluster Analysis result plotted the study area near fragments of Cerrado *Sensu Stricto*, in which the Jaccard similarity index was 0.14 (Figure 2). We found an average height of 4.12 m (± 1.27 m) to the tree community (Table 2). A total of 118 individuals, distributed in 21 species, were sampled in the lower stratum (<2.85 m). The most abundant species were *Machaerium opacum* Vogel, corresponding to 22% of the individuals; *Heteropterys byrsonimifolia* A. Juss. (16%), *Curatella americana* L. and *Astronium fraxinifolium* Schott (13% each one). We detected 659 individuals in the middle stratum (≥2.85 and ≤5.39 m), which are divided into 46 species. The most abundant species were *H. byrsonimifolia*, *A. fraxinifolium*, and *M. opacum*, representing, respectively, 21%, 14%, and 10% of the individuals sampled. Finally, we found 140 individuals, distributed in 27 species, to the upper stratum (> 5.39 m). In this stratum the most abundant were *M. urundeuva* and *Copaifera langsdorffii* Desf. (14% of individuals each one). In addition, the species with the highest values of sociological position (SP), in decreasing order, were *H. byrsonimifolia*, *A. fraxinifolium*, and *M. opacum*, representing 45% of the total SP.

TABLE 2 - Vertical structure of the transition vegetation between cerrado *sensu stricto* and seasonal deciduous forest in Montes Claros city, Minas Gerais State, Brazil.

Species	Lower stratum H < 2.85	Middle stratum 2.85 <= H < 5.39	Upper stratum H >= 5.39	RSP
Heteropterys byrsonimifolia A. Juss.	19	141	8	20.58
Astronium fraxinifolium Schott	15	94	8	13.86
Machaerium opacum Vogel	26	66	7	10.16
Tabebuia aurea (Silva Manso) Benth. & Hook. f. ex S. Moore	7	35	6	05.29
Terminalia fagifolia Mart.	2	29	7	04.35
Curatella americana L.	15	27	2	04.24
Magonia pubescens A.St.-Hil.	1	29	2	04.17
Astronium urundeuva (M. Allemão) Engl.	4	22	20	03.80
Copaifera langsdorffii Desf.	0	20	20	03.42
Tocoyena formosa (Cham. & Schltdl.) K. Schum.	2	19	0	02.73
Sebastiania brasiliensis Spreng.	2	17	7	02.65
Combretum leprosum Mart.	3	15	0	02.19
Leptolobium dasycarpum Vogel	3	14	0	02.05
Jacaranda brasiliana (Lam.) Pers.	2	12	9	02.01
Schinopsis brasiliensis Engl.	1	11	6	01.75
Sclerolobium sp.	1	12	0	01.72
Byrsonima sp.	3	11	0	01.63
Alibertia edulis (Rich.) A.Rich.	4	9	0	01.37
Monteverdia truncata (Nees) Biral	0	9	1	01.30
Machaerium sp.	0	7	9	01.26
Annona leptopetala (R.E.Fr.) H. Rainer	0	7	1	01.02
Plathymenia reticulata Benth.	0	5	7	00.91
Luehea paniculata Mart.	1	6	1	00.90
Handroanthus ochraceus (Cham.) Mattos	0	4	2	00.62
Lachesiodendron viridiflorum (Kunth) P. G. Ribeiro et al.	0	3	5	00.57
Psidium firmum O. Berg	0	4	0	00.56
Ximenia americana L.	2	3	0	00.47
Platypodium elegans Vogel	0	3	1	00.45
Qualea parviflora Mart.	0	3	0	00.42
Erythroxylum sp.	4	2	0	00.38
Callisthene major Mart.	0	2	0	00.28
Antonia ovata Pohl	0	2	0	00.28
Senna sp.	0	2	0	00.28
Dalbergia sp.	0	2	0	00.28
Roupala montana Aubl.	0	1	3	00.23
Amburana cearensis (Allemão) A. C. Sm.	1	1	1	00.20
Senna spectabilis (DC.) H. S. Irwin & Barneby	0	1	1	00.17
Dilodendron bipinnatum Radlk.	0	1	1	00.17
Eugenia dysenterica (Mart.) DC.	0	1	0	00.14
Byrsonima crassifolia (L.) Kunth	0	1	0	00.14
Lithraea molleoides (Vell.) Engl.	0	1	0	00.14
Psidium sp.	0	1	0	00.14
Lafoensia pacari A.St.-Hil.	0	1	0	00.14
Eugenia florida DC.	0	1	0	00.14
Combretum duarteanum Cambess.	0	1	0	00.14
Not identified	0	1	0	00.14
Eriotheca pubescens (Mart.) Schott & Endl.	0	0	2	00.06
Senegalia polyphylla (DC.) Britton & Rose	0	0	2	00.06
Guazuma ulmifolia Lam.	0	0	1	00.03
Total	118	659	140	100

RSP = relative sociological position.

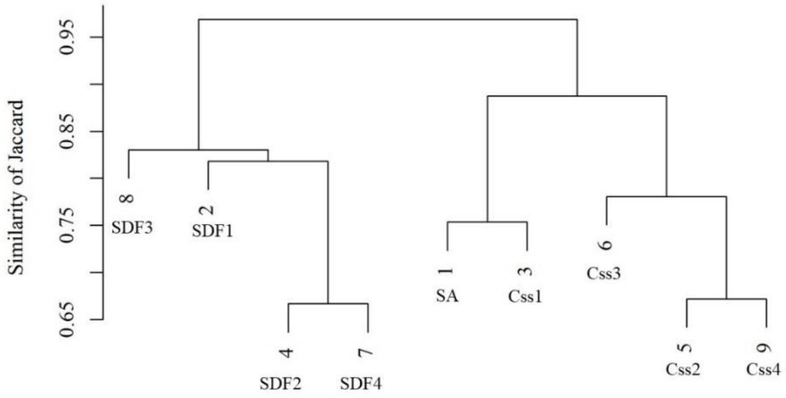

FIGURE 2 - Dendrogram of floristic similarity between areas of Cerrado *Sensu Stricto* and seasonal deciduous forest in Northern Minas Gerais state, Brazil. AS = study area, SDF1 = Capitão Enéas (ARRUDA et al., 2011), SDF2 = Juramento (SANTOS et al., 2007), SDF3 = Montes Claros (SANTOS; VIEIRA, 2006), SDF4 = Peruaçu (GONZAGA et al., 2013), Css1 = Grão Mogol (COSTA et al., 2010), Css2: Montes Claros (CAMPOS et al., 2020), Css3 = Montes Claros (PEREIRA et al., 2016), Css4 = Rio Pardo de Minas (LIMA et al., 2012).

The predominance of the Fabaceae in Neotropical forests has been described as a worldwide pattern (COLLEVATTI et al., 2013; LPWG, 2013). This family is particularly abundant in areas with a pronounced dry season (MAYLE, 2004). The species richness of our study area is more similar to the richness of Cerrado *Sensu Stricto* communities than in areas of seasonal deciduous forest, compared to studies carried out in the Northern of Minas Gerais (Table 3).

The Shannon diversity and Pielou equitability index results were similar to those observed for different areas of Cerrado *Sensu Stricto* in the Northern Minas Gerais state. However, the results are inferior or overlap those found in the Cerrado of other regions of Brazil. As example, Ferreira et al. (2017), considering a study area in Gurupi-Tocantins, found a diversity index of 3.52 to 3.70 nats.ind^{-1}, and Pielou equitability from 0.79 to 0.87. Also, Costa et al. (2019) observed a diversity equal to 3.64 nats ind^{-1}, and Pielou equitability of 0.81 at the Triângulo Mineiro and Alto Paranaíba in Minas Gerais state. Our findings may be related to anthropic intervention, since our study fragment is located next to an urbanized area.

TABLE 3 - Characterization of species richness, Shannon's diversity, and Pielou equability for studies carried out in the Northern region of Minas Gerais state, Brazil.

Region/City	Inclusion criteria	Sampling method	S	H’	J’	References
Montes Claros (Css)	DAS ≥ 5 cm	10 plots (1000 m^2)	34	2.61	0.74	Campos et al. (2020)
Rio Pardo de Minas (Css)	DAS ≥ 5 cm	15 plots (1000 m^2)	48	3.11	0.80	Lima et al. (2012)
Duas Áreas - Grão Mogol (Css)	DBH ≥ 3 cm and H ≥ 1.5 m	48 points quadrant sampling by area	73	3.13/3.27	0.87/ 0.84	Costa et al. (2010)
Peruaçu (SDF)	DBH ≥ 5 cm	25 plots (400 m^2)	79	-	-	Gonzaga et al. (2013)
Juramento (SDF)	DBH ≥ 5 cm	Walk-and-count transects	55	-	-	Santos et al. (2007)
Capitão Enéias Morro Cotia (SDF)	CBH ≥ 15 cm	48 points quadrant sampling	36	2.21	0.61	Arruda et al. (2011)
Our study	DBH ≥ 3 cm	25 plots 400 m^2	48	3.03	0.77	

Css = Cerrado *Sensu Stricto*, SDF = seasonal deciduous forest, S = species richness, H' = Shannon's diversity index, J’ = Pielou equability index, DAS = diameter at 0.30 m from the soil, CBH = circumference at breast height.

The two species with the highest IVI, *H. byrsonimifolia*, and *M. opacum*, are typical cerrado *sensu stricto* species, abundant throughout the entire distribution of this vegetation (FLORA DO BRASIL, 2020; MIRANDA et al., 2020). Other representative species of cerrado *sensu stricto* are *T. aurea*, *C. americana*, *T. fagifolia* and *P. reticulata* (ARAÚJO et al., 2019). On the other hand, *A. fraxinifolium*, *A. urundeuva*, and *S. brasiliensis* are common in seasonal deciduous forest, often composing the dominant group of vegetation (PEREIRA et al., 2011; HAIDAR et al., 2013).

The Cerrado domain tends to show zoochory as dominant, occurring in more than 50% of the existing species (REIS et al., 2012; OLIVEIRA et al., 2018). The zoochory frequency demonstrates the plant community’s dependence on biotic vectors (STEFANELLO et al., 2010). However, more humid environments have shown greater representativeness of the zoochory, differing from the communities of dry areas in which the predominance of abiotic vectors occurs as responsible for the dispersion (SILVA; RODAL, 2009). Thus, our study area shows greater climatic seasonality, which may explain the higher index of anemochorous species. Moreover, the fragment is spotted close to human settlements and has a history of disturbances supporting those results. The anthropic intervention may lead to clearings opening in the vegetation, implying in a dominance of anemochorous species.

Of the rare species sampled in the area, the *E. dysenterica*, *B. crassifolia* and *L. pacari* are typical of Cerrado, where they occur in densities greater than those found in the study area (COSTA et al., 2010; FERREIRA et al., 2010; SOARES; NUNES, 2013). On the other hand, *E. florida*, *L. molleoides* and *C. duarteanum* are indicator species of seasonal deciduous forest with a greater number of individuals than reported for our study area (ARRUDA et al., 2011; SCHUMACHER et al., 2018). Therefore, the atypical densities found for the fragment may be a response to changes in the transitional environment, which represents a distinct community structure.

According to the Jaccard index we may infer about the low similarity between the fragments, since the index presented a value below 0.5, indicating a high heterogeneity (PRADO JÚNIOR et al., 2012). The study area species showed a greater similarity to the Cerrado *Sensu Stricto* species than to seasonal deciduous forest species. From our results, we may infer as to the middle stratum dominance, since this stratum includes the most important species that characterize the community. The evaluation of the vertical structure in uneven-aged forests is essential for actions that aim the vegetation management sustainability. Thus, the task of recognizing tree strata in the plant community is one of the main elements of the vertical structure study (COSTA et al., 2018).

In the Cerrado *Sensu Stricto* there is such a great difficulty in defining the species ecological group, since the species are classified as heliophytes (PINHEIRO; DURIGAN, 2012). Otherwise, regarding the seasonal deciduous forest, studies have already shown that communities in early and advanced stages are similar, due to the continuous regrowth of individuals (SAMPAIO et al., 2007). Other determining factors of the successional stage of each area are the previous agricultural practices (LORENZONI-PASCHOA et al., 2019). During the field survey, traces of domestic animals' existence were observed, which may have contributed to the low number of individuals present in the lower stratum and to the high dominance of some species.

The animals trampling and opening trails due their entrance in the area impairs natural regeneration, compromising the seedlings establishment and seed banks in plant communities (FRAGOSO et al., 2017). The presence of animals and other impacts determine the vegetation successional stage, and such practices are constant in the natural remnants in the Northern of Minas Gerais state, where is common to use natural areas for livestock activities in periods of drought (LÚCIO et al., 2014). We may infer that the study area has greater similarity to the Cerrado *Sensu Stricto*' vegetation type. However, we also noticed the presence of typical species of seasonal deciduous forest. Thus, considering that the fragment is a transition area, conservation strategies should be elaborated, since the biome acts as a ecosystem services provider (CORDEIRO et al., 2020).

CONCLUSIONS

Environmental gradient tends to determines the occurrence of transitional vegetation makes each remnant unique in terms of species and structure.

Thus, highlighting the relevance of studies of these mixed communities for the conservation of biodiversity.

ACKNOWLEDGE

The authors express their gratitude to the Institute of Agrarian Sciences, Federal University of Minas Gerais (UFMG) for the support and infrastructure to the study development.

Also, the authors express the gratitude to Santos D'ângelo Neto (*in memoriam*) teacher for the species identification.

This study was partially supported by the Coordenação de Aperfeiçoamento de Pessoal de Nível Superior (CAPES) - Finance Code 001.

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