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After-fire Variations in Floristic Composition at the Cerrado (Brazilian Savannah) Phytophysiognomies in Curvelo, Minas Gerais, Brazil

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Abstract

This study aimed to evaluate the changes in the floristic composition at the Cerrado (Brazilian Savannah) *stricto sensu* and Cerradão (*xeromorphic forest*) phytophysiognomies. In the first inventory in 2010, 15 soil plots of 20 × 50 m in the Cerrado *stricto sensu* (CSS) and 10 soil sample plots of 20 × 50 m in the Cerradão (CD) were separated, and individual samples with diameter at soil height ≥ 5 cm were measured. The second inventory, conducted in 2015, used the same criteria. A fire hit both phytophysiognomies after the first inventory. Species loss and a mortality rate higher than recruitment rate were observed in both phytophysiognomies. Species richness and individual density have been diversified over time. Floristic changes were more intense in CD, with significant alterations between mortality and recruitment rates – the species that disappeared were represented by a few individuals; in the CSS, the changes were not significant.

Keywords: conservation, disturbances, diversity dynamics.

1. INTRODUCTION AND OBJECTIVES

The Cerrado is composed of a vegetal formation complex, ranging from rural formations to forest formations (Ribeiro & Walter, 2008) and presents one of the richest and most diverse floras in the world. The species richness reflects environmental heterogeneity with diverse phytophysiognomies, which are morphological characteristics of the plant community found in this biome (Santos & Henriques, 2010).

Despite being considered an ecosystem of high floristic richness and high rate of endemism, the Cerrado is extremely threatened by anthropic action, especially by agriculture and cultivated pasture (Cipriani et al., 2016).

These processes reduce native vegetation, making it rather fragmented, which interferes with the viability of maintenance, reproduction, and the preservation potential of species (Carvalho et al., 2009).

In the Cerrado vegetable formation, the Cerrado *stricto sensu* stands out, covering the largest extension of the biome domain, characterized by an herbaceous-grassy stratum and sparse low trees (Ribeiro & Walter, 2008; Rodrigues & Araújo, 2014).

The Cerradão (*xeromorphic forest*) can be found in regions of ecotone, usually restricted to small isolated fragments. This formation is associated with deep and well-drained soils, in latosols and dystrophic cambisols. The tree species are well structured, with excellent crown cover (Ribeiro & Walter 2008; Solorzano et al., 2012), a great contribution of biomass and deposition of organic matter.

In all these vegetal formations, the floristic composition of a community can undergo different changes along space and time. This dynamic can occur by successional process or by different types of disturbances, mainly by anthropic actions. Hoffmann et al. (2012) classified the fires as one of the agents responsible for vegetation changes in the Cerrado. According to Hoffmann et al. (2009), intense burning can cause death of the crown, which, consequently, impairs the reproductive process of the plants. Burns can reduce recruitment rates, richness, density, and diversity of woody species (Pivello, 2011).

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These changes are evaluated by permanent monitoring of the plots, also known as continuous forest inventory. Monitoring is essential to understand the dynamics of a community because the entry of new individual species, growth, recruitment rate, and mortality rate can be evaluated (Higuchi et al., 2008). Therefore, the need for studies on vegetation dynamics is emphasized, which can support initiatives for preservation, sustainable management, and recovery of degraded areas (Chaves et al., 2013), in addition to assessing the causes and consequences of the changes that have occurred on population structure over time.

Thus, this study sought to evaluate and describe the changes in floristic composition and richness of tree species in the Cerrado *stricto sensu* and the Cerradão phytophysiognomies, at the Experimental Farm of Moura, in Curvelo, state of Minas Gerais, Brazil.

2. MATERIALS AND METHODS

2.1. Characterization of the study area

This study was conducted at the Experimental Farm of Moura, in Curvelo, state of Minas Gerais. The farm, which is under a lending system of Universidade Federal dos Vales do Jequitinhonha and Mucuri (UFVJM), is composed of a continuous area of approximately 436 ha (4,360,000 sqm). It is located at the São Francisco river basin (18° 49' 26.12" S and 44° 24' 12.69" W geographical coordinates, approximate altitude of 715 meters).

According to Köppen, the local climate is of Aw tropical type, dry winter, average annual temperatures around 28 °C, and 1,238 mm rainfall index annually. There is a predominance of two pedological units in the farm, cambisols Haplic and Latosols, according to the Fundação Estadual do Meio Ambiente (2010).

The farm covers an ecotonal region, where there are three distinct phytophysiognomies, the Cerrado *stricto sensu* (CSS), the Cerradão (CD), and the semidecidual seasonal forest. The Cerrado *stricto sensu* is located at the 18° 50' 7.26" S and 44° 23' 33.49" W coordinates, predominantly in dystrophic soils and in acid Latosol, classified according to the proposal of Ribeiro & Walter (2008). Its area covers 54 ha (540,000 sqm) with small trails and a road separating the vegetation into two parts.

The Cerradão (CD) is classified according to the proposal of Ribeiro & Walter (2008) and is located at the 18° 49' 56.11" S and 44° 23' 6.42" W coordinates. It covers an area of approximately 220 ha (2,200,000 sqm), under flattened relief, belonging to the phytogeographic group of the Mid-Southeast of the state, recognized by Ratter et al. (2003). The soil was characterized in general as dystrophic red Latosol.

A fire hit both CSS and CD just after the first inventory conducted in 2010. The fire affected all plots of both phytophysiognomies. Visually, the fire was more intense in the CD, considering the amount of dead individual species found in this phytophysiognomy.

2.2. Monitoring the tree compartment

The CSS and CD were the subject of the floristic and structural study carried out by Otoni et al. (2013). The CSS and CD tree community was sampled in the year 2010 with 15 CSS permanent plots of 20 × 50 m, and 10 CD permanent plots of 20 × 50 m, and they were distributed systematically, spaced 100 m apart in both phytophysiognomies. In each plot, individual species with ≥ 5 cm diameter at soil height (DSH) were identified and measured. Individual species with multiple tree trunks were measured when the root of the DSH sum squares reached ≥ 5 cm.

The floristic list referring to the aforementioned studies was reviewed and corrected due to changes in the number of species. The species were identified by querying the literature and specialists or by comparisons with specimens in the Herbário Dendrológico Jeanine Felfili (HDJF) (Jeanine Felfili Dendrological Herbarium) at UFVJM. The exsiccata made with the collected material are part of the HDJF collection (Otoni et al., 2013).

Identification followed the Angiosperm Phylogeny Group III 2009 system (APG III). The spelling and updating of the scientific names of the species were conducted based on the Brazilian Flora 2020 data (under construction) (JBRJ, 2018).

The second inventory was carried out in 2015, using the same methodology as the previous inventory. Thus, new individual species (recruits) that reached the minimum inclusion diameter (DSH ≥ 5 cm) were identified, measured, and labeled; the dead individual species were recorded, and the survivors were measured again.

2.3. Data analysis

The floristic dynamics was conducted by counting the surviving, dead, and recruited individuals for each species. For each phytophysiognomy, Poisson counts were compared (Zar, 1996) for detecting possible changes in the richness patterns related to species gains and losses.

The species were also classified in dispersion guilds, according to the criteria adopted by Nunes et al. (2003), Toniato & Oliveira-Filho (2004), Pereira et al. (2010), Lopes et al. (2011), and Miguel et al. (2016): (a) anemochorous, species whose diaspores are spread by the wind; (b) autochorous, species that disperse their seeds by gravity or by explosive dehiscence; (c) zoochorous, species whose diaspores are disseminated by animals; and (d) barocoric, those that disperse seeds via gravity. This classification was made using information on the biology of species in literature.

Regarding the conservation status, the species were classified according the categories of the online database of the red list of the Brazilian Centro Nacional de Conservação da Flora (JBRJ, 2014).

The analysis of floristic richness by phytophysiognomy was conducted using the PAST 3.0 program (Hammer, 2001), and the diversity indexes of Shannon (H') and Pielou equability (J') (Brower & Zar, 1984) were calculated using phytophysiognomy.

3. RESULTS AND DISCUSSION

The floristic composition showed some changes in species richness and in the number of genera and families in the period between the two inventories (Table 1).

In the CSS, the number of botanical families (26) remained the same when compared with the first sampling; however, there was species loss (63 and 62, respectively). The losses were higher in the CD, in which two botanical families (34 to 30) and eleven species reduced. Only one species increased (100 and 90) (Table 1).

In the CSS, the most representative families in the two inventories were Fabaceae (13 and 13), Bignoniaceae (5 and 4), Vochysiaceae (5 and 5), and Malpighiaceae (4 and 4), respectively. In the CD, Fabaceae (15 and 14), Rubiaceae (8 and 8), Myrtaceae (8 and 6), and Bignoniaceae (7 and 6) were the most important families in relation to the number of species. Fabaceae family is frequently recorded among the most important in the cerrado phytophysiognomies in the Southeastern region of the country (Almeida et al., 2014; Pereira & Silva, 2011). According to Cordeiro (2000), due to the nodulation capacity, species belonging to Fabaceae family have greater adaptation in regions with low nitrogen content, which is a competitive advantage when compared with other species, mainly in the Cerrado, where the soil shows low natural fertility.

Loss of Siparunaceae and Opiliaceae families was observed. A single species and a few individuals represented these families in the first inventory. It is important to emphasize that seventeen families were represented by only one species each. This fact shows the fragility of this fragment, since the extinction of a species can result in diversity and function loss in the system.

In the CSS, the losses of species reflected on the Shannon diversity index (H'), which decreased from 3.09 to 3.06, and Pielou equability (J'), from 0.74 to 0.73. These results were lower than those results found by Almeida et al. (2014) in a Cerrado *stricto sensu*. These authors used the same inclusion criterion adopted in this study; however, they used a higher number of sample units and no fire event. In the CD, the indexes changed in Shannon (H') from 3.54 to 3.42 and in Pielou equability (J'), from 0.77 to 0.76 (Table 1).

Some studies have shown that, even with fire events, the Cerrado tends to be resilient (Ribeiro et al., 2012). According to Hoffmann et al. (2012), species in formation at the Cerrado present adaptive morphological characteristics that allow them to survive and regenerate after the fire event. In the relation among species gains and losses by the Poisson count, the changes were little, being not significant in the CSS, characterizing resistance (low mortality rate) and recovery capacity. According to Souchie et al. (2017), the species present effective protection against fire.

Table 1. Richness and diversity of species of the tree community in Cerrado *stricto sensu* (CSS) and Cerradão (CD), Fazenda do Moura, Curvelo, state of Minas Gerais, Brazil.

Awareness campaigns	CSS	CD	CSS	CD	CSS	CD
	Number of species		**Diversity Index**		**Pielou Equability**	
First Inventory 2010	63	100	3.09	3.54	0.74	0.77
Second Inventory 2015	62	90	3.06	3.42	0.73	0.76
Gain of species	0	1				
Loss of species	1	11				
Z	1.00	2.89				
P	ns	0.005				

In CSS, the fire impact showed little influence on species mortality rate. The adaptations acquired by Cerrado species (the bark thickness) over time determine their ability to tolerate fire. This adaptation is a determinant factor for the ability of the species to respond to fire damage, as found by Lawes & Clarke (2011) and Souchie et al. (2017). The changes were significant in the CD ($p < 0.05$), which presented loss of eleven species (*Agonandra brasiliensis, Aspidosperma subincanum, Brosimum gaudichaudii, Calyptranthes lucida, Cybistax antisyphilitica, Erythroxylum tortuosum*, Unclassified 1, *Lafoensia vandelliana, Myrcia rostrata, Siparuna guianensis* and *Stryphnodendron adstringens*) and gain of only one species (Neea theifera) (Table 2). This richness decrease is possibly associated with the higher intensity of fire found in the CD. Generally, patterns of positive change are found in areas that have not been disturbed recently (Mews et al., 2011).

In the five years period between the two inventories in CSS, there was loss of a single species (*Zeyheria montana*) and there was no species gain event (Table 2).

The fire event contributed to the variations in the floristic composition in the two phytophysiognomies. CD was the most affected with the changes, where the fire event resulted in a thinned and reduced population. It is worth mentioning that some species were only represented by a few individuals in the first inventory, which contributed to the fact that eleven species were left out in the CD. According to Libano & Felfili (2006) and Ribeiro et al. (2012), the fire eliminates species that have low density. Almeida et al. (2014) observed that the number of individual species decreases with the fire event.

Regarding dispersion strategies in the CSS, 48.38% of the species present zoochorous dispersion, followed by anemochorous (43.54%) and autochorous (8.06%). In the CD, 52.22% of the species presented a zoochorous dispersion, followed by anemochorous (42.22%), autochorous (4.44%), and unclassified species (0.11%) (Table 2).

The species with zoochorous dispersion were more representative; although Cerrado does not present a continuous canopy, Batalha & Mantovani (2000) observed that zoochoric species are predominant. Batalha & Mantovani (2000) found that 62% of the species presented zoochorous dispersion, followed by anemochorous (26%) and autochorous (12%). In a Cerrado area in the state of Tocantins, Ferreira et al. (2016) found that 62.33% of the species presented zoochorous dispersion syndrome, 33.76% anemochorous, and 3.91% autochorous. Some studies about Cerrado areas show that autochorous dispersion is usually found with low frequency (Melo et al., 2013; Oliveira, 2014; Reis et al., 2012).

Regarding conservation status, in the CSS, 62.9% of the species presented insufficient data, followed by the least worrisome species (25.8%), almost threatened (4.8%), endangered species (3.2%), and vulnerable species (1.5%) (Table 2).

Table 2. List of phytophysiomies species sampled in Cerrado at Fazenda do Moura in Curvelo, state of Minas Gerais, Brazil. The families are shown in alphabetical order, followed by Cerrado *stricto sensu* (CSS) and Cerradão (CD), along with the number of the species individuals in the inventories (I and II).

Families	Species	CSS		CD		ES	SD
		I	II	I	II		
Anacardiaceae	*Astronium fraxinifolium* Schott	99	95	46	34	LC	Ane
	Astronium graveolens Jacq.	0	0	6	10	LC	Ane
	Lithraea molleoides (Vell.) Engl.	0	0	10	3	DD	Zoo
	Myracrodruon urundeuva Allemão	0	0	8	4	LC	Ane
Annonaceae	*Annona crassiflora* Mart.	28	28	11	10	DD	Zoo
	Xylopia aromatica (Lam.) Mart.	2	1	65	27	LC	Zoo
Apocynaceae	*Aspidosperma macrocarpon* Mart.	1	1	20	12	LC	Ane
	Aspidosperma subincanum Mart. ex A. DC.	0	0	1	0	DD	Ane
	Aspidosperma tomentosum Mart.	77	79	23	15	LC	Ane
Araliaceae	*Schefflera macrocarpa* (Cham. & Schltdl.) Frodin	12	10	2	1	DD	Zoo
Asteraceae	*Piptocarpha rotundifolia* (Less.) Baker	62	60	18	7	EN	Ane
Bignoniaceae	*Cybistax antisyphilitica* (Mart.) Mart.	0	0	1	0	DD	Ane
	Handroanthus impetiginosus (Mart. ex DC.) Mattos	0	0	4	4	NT	Ane
	Handroanthus ochraceus (Cham.) Mattos	10	9	8	8	DD	Ane
	Handroanthus serratifolius (Vahl) S.O.Grose	1	1	0	0	EN	Ane

Table 2. Continued...

Families	Species	CSS		CD		ES	SD
		I	II	I	II		
Bignoniaceae	*Tabebuia aurea* (Silva Manso) Benth. & Hook.f. ex S.Moore	48	42	34	27	DD	Ane
	Tabebuia roseoalba (Ridl.) Sandwith	0	0	3	2	DD	Ane
	Jacaranda brasiliana (Lam.) Pers.	1	1	1	1	DD	Ane
	Zeyheria montana Mart.	1	0	9	2	LC	Ane
Burseraceae	*Protium heptaphyllum* (Aubl.) Marchand	0	0	86	77	DD	Zoo
Calophyllaceae	*Kielmeyera coriacea* Mart	224	200	1	4	DD	Ane
	Kielmeyera grandiflora (Wawra) Saddi	0	0	88	55	DD	Ane
Caryocaraceae	*Caryocar brasiliense* A. St.-Hil	35	37	13	7	LC	Zoo
Celastraceae	*Maytenus floribunda* Reissek	0	0	21	14	LC	Zoo
	Plenckia populnea Reissek	46	46	25	17	DD	Ane
Combretaceae	*Buchenavia tomentosa* Eichler	0	0	1	1	DD	Zoo
	Terminalia argentea Mart.	37	36	77	65	LC	Ane
	Terminalia fagifolia Mart.	0	0	1	1	DD	Ane
Connaraceae	*Connarus suberosus* Planch.	5	5	3	2	DD	Zoo
	Curatella americana L.	4	6	16	12	DD	Zoo
	Diospyros sericea A. DC.	0	0	18	9	DD	Zoo
	Diospyros hispida A. DC.	51	43	8	3	LC	Zoo
Erythroxylaceae	*Erythroxylum suberosum* A. St.-Hil.	141	122	23	8	DD	Zoo
	Erythroxylum deciduum A.St.-Hil.	56	56	32	12	DD	Zoo
	Erythroxylum daphnites Mart.	0	0	7	1	DD	Zoo
	Erythroxylum tortuosum Mart.	10	8	1	0	DD	Zoo
Fabaceae	*Acosmium dasycarpum* (Vogel) Yakovlev	16	17	71	32	DD	Ane
	Andira vermifuga Benth.	1	1	0	0	NT	Zoo
	Bowdichia virgilioides Kunth	37	37	16	15	NT	Ane
	Copaifera langsdorffii Desf.	0	0	9	6	DD	Zoo
	Dalbergia miscolobium Benth.	5	5	5	4	DD	Ane
	Dimorphandra mollis Benth.	15	7	22	14	DD	Aut
	Enterolobium gummiferum (Mart.) J .F. Macbr.	5	5	1	1	DD	Aut
	Hymenaea stigonocarpa Hayne	14	14	8	8	DD	Zoo
	Leptolobium dasycarpum Vogel	24	23	0	0	VU	Ane
	Machaerium opacum Vogel	48	48	45	25	DD	Ane
	Plathymenia reticulata Benth.	20	23	6	8	LC	Ane
	Platypodium elegans Vogel	0	0	2	3	DD	Ane
	Sclerolobium aureum (Tul.) Baill.	0	0	1	1	DD	Ane
	Sclerolobium paniculatum Vogel	0	0	206	122	DD	Ane
	Stryphnodendron adstringens (Mart.) Coville	12	8	2	0	LC	Zoo
	Tachigali aurea Tul.	34	32	46	39	NT	Ane
	Vatairea macrocarpa (Benth.) Ducke	91	84	36	27	DD	Ane
	Unclassified 1	0	0	1	0	*	*
	Unclassified 2	0	0	1	1	*	*
Lamiaceae	*Hyptidendron canum* (Pohl ex Benth.) Harley	7	11	47	20	*	Aut

Table 2. Continued...

Families	Species	CSS		CD		ES	SD
		I	II	I	II		
Loganiaceae	*Antonia ovata* Pohl.	0	0	10	6	DD	Ane
	Strychnos pseudoquina A. St.-Hil.	9	8	5	4	DD	Zoo
Lythraceae	*Lafoensia pacari* A. St.-Hil.	6	6	13	10	LC	Aut
	Lafoensia vandelliana Cham. & Schltdl.	57	42	1	0	DD	Ane
Malpighiaceae	*Byrsonima coccolobifolia* Kunth	110	101	27	13	LC	Zoo
	Byrsonima crassa Nied.	10	8	0	0	DD	Zoo
	Byrsonima pachyphylla A. Juss.	1	2	29	16	DD	Zoo
	Byrsonima verbascifolia (L.) DC.	43	40	12	2	DD	Zoo
	Heteropterys byrsonimifolia A. Juss.	0	0	12	10	DD	Ane
Malvaceae	*Eriotheca pubescens* (Mart. & Zucc.) Schott & Endl.	8	8	20	19	LC	Ane
	Luehea grandiflora Mart.	0	0	21	15	DD	Ane
	Pseudobombax tomentosum (Mart. & Zucc.) A.Robyns	2	3	18	4	DD	Zoo
Moraceae	*Brosimum gaudichaudii* Trécul	0	0	2	0	DD	Zoo
Myrtaceae	*Calyptranthes lucida* Mart. ex DC.	0	0	1	0	DD	Zoo
	Eugenia dysenterica DC.	6	6	19	6	DD	Zoo
	Myrcia amazonica DC.	0	0	4	4	DD	Zoo
	Myrcia guianensis (Aubl.) DC.	1	1	14	7	LC	Zoo
	Myrcia heringii D. Legrand	10	12	19	11	LC	Zoo
	Myrcia neorostrata Sobral	0	0	2	2	DD	Zoo
	Myrcia rostrata DC.	0	0	3	0	DD	Zoo
	Myrcia tomentosa (Aubl.) DC.	0	0	3	1	DD	Zoo
Nyctaginaceae	*Guapira graciliflora* (Mart. ex J. A. Schmidt) Lundell	0	0	1	2	DD	Zoo
	Guapira noxia (Netto) Lundell	0	0	9	5	DD	Zoo
	Neea theifera Oerst	0	0	0	2	DD	Zoo
Ochnaceae	*Ouratea castaneifolia* (DC.) Engl.	0	0	12	8	DD	Zoo
	Ouratea hexasperma (A. St.-Hil.) Baill.	58	64	15	10	DD	Zoo
Opiliaceae	*Agonandra brasiliensis* Miers ex Benth.	4	5	7	0	DD	Aut
Primulaceae	*Myrsine gardneriana* A. DC.	0	0	3	2	DD	Zoo
Proteaceae	*Roupala montana* Aubl.	14	19	46	24	DD	Ane
Rhamnaceae	*Condalia buxifolia* Reissek	0	0	1	1	EN	Ane
Rubiaceae	*Amaioua guianensis* Aubl.	0	0	5	3	DD	Zoo
	Cordiera macrophylla (K. Schum.) Kuntze	0	0	1	3	DD	Zoo
	Cordiera sessilis (Vell.) Kuntze	0	0	11	5	DD	Zoo
	Coussarea hydrangeifolia (Benth.) Benth. & Hook.f. ex Müll. Arg.	0	0	11	14	LC	Zoo
	Guettarda viburnoides Cham. & Schltdl.	0	0	10	5	DD	Zoo
	Palicourea rigida Kunth	10	4	3	2	DD	Zoo
	Rudgea viburnoides (Cham.) Benth.	1	1	5	3	DD	Zoo
	Tocoyena formosa (Cham. & Schltdl.) K. Schum.	22	22	1	1	DD	Zoo
Salicaceae	*Casearia sylvestris* Sw.	0	0	4	2	DD	Zoo
Sapindaceae	*Dilodendron bipinnatum* Radlk.	0	0	32	16	LC	Zoo
	Magonia pubescens A. St.-Hil.	833	815	472	354	LC	Ane

Table 2. Continued...

Families	Species	CSS I	CSS II	CD I	CD II	ES	SD
Sapotaceae	*Pouteria ramiflora* (Mart.) Radlk.	97	93	14	11	DD	Zoo
	Pouteria torta (Mart.) Radlk.	4	2	0	0	LC	Zoo
Simaroubaceae	*Simarouba* sp.	0	0	3	1	DD	Zoo
Siparunaceae	*Siparuna guianensis* Aubl.	0	0	4	0	DD	Zoo
Styracaceae	*Styrax camporum* Pohl	0	0	1	1	DD	Zoo
	Styrax ferrugineus Nees & Mart.	16	13	0	0	DD	Zoo
Verbenaceae	*Aloysia virgata* (Ruiz & Pav.) Juss.	15	9	0	0	DD	Zoo
Vochysiaceae	*Qualea grandiflora* Mart.	129	126	211	167	DD	Ane
	Qualea multiflora Mart.	48	40	22	17	DD	Ane
	Qualea parviflora Mart.	283	273	83	57	DD	Ane
	Salvertia convallariodora A. St.-Hil.	2	2	1	1	DD	Ane
	Vochysia rufa Mart.	5	5	0	0	DD	Ane

ES: conservation status; DD: insufficient data; LC: less worrying; NT: near threatened; EN: endangered; CR: critically endangered; VU: vulnerable; SD: dispersion syndrome; Ane: anemochorous; Zoo: zoochorous; Aut: autochorous. * No information.

In the CD, 68.8% of the species presented insufficient data, followed by less worrying (23.3%), almost threatened (3.3%), endangered (2.2%), and unclassified species (2.4%) (Table 2).

In the two phytophysiognomies, most of the species present insufficient data, that is, at that moment they were not classified as threatened. A few individuals represented both endangered and vulnerable species. Among the new species that emerged in the second inventory, none was classified as endangered.

Three species are in the list of endangered species (EN): (a) *H. serratifolius*, sampled in the CSS, is considered a species of economic value; (b) *C. buxifolia*, present on the CD, was represented by only one individual; and (c) *P. rotundifolia*, present in both phytophysiognomies, is found along with more individuals.

New species were not found in CSS. *N. theifera*, found in the second inventory in the CD, is classified with insufficient data. Few individuals represented both endangered and vulnerable species; this fact deserves special attention for the conservation of these fragments, since they are important for the survival of these species over time. The fact that none of the new species is on the list of endangered species should be emphasized. Considering the two phytophysiognomies, twelve species disappeared after the first inventory; nine of which were classified with insufficient data for risk classification, two as less worrying, and one without classification (Table 2).

Studies of this kind in different phytophysiognomies need to be expanded throughout the Brazilian territory, since they are important to classify the species extinction risk. Some species are represented by few individuals, which tends to increase the extinction risk, since there is a strong pressure on different types of vegetation due to the high rates of deforestation registered in Brazil.

The high floristic richness registered in these phytophysiognomies, as well as species classified as endangered and vulnerable, reinforces the importance of the studied phytophysiognomies preservation, necessary for these species perpetuation.

4. CONCLUSIONS

The results found in the two phytophysiognomies indicate that changes in the floristic composition, number of species and richness varied over time. The floristic changes were more substantial in the CD, which registered significant changes to the species loss and floristic richness. In the CSS, even with the fire impact, the changes were not significant because the floristic parameters remained over time.

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