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 sucessional 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).
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 Latosols, according to the Fundação Estadual do Meio Ambiente (2010).

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 exsiccatas 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) zochorous, 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.

| Awareness campaigns | CSS | CD | CSS | CD | CSS | CD |
|---------------------|-----|----|-----|----|-----|----|
|                     |     |    |     |    |     |    |
| Number of species   |     |    |     |    |     |    |
| 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 brasilensis, Aspidosperma subincanum, Brosimum gaudichaudii, Calyptranthes lucida, Cybistax antisphyilitica, 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 phytophysiospecies 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 |
|               | *Astronium graveolens* Jacq.                 | 0     | 0    | 6    | 10 |
|               | *Lithraea molleoides* (Vell.) Engl.          | 0     | 0    | 10   | 3  |
|               | *Myracrodruon urundeuva* Allemão             | 0     | 0    | 8    | 4  |
| Annonaceae    | *Annona crassiflora* Mart.                  | 28    | 28   | 11   | 10 |
|               | *Xylopia aromatic* (Lam.) Mart.              | 2     | 1    | 65   | 27 |
| Apocynaceae   | *Aspidosperma macrocarpon* Mart.             | 1     | 1    | 20   | 12 |
|               | *Aspidosperma subincanum* Mart. ex A. DC.    | 0     | 0    | 1    | 0  |
|               | *Aspidosperma tomentosum* Mart.              | 77    | 79   | 23   | 15 |
| Araliaceae    | *Schefleria macrocarpa* (Cham. & Schltdl.) Frodin | 12    | 10   | 2    | 1  |
| Asteraceae    | *Piptocarpha rotundifolia* (Less.) Baker    | 62    | 60   | 18   | 7  |
| Bignoniaceae  | *Cybistax antisphyilitica* (Mart.) Mart.     | 0     | 0    | 1    | 0  |
|               | *Handroanthus impetiginosus* (Mart. ex DC.) Mattos | 0     | 0    | 4    | 4  |
|               | *Handroanthus ochraceus* (Cham.) Mattos      | 10    | 9    | 8    | 8  |
|               | *Handroanthus serratifolias* (Vahl) S.O.Grose | 1     | 1    | 0    | 0  |

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| Families         | Species                                      | CSS | CD | ES | SD |
|------------------|----------------------------------------------|-----|----|----|----|
| Bignoniaceae     | Tabebuia aurea (Silva Manso) Benth. & Hook.f. ex S.Moore | 48  | 42 | 34 | 27 |
|                  | Tabebuia rosea (Ridl.) Sandwith              | 0   | 0  | 3  | 2  |
|                  | Jacaranda brasiliana (Lam.) Pers.            | 1   | 1  | 1  | 1  |
|                  | Zeyheria montana Mart.                       | 1   | 0  | 9  | 2  |
| Burseraceae      | Protium heptaphyllum (Aubl.) Marchand        | 0   | 0  | 86 | 77 |
| Calophyllaceae   | Kielmeyera coriacea Mart                     | 224 | 200| 1  | 4  |
|                  | Kielmeyera grandiflora (Wawra) Saddi         | 0   | 0  | 88 | 55 |
| Caryocaraceae    | Caryocar brasiliense A. St.-Hil              | 35  | 37 | 13 | 7  |
| Celastraceae     | Maytenus floribunda Reissek                  | 0   | 0  | 21 | 14 |
|                  | Plenckia populnea Reissek                    | 46  | 46 | 25 | 17 |
| Combretaceae     | Buchenavia tomentosa Eichler                 | 0   | 0  | 1  | 1  |
|                  | Terminalia argentea Mart.                    | 37  | 36 | 77 | 65 |
|                  | Terminalia jagjfolia Mart.                   | 0   | 0  | 1  | 1  |
| Conneraceae      | Con narzus suberosus Planch.                 | 5   | 5  | 3  | 2  |
|                  | Curatella americana L.                       | 4   | 6  | 16 | 12 |
| Caryophyllaceae  | Diopryos sericea A. DC.                     | 0   | 0  | 18 | 9  |
|                  | Diopryos hispida A. DC.                     | 51  | 43 | 8  | 3  |
| Erythroxylaceae  | Erythroxylum suberosum A. St.-Hil.           | 141 | 122| 23 | 8  |
|                  | Erythroxylum deciduum A.St.-Hil.             | 56  | 56 | 32 | 12 |
|                  | Erythroxylum daphnites Mart.                 | 0   | 0  | 7  | 1  |
|                  | Erythroxylum tortuorum Mart.                 | 10  | 8  | 1  | 0  |
| Fabaceae         | Aeosmium dasycarpum (Vogel) Yakovlev         | 16  | 17 | 71 | 32 |
|                  | Andira vermicula Benth.                     | 1   | 1  | 0  | 0  |
|                  | Bowdichia virgilioides Kunth                 | 37  | 37 | 16 | 15 |
|                  | Copaifer a lentorrhoffii Desf.               | 0   | 0  | 9  | 6  |
|                  | Dalbergia miscobium Benth.                   | 5   | 5  | 5  | 4  |
|                  | Dimorphandra moliis Benth.                   | 15  | 7  | 22 | 14 |
|                  | Enterolobium gummiferum (Mart.) J.F. Machr. | 5   | 5  | 1  | 1  |
|                  | Hymenaea stigonocarpa Hayne                  | 14  | 14 | 8  | 8  |
|                  | Leptolobium dasycarpum Vogel                 | 24  | 23 | 0  | 0  |
|                  | Machaerium opacaum Vogel                     | 48  | 48 | 45 | 25 |
|                  | Plathymenia reticula Benth.                  | 20  | 23 | 6  | 8  |
|                  | Platypodium elegans Vogel                    | 0   | 0  | 2  | 3  |
|                  | Sclerolobium aureum (Tul.) Baill.            | 0   | 0  | 1  | 1  |
|                  | Sclerolobium paniculatum Vogel               | 0   | 0  | 206| 122|
|                  | Styphnodendron adstringens (Mart.) Coville   | 12  | 8  | 2  | 0  |
|                  | Tachigali aurea Tul.                         | 34  | 32 | 46 | 39 |
|                  | Vatairea macrocarpa (Benth.) Ducke           | 91  | 84 | 36 | 27 |
| Unclassified     | Unclassified 1                              | 0   | 0  | 1  | 0  |
| Unclassified     | Unclassified 2                              | 0   | 0  | 1  | 1  |
| Lamiaceae        | Hyptidendron canum (Pohl ex Benth.) Harley  | 7   | 11 | 47 | 20 |

Table 2. Continued...
| Families               | Species                                                | CSS | CD | ES | SD |
|-----------------------|--------------------------------------------------------|-----|----|----|----|
| **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 byronimifolia* 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**         | *Calyptrothecia 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 neostrastra* 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**         | *Amaoua 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 |
|                       | *Paricourea 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 |
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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