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Structural differences in herbaceous communities on edge and interior atlantic forest in South Brazil

João Carlos Ferreira de Melo Júnior[1,2]; Allison Leandro Tietz[1], Andressa da Cruz[1]; Bruna Geovana Reis[1]; Gabriel da Rosa Schroeder[1]; Lucas Souza de Almeida[1]; Renata Cristine Temóteo Travassos[1] Rodrigo Dümes Chaves Cabral[1] & Walter Kampmann[1]

1Laboratory of Morphology and Plant Ecology, Universidade da Região de Joinville Santa Catarina, Brazil
2Corresponding author: joao.melo@univille.br

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ABSTRACT
The Atlantic Forest is recognized worldwide as hotspots due to its megadiversity. It is estimated that in this biome there are about 20 thousand plant species, which represents 35% of the species existing in Brazil. This study aimed to evaluate whether there are differences between the floristic and structural diversity of the herbaceous component in an edge and interior region of the southern Brazilian Atlantic Forest. The study was developed in a forest fragment (13 hectars) located in the state of Santa Catarina, south Brazil. The edge of the fragment is characterized by an area up to 10-15m wide, covered massively by herbaceous-subshrub vegetation and rare arboreal individuals. The interior is discontinuously shaded by the arboreal and shrub component contained in the upper strata of the forest. The phytosociological survey used the plot method. 100 plots of 1 m² were established, 50 on the edge of the forest fragment and 50 plots inside it. obtained in linear transects of 20m. The phytosociological parameters studied for both areas were absolute frequency (AF), relative frequency (RF), absolute coverage (AC) and relative coverage (RC). Through the treatment and analysis of these data, the importance value index (IVI) of each species was obtained. At the edge of the forest fragment, 18 families and 34 species were identified. Of the 34 species found, 31 are angiosperms (24 dicots and 7 monocots) and 3 are monilophytes. All species are native to the Brazilian flora, with the exception of *Centella asiatica* and 2 lycophytes. In the interior, 14 species were found, being represented by 10 families. All species in the interior were angiosperms (4 dicots and 8 monocots) and 2 monilophytes. All species are native to the Brazilian flora and have herbaceous habit. The herbaceous community in the interior is different from the herbaceous community at the forest edge. The initial hypothesis of the work was confirmed, since none of the species present at the edge of the forest occurs in the interior of the forest.
Keywords: atlantic forest, rain forest, herbaceous community, phytosociology, biodiversity conservation

Diferenças estruturais em comunidades herbáceas na transição entre a floresta atlântica e o interior no Sul do Brasil

A Floresta Atlântica é reconhecida mundialmente como um hotspot devido à sua megadiversidade. Estima-se que nesse bioma existam cerca de 20 mil espécies de plantas, o que representa 35% das espécies existentes no Brasil. Este estudo teve como objetivo avaliar se há diferenças na diversidade florística e estrutural do componente herbáceo em uma região de transição e no interior da Floresta Atlântica no sul do Brasil. O estudo foi desenvolvido em um fragmento florestal de 13 hectares localizado no estado de Santa Catarina, sul do Brasil. A borda do fragmento é caracterizada por uma área com largura de até 10-15m, coberta massivamente por vegetação herbácea-arbustiva e raros indivíduos arbóreos. O interior é sombreado de forma descontínua pelo componente arbóreo e arbustivo presente nos estratos superiores da floresta. O levantamento fitossociológico utilizou o método de parcelas, sendo estabelecidas 100 parcelas de 1 m², 50 na borda do fragmento florestal e 50 no interior, obtidas em transectos lineares de 20m. Os parâmetros fitossociológicos estudados para ambas as áreas foram

frequência absoluta (FA), frequência relativa (FR), cobertura absoluta (CA) e cobertura relativa (CR). Através do tratamento e análise desses dados, foi obtido o índice de valor de importância (IVI) de cada espécie. Na borda do fragmento florestal, foram identificadas 18 famílias e 34 espécies. Das 34 espécies encontradas, 31 são angiospermas (24 dicotiledôneas e 7 monocotiledôneas) e 3 são monilófitas. Todas as espécies são nativas da flora brasileira, com exceção de Centella asiatica e 2 licófitas. No interior, foram encontradas 14 espécies, representadas por 10 famílias. Todas as espécies no interior eram angiospermas (4 dicotiledôneas e 8 monocotiledôneas) e 2 monilófitas. Todas as espécies são nativas da flora brasileira e possuem hábito herbáceo. A comunidade herbácea no interior difere da comunidade herbácea na borda da floresta. A hipótese inicial do trabalho foi confirmada, pois nenhuma das espécies presentes na borda da floresta ocorre no interior da floresta.
Palavras-chave: floresta atlântica, floresta tropical, comunidade herbácea, fitossociologia, conservação da biodiversidade

Introduction

The Atlantic Forest is recognized worldwide as hotspots due to its megadiversity (Queiroz *et al*. 2006). Despite this, it still has a high rate of endemism to the detriment of the historical process of erosion (Myers *et al*. 2000; Lima *et al.* 2011). It is estimated that in this biome there are about 20 thousand plant species, which represents about 35% of the species existing in Brazil (MMA 2021). The Atlantic Forest is characterized by distinct ecosystems that are distributed along an altitudinal, longitudinal and latitudinal gradient (Fernandes 2006), being represented by different vegetation types: Dense Ombrophilous Forest, Mixed Ombrophilous Forest (also known as Araucaria Forest), Open Rain Forest, Seasonal Semideciduous Forest and Seasonal Deciduous Forest, as well as mangroves, restinga vegetation, inland swamps, high altitude fields and forest enclaves in the Northeast (IBGE 2012). The Atlantic Forest is structured along a vertical axis and is composed of strata of vegetation. The upper stratum, called canopy, is represented by species, in general, of arboreal habit and is subject to full sunlight. The understory stratum, which can vary from one to two levels in height, comprises species that are mostly shrubs and small trees subject to high levels of shading. Finally, the last stratum is associated with the forest floor and is represented massively by herbaceous plants continuously subject to shading (Gommers *et al*. 2013).

According to the National Institute for Space Research (INPE 2014), in the period 2007–2013, the area that suffered forest degradation (102,923 km²) was twice the area deforested in the previous period (55,906 km²), intensifying the fragmentation of the remnants still existing. In the state of Santa Catarina, forest fragmentation reached the highest level between 1985-1990, with approximately 19,882 hectares of forest suppressed. Currently, the deforestation rate in this state has declined and reached the mark of 672 hectares between the years 2012-2013 (SOS Mata Atlântica 2016). The result is habitat fragmentation, a precursor process of severe impacts on the ecosystem, exposing the forest to different conditions of incident solar radiation, hot and dry winds in addition to increased water stress, which considerably increases the mortality rate of trees. Close to the edges of the fragment, the formation of gaps, the rupture of biological connectivity and contamination by exotic species that, in turn, alter the structure and composition of the flora and reflect on the loss of biodiversity (Tabarelli *et al*. 2008). Such fragments occupy small dimensions with little or no connectivity between them and are constituted by secondary forests in different stages of natural regeneration (MMA 2010).

Secondary forests are those in the stage of regeneration after having been cleared for economic activities, such as agriculture, livestock and logging, and this type of vegetation is very common throughout the Brazilian Atlantic Forest (Apremavi 2021). From a scientific point of view, secondary forests can be classified into three stages of ecological succession: capoeirinha (initial) - characterized by predominantly herbaceous vegetation and some pioneer trees, lasting between five to ten years after the end of the impact that caused the degradation of the forest; capoeira (intermediate) - composed of trees of approximately up to 10 meters in height and 9 cm in diameter at breast height (DBH), undergrowth less expressive than capoeirinha, which may extend from ten to 20 years after clear cutting depending on the conditions of the deforested area; and capoeirão (advanced) consisting of trees larger than 10 m and DBH of approximately 11 cm, ranging from 20 years to centuries until returning to primary forest conditions (Salomão *et al*. 2012). Due to forest fragmentation, there is the so-called edge effect, a condition capable of altering the local vegetation, altering the microclimate and, therefore, causing disturbances in the biological diversity of the ecosystem in question (Campos *et al*. 2018). In this way, it is possible to perceive significant changes between the edge and the interior of a secondary forest, especially in the vegetation structure, microclimate, species composition and population dynamics present in the area, including the distribution and sociological organization of plants from the upper strata, and also from the plants on the forest floor (Silva *et al*. 2015).

Among the main abiotic factors that affect the occurrence of herbaceous species in an area of secondary forest, we can mention the uneven incidence of sunlight, allowing the installation of cyophytic plants inside the forest and of heliophytic and pioneer plants in edges and of clearings (Alves and Mertzger 2006). Temperature is also crucial for the occurrence of certain species, and there may be major floristic changes even in relatively close areas (Silva *et al*. 2012). With regard to the relative humidity, it is a determining factor for the occurrence of several herbaceous species, presenting higher rates inside the forests than on the edge, thus explaining changes in the floristic diversity between the two portions (Pezzopane 2001). Edge communities usually have a high density of individuals that are smaller in size and highly dependent on sunlight, being characterized by many pioneer species (Pschdeidt *et al*. 2018). On the other hand, with regard to communities in the interior of the forest, they are characterized by a lower density of individuals, having larger organisms and less dependent on the incidence of sunlight, being species of more advanced stages within the stages of ecological succession (Pschdeidt *et al*. 2018).

The present study aimed to evaluate differences between floristic and structural diversity of the herbaceous component in a region of edge and interior of the Dense Ombrophylous Forest, in a secondary successional stage, following the hypothesis that there is considerable heterogeneity between the two communities.

Materials and methods

Study area

The study was carried out in a forest fragment located in the area of the drainage area of the Cachoeira river basin, located in the municipality of Joinville, northeast region of the state of Santa Catarina (Figure 1). The studied forest fragment has an area of 13 ha and is located in the northern portion close to the industrial zone of the city, making up the Botanical Garden of the University of the Region of Joinville. It is cut by several trails and is surrounded by industries and other occupations (Arriola and Melo Jr. 2017). The edge part is characterized by an area up to 10-15m wide, covered massively by herbaceous-subshrub vegetation and rare arboreal individuals. The interior is discontinuously shaded by the arboreal and shrub component contained in the upper strata of the forest. There are also clearings and dense tangles of lianas.

The city of Joinville is located in the northern mesoregion of the state of Santa Catarina and has a territorial area of 1,127,946 km², being fully inserted in the Atlantic Forest biome (IBGE 2020). The climate of the municipality is classified as Cfa (Köppen) and characterized as mesothermic with no defined dry season and hot summers. The average annual rainfall is 1.874 mm, and the summer season is considered the wettest. The average annual relative humidity of the air is 76.04%. The average annual temperature is 22.63°C, with the average maximum being 27.18°C and the average minimum being 18.91°C. The hottest month is January, with an average temperature around 25°C, and July is the coldest month, with an average temperature of 17°C (Knie 2002).

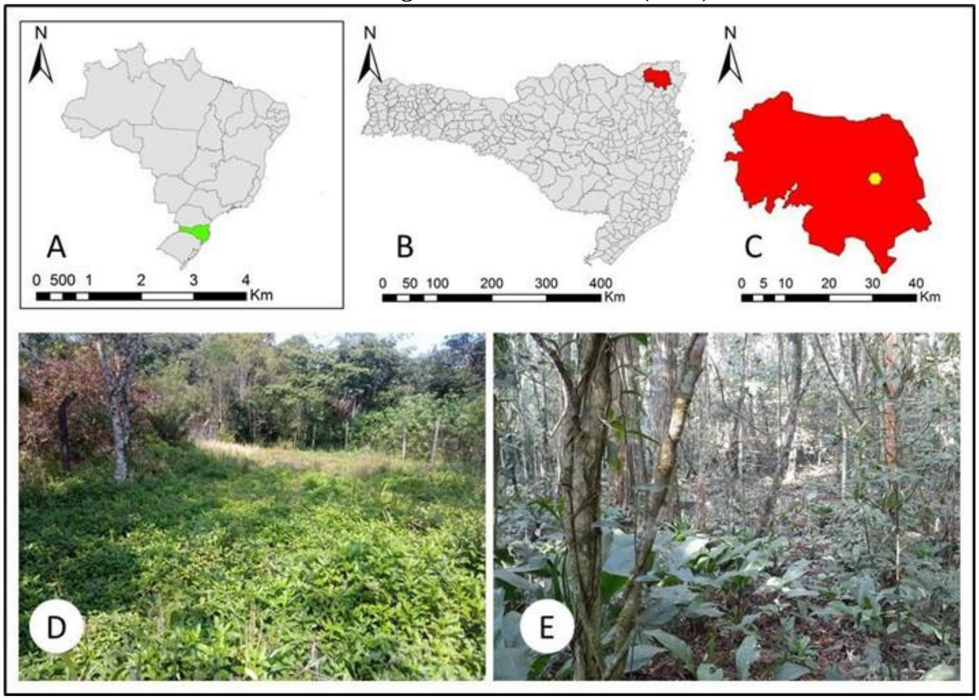

Figure 1. Spatial location of the studied Atlantic Forest fragment. Legend: A - situation of the state of Santa Catarina in Brazil. B - situation of the municipality of Joinville in the state of Santa Catarina. C - situation of the fragment of the municipality of Joinville. D - aspect of the fragment edge and E aspect of the interior of the fragment. Primary source.

Phytosociological survey

The phytosociological survey was carried out using the plot method (Felfili *et al*. 2011). 100 plots of 1 m² were established, 50 of them on the edge of the forest fragment (Figure 1: D) and 50 plots inside it (Figure 1: E). The same were obtained in linear transects of 20m, using a quadrat made of PVC of 1m x 1m, in which squares of 1m² were established in which the researchers collected the data alternately, collecting information from the first square and skipping the second, and so on, until reaching the sampling of 50 plots in each studied area.

Each identified species was defined by a symbol, collected using pruning material and taken to the preparation of exsiccates. In each plot, the presence of species already collected or not was identified, and their coverage class was estimated, being defined according to the scale of Causton (1988).

The phytosociological parameters studied for both areas were absolute frequency (FA), relative frequency (FR), absolute coverage (CA) and relative coverage (CR) (Mueller-Dombois and Eellenberg 1974). Through the treatment and analysis of these data, the relative importance value (VI) of each species was obtained. Species coverage was estimated in the field using the Causton scale (1988), with five classes that evaluate in percentage terms the projection of the aerial part of the plant on the surface of the plot, and the average coverage value was later adopted. As an indicator of the biological diversity contained both at the edge and inside the forest, the Shannon Diversity (H') and Pielou Equability (Magurran 2011) indices were calculated using Past software (Hammer *et al*. 2001), later used for purposes of approximation to other surveys carried out in the Atlantic Forest stricto sensu.

Species identification was performed by comparing the exsiccates obtained with data from digital herbaria and by reviewing specialized literature. All botanical material collected was processed according to the usual collection, preparation and herborization techniques described by IBGE (2012). The species classification followed the APG IV system (2016), and the validity of the names of the species and the respective authors was verified in the List of Species of Flora of Brazil (Reflora 2020).

Results and discussion

At the edge of the forest fragment, 18 families and 34 species were identified (Table 1). The most representative genera were *Cyperus* sp. and *Desmodium* sp.(three species each). The most representative families were Fabaceae (five species), Poaceae and Asteraceae (4). In general,, 31 species were angiosperms (24 dicots and 7 monocots) and three were monilophytes. All species were native. except *Centella asiatica*, and 2 lycophytes.

In the interior, 14 species were found, represented by 10 families, the most representative being Araceae with 5 species (Table 01). All species in the interior were angiosperms (4 dicots and 8 monocots) and 2 monilophytes. All species are native to the Brazilian flora and have herbaceous habits.

Both the forest edge and interior communities are made up of herbaceous species, but none of the species found in this study are present in both environments. The herbaceous species found on the edge and inside the fragment belonging to the Cyperaceae, Poaceae, Asteraceae, Fabaceae and Rubiaceae families have a wide distribution, mainly because they are easily dispersed and are considered pioneers (Richards 1997).

The community structuring species found at the forest edge are: *Sphagneticola trilobata* (L.) Pruski, *Pterolepis glomerata* (Rottb.) Miq, *Paspalum notatum* Flüggé, *Oplismenus undulatifolius* (Ard.) Roem. & Schult., *Centella asiatica* (L.) Urb., *Urochloa humidicola* (Rendle) Morrone & Zuloaga and *Desmodium barbatum* (L.) Benth.

Sphagneticola trilobata (L.) Pruski is a plant native to Brazil (Correia 1984), it is characterized by being a creeping herb, approximately 20 cm high, tolerates excessive humidity, flooding or droughts (Santos *et al*. 2015). It has a wide distribution, occurring from Mexico and the Antilles to southern Argentina, being naturalized to the east of Australia, Malaysia and the Pacific Islands (Pruski 1996), in Brazil it is present in all regions (Souza *et al*. 2018), in the Phytogeographic domains Amazon, Caatinga, Cerrado, Atlantic Forest, Pampa and Pantanal (Mondin and Bringel 2015).

Pterolepis glomerata is a terrestrial herb (GOLDENBERG *et al*. 2020) that occurs in the Dominican Republic, Puerto Rico, Antilles, Venezuela, Guyanas, Bolivia, Paraguay and Brazil (Renner 1994), and in Brazil, it occurs in all states, except in Acre, Alagoas, Mato Grosso do Sul, Paraíba and Rio Grande do Sul (Romero 2014). Found in Mata Humida, Restinga, Campo Limpo, Campo Humido and Floresta de Tabuleiro (CNCFlora 2011).

Paspalum notatum is a perennial, summer plant with a rhizomatous habit with good foraging value (Barreto and Kappel 2017). In Brazil, it occurs in the North (Acre, Amapá and Pará), Northeast (Bahia), Southeast (Espírito Santo, Minas Gerais, Rio de Janeiro, São Paulo) and South (Paraná, Rio Grande do Sul, Santa Catarina), being present in the Amazon, Cerrado, Atlantic Forest and Pampa domains (Flora do Brasil 2020).

Oplismenus undulatifolius a type of annual or perennial grass that occurs in tropical and temperate zones (Moktan *et al.* 2012).

Centella asiatica is a rhizomatous perennial herb that has phenotypic plasticity in terms of the size of its leaves, which are smaller in light (Coelho *et al*. 2005). The plant is present in Brazil, in the Northeast (Alagoas, Bahia, Ceará, Paraíba, Pernambuco, Rio Grande do Norte and Sergipe), Midwest (Federal District, Goiás and Mato Grosso do Sul), Southeast (Espírito Santo, Minas Gerais, Rio de Janeiro and São Paulo) and South (Paraná, Rio Grande do Sul and Santa Catarina), in the Cerrado, Atlantic Forest and Pampa phytogeographic domains (Lucas 2020).

Urochloa humidicola is perennial (Smith *et al*. 1982) and rhizomatous (Alcântara and Bufarah 1992), and can also tolerate periods of drought and flooded soils (VALLE *et al*. 2010). In Brazil, it is present in the North (Amazonas, Pará and Roraima), Northeast (Alagoas, Bahia, Maranhão, Pernambuco, Piauí and Sergipe), Midwest (Federal District, Goiás, Mato Grosso do Sul and Mato Grosso), Southeast (Espírito Santo, Minas Gerais, Rio de Janeiro and São Paulo) and South (Paraná, Rio Grande do Sul and Santa Catarina), in the phytogeographic domains Amazon, Caatinga, Cerrado, Atlantic Forest and Pampa (Flora do Brasil, 2020).

Table 1. Data obtained for forest edge and interior. (Legend: Npi – number of plots in which the species were observed; AF- Absolute frequency; RF - Relative frequency; AC - Absolute coverage class; RC - Relative coverage class; IVI - Importance value index).

Family	Species	Npi	AF	RF	AC	RC	IVI	location
Asteraceae	*Sphagneticola trilobata* (L.) Pruski	49	98	11.92	28.57	20.19	32.11	edge
Melastomataceae	*Pterolepis glomerata* (Rottb.) Miq	37	74	9.00	9.26	6.54	15.54	edge
Poaceae	*Paspalum notatum* Flüggé	30	60	7.30	9.75	6.89	14.19	edge
Poaceae	*Oplismenus undulatifolius* (Ard.) Roem. & Schult.	36	72	8.76	7.50	5.30	14.06	edge
Apiaceae	*Centella asiatica* (L.) Urb.	45	90	10.95	2.50	1.77	12.72	edge
Poaceae	*Urochloa humidicola* (Rendle) Morrone & Zuloaga	14	28	3.41	10.71	7.57	10.98	edge
Fabaceae	*Desmodium barbatum* (L.) Benth.	36	72	8.76	2.71	1.91	10.67	edge
Cyperaceae	*Cyperus rotunlus* L.	17	34	4.14	6.32	4.47	8.60	edge
Ochnaceae	*Sauvagesia erecta* L.	27	54	6.57	2.78	1.96	8.53	edge
Solanaceae	*Solanum americanum* Mill.	7	14	1.70	7.14	5.05	6.75	edge
Cyperaceae	*Cyperus* sp. 1	17	34	4.14	3.65	2.58	6.72	edge
Commelinaceae	*Commelina diffusa* Burm.f.	12	24	2.92	3.13	2.21	5.13	edge
Asteraceae	*Acanthospermum* sp	11	22	2.68	2.50	1.77	4.44	edge

Fabaceae	*Desmodium adscendens* (Sw.) DC.	10	20	2.43	2.50	1.77	4.20	edge
Fabaceae	*Desmodium incanum* (Sw.) DC.	10	20	2.43	2.50	1.77	4.20	edge
Araliaceae	*Hydrocotyle bonariensis* Lam.	9	18	2.19	2.50	1.77	3.96	edge
Asteraceae	*Mikania micrantha* Kunth	6	12	1.46	2.50	1.77	3.23	edge
Verbanaceae	*Lippia alba* (Mill.) N. E. Br. ex Britton & P.Wilson	5	10	1.22	2.50	1.77	2.98	edge
Fabaceae	*Mimosa pudica* L.	5	10	1.22	2.50	1.77	2.98	edge
Rubiaceae	*Richardia scabra* L.	5	10	1.22	2.50	1.77	2.98	edge
Commelinaceae	*Tripogandra* sp. Cf	5	10	1.22	2.50	1.77	2.98	edge
Asteraceae	*Vernonanthura branliana* (L.) H.Rob.	3	6	0.73	2.50	1.77	2.50	edge
Asteraceae	*Baccharis trimera* (Les.) DC.	2	4	0.49	2.50	1.77	2.25	edge
Caryophyllaceae	*Drymaria cordata* (L.) Willd. ex Roem. & Schult.	2	4	0.49	2.50	1.77	2.25	edge
Asteraceae	*Emilia fosbergii* Nicolson	2	4	0.49	2.50	1.77	2.25	edge
Concolculaceae	*Ipomoea cairica* (L.) Sweet	2	4	0.49	2.50	1.77	2.25	edge
Blechnaceae	*Neoblechnum brasiliense* (Desv.) Gasper & V.A.O. Dittrich	2	4	0.49	2.50	1.77	2.25	edge
Asteraceae	*Vernonanthura beyrichii cf*	2	4	0.49	2.50	1.77	2.25	edge
Gleicheniaceae	*Gleichenia* sp.	1	2	0.24	2.50	1.77	2.01	edge
Oxilidaceae	*Oxalis triangularis* A.St.-Hil.	1	2	0.24	2.50	1.77	2.01	edge
Verbanaceae	*Stachytarpheta caynnensis* (Rich.) Vahl	1	2	0.24	2.50	1.77	2.01	edge

Marantaceae	*Calathea monophylla* Körn.	39	78	26,17	9,68	14,68	41,39	interior
Araceae	*Anthurium loefgrenii* Engl.	40	80	26,85	5,31	8,06	35,45	interior
Araceae	*Philodendron missionum* (Hauman) Hauman	35	70	23,49	4,57	6,93	30,91	interior
Bromeliaceae	*Nidularium innocentii* Lem.	1	2	0,67	10	15,17	15,85	interior
Cyatheaceae	*Cyathea atrovirens* (Langsd. & L. Fisch.) Domin.	1	2	0,67	10	15,17	15,85	interior
Araceae	*Anthurium scandens* (Aubl.) Engl.	15	30	10,07	2,5	3,79	14,07	interior
Menispermaceae	*Chondrodendron microphyllum* (Eichler) Moldenke	4	8	2,68	4,5	6,82	9,56	interior
Solanaceae	*Capsicum* sp.	4	8	2,68	4,38	6,63	9,37	interior
Violaceae	*Viola sp.*	2	4	1,34	2,5	3,79	5,16	interior
Araceae	*Rhaphidophora aurea* (Linden & André) Birdsey	1	2	0,67	2,5	3,79	4,48	interior
Araceae	*Philodendron sp.*	1	2	0,67	2,5	3,79	4,48	interior
Dryopteridaceae	*Rumohra adiantiformis* (G.Forst.) Ching	1	2	0,67	2,5	3,79	4,48	interior
Piperaceae	*Manekia obtusa* Yunck.	1	2	0,67	2,5	3,79	4,48	interior
Poaceae	*Ichnanthus ruprechtii* Döll	1	2	0,67	2,5	3,79	4,48	interior

Desmodium barbatum is a perennial and rhizomatous plant (Ciotti and Schinini 2005), with a prostrate habit, mainly in degraded areas (Nobre *et al*. 2008) and is present throughout the Brazilian territory, in all phytogeographic domains of the country (Lima 2020).

The community structuring species found within the forest are: *Calathea monophylla* Körn., *Anthurium loefgrenii* Engl., *Philodendron missionum* (Hauman) Hauman, *Nidularium innocentii* Lem., *Cyathea atrovirens* (Langsd. & L. Fisch.) Domin., *Anthurium scandens* (Aubl.) Engl.

Thirty-one species were found at the edge of the forest and 14 in the interior of the forest, it is observed that no species was present in both. According to Didhan and Lawton (1999) the forest edge is more exposed to external disturbances, containing greater diversity of plant species, this characteristic was observed in this work.

The most representative families at the forest edge were Asteraceae (7 species), Fabaceae (4 species) and Poaceae (3 species), this representativeness may be related to the fact that these families are considered pioneers (Richars 1997; Longhi-Wagner 2001). In this work, the pioneer species represented 45.16% of the forest edge herbaceous community, and in addition, the structuring species of the community are part of these 3 Families (with the exception of 2 species), demonstrating the influence that pioneer species have on the forest edge.

Poaceae and Asteraceae also showed representation in another work involving herbaceous communities in forest edges (Maraschin-Silva *et al*. 2009).

The most representative genera in the forest edge herbaceous community were *Desmodium* (with 3 species), *Cyperus* and *Vernonanthura* (with 2 species each). The genera *Cyperus* and *Desmodium* also appear in the work by Maraschin-Silva (2009), with 2 species each.

As in the current work, *Centella asiatica* was present with one of the highest values of importance in the work of Maraschin-Silva (2009), both in this work and in that of the authors cited, *C. asiatica* had a very high relative and absolute frequency, which contributed to its positioning regarding the value of importance in the community.

The most representative Family in the interior of the forest was Araceae, with 5 species. Such information corresponds to the studies by Coelho *et al*. (2009), in which he states that the Araceae family is one of the most representative in the Neotropics, being well represented by both epiphytes and herbaceous species.

The most representative genus in the interior of the forest was *Anthurium*, with 2 species, which according to Maia *et al.* (2020) has a rich diversity of shapes, beautiful leaves and durability, constituting a large number of species of Brazilian flora that can even be commercially exploited as ornamental plants.

Calathea monophylla has rosulate phyllotaxis and cataphylls that can reach 25 cm in length (Braga 2005). The species is naturally occurring in the states of Bahia, throughout the Southeast and also in Paraná and Santa Catarina (Braga 2011).

Anthurium loefgrenii has a succulent stem, growing in humid and shady environments of restingas and dense ombrophilous forests, especially in montane hillside forests, reaching altitudes of up to 1200m, occurring from the state of São Paulo to Santa Catarina (Coelho *et al*. 2009)

Philodendron missionum is a species whose adult leaf has a long sheath, exceeding more than half the length of the petiole and involute closed sheath, being present (Buturi *et al.* 2016), with geographic distribution in the states of Paraná, Santa Catarina and Rio Grande do Sul. (Sakuragui *et al.* 2012).

Nidularium innocentii Lem. is a variable taxon in terms of size, leaf color, leaf rosette and floral rosette conformation, as well as the color of the primary bracts. The species is endemic to Brazil, occurring in the states of the Southeast (São Paulo, Rio de Janeiro) and South (Paraná, Santa Catarina, Rio Grande do Sul) regions, from Bahia (Forzza *et al*. 2012), with a gap significant in its distribution pattern in the State of Espirito Santo (Leme 2000; Wanderley *et al*. 2007).

Cyathea atrovirens (Langsd. & Fisch.) Domin. are arborescent plants with an erect to decumbent stem, 0.4-5 m high, base of petioles persistent along its length. Endemic to Brazil, with confirmed occurrence in the Northeastern states (Bahia, Paraíba, Pernambuco); Midwest (Mato Grosso do Sul); Southeast (Espírito Santo, Minas Gerais, Rio de Janeiro, São Paulo); South (Paraná, Rio Grande do Sul, Santa Catarina) (Reflora 2020).

Anthurium scandens (Aubl.) Engl. are epiphytic plants, have stem: cataphyll(s) and prophyll in fiber(s) throughout the stem(s); erect position(s). Leaf: petiole(s) cylindrical/grooved shape(s) with obtuse adaxial margin(s) plump abaxial(s); The species is not endemic to Brazil, with its geographic distribution confirmed in the Northern states (Acre, Amazonas); Northeast (Bahia, Ceará, Pernambuco); Midwest (Federal District); Southeast (Espírito Santo, Minas Gerais, Rio de Janeiro, São Paulo) and South (Paraná, Santa Catarina) (Reflora 2020).

In the present study, it was possible to observe a difference in the composition of the vegetation in the interior and at the edge of the forest, the composition of the flora at the edge and interior of the forest can change due to microclimatic changes, favoring the appearance of pioneer species on the edge and secondary species in the interior (Oliveira Filho *et al*. 2007; Tabarelli *et al*. 2010). Likewise, the occurrence of species of dispersal syndromes may differ between these areas, with biotic dispersal - zoochory - being more frequent in the lower stratum and abiotic dispersal - anemochory and autochory - in the lower stratum (Savary *et al*. 2003; Yamamoto *et al*. 2007), these different ecological strategies are important for the floristic complementation of fragments. The formation of borders, “edge effect” can cause changes in the species composition of an area and influence the interactions between plants and animals (Turner 1996; Bierregaard *et al*. 2001). Plants may have different phenological responses according to the microclimatic characteristics found at edges (Murcia 1995). Evidences of changes in the phenological dynamics of plants can be related to the alterations that occur at the edge (Laurence and Yensen 1991; Silva and Tabarelli 2000). With the fragmentation of habitats, several changes occur in the abiotic and biotic factors of the remnants. With regard to abiotics, the main changes are in the microclimate, such as increased air temperature, increased wind intensity and decreased air and soil moisture (Kapos *et al*. 1997; Siqueira *et al*. 2004; Portela *et al*. 2007). Another important change that ends up accentuating the changes in the microclimate is the increase in light intensity inside the fragments due to the increase in the canopy opening (Kapos 1989). These microclimatic changes generate several changes in the plant community of the remnants, such as increased mortality rates of trees near the edge (Laurance *et al.* 2001), low germination rate in forest fragments (Bruna 2002), decreased richness and abundance of woody and herbaceous species near the edge (Fontoura *et al*. 2006).

Conclusion

The herbaceous community of the interior is different from the herbaceous community of the forest edge, fully proving the initial hypothesis of the study, since no species present at the edge of the forest also occurred inside it, favoring the tendency that the “edge effect ” has differentiation in the variability of species compared to the interior of the forest, which has both biotic and abiotic characteristics significantly different, especially considering the microclimate in both areas (Nascimento and Laurance 2006).

Not only was there no repetition of the species in the two areas, but also the families of the structuring species of both communities are totally different, with the occurrence mainly of Asteraceae, Melastomataceae, Poaceae, Apiaceae and Fabaceae on the edge, while in the interior of the forest the families of most relevant species were Marantaceae, Araceae, Bromeliaceae and Cyatheaceae.

It is also evident the need for greater investment in phytosociology research of herbaceous vegetation in secondary forests, evidenced by the scarcity of data to discuss the results obtained during this research.

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