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# **PRESERVATION OF PRIMARY FOREST CHARACTERISTICS DESPITE FRAGMENTATION AND ISOLATION IN A FOREST REMNANT FROM VIÇOSA, MG, BRAZIL<sup>1</sup>**

Markus Gastauer<sup>2</sup>, Marcos Eduardo Guerra Sobral<sup>3</sup> e João Augusto Alves Meira-Neto<sup>4</sup>

**ABSTRACT** – According to its owners, the Forest of Seu Nico (FSN) from the Viçosa municipality, Minas Gerais, Brazil, never has been logged and is therefore considered a primary forest. Nevertheless, the forest patch suffered impacts due to selective wood and non-timber extraction, fragmentation and isolation. Aim of this study was to test if the FSN, despite impacts, preserved characteristics of primary forests, which are elevated percentages of non-pioneer (>90%), animal-dispersed (>80 %), understory (>50%) and endemic species (~40%). For that, all trees with diameter at breast height equal or major than 3.2 cm within a plot of 100 x 100 m were identified. With 218 tree species found within this hectare, the FSN's species richness is outstanding for the region. The percentages of non-pioneer (92 %), animal-dispersed (85 %), understory (55 %) and endemic species (39.2 %) from the FSN fulfill the criteria proposed for primary forest. Therefore, we conclude that the FSN maintained its characteristics as a primary forest which highlights its importance for the conservation of biotic resources in the region, where similar fragments are lacking or not described yet.

**Keywords:** Endemism; Species composition; Species richness.

## ***PRESERVAÇÃO DAS CARACTERÍSTICAS DE FLORESTAS PRIMÁRIAS, APESAR DE FRAGMENTAÇÃO E ISOLAMENTO NUM REMANESCENTE FLORESTAL EM VIÇOSA, MG, BRASIL***

**RESUMO** – Segundo seus proprietários, a Floresta de Seu Nico (FSN), situada no Município de Viçosa, Minas Gerais, Brasil, nunca sofreu corte raso, porém é considerada floresta primária. No entanto, o fragmento florestal sofreu impactos por extração seletiva de madeira e produtos não madeireiros, além de fragmentação e isolamento. O objetivo desse estudo foi testar se a FSN, apesar de impactos, preservou características de florestas primárias, que são porcentagens elevadas de espécies não pioneiras (>80%), espécies dispersas por animais (>90%), espécies de sub-bosque (> 50%) e espécies endêmicas (~40%). Para isso, todas as árvores com diâmetro à altura do peito igual ou superior a 3,2 cm, dentro de uma parcela de 100 x 100 m, foram identificadas. Com 218 espécies de árvores encontradas dentro da parcela, a riqueza de espécies da FSN é elevada na região. As porcentagens de espécies não pioneiras (92 %), dispersas por animais (85%), de sub-bosque (55%) e endêmicas (39,2%) da FSN cumprem os critérios propostos para florestas primárias. Porém, conclui-se que a FSN manteve suas características como floresta primária, que destaca a sua importância para a conservação dos recursos bióticos da região, onde fragmentos semelhantes estão faltando ou, ainda, não foram descritos.

**Palavras-chave:** Endemismo; Composição de espécies; Riqueza de espécies.

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## 1. INTRODUCTION

Before the Europeans arrived in South America, the Atlantic Forest covered between 1.300.000 and 1.500.000 km<sup>2</sup> distributed nearly along the entire Brazilian coast. Today, this formerly continuous area is highly fragmented with only 11 to 16 % of the original vegetation cover remaining; most of existing forests are secondary fragments that recover from some type of land clearance (RIBEIRO et al., 2009a). Primary forest remnants, i.e., forest patches never logged or clear-cut (VELOSO et al., 1991) that have experienced little or no human disturbance (GIBSON et al., 2011), are rare. Primary forests show higher species richness and diversity than secondary forests (BROWNING et al., 2010; STYRING et al., 2010), although they might have suffered selective wood or non-timber extraction. Furthermore, indirect impacts such as fragmentation and isolation create extinction debts (LIRA et al., 2012) initiating their degradation (GASTAUER; MEIRA-NETO, 2013).

But primary and secondary forests differ not only in species richness and diversity (PETERSON; CARSON, 2008) but also in regeneration, stratification and dispersion strategies of species forming these forests (NUNES et al., 2003). Because environmental conditions, such as nutrient supply and light availability in the understory, change gradually during succession (LAURANCE et al., 2002), the percentage of pioneer species is higher in the initial than in later stages of succession. Due to reduced light availability in primary, old-growth forests, the proportion of understory species should be higher within primary forests than secondary fragments (GUARIGUATA; OSTERTAG, 2001). Furthermore, wind-dispersed species dominate the species assemblage in the initial phases of succession (INGLE, 2003) and are substituted by animal-dispersed species in advanced stages. Finally, widespread species are expected to colonize disturbed or logged habitats faster than endemic species with a narrow geographic distribution (MORI et al., 1981).

The proportions of non-pioneer, animal-dispersed, understory and endemic species have been used to estimate the time necessary to regenerate the Atlantic Forests after a disturbance (LIEBSCH et al., 2008). Liebsch et al. (2008) postulated for primary remnants from the Atlantic Forests to hold a proportion of less than 10% of pioneer species, more than 50% of understory species, more than 80% of animal-dispersed species and around

40% of species endemic to the Atlantic Forest biome. In this article, we use these characteristics to test if the Forest of Seu Nico (FSN), an unlogged forest patch that underwent only selective wood extraction and exploitation of further, non-timber products (CAMPOS et al., 2006), maintained its characteristics as a primary, old-growth forest despite fragmentation and isolation.

## 2. MATERIAL AND METHODS

Located at 20°47' S and 42°50' W at the Bom Sucesso Farm, Viçosa, Minas Gerais State, Brazil, the FSN is a forest fragment covering approximately 36 ha of a small valley. According to the Köppen system, the climate of Viçosa is characterized as Cwb (PEEL et al., 2007). Cwb is a mesothermic climate with mild, rainy summers and dry winters. The predominant soils are oxisols, but inceptisols are found on the slopes and neosols are found in the sedimentation areas. According to Velloso et al. (1991), the predominant vegetation is characterized as a Submontane Seasonal Semideciduous Forest.

For the sample, the plot method has been applied (NEWTON, 2007): one hectare was divided in 100 quadratic plots of 10 x 10 m. All trees with diameter at breast height (dbh) larger than 3.2 cm were identified. Nomenclature and systematic classification of species follows the database of Missouri Botanical Garden (2013). All species have been classified according to their regeneration, stratification and dispersion guilds. Thus, two regeneration (or successional) guilds have been defined (SIMBERLOFF; DAYAN, 1991). The pioneer species require direct light for all phases of development, while non-pioneer species are able to develop one or more phases of their life in shady conditions of the understory (GANDOLFI et al., 1995). Classifying species in stratification guilds separates understory species reaching heights up to 15 m only from canopy species regularly exceeding this value (LIEBSCH et al., 2008). Furthermore, two dispersion guilds were distinguished (animal-dispersed species and other vectors).

Species classification in regeneration, and dispersion guilds was performed by consulting the following literature (sorted in alphabetic order, not by relevance): Appolinário et al. (2005), Aquino and Barbosa (2009), Araújo et al. (2005), Carvalho et al. (2007), Carvalho and Nascimento (2009), Lopes et al. (2002), Nunes et al. (2003), Oliveira-Filho et al. (2004,

**Table 1** – Geographic distribution and affiliation to ecological guilds of tree species from the one hectare plot in the FSN. 'yes' is species endemic to the Atlantic Rain Forest biome, 'no' is species not endemic to the Atlantic Rain Forest biome, 'pio' is pioneer species, 'npio' is non-pioneer species, 'zoo' is animal-dispersed species, 'nzoo' is not animal-dispersed species, 'us' is understory species and 'cp' is canopy species.

**Tabela 1** – Distribuição geográfica e afiliação a guildas ecológicas de espécies de árvores encontradas numa parcela de um hectare na FSN, isto é, espécies endêmicas do bioma da Mata Atlântica não o são não endêmicas do bioma da Mata Atlântica, 'pio' é espécie pioneira, 'npio' é espécie não pioneira, 'zoo' é espécie dispersa por animais, 'nzoo' é espécie não dispersa por animais, 'us' é espécie de sub-bosque e 'cp' é espécie do dossel.

Family	Species name	Geographic distribution	Affiliation to ecological guilds
Achariaceae	<i>Carpotroche brasiliensis</i> (Raddi) A. Gray	yes	npio-zoo-us
Anacardiaceae	<i>Astronium fraxinifolium</i> Schott	no	npio-nzoo-us
	<i>Astronium graveolens</i> Jacq.	no	npio-nzoo-cp
	<i>Tapirira guianensis</i> Aubl.	no	npio-zoo-us
	<i>Tapirira obtusa</i> (Benth.) J.D. Mitch.	no	npio-zoo-cp
Annonaceae	<i>Annona cacans</i> Warm.	yes	npio-zoo-cp
	<i>Guatteria australis</i> A. St.-Hil.	yes	npio-zoo-us
	<i>Guatteria villosissima</i> Saint-Hilaire	no	npio-zoo-us
	<i>Guatteria</i> sp. 1	nc	nc-zoo-us
	<i>Guatteria</i> sp. 2	nc	nc-zoo-us
	<i>Rollinia laurifolia</i> Schlttdl	yes	npio-zoo-cp
	<i>Xylopia brasiliensis</i> Spreng.	yes	npio-zoo-cp
Apocynaceae	<i>Xylopia sericea</i> A. St.-Hil.	no	pio-zoo-us
	<i>Aspidosperma olivaceum</i> Müll. Arg.	yes	npio-nzoo-us
	<i>Aspidosperma polyneuron</i> Müll. Arg.	yes	npio-nzoo-us
	<i>Aspidosperma subincanum</i> Mart.	no	npio-nzoo-us
	<i>Tabernaemontana hystrix</i> Steud.	yes	pio-zoo-us
Aquifoliaceae	<i>Ilex cerasifolia</i> Reissek	no	npio-zoo-us
Araliaceae	<i>Dendropanax cuneatus</i> (DC.) Decne. & Planch.	no	npio-zoo-us
	<i>Schefflera morototoni</i> (Aubl.) Maguire et al.	no	pio-zoo-cp
Arecaceae	<i>Astrocaryum aculeatissimum</i> (Schott) Burret	yes	npio-zoo-us
	<i>Euterpe edulis</i> Mart.	no	npio-zoo-us
Asteraceae	<i>Vernonantha diffusa</i> (Less.) H. Rob.	no	pio-nzoo-cp
Bignoniaceae	<i>Jacaranda macrantha</i> Cham.	no	npio-nzoo-cp
	<i>Sparattosperma leucanthum</i> (Vell.) K. Schum.	no	npio-nzoo-us
	<i>Handroanthus chrysotrichus</i> (Mart. ex A. DC.) Mattos	no	npio-nzoo-us
Boraginaceae	<i>Cordia sellowiana</i> Cham.	no	npio-zoo-cp
Burseraceae	<i>Protium heptaphyllum</i> (Aubl.) Marchand	no	npio-zoo-cp
	<i>Protium warmingianum</i> Marchand	no	npio-zoo-cp
	<i>Trattinnickia ferruginea</i> Kuhlman	yes	nc-zoo-cp
	<i>Celtis iguanaea</i> (Jacq.) Sarg.	no	pio-zoo-us
Cannbaceae	<i>Citronella paniculata</i> (Mart.) R.A. Howard	yes	npio-zoo-us
Cardiopteridaceae	<i>Jacaratia cf. heptaphylla</i> (Vell.) A. DC.	yes	npio-zoo-cp
Celastraceae	<i>Maytenus floribunda</i> Reissek	no	npio-zoo-us
	<i>Maytenus robusta</i> Reissek	no	npio-zoo-us
	<i>Maytenus salicifolia</i> Reissek	no	npio-zoo-cp
	<i>Salacia elliptica</i> (Mart. ex Schult.) G. Don	no	npio-zoo-us
	<i>Hirtella hebeclada</i> Moric. ex DC.	yes	npio-zoo-cp
Chrysobalanaceae	<i>Licania belemii</i> Prance	yes	nc-zoo-cp
	<i>Garcinia brasiliensis</i> Mart.	no	npio-zoo-us
	<i>Kielmeyera albopunctata</i> Saddi	yes	nc-nc-us
Clusiaceae	<i>Tovomita glazioviana</i> Engl.	yes	npio-zoo-us
	<i>Tovomitopsis saldanhae</i> Engl.	yes	npio-zoo-cp
	<i>Terminalia glabrascens</i> Mart.	no	npio-nzoo-us
Combretaceae	<i>Sloanea hirsuta</i> (Schott) Planch ex Benth.	yes	npio-zoo-us
Elaeocarpaceae			

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Table 1 – Cont.  
Tabela 1 – Cont.

Family	Species name	Geographic distribution	Affiliation to ecological guilds
Erythroxylaceae	<i>Erythroxylum daphnites</i> Mart.	no	nc-zoo-us
	<i>Erythroxylum pelleterianum</i> A. St.-Hil.	no	npio-zoo-us
Euphorbiaceae	<i>Alchornea glandulosa</i> Poepp. & Endl.	no	pio-zoo-cp
	<i>Alchornea triplinervia</i> (Spreng.) Müll. Arg.	no	npio-zoo-cp
	<i>Aparisthium cordatum</i> (A.Juss.) Baill.	no	npio-nzoo-us
	<i>Croton floribundus</i> Spreng.	no	pio-nzoo-cp
	<i>Mabea fistulifera</i> Mart.	no	pio-nzoo-cp
	<i>Maprounea guianensis</i> Aubl.	no	npio-nzoo-cp
	<i>Pera glabrata</i> (Schott) Poepp. ex Baill.	no	npio-zoo-cp
	<i>Sapium glandulosum</i> (L.) Morong	no	pio-zoo-cp
	Euphorbiaceae sp. 1	nc	nc
	Euphorbiaceae sp. 2	nc	nc
	Euphorbiaceae sp. 3	nc	nc
Fabaceae	<i>Andira fraxinifolia</i> Benth.	no	npio-zoo-us
	<i>Apuleia leiocarpa</i> (Vogel) J.F. Macbr.	no	npio-nzoo-cp
	<i>Copaifera langsdorffii</i> Desf.	no	npio-zoo-cp
	<i>Dalbergia nigra</i> (Vell.) Allemao ex Benth.	yes	npio-nzoo-cp
	<i>Hymenaea</i> sp.	nc	nc
	<i>Inga capitata</i> Desv.	no	npio-zoo-cp
	<i>Inga cylindrica</i> (Vell.) Mart.	no	npio-zoo-cp
	<i>Inga vera</i> Willd.	no	npio-zoo-cp
	<i>Inga</i> sp.	nc	nc-zoo-cp
	<i>Lonchocarpus cultratus</i> (Vell.) A.M.G. Azevedo & H.C. Lima	no	npio-nzoo-cp
	<i>Machaerium caratinganum</i> Kuhlman & Hoehne	yes	npio-nzoo-nc
	<i>Machaerium nyctitans</i> (Vell.) Benth.	yes	npio-nzoo-cp
	<i>Machaerium</i> sp.	nc	nc-nzoo-nc
	<i>Melanoxylon brauna</i> Schott	yes	npio-nzoo-cp
	<i>Ormosia arborea</i> (Vell.) Harms	yes	npio-zoo-cp
	<i>Peltophorum dubium</i> (Spreng.) Taub.	no	npio-zoo-cp
	<i>Piptadenia gonoacantha</i> (Mart.) J.F. Macbr.	no	pio-nzoo-cp
	<i>Pseudopiptadenia contorta</i> (DC.) G.P. Lewis & M.P. Lima	no	npio-nzoo-cp
	<i>Swartzia acutifolia</i> Vogel	yes	npio-zoo-cp
	<i>Swartzia myrtifolia</i> Sm.	no	npio-zoo-us
	Fabaceae sp.	nc	nc
Humiriaceae	<i>Vantanea obovata</i> (Nees & Mart.) Benth.	no	nc-zoo-us
Lacistemaceae	<i>Lacistema pubescens</i> Mart.	no	npio-zoo-us
Lauraceae	<i>Aniba firmula</i> (Nees & C. Mart.) Mez	no	npio-zoo-cp
	<i>Cinnamomum glaziovii</i> (Mez) Kosterm.	yes	npio-zoo-cp
	<i>Cryptocarya moschata</i> Nees & C. Mart. ex Nees	yes	npio-zoo-cp
	<i>Nectandra lanceolata</i> Nees & Mart.	no	npio-zoo-cp
	<i>Nectandra oppositifolia</i> Nees & Mart.	no	npio-zoo-cp
	<i>Ocotea corymbosa</i> (Meisn.) Mez	no	npio-zoo-cp
	<i>Ocotea dispersa</i> (Nees & Mart.) Mez	yes	npio-zoo-us
	<i>Ocotea odorifera</i> (Vell.) Rohwer	yes	npio-zoo-cp
	<i>Ocotea pulchella</i> (Nees & Mart.) Mez	no	npio-zoo-cp
	<i>Ocotea silvestris</i> Vattimo-Gil	yes	npio-zoo-us
	<i>Ocotea</i> sp.	nc	nc-zoo-us
	<i>Phyllostemonodaphne geminiflora</i> (Mez) Kosterm.	yes	npio-zoo-us
	<i>Urbanodendron verrucosum</i> (Nees) Mez	yes	npio-zoo-us
	Lauraceae sp. 1	nc	nc-zoo-us
	Lauraceae sp. 2	nc	nc-zoo-us

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Table 1 – Cont.

Tabela 1 – Cont.

Family	Species name	Geographic distribution	Affiliation to ecological guilds
Lecythidaceae	<i>Cariniana estrellensis</i> (Raddi) Kuntze	no	npio-nzoo-cp
	<i>Cariniana legalis</i> (Mart.) Kuntze	yes	npio-nzoo-cp
Lythraceae	<i>Lafoensia glyptocarpa</i> Koehne	no	npio-nc-cp
Malvaceae	<i>Ceiba speciosa</i> (A. St.-Hil.) Ravenna	no	npio-nzoo-cp
	<i>Eriotheca candolleana</i> (K. Schum.) A. Robyns	no	npio-nzoo-us
	<i>Luehea grandiflora</i> Mart.	no	npio-nzoo-us
	<i>Sterculia curiosa</i> (Vell.) Taroda	yes	npio-zoo-cp
Melastomataceae	<i>Miconia brunnea</i> Mart. ex DC.	yes	nc-zoo-us
	<i>Miconia budlejoides</i> Triana	yes	npio-zoo-us
	<i>Miconia cinnamomifolia</i> (DC.) Naudin	yes	pio-zoo-us
	<i>Miconia minutiflora</i> (Bonpl.) DC.	no	nc-zoo-cp
	<i>Miconia tristis</i> Spring	yes	npio-zoo-us
	<i>Mouriri glazioviana</i> Cogn.	no	npio-zoo-us
Meliaceae	<i>Cabralea canjerana</i> (Vell.) Mart.	no	npio-zoo-cp
	<i>Cedrela fissilis</i> Vell.	no	npio-zoo-cp
	<i>Guarea guidonia</i> (L.) Sleumer	no	npio-zoo-cp
	<i>Guarea kunthiana</i> A.Juss.	no	npio-zoo-cp
	<i>Guarea macrophylla</i> Vahl	no	npio-zoo-cp
	<i>Guarea pendula</i> R.da Silva Ramalho, A.L. Pinheiro & T.D. Penn.	yes	npio-zoo-us
	<i>Trichilia catigua</i> A. Juss.	no	npio-zoo-us
	<i>Trichilia emarginata</i> (Turcz.) C. DC.	yes	npio-zoo-us
	<i>Trichilia lepidota</i> Mart.	no	npio-zoo-cp
	<i>Trichilia pallida</i> Sw.	no	npio-zoo-cp
Monimiaceae	<i>Mollinedia schottiana</i> (Spreng.) Perkins	no	npio-zoo-us
Moraceae	<i>Brosimum guianense</i> (Aubl.) Huber	no	npio-zoo-cp
	<i>Clarisia ilicifolia</i> (Spreng.) Lanj. & Rossberg	no	npio-zoo-us
	<i>Ficus enormis</i> (Mart. ex Miq.) Mart.	no	npio-zoo-cp
	<i>Ficus gomelleira</i> Kunth & C.D. Bouché	no	npio-zoo-cp
	<i>Ficus luschnathiana</i> (Miq.) Miq.	no	npio-zoo-cp
	<i>Helicostylis tomentosa</i> (Poepp. & Endl.) Rusby	no	npio-zoo-cp
	<i>Maclura tinctoria</i> (L.) D. Don ex Steud.	no	npio-zoo-cp
	<i>Naucleopsis oblongifolia</i> (Kuhlm.) Carauta	yes	npio-zoo-cp
	<i>Sorocea bonplandii</i> (Baill.) W.C. Burger, Lanj. & Wess. Boerno	yes	npio-zoo-us
	<i>Sorocea hilariana</i> (Cesar.) Bureau	yes	npio-zoo-us
	<i>Virola bicuhyba</i> (Schott ex. Spreng.) Warb.	yes	npio-zoo-cp
	<i>Virola gardneri</i> (A. DC.) Warb.	yes	npio-zoo-cp
Myrtaceae	<i>Calyptanthus brasiliensis</i> Spreng.	yes	npio-zoo-us
	<i>Campomanesia xanthocarpa</i> (Mart.) O. Berg	yes	npio-zoo-us
	<i>Eugenia</i> cf. <i>lambertiana</i> DC.	no	npio-zoo-us
	<i>Eugenia dodonaeifolia</i> Cambess.	yes	npio-zoo-us
	<i>Eugenia florida</i> DC.	no	npio-zoo-us
	<i>Eugenia leptoclada</i> O.Berg	yes	npio-zoo-us
	<i>Marlierea excoriata</i> Mart.	yes	npio-zoo-us
	<i>Marlierea suaveolens</i> Cambess.	yes	npio-zoo-us
	<i>Marliereateuscheriana</i> (O.Berg) D.Legrand	yes	npio-zoo-us
	<i>Myrcia anceps</i> (Spreng.) O. Berg	yes	npio-zoo-us
	<i>Myrcia laxiflora</i> Cambess.	yes	npio-zoo-us
	<i>Myrcia pubipetala</i> Miq.	yes	npio-zoo-us
	<i>Myrcia splendens</i> (Sw.) DC.	no	npio-zoo-us
	<i>Myrciaria floribunda</i> (H.West ex Willd.) O.Berg	no	npio-zoo-us
	<i>Myrciaria pallida</i> O. Berg	yes	npio-zoo-us
	<i>Neomitranthes</i> sp.	nc	nc-zoo-us
	<i>Plinia</i> cf. <i>grandifolia</i> (Mattos) Sobral	yes	npio-zoo-us
	<i>Psidium</i> cf. <i>oblongatum</i> O. Berg	yes	nc-zoo-us
	Myrtaceae sp.	nc	nc-zoo-nc

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Table 1 – Cont.  
Tabela 1 – Cont.

Family	Species name	Geographic distribution	Affiliation to ecological guilds
Nyctaginaceae	<i>Guapira hirsuta</i> (Choisy) Lundell	yes	npio-zoo-us
	<i>Guapira opposita</i> (Vell.) Reitz	no	npio-zoo-cp
	<i>Pisonia ambigua</i> Griseb.	no	npio-zoo-cp
	Nyctaginaceae sp.	nc	nc-zoo-nc
Ochnaceae	<i>Ouratea polygyna</i> Engl.	yes	npio-zoo-us
Olacaceae	<i>Heisteria silvianii</i> Schwacke	yes	npio-zoo-us
	<i>Tetrastylidium grandiflorum</i> (Baill.) Sleumer	yes	npio-zoo-us
	Oleaceae sp.	nc	nc-zoo-nc
Phyllanthaceae	<i>Hieronyma alchorneoides</i> Allemão	no	npio-zoo-cp
	<i>Margaritaria nobilis</i> L. f.	no	npio-zoo-cp
Piperaceae	<i>Piper arboreum</i> Aubl.	no	npio-zoo-us
	<i>Piper gigantifolium</i> C. DC.	no	nc-zoo-us
Primulaceae	<i>Ardisia</i> cf. <i>catharinensis</i> Mez	yes	nc-zoo-us
	<i>Cybianthus fuscus</i> Mart.	no	nc-zoo-nc
	<i>Myrsine umbellata</i> Mart.	yes	npio-zoo-us
Rhamnaceae	<i>Colubrina glandulosa</i> Perkins	no	npio-zoo-cp
Rosaceae	<i>Prunus myrtifolia</i> (L.) Urb.	no	npio-zoo-cp
Rubiaceae	<i>Alseis floribunda</i> Schott	no	npio-zoo-us
	<i>Amaioua guianensis</i> Aubl.	no	npio-zoo-us
	<i>Bathysa cuspidata</i> (A.St. Hil.) Hook.f. ex K.Schum.	yes	npio-nzoo-us
	<i>Bathysa nicholsonii</i> K. Schum.	yes	npio-nzoo-us
	<i>Genipa americana</i> L.	no	npio-zoo-cp
	<i>Guettarda viburnoides</i> Cham. & Schltdl.	no	npio-zoo-us
	<i>Ixora gardneriana</i> Benth.	yes	npio-zoo-us
	<i>Psychotria carthagenensis</i> Jacq.	no	npio-zoo-us
	<i>Psychotria conjungens</i> Müll. Arg.	yes	npio-zoo-us
	<i>Psychotria myriantha</i> Müll. Arg.	yes	npio-zoo-us
	<i>Psychotria nuda</i> (Cham. & Schltdl.) Wawra	yes	npio-zoo-us
	<i>Psychotria vellosiana</i> Benth.	no	npio-zoo-us
	<i>Psychotria</i> sp.	nc	nc-zoo-nc
	<i>Randia ferox</i> (Cham. & Schltdl.) DC.	yes	npio-zoo-us
	<i>Rudgea jasminoides</i> (Cham.) Müll.Arg.	no	npio-zoo-us
	Rubiaceae sp.	nc	nc-zoo-nc
	<i>Zanthoxylum rhoifolium</i> Lam.	no	npio-zoo-us
	<i>Hortia brasiliiana</i> Vand. ex DC.	yes	nc-zoo-cp
Sabiaceae	<i>Meliosma itatiaiae</i> Urb.	yes	nc-zoo-us
Salicaceae	<i>Casearia arborea</i> (Rich.) Urb.	no	npio-zoo-cp
	<i>Casearia decandra</i> Jacq.	no	npio-zoo-cp
	<i>Casearia gossypiosperma</i> Briq.	no	npio-nzoo-us
	<i>Casearia sylvestris</i> Sw.	no	pio-zoo-us
	<i>Casearia ulmifolia</i> Vahl ex Vent.	no	npio-zoo-us
	<i>Macrothumia kuhlmannii</i> (Sleumer) M.H.Alford	yes	nc-zoo-cp
	<i>Prockia crucis</i> P. Browne ex L.	no	npio-zoo-us
	<i>Xylosma prockia</i> (Turcz.) Turcz.	no	npio-zoo-us
	Salicaceae sp.	nc	nc-zoo-nc
	<i>Allophylus edulis</i> (A. St.-Hil. et al.) Hieron. ex Niederl.	no	npio-zoo-us
Sapindaceae	<i>Cupania vernalis</i> Cambess.	no	npio-zoo-cp
	<i>Matayba elaeagnoides</i> Radlk.	no	npio-zoo-cp
Sapotaceae	<i>Chrysophyllum gonocarpum</i> (Mart. & Eichler ex Miq.) Engl.	no	npio-zoo-cp
	<i>Chrysophyllum lucentifolium</i> Cronquist	no	npio-zoo-us
	<i>Chrysophyllum</i> cf. <i>marginatum</i> (Hook. & Arn.) Radlk.	no	npio-zoo-cp
	<i>Chrysophyllum</i> sp.	nc	nc-zoo-nc
	<i>Pouteria caimito</i> (Ruiz & Pav.) Radlk.	no	npio-zoo-cp
	<i>Pradosia lactescens</i> (Vell.) Radlk.	no	npio-zoo-cp

Continua...

Continue...

Table 1 – Cont.

Tabela 1 – Cont.

Family	Species name	Geographic distribution	Affiliation to ecological guilds
Siparunaceae	<i>Siparuna guianensis</i> Aubl.	no	npio-zoo-us
	<i>Siparuna reginae</i> (Tul.) A. DC.	no	npio-zoo-us
Solanaceae	<i>Brunfelsia uniflora</i> (Pohl) D. Don	no	npio-zoo-us
	<i>Cestrum mariquitense</i> Kunth	no	nc-zoo-us
	<i>Cestrum</i> sp.	nc	nc-zoo-nc
	Solanaceae sp.	nc	nc-zoo-nc
Urticaceae	<i>Cecropia hololeuca</i> Miq.	yes	pio-zoo-cp
	<i>Coussapoa floccosa</i> Akkermans & C.C. Berg	yes	nc-zoo-us
	<i>Coussapoa microcarpa</i> (Schott) Rizzini	yes	npio-zoo-cp
	<i>Pourouma guianensis</i> Aubl.	no	pio-zoo-cp
Vochysiaceae	<i>Qualea jundiahy</i> Warm.	yes	npio-zoo-cp
Unknown family	Unidentified sp. 1	nc	nc
	Unidentified sp. 2	nc	nc

2007), Paula et al. (2004) and Pinto et al. (2005). Information about species' stratification guild was retrieved from Oliveira-Filho (2014), geographic distribution was obtained from Stehmann et al. (2009) and Forzza et al. (2013); endemic species are those endemic to the Atlantic Forest biome. In the event of contradictory information for classification, the species were allocated to the guild indicated by the majority of references.

### 3. RESULTS

In the one hectare plot from the FSN, 2529 alive and 100 dead individuals with dbh  $\geq 3.2$  cm were sampled. Altogether, 218 (morpho-)species belonging to 139 genus and 52 families have been detected within the survey (Table 1). Due to lack of appropriate material (e.g. flowers) to provide a definite determination, 23 morphospecies were not identified until species level. Guild classification of these taxa was not always possible (Table 1).

From all classified species, only 14 species are recognized as pioneer species, so that 92% of all classified taxa are non-pioneer species. 179 or 85% of all species are dispersed by animals and 109 species or 55 % of all 199 classified species are understory species. 39.2% of completely identified species are endemic to the Atlantic Rain Forest, while 118 or little more than 60 % occur in further biomes as well.

### 4. DISCUSSION

The FSN supports higher tree species richness than comparable plots from secondary forest in its neighborhood (RIBEIRO et al., 2009b; GASTAUER;

MEIRA-NETO, 2013). Furthermore, the species lists gathered in a one hectare plot within the FSN fulfills all criteria proposed by Liebsch et al. (2008) for old-growth, primary forests as there are less than 10 % of non-pioneer, more than 80 % of zoochorus, more than 50 % understory species and about 40% of species endemic to the Atlantic Forest biome.

The Atlantic Forest is a heterogeneous ecosystem comprising more than 27 latitudinal degrees, with precipitation regimes ranging from arid conditions to more than 3,000 mm per year and altitudes from sea level up to 3000 m (STEHMANN et al., 2009). Therefore, the characteristics and their scores proposed by Liebsch et al. (2008) for primary evergreen forests from the Southern Atlantic Forest cannot be generalized for the entire Atlantic Forest and its associated ecosystems (ALMEIDA-NETO et al., 2008). Consequently, real scores for primary forests in the study region are unknown. Furthermore, the classification of a single species with all of its genotypic and phenotypic variability within a single guild might be subjective or inaccurate, although species classification is based on non-ambiguous definitions. Additionally, insufficient knowledge about species' ecology might influence guild classification. Therefore, alterations in the classification and the definition of maximal scores might change the results and influence the interpretation and conclusions.

Despite the above mentioned restrictions, we can conclude from the species list from the one hectare plot that the FSN has maintained its characteristics



as an old-growth, primary forest despite fragmentation and isolation, at least in some parts. In other parts, edge effects due to isolation or landscape fragmentation and the selective wood extraction that occurred within the fragment might have altered the primary forest characteristics or may alter them in the future, as indicated by a slight loss of species richness and diversity during the last decade (GASTAUER; MEIRA-NETO, 2013).

## 5. CONCLUSION

As the FSN is the only known forest fragment in the Viçosa municipality that has never been logged. Therefore, we expect that the FSN is the only forest patch that fulfills the criteria to be identified as a primary forest. Unique species richness, diversity and fulfillment of primary forest characteristics in a highly degraded and fragmented landscape emphasize the FSN's special role as a species pool for surrounding forest fragments and illustrate its insubstitutability for biological conservation.

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