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TERRESTRIAL VERTEBRATE FAUNA OF ASSIS' STATE FOREST: A CERRADO REMNANT IN THE STATE OF SÃO PAULO, BRAZIL[1]

VERTEBRADOS TERRESTRES DA FLORESTA ESTADUAL DE ASSIS, UM REMANESCENTE DE CERRADO DO ESTADO DE SÃO PAULO, BRASIL[1]

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ABSTRACT - In the current scenario of environmental changes, anthropic pressures on biodiversity are in constant increase, stressing the importance of assessing the distribution and occurrence of organisms in natural regions, especially in protected areas. Here we surveyed the terrestrial vertebrate fauna of Assis State Forest and updated the existing species list. Reptiles were sampled using pitfall traps and active search, birds by transects and listening points, while terrestrial mammals were sampled using camera traps, linear transect census, active search, pitfall and live traps. Four samplings were conducted, totaling 28 days of sampling effort. We recorded a total richness of 230 terrestrial vertebrate species: 21 amphibians, 17 reptiles, 164 birds, 23 medium and large-sized mammals and 25 small mammals. Of these, seven species are considered endangered at the state and / or federal level. Our results led to the inclusion of 78 bird species and six medium- and large-sized mammals to the species list of ASF's Management Plan, in addition to three new species of herpetofauna that were not reported by other fauna surveys carried out in the region. Our data shows that the area is highly diverse, with some differences in species composition between sampled phytophysiognomies. These data can also be used to update the management plan for the area, as well as for the zoning of the unit.

Keywords: Birds; Brazilian-savanna; Herpetofauna; Inventory; Mammals; Protected Area.

RESUMO – No presente cenário de alterações ambientais, a pressão sobre a biodiversidade faz com que seja imprescindível conhecer a ocorrência e diversidade da fauna, especialmente em Unidades de Conservação. O objetivo deste estudo foi realizar o levantamento da fauna de vertebrados terrestres da Floresta Estadual de Assis (FEA), São Paulo, e atualizar a lista de espécies existente. A herpetofauna foi amostrada através de armadilhas de intercepção e queda e busca ativa por indivíduos, aves por censo por transecto de varredura e ponto de escuta, enquanto os mamíferos foram amostrados através do uso de armadilhas fotográficas, censo por transecto linear e busca ativa, armadilhas de interceptação e queda e armadilhas de gaiola. Foram realizadas quatro campanhas para cada grupo taxonômico, totalizando 28 dias de amostragem ao longo de 48 meses (2017-2019). Foi registrada uma riqueza de 230 espécies de vertebrados terrestres: 21 anfíbios, 17 répteis, 164 aves, 23 mamíferos de médio e grande porte e 25 mamíferos de pequeno porte. Destes, sete espécies encontram-se em algum nível de ameaça a nível estadual e/ou federal. Esses resultados também levaram à inclusão de 78 espécies de aves e seis de mamíferos de grande e médio porte à lista presente no Plano de Manejo desta Unidade de Conservação, além de três novas espécies de herpetofauna que não foram reportadas por outros trabalhos realizados na região. Nossos dados mostram que a área é altamente diversa com algumas diferenças na composição de espécies entre as fitofisionomias

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amostradas. Esses dados podem ainda ser usados para atualizar o plano de manejo da área, bem como, para o zoneamento da unidade.

Palavras-chave: Áreas Protegidas; Aves; Cerrado; Herpetofauna; Inventários, Mamíferos.

1 INTRODUCTION

In the current scenario of environmental change, anthropogenic pressures on biodiversity are constantly increasing (Galetti et al., 2021), stressing the importance of increasing knowledge on the occurrence and diversity of organisms in natural areas to subsidize more effective conservation planning (Ferraz et al., 2020). One of the few ways to acquire information about species distribution and occurrence is through field research. Furthermore, primary data sampling is important to maintain and update lists of organisms in natural areas, providing a better understanding over time and accounting for environmental changes that may lead to changes in community composition (Ríos-Saldaña et al., 2018). One major environmental change responsible for alterations in a region's species composition are land cover and land use changes (Pardini et al., 2005; Newbold et al., 2015; Chase et al., 2020). These processes lead to the reduction and fragmentation of natural areas, resulting in low-quality habitats for many species (Ratter et al., 1997; MMA, 2003; Betts et al., 2017), which affects several biological processes and factors, such as population size, species dispersion, assemblage structure, and resource and habitat use (Pardini et al., 2005; Magioli et al., 2019).

The Cerrado is the second largest Brazilian biome, surpassed only by the Amazon rainforest. It occupies about 21% of the national territory (Pivello, 2006) and is considered both as a world biodiversity hotspot (Mittermeier et al., 2011) and as the last agricultural frontier on the planet (Borlaug, 2002). With a total area of more than 2 million km², it constitutes a vast mosaic of xeromorphic vegetation types, ranging from dry (clean field) or wet fields to woodlands ("cerradão"), and gallery forests, deciduous and semi-deciduous forests patches (Silva e Bates, 2002; Voss et al., 2009). Its pluviometric indexes are concentrated in the humid season (800 - 2,000 mm/year), with the dry season lasting for four months a year (Nimer, 1989). Cerrado is highly biodiverse, with a number of vascular plants higher than that found in most regions of the world (Colli et al., 2020). Herbaceous vegetation, shrubs, trees, and lianas add up to more than 7,000 species (Mendonça et al., 1998). Moreover, 44% of that flora is endemic, making the Cerrado the most diverse tropical savanna in the world (Furley, 2002). For fauna, the richness of mammals (n = 199) is considered small (Marinho-Filho et al., 2002) since these animals are mainly associated or restricted to forest fragments or gallery forests (Redford e Fonseca, 1986). The avifauna is rich, with more than 830 species, despite a low level of endemism (3.4%). Reptiles and amphibians together add up to almost a thousand species, of which 45% are endemic to the biome (Klink e Machado, 2005).

The loss of natural habitat in the Cerrado due to land use changes (Klink e Machado, 2005) is so widespread that about half of its original area has been converted into farming lands: about 15% of Brazilian Cerrado was converted from natural coverage to pasture or agriculture since 1986 and nowadays 55% of its territory is covered by natural vegetation (MapBiomas, 2020; Souza et al., 2020). The Cerrado in the southern portion of the country, in the states of São Paulo, Paraná and Mato Grosso do Sul, is even more degraded, with barely any of their original vegetation cover remaining in 2002 (13%, 32% and 32%, respectively - Sano et al., 2008). In addition, only 2.9% of the biome is under strictly protection (Drummond et al., 2010). The land use changes that occurred in the Cerrado brought great environmental damage, such as habitat loss and fragmentation, biodiversity extinction, invasion by exotic species, soil erosion and alteration in the natural fire regime (Durigan et al., 2007). As a result, at least 307 animal species that occur in the Cerrado are threatened with extinction (ICMBio, 2018).

In protected areas, changes in land use are more restricted, and therefore animal and plant communities are expected to be less impacted over time. However, the areas surrounding these protected areas continue to suffer human influences (Ward et al., 2020) and even the area within them there are prone to significant changes, such as the increase of vegetation cover, the densification of vegetation (replacement of non-forest natural areas by forests) and the improvement in air, water and soil quality over

time. In this sense, the communities within protected areas can change, with new organisms colonizing the area due to the improvement of environmental quality within it, or by the disappearance of other species due to the decrease of the quality of adjacent areas, that ends affecting the ecosystem (Vandermeer e Carvajal, 2001; Häkkilä et al., 2018). Thus, it is important to keep an updated inventory of species that occur within protected areas, complementing and reviewing existing lists available and allowing for better management of those areas.

Therefore, we aimed to update the list of terrestrial vertebrate fauna in Assis´s State Forest, a protected area of sustainable use in the Brazilian Cerrado, with goals of not only conserving local biodiversity but also promoting a better management of its natural resources. Our study was the first to assess the richness and diversity of small-sized mammals (< 1 kg) in Assis State Forest (henceforth ASF).

2 METHODS

2.1 Study site

The Assis´s State Forest (ASF) and Assis´s Ecological Station (AES) are two contiguous protected areas located in the municipality of Assis, in the southwest region of São Paulo (Figure 1). It has an area of 4,577.06 ha: 2,816.42 ha belonging to the State Forest and 1,760.64 ha to the Ecological Station. The area is located in a transition zone between two Koppen climatic types: Cwa and Cfa, both characterized by hot and rainy summers and dry winters, but differentiated by the length of the drought period, longer in Cwa. The average annual rainfall is around 1,450 mm, concentrated from October to March; the average temperature is 21.8°C and the average daily amplitude of 4.5°C (Instituto Florestal, 2010). The predominant vegetation type in the ASF is the Cerradão, with gallery forests and transition areas with Seasonal Semideciduous forests (Max et al., 2007). There are also vegetation patches occupied by Pinus and Eucalyptus plantations, some of which have been gradually restored into native vegetation (Instituto Florestal, 2010).

2.2 Data collection and identification

We sampled three areas in ASF, which were selected aiming to sample a representative diversification of habitats: (A1) Cerrado per se; (A2) one-year old restoration; (A3) a restoration area of approximately five years of age (Figure 1). We conducted four sampling campaigns, lasting eight days each, two in the dry and two in the rainy season.

We sampled birds using linear transects and listening points. Linear transects followed the method described by Peres (1999) between 16h and 20h (Greenwood, 1996), totaling 128 hours of effort. Ten listening points were also distributed in each transect, spaced at least 100 m away from one another, starting around 5h30 (Blondel et al., 1970; Vielliard e Silva, 1990; Bibby et al., 1993). We used field guides to help in species identification (Erize et al., 2006; Ridgely e Tudor, 2009). Later, we classified species according to their diet (Motta-Júnior, 1990; Marçal-Júnior et al., 2009), main habitat use (Silva, 1995; Marçal-Júnior et al., 2009), migratory status (Somenzari et al., 2018), conservation status (SMA, 2018; IUCN, 2020), sensibility to human disturbances (Parker III et al., 1996), endemism to the Cerrado (Silva e Bates, 2002) and to Brazil (Piacentini et al., 2015).

For amphibians, we focused our active search on reproductive sites and water bodies' margins inside the sampling areas (Scott Jr. e Woodward, 1994). We only added visualized specimens to the species list. The sampling effort was of two hours per night, totalizing 16 hours per campaign, and a total sampling effort of 64 hours. For reptilians, we applied time-constrained active search (Campbell e Christman, 1982) near pitfall traps and in probable microhabitats. We carried out searches during daytime and the sampling effort was the same as with the amphibians. We also utilized pitfall traps (Figure 2), with a sampling effort of 32 buckets/day, totaling 512 buckets during all campaigns (Cechin e Martins, 2000). Specimens found while moving between transects or sampling areas, as well as specimens found in the surroundings areas, were registered as "Occasional Encounters". We identified specimens with the help from field guides (Costa e Bérnils, 20182015; Segalla et al., 2014) and classified them according to their conservation status (SMA, 2018; IUCN, 2020). They were also characterized based on endemism (Rossa-Feres et al., 2011; Zaher et al., 2011). Taxonomic status follows (Frost, 2021).

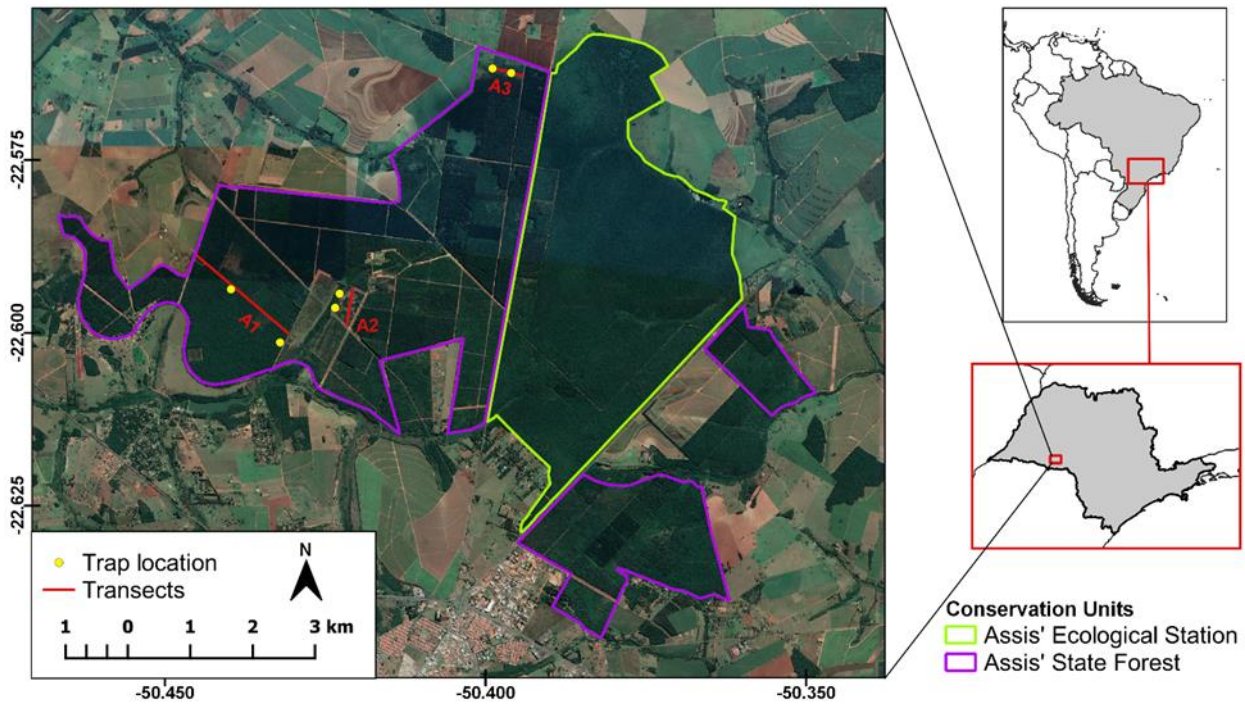

Figure 1. Conservation Units limits and location. A1, A2 and A3 correspond to the three sampled areas in this study. Yellow dots represent the traps' locations.

Figura 1. Limites e localização das Unidades de Conservação. A1, A2 e A3 correspondem às três áreas amostradas neste estudo. Os pontos amarelos representam a localização das armadilhas.

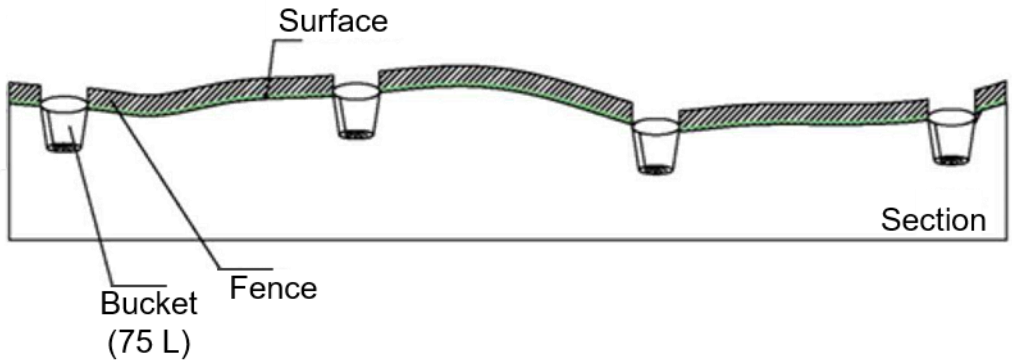

Figure 2. Schematic representation of pitfall traps used for sampling amphibians, reptiles and small mammals in Assis State Forest, São Paulo, Brazil.

Figura 2. Representação esquemática das armadilhas do tipo pitfalls usadas para amostragem de anfíbios, répteis e pequenos mamíferos na Floresta Estadual de Assis, São Paulo, Brasil.

For the medium and large-sized mammals (> 1 kg; Chiarello, 2000), we used camera traps, STEALTH CAM G42NG (O'Connell et al., 2011), surveys in linear transects (Peres, 1999; Buckland et al., 2001) and active search in trails and traces, such as feces and food leftovers (Voss e Emmons, 1996). We used baits to attract nocturnal and rare mammals (Hawbaker's Wild Cat Lure #2; Michalski e Peres, 2007) and installed eight camera traps – two in each sampling area and other two in places we expected to have a high mammalian occurrence (Figure 1). We placed

camera traps in tree trunks at 30-40 cm above the ground, and they remained active for 24h, with a total sampling effort of 616 trap/days. We sampled transects during the morning, eight days per campaign, totaling 108 km traversed. In addition, we made 133 hours of active search in locations where we expected to find evidence of mammalian presence (e.g.: near rivers and other water bodies) and far from the transects. Occasionally, we also performed night searches by car, travelling at low speed with headlights on. Taxonomic status follows Abreu et al. (2021). We used field guides to help identifying species (Wilson e Reeder, 2005; Patton et al., 2015) and classified according to their diet, endemism to the Cerrado or Atlantic Forest (Paglia et al., 2012) and if they are of commercial interest and possibly threatened by overexploitation based on the list of the Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES, 2018). Regional (ICMBio, 2018), Local (SMA, 2018) and international (IUCN, 2020) conservation status were accessed.

Lastly, we sampled small mammals (< 1 kg, Chiarello, 2000) using two pitfall traps (the same used for the herpetofauna, with total sample effort of 512 buckets/day) and two Sherman and two Tomahawk live traps per area, one of each was installed in high places, such as trees, to capture arboreal animals (Santos-Filho et al., 2015; Vieira et al., 2014). The total sampling effort for the live traps was 496 traps/day in four campaigns. We classified specimens according to their species or genus when it was not possible to identify them in the field (since biological samples and specimens were not collected), conservation status (SMA, 2018; IUCN, 2020), endemism and diet (Paglia et al., 2012).

We estimated species richness using a first order Jackknife (Heltshe e Forrester, 1983) and made rarefaction curves to evaluate sampling sufficiency, using R 3.5.2 and the package "vegan" and "ggplot2" (Colwell, 2013; Wickham, 2016; Oksanen et al., 2017; R Core Team, 2019). The richness found was compared with the species list found for both conservation units, ASF and AES. As they are contiguous, some species must use both units as a whole. Given their spatial proximity and ecological similarity, the list of species of one Unit should be the same as in the other, and any variation found should be due to the occupation pattern based on local characteristics.

3 RESULTS AND DISCUSSION

We recorded 233 species (four of those were classified only to genus level) of terrestrial vertebrates for the ASF (Figure 3).

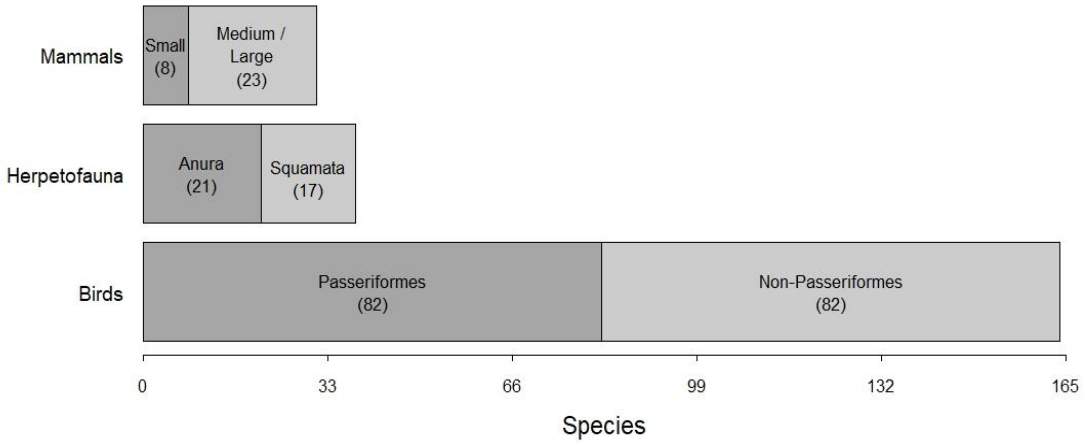

Figure 3. Species richness of each taxonomic group (birds, herpetofauna and mammals) in Assis State Forest, São Paulo, Brazil.

Figura 3. Riqueza de espécies de cada grupo taxonômico (aves, herpetofauna e mamíferos) na Floresta Estadual de Assis, São Paulo, Brasil.

3.1 Avifauna

We recorded 164 bird species (45 families and 22 orders - Figure 4; see the detailed list in Appendix 1) during the four campaigns, 113 on sampling area A1 (Cerradão), 87 species on A2 (one-year restoration area), and 54 species on A3. Tyrannidae was the most represented family with 26 species (Figure 4). According to the Jackknife, 182.4 ± 6.1 species were expected in our study site, and we registered 90.6% of this value (Figure 5). At the same time, the accumulation curve, after 32 sampling days (the duration of our data collection), showed signs of stabilization, indicating that more species could be found if the sampling effort was higher, especially rarer and vagant species found in the region, such as *Patagioenas speciosa* (Gmelin, 1789) found in AES by Antunes and collaborators (2016). We sampled 78 species that were not registered in ASF's Management Plan and 35 species that were not previously recorded in AES, but all of them are species that occur in the region and are expected for the study area (Appendix 1). Our study sites showed some difference between them, mainly because some forest specialists were registered only in A1 (e.g.: *Crypturellus tataupa* (Temminck 1815), *Leptodon cayanensis* (Latham 1790), *Celeus flavescens* (Gmelin 1788), *Dromococcyx pavoninus* (Pelzeln 1870), *Conopophaga lineata* (Wied 1831)), while open area specialists were found exclusively in A2 (e.g.: *Rhynchotus rufescens* (Temminck 1815), *Colaptes campestris* (Vieillot 1818), *Xolmis velatus* (Lichtenstein 1823), *Ammodramus humeralis* (Bosc 1792), *Zonotrichia capensis* (Muller 1776)).

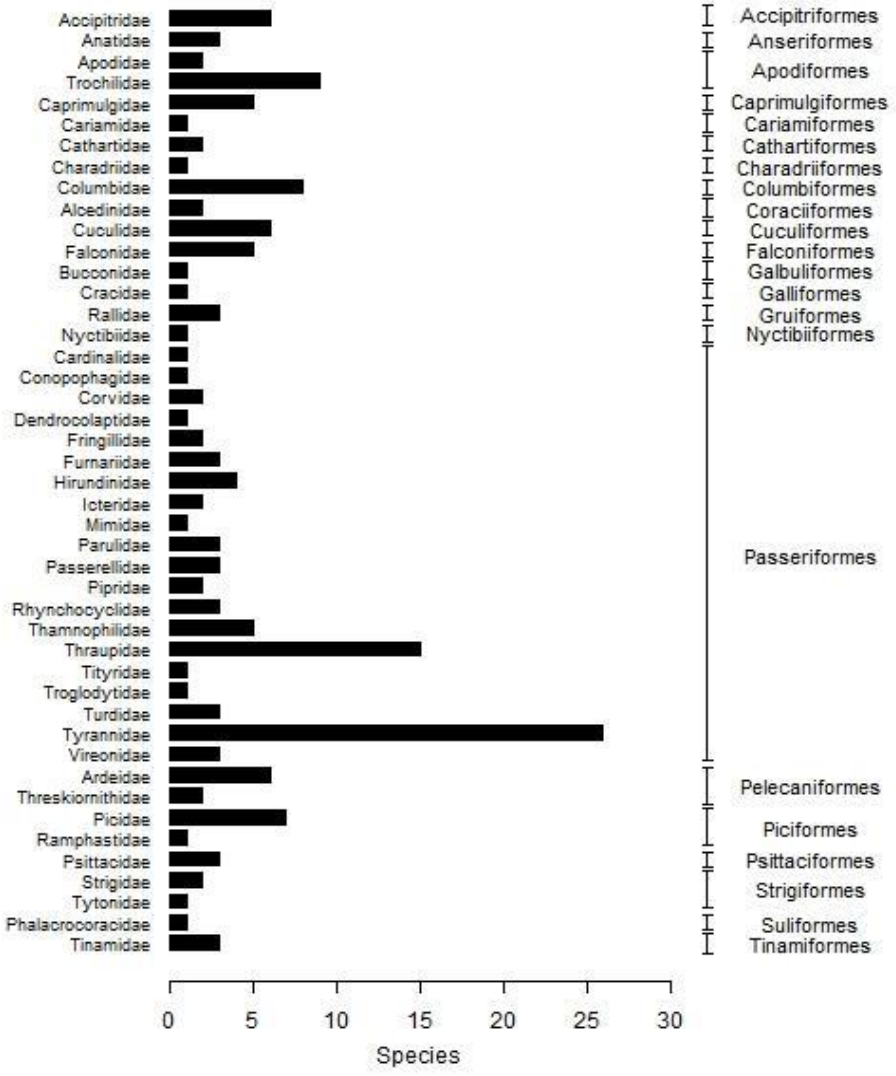

Figure 4. Number of recorded bird species in Assis State Forest, São Paulo, Brazil.

Figura 4. Número de espécies de aves registradas na Floresta Estadual de Assis, São Paulo, Brasil.

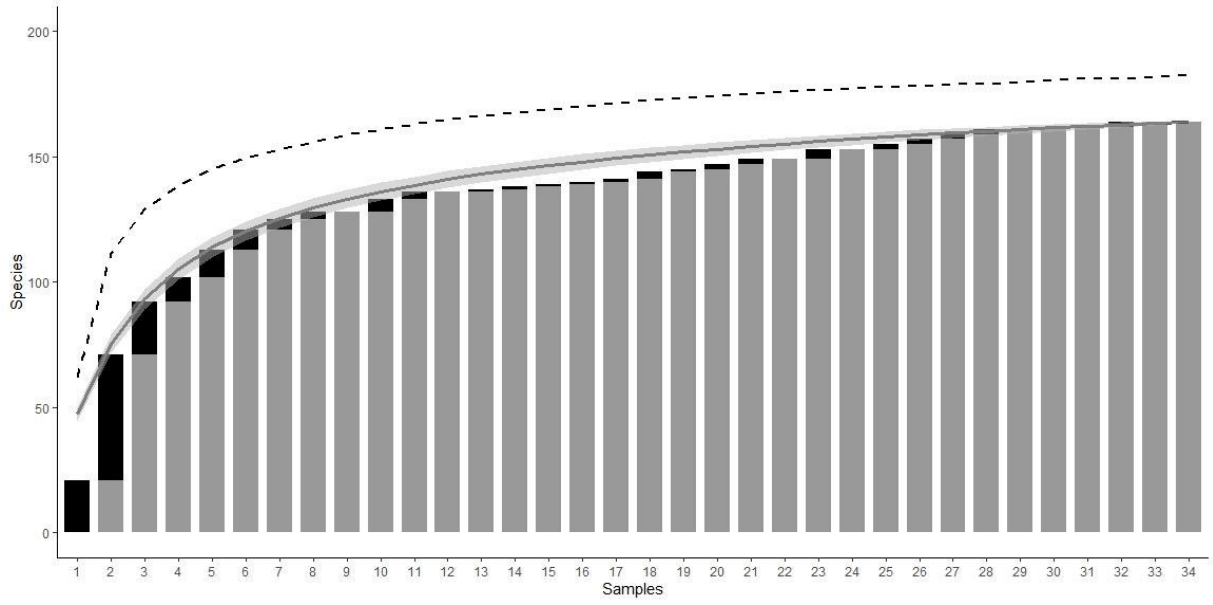

Figure 5. Rarefaction curve for estimated bird richness in Assis State Forest, São Paulo, Brazil. The dotted black line represents the estimated bird richness, the gray line the species accumulation curve and the gray shaded area represents the 95% confidence interval for the accumulation curve. Gray bars represent the number of species found in previous samples and black bars species added in each current sample.

Figura 5. Curva de rarefação da riqueza estimada de aves da Floresta Estadual de Assis, São Paulo, Brasil. A linha preta pontilhada representa a riqueza estimada de aves, a linha cinza a curva de acúmulo de espécies e a área sombreada cinza representa o intervalo de confiança de 95% para a curva de acúmulo. As barras cinzas representam o número de espécies acumulado e as barras pretas as espécies adicionadas em cada unidade amostral.

Concerning dietary guilds (Motta-Júnior, 1990; Marçal-Júnior et al., 2009), 39.5% of the recorded species were insectivorous, 29.9% omnivorous and 7.3% carnivorous. We already expected the dominance of insectivorous birds, because they usually are more abundant in tropical forests, along with frugivorous birds (O´Dea e Whittaker, 2007). The high number of generalist birds can be explained by the fact that they can easily acquire food in modified environments and in early successional stage vegetation (O´Dea e Whittaker, 2007). Two species appear on the local red list as near threatened (SMA 2018): *Neopelma pallescens* (Lafresnaye, 1853) and *Rhynchotus rufescens* (Temminck 1815). *Neopelma pallescens* is an endemic forest-dependent species that uses as habitats areas such as Cerradão and gallery forests (Figueiredo, 2009). *Rhynchotus rufescens* inhabits native open areas that have been suffering from the invasion of exotic species, such as *Urochloa* spp. and *Pinus* spp., or from densification, a process characterized by the replacement of Cerrado stricto sensu by other densely vegetated formations of the Cerrado. Besides habitat loss, this species is also exploited by sport hunting or for their meat (Antunes, 2009).

Besides *Neopelma pallescens*, we found other two endemic species (Silva e Bates, 2002): *Antilophia galeata* (Lichtenstein 1823) and *Cyanocorax cristatellus* (Temminck 1823). *Antilophia galeata* is a species associated with gallery forests and buritizais, being highly dependent on forest habitats, and its distribution is currently expanding towards the Pantanal (Snow e de Juana, 2017; BirdLife International, 2020). *Cyanocorax cristatellus*, unlike *Antilophia galeata*, is an arboreal species with little forest dependency and it has been expanding its area of occurrence, colonizing disturbed areas (Mallet-Rodrigues et al., 2007). Another registered species, *Dromococcyx pavoninus*, can also be considered ecological indicator, mainly because it is highly sensitive to human disturbance (Stotz et al., 1996). *Dromococcyx pavoninus* is a rare bird that occurs in forests and in shrublands, but it tends to disappear in fragmented environments (Payne, 2017).

3.2 Herpetofauna

Our data collection resulted in 38 species registered for the herpetofauna, being 21 amphibians (five families) and 17 reptiles (three families for lizards and three for snakes; see the detailed list in Appendix 2), as shown in Figure 6. Rarefaction curves did not reach stability and Jackknife estimated 48.7 ± 4.0 species, while we recorded 38 species (85%), meaning that an additional sampling effort could have resulted in more rare species being found (Figure 7). Ribeiro-Júnior and Bertoluci (2009) also found 21 Anura for ASF, but they found *Pseudopaludicola mystacalis* (Cope 1887) and *Chiasmocleis albopunctata* (Boettger, 1885), which were not registered in our survey, while we found *Boana caingua* (Carrizo 1991), *Physalaemus centralis* (Bokermann 1962) and *Phyllomedusa tetraploidea* (Pombal and Haddad 1992), absent in theirs. Many species from the herpetofauna recorded are generalists that use more than one habitat, transitioning between the forest and open areas to forage for food, including restoration areas and forest edges.

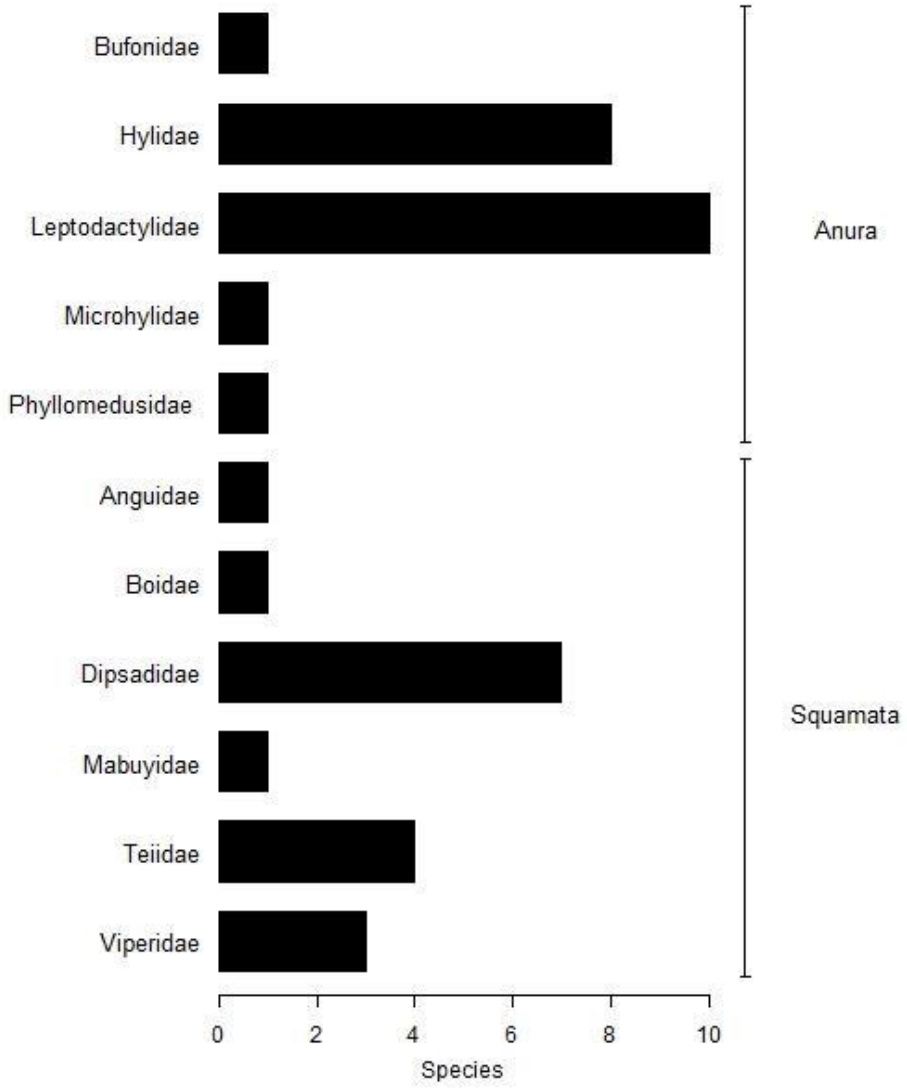

Figure 6. Number of inventoried herpetofauna (amphibians and reptiles) species in Assis State Forest, São Paulo, Brazil.

Figura 6. Número de espécies inventariadas de herpetofauna (anfíbios e répteis) na Floresta Estadual de Assis, São Paulo, Brasil.

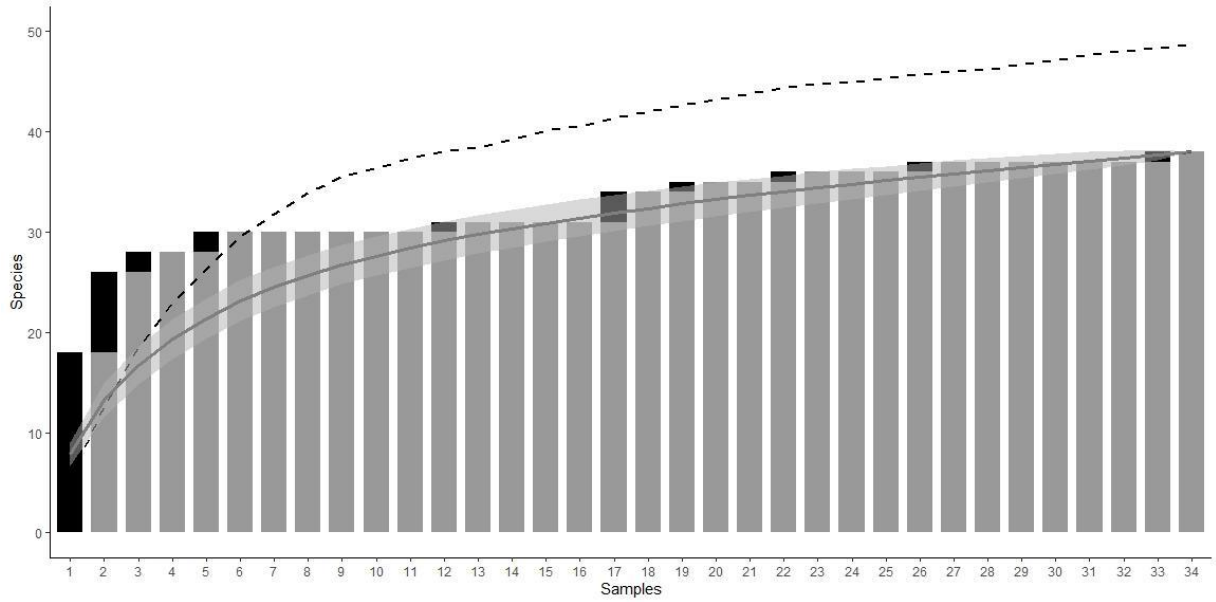

Figure 7. Rarefaction curve for estimated herpetofauna richness (amphibians and reptiles) in Assis State Forest, São Paulo, Brazil. The dotted black line represents the estimated herpetofauna richness, the gray line the species accumulation curve and the gray shaded area represents the 95% confidence interval for the accumulation curve. Gray bars represent the number of species found in previous samples and black bars species added in each current sample.

Figura 7. Curva de rarefação da riqueza estimada da herpetofauna (anfíbios e répteis) da Floresta Estadual de Assis, São Paulo, Brasil. A linha preta pontilhada representa a riqueza estimada, a linha cinza a curva de acúmulo de espécies e a área sombreada cinza representa o intervalo de confiança de 95% para a curva de acúmulo. As barras cinzas representam o número de espécies acumulado e as barras pretas as espécies adicionadas em cada unidade amostral.

There was no survey for the herpetofauna in ASF's Management Plan (Max et al., 2007). Comparing with records from AES's Management Plan species list, we added six new records to it: *Kentropyx paulensis* (Boettger 1893), *Dipsas indica* (Laurenti 1768), *Pseudoboa nigra* (Duméril Bibron e Duméril 1854), *Bothrops pauloensis* (Amaral 1925), *Physalaemus centralis* (Bokermann 1962) and *Erythrolamprus poecilogyrus* (Wied-Neuwied 1825), being that the first three are also not included in the secondary data from ASF we analyzed (Araujo e Almeida-Santos, 2011; Bertoluci et al., 2007 – Appendix 3). There were no threatened species in the international list (IUCN, 2020), but two species are in the local list (SMA, 2018): *Ameivula ocellifera* (Spix 1825) and *Kentropyx paulensis*, both classified as "endangered". *Ameivula ocellifera* is widely distributed in South America, but it is probably a species complex, requiring further taxonomic studies (Rocha et al., 1997, 2000). *Kentropyx paulensis* is endemic to the Cerrado, with its distribution in the central-south part of the biome (Oliveira-Drummond et al., 2014). Two species of reptiles, *Boa constrictor* (Linnaeus 1758) and *Salvator merianae* (Duméril e Bibron 1839) are listed in Appendix II of CITES (Convention on International Trade in Endangered Species of Wild Fauna and Flora) for reasons of trade control (CITES, 2018). They are common and abundant species throughout the national territory, whose exploitation in international trade can occur for the use of skin, as pets and/or meat, a situation that should not occur in the sampled region. Six species are endemic to the Cerrado: *Boana lundii* (Burmeister 1856), *Physalaemus centralis* (Bokermann 1962), *Physalaemus marmoratus* (Reinhardt e Lütken 1862), *Physalaemus nattereri* (Steindachner 1863), *Kentropyx paulensis* (Boettger, 1893) and *Bothrops pauloensis* (Amaral, 1925) (Nogueira et al., 2011; Valdujo et al., 2012), but most of them are widely distributed within the biome (Maffei e Ubaid, 2014; Costa e Bérnils, 2015).

Non-Volant Mammalian fauna

We recorded 23 species of medium-and large-sized mammal (Figure 8; see the detailed list in Appendix 3). From those species, 20 are native,

none of which are endemic to the Cerrado (Table 3). One specimen (*Leopardus* sp.) was only classified to genus level since we only found indirect evidence of its occurrence (tracks and feces). According to the rarefaction curve and the first order Jackknife, which estimated 25.9 ± 1.7 species, indicating sampling sufficiency (Figure 9). Two species are listed as classified in some threat category in São Paulo: *Leopardus pardalis* (Linnaeus 1758) - ocelot and Puma concolor (Linnaeus 1771) - cougar. *L. pardalis* is the largest Brazilian mesocarnivore, occurring in a wide variety of environments. Despite being found in agricultural areas, it occurs only if there are remnants of natural vegetation in the surroundings. To a lesser extent, the population decline of the species is caused by human retaliation for the predation of poultry, roadkill (Abra et al., 2021) and the transmission of diseases by domestic animals, such as dogs and cats (Oliveira et al., 2013). P. concolor is a territorial and solitary species, occurring in a variety of habitat types, including anthropogenic areas, such as agricultural areas (Magioli et al., 2014, 2016) and reforestation of *Pinus* spp. and *Eucalyptus* spp. (Miotto et al., 2011), in search of food and shelter. Despite having great environmental plasticity (Magioli et al., 2014), the cougar suffers from several threats, including hunting, habitat loss and road mortality (Azevedo et al., 2013).

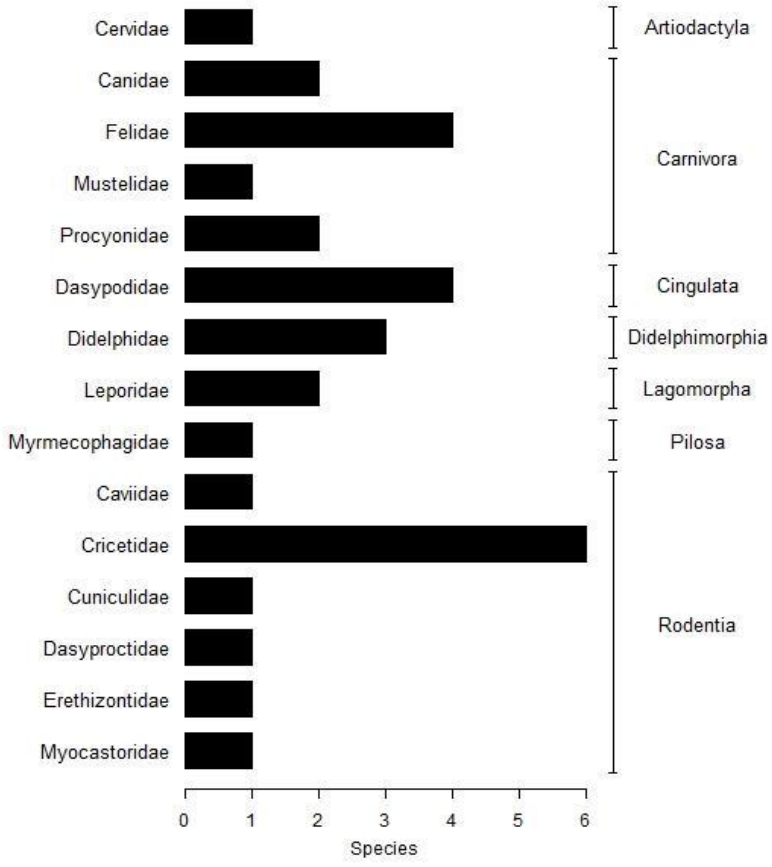

Figure 8. Number of recorded mammal species in Assis State Forest, São Paulo, Brazil.

Figura 8. Número de espécies de mamíferos registrada na Floresta Estadual de Assis, São Paulo, Brasil.

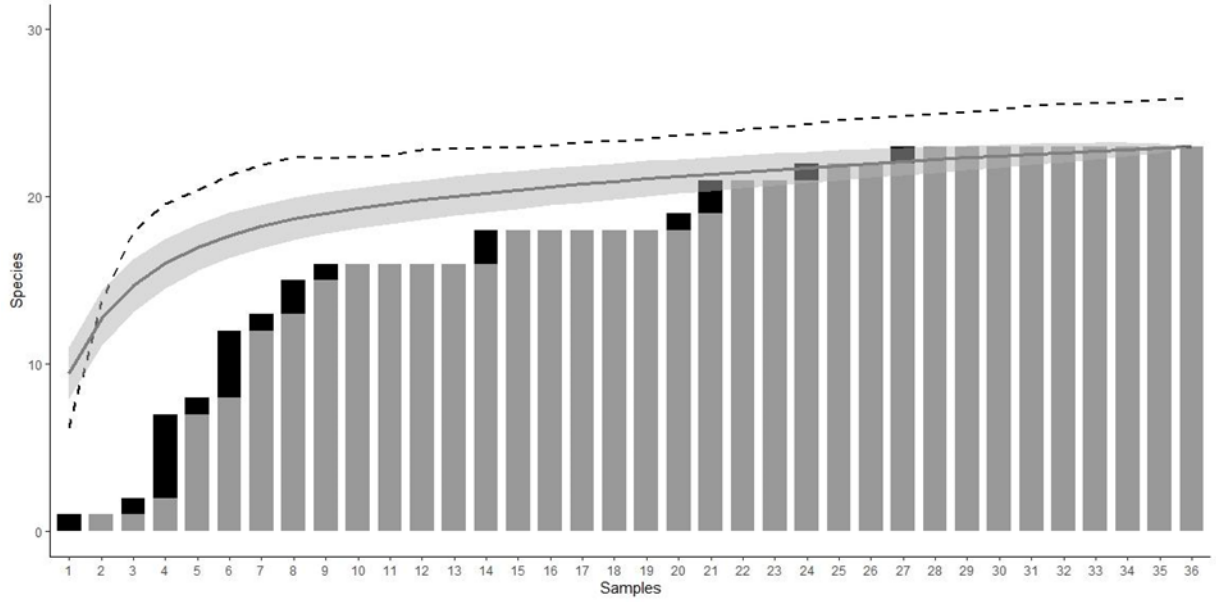

Figure 9. Rarefaction curve for estimated mammal richness in Assis State Forest, São Paulo, Brazil. The dotted black line represents the estimated mammal richness, the gray line the species accumulation curve and the gray shaded area represents the 95% confidence interval for the accumulation curve. Gray bars represent the number of species found in previous samples and black bars species added in each current sample.

Figura 9. Curva de rarefação da riqueza estimada para os mamíferos da Floresta Estadual de Assis, São Paulo, Brasil. A linha preta pontilhada representa a riqueza estimada, a linha cinza a curva de acúmulo de espécies e a área sombreada cinza representa o intervalo de confiança de 95% para a curva de acúmulo. As barras cinzas representam o número de espécies acumulado e as barras pretas as espécies adicionadas em cada unidade amostral.

We added six new species to the ASF's species list: four species of the family Dasypodidae - *Cabassous unicinctus* (Linnaeus 1758), *Dasypus novemcinctus* (Linnaeus 1758), *Dasypus septemcinctus* (Linnaeus 1758), *Euphractus sexcinctus* (Linnaeus 1758), *Puma concolor* (Linnaeus 1771) and *Procyon cancrivorus* (G. Cuvier 1798). It is important to remember that the mammalian species list present at ASF's Management Plan was built based on verbal reports from ASF's employees and neighbors and not a scientific survey, which may bias their results. We highlight the presence of *Dasypus septemcinctus*, similar to *Dasypus novemcinctus*, absent in AFS and AES's species lists. Their differences are the body size, and *D. spetemcinctus* having seven bands on its carapace (Reis et al., 2006). Some species were present in the ASF list but were not detected in the present survey – tapir (*Tapirus terrestris*), margay (*Leopardus wiedii*), maned wolf (*Chrysocyon brachyurus*) and the pecari (*Pecary tajacu*), introduced at AES in 1991 (Max et al., 2007; São Paulo, 2010). The maned wolf for example, was last seen in 1993, and probably is locally extinct. The collared peccary and the tapir were seen in 2002 (Max et al., 2007), indicating that further sampling may still result in the detection of these species.

For the small mammals, we only identified five species at species level: *Calomys tener* (Winge 1887), *Cryptonanus* cf. *agricolai* (Moojen 1943), *Oligoryzomys nigripes* (Olfers 1818), *Oligoryzomys flavescens* (Waterhouse 1837) and *Necromys lasiurus* (Lund 1840). However, another 20 specimens were only identified to genus-level (i.e., *Akodon* spp., *Cerradomys* spp. and *Gracilinanus* spp.) (Figure 8). Since there were no previous studies with small mammals in ASF, these are the first official records documented (Max et al., 2007). None of the registered species are considered threatened or endemic. It is worth noting that if a greater number of live traps had been used, in a greater number of areas throughout the ASF, the number of species recorded would have been greater, and could include rarer and less common species. Still, as the objective of the study was not to capture and euthanize the animals, it was decided to keep the identification up to the generic level, which also decreased the species richness for this group.

The difference found between sampling areas for birds, a group with many species sensitive to habitat changes (Savard et al., 2000), shows that it is important to maintain the variety of phytophysiognomies in Cerrado areas, which range from forests to grasslands, as well as to include all

of them in inventory studies. For other taxonomic groups, many species were inhabiting and transitioning between the different habitat types.

Two emblematic species from the Cerrado were neither registered on previous surveys nor on our study: *Chrysocyon brachyurus* (Illiger 1815) - maned-wolf and *Myrmecophaga tridactyla* (Linnaeus 1758) - giant-anteater. The local disappearance of these species may be related to roadkill, habitat loss and fragmentation, and the reduction of open areas phytophysiognomies in the last decades (Abra et al., 2021; Durigan e Ratter 2015; Veldman et al. 2015). Although the FEA is a sustainable-use conservation unit, it was not the object of this research to try to understand the effects of its management type on the persistence of the species. However, given that most of the species found are mostly typical of Cerrado areas, it is expected that with the management of the areas planted with exotic species (i.e., logging) the fauna will actively use these areas. Care should be taken that this management is done little by little, with small areas being managed each time, to avoid a temporary frightening away of the fauna. There are studies that show that if the zoning and management plan of the Unit are respected, the conservation of the species present there can be maintained (Queiroz, 2005).

Given that the Cerrado is a biodiversity hotspot, protected areas such as the ASF are of great importance for the maintenance of its natural habitats and for the persistence of fauna, characterized by a high endemism level. Its importance is even greater in regions such as the São Paulo state, because it is South America's most urbanized region, and the anthropic influence is constantly increasing towards natural areas. This survey added several species to the protected area' list, which may serve as a basis for future scientific work, environmental consultancy and the Management Plan review. Furthermore, knowing the fauna of this protected area helps in the planning of more effective conservation strategies.

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Appendix 1. Bird species registered on Assis State Forest (taxonomy according to Piacentini et al., 2015), in each campaign (1 - August 2017; 2 - May 2018; 3 - October 2018; 4 - January and February 2019), for each sampling area (A1 - *Cerradao*; A2 - One year restoration; A3 - Five-year restoration). Migr. Status = Migratory status (MPG = migratory; MPR = partially migratory; ND = migratory movements not defined; * = more information required). Endemism (CE = endemic to the *Cerrado*; BR = endemic to Brazil). Mgmt. Plan = Recorded on (AES) Assis Ecological Station's (Antunes, 2010) or on (AFS) Assis State Forest's (Max et al., 2007) Management Plan. Sens. = Sensibility to human disturbances according to Parker III et al. (1996) (L = low; M = medium; H = high). Diet = main feeding guild (OMN = omnivore; NEC = nectarivore; FRU = frugivorous; CAR = carnivore; INS = insectivorous; GRA = granivore; DET = detritivore; PIS = piscivore). Cons. status = Conservation status: SP/IUCN= LC = least concerned; NT = near threatened; EN = endangered.

Apêndice 1. Espécies de aves registradas na Floresta Estadual de Assis (taxonomia de acordo com Piacentini et al., 2015), em cada campanha (1 - agosto 2017; 2 - maio 2018; 3 - outubro 2018; 4 - janeiro e fevereiro 2019), para cada área de amostragem (A1 - Cerradão; A2 - Restauração com um ano; A3 - Restauração com cinco anos). Status Migr. = Status migratório (MPG = migratório; MPR = parcialmente migratório; ND = movimentos migratórios não definidos; * = mais informações necessárias). Endemismo (CE = endêmico para o Cerrado; BR = endêmico para o Brasil). Mgmt. Plano = Registrado na Estação Ecológica de Assis (AES) (Antunes, 2010) ou no Plano de Manejo da Floresta Estadual de Assis (Max et al., 2007). Sensibilidade = Sensibilidade a distúrbios humanos segundo Parker III et al. (1996) (L = baixo; M = médio; H = alto). Dieta = principal grêmio alimentar (OMN = omnívoro; NEC = nectarívoro; FRU = frugívoro; CAR = carnívoro; INS = insetívoro; GRA = granívoro; DET = detritívoro; PIS = piscívoro). Cons. status = estado de conservação: SP/IUCN = menos preocupado; NT = quase ameaçado; EN = ameaçado.

Taxon	Camp.	Migr. status	End.	Mgmt. Plan		Area			Sens.	Diet	Cons. status	
				AES	ASF	A1	A2	A3			SP	IUCN
Tinamiformes												
Tinamidae												
Crypturellus parvirostris (Wagler 1827)	1,2,3,4			X	X	X	X	X	L	OMN		LC
Crypturellus tataupa (Temminck 1815)	1,2			X	X	X			L	OMN		LC
Rhynchotus rufescens (Temminck 1815)	1,2,3,4			X	X		X		L	OMN	AM	LC
Anseriformes												
Anatidae												
Dendrocygna viduata (Linnaeus 1766)	3								L	OMN		LC
Cairina moschata (Linnaeus 1758)	1,3								M	OMN		LC
Amazonetta brasiliensis (Gmelin 1789)	1,3,4								L	OMN		LC
Galliformes												
Cracidae												
Penelope superciliaris (Temminck 1815)	1,2,3,4			X	X	X	X		M	FRU		LC
Suliformes												
Phalacrocoracidae												
Nannopterum brasilianus (Gmelin 1789)	3.4			X					L	PISC		LC
Pelecaniformes												
Ardeidae												
Tigrisoma lineatum (Boddaert 1783)	1								M	PISC		LC
Nycticorax nycticorax (Linnaeus 1758)	4			X					L	PISC		LC
Butorides striata (Linnaeus 1758)	4								L	PISC		LC
Bubulcus ibis (Linnaeus 1758)	1			X					L	INS		LC
Ardea alba (Linnaeus 1758)	1			X					L	PISC		LC
Syrigma sibilatrix (Temminck 1824)	1,2,3,4			X			X		M	INS		LC
Threskiornithidae												
Mesembrinibis cayennensis (Gmelin 1789)	1,2,3,4								M	OMN		LC
Theristicus caudatus (Boddaert 1783)	1.4								L	OMN		LC

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continuation – Appendix 1
continuação – Apêndice 1

Taxon	Camp.	Migr. status	End.	Mgmt. Plan		Area			Sens.	Diet	Cons. status	
				AES	ASF	A1	A2	A3			SP	IUCN
Cathartidae												
Cathartiformes												
Cathartes aura (Linnaeus 1758)	1,2,3,4					X			L	DET		LC
Coragyps atratus (Bechstein 1793)	1,2,3,4			X	X	X	X		L	DET		LC
Accipitriformes												
Accipitridae												
Leptodon cayanensis (Latham 1790)	1,3					X			M	CAR		LC
Ictinia plumbea (Gmelin 1788)	3,4	MPR		X		X			M	INS		LC
Geranospiza caerulescens (Vieillot 1817)	1						X		M	CAR		LC
Rupornis magnirostris (Gmelin 1788)	1,2,3,4			X	X	X	X	X	L	CAR		LC
Geranoaetus albicaudatus (Vieillot 1816)	1,4					X			L	CAR		LC
Buteo brachyurus (Vieillot 1816)	2,3,4			X	X	X			M	CAR		LC
Gruiformes												
Rallidae												
Aramides cajaneus (Muller 1776)	1,2,3,4			X		X	X		H	OMN		LC
Amaurolimnas concolor (Gosse 1847)	1,3,4								M	OMN		LC
Mustelirallus albicollis (Vieillot 1819)	1,3			X	X		X		M	OMN		LC
Charadriiformes												
Charadriidae												
Vanellus chilensis (Molina 1782)	1,3,4			X	X		X		L	OMN		LC
Columbiformes												
Columbidae												
Columbina talpacoti (Temminck 1810)	1,2,3,4			X	X	X	X	X	L	GRA		LC
Columbina squammata (Lesson 1831)	1,2,3,4			X	X	X	X		L	GRA		LC
Claravis pretiosa (Ferrari-Perez 1886)	2,4					X			L	FRU		LC
Patagioenas picazuro (Temminck 1813)	1,2,3,4			X	X	X	X	X	M	FRU		LC
Patagioenas cayennensis (Bonnaterre 1792)	1,2,3			X	X	X			M	FRU		LC
Zenaida auriculata (Des Murs 1847)	2,3			X	X	X	X	X	L	GRA		LC
Leptotila verreauxi (Bonaparte 1855)	1,2,3,4			X	X	X	X	X	L	FRU		LC
Leptotila rufaxilla (Richard & Bernard 1792)	2,3,4					X			M	FRU		LC
Cuculiformes												
Cuculidae												
Piaya cayana (Linnaeus 1766)	1,2,3,4			X	X	X	X	X	L	INS		LC
Coccyzus melacoryphus (Vieillot 1817)	3	MGT						X	L	INS		LC
Crotophaga ani (Linnaeus 1758)	1,2,3,4			X	X		X	X	L	INS		LC
Guira guira (Gmelin 1788)	1,2,3,4			X	X		X		L	INS		LC
Tapera naevia (Linnaeus 1766)	1,3,4						X		L	INS		LC
Dromococcyx pavoninus (Pelzeln 1870)	1,2			X		X			H	INS		LC
Strigiformes												
Tytonidae												
Tyto furcata (Temminck 1827)	4			X	X				L	CAR		LC

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Taxon	Camp.	Migr. status	End.	Mgmt. Plan		Area			Sens.	Diet	Cons. status	
				AES	ASF	A1	A2	A3			SP	IUCN
Strigidae												
Megascops choliba (Vieillot 1817)	1,3,4			X	X	X			L	INS		LC
Athene cunicularia (Molina 1782)	1,2			X	X	X	X		M	CAR		LC
Nyctibiiformes												
Nyctibiidae												
Nyctibius griseus (Gmelin 1789)	3,4			X		X			L	INS		LC
Caprimulgiformes												
Caprimulgidae												
Antrostomus rufus (Boddaert 1783)	1,2,3,4			X		X	X	X	L	INS		LC
Lurocalis semitorquatus (Gmelin 1789)	3,4	MPR		X					M	INS		LC
Nyctidromus albicollis (Gmelin 1789)	1,2,3,4			X	X	X	X	X	L	INS		LC
Hydropsalis parvula (Gould 1837)	1,2,3,4	MPR		X		X	X		L	INS		LC
Hydropsalis torquata (Gmelin 1789)	1,2,4			X	X	X			L	INS		LC
Apodiformes												
Apodidae												
Chaetura meridionalis (Hellmayr 1907)	3	MGT*		X	X		X		L	INS		LC
Tachornis squamata (Cassin 1853)	1					X			L	INS	EN	LC
Trochilidae												
Phaethornis pretrei (Lesson & Delattre 1839)	4			X	X		X		L	NEC		LC
Eupetomena macroura (Gmelin 1788)	1,2,3			X	X	X	X		L	NEC		LC
Florisuga fusca (Vieillot 1817)	3	MPR*		X					L	NEC		LC
Anthracothorax nigricollis (Vieillot 1817)	3	MPR		X					L	NEC		LC
Chlorostilbon lucidus (Shaw 1812)	2.3			X	X	X		X	L	NEC		LC
Hylocharis chrysura (Shaw 1812)	1,2,3,4			X	X	X	X	X	M	NEC		LC
Leucochloris albicollis (Vieillot 1818)	2								L	NEC		LC
Amazilia lactea (Lesson 1832)	1,2,3,4					X	X		L	NEC		LC
Heliomaster squamosus (Temminck 1823)	3								M	NEC		LC
Coraciiformes												
Alcedinidae												
Megaceryle torquata (Linnaeus 1766)	1,3,4			X	X				L	PISC		LC
Chloroceryle amazona (Latham 1790)	2.4			X					L	PISC		LC
Galbuliformes												
Bucconidae												
Nystalus chacuru (Vieillot 1816)	2,3			X	X		X		M	INS		LC
Piciformes												
Ramphastidae												
Ramphastos toco (Muller 1776)	1,2,4					X	X		M	OMN		LC
Picidae												
Picumnus albosquamatus (d'Orbigny 1840)	1,3,4			X		X	X		L	INS		LC
Melanerpes candidus (Otto 1796)	1,2,3			X	X	X		X	L	OMN		LC

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Taxon	Camp.	Migr. status	End.	Mgmt. Plan		Area			Sens.	Diet	Cons. status	
				AES	ASF	A1	A2	A3			SP	IUCN
Veniliornis passerinus (Linnaeus 1766)	1,2,3,4			X		X		X	L	INS		LC
Colaptes melanochloros (Gmelin 1788)	1,2,3,4			X		X			L	INS		LC
Colaptes campestris (Vieillot 1818)	1,2,3,4			X	X		X	X	L	INS		LC
Celeus flavescens (Gmelin 1788)	1,2,3,4			X	X	X			M	INS		LC
Dryocopus lineatus (Linnaeus 1766)	1,2,3,4			X		X	X		L	INS		LC
Cariamiformes												
Cariamidae												
Cariama cristata (Linnaeus 1766)	1,2,3,4			X	X	X	X	X	M	OMN		LC
Falconiformes												
Falconidae												
Caracara plancus (Miller 1777)	1,2,3,4			X	X	X	X	X	L	CAR		LC
Milvago chimachima (Vieillot 1816)	1,2,3,4			X	X	X	X	X	L	CAR		LC
Herpetotheres cachinnans (Linnaeus 1758)	2,3,4					X			L	CAR		LC
Micrastur semitorquatus (Vieillot 1817)	2,3,4					X			M	CAR		LC
Falco femoralis (Temminck 1822)	1,2,3			X		X	X		L	CAR		LC
Psittaciformes												
Psittacidae												
Psittacara leucophthalmus (Muller 1776)	1,2,3,4			X	X	X		X	L	FRU		LC
Brotogeris chiriri (Vieillot 1818)	1,2,3,4			X		X	X		M	FRU		LC
Amazona aestiva (Linnaeus 1758)	3					X			M	FRU	NT	NT
Passeriformes												
Thamnophilidae												
Formicivora rufa (Wied 1831)	1,2,3,4			X	X	X	X		L	INS		LC
Thamnophilus doliatus (Linnaeus 1764)	1,2,3,4			X	X	X	X		L	INS		LC
Thamnophilus pelzelni (Hellmayr 1924)	1,2,3,4			X		X		X	L	INS		LC
Thamnophilus caerulescens (Vieillot 1816)	2,3,4			X		X			L	INS		LC
Taraba major (Vieillot 1816)	2,3,4			X		X			L	INS		LC
Conopophagidae												
Conopophaga lineata (Wied 1831)	1			X	X	X			M	INS		LC
Dendrocolaptidae												
Lepidocolaptes angustirostris (Vieillot 1818)	1,2,3,4			X		X	X	X	M	INS		LC
Furnariidae												
Furnarius rufus (Gmelin 1788)	1,2,3,4			X	X	X	X		L	INS		LC
Synallaxis frontalis (Pelzeln 1859)	1,3,4			X	X	X			L	INS		LC
Synallaxis albescens (Temminck 1823)	1						X		L	INS	NT	LC
Pipridae												
Neopelma pallescens (Lafresnaye 1853)	1,2,3,4		CE			X			M	INS	EN	LC
Antilophia galeata (Lichtenstein 1823)	1,2,3,4		CE	X	X	X			M	FRU	NT	LC
Tityridae												
Pachyramphus polychopterus (Vieillot 1818)	1,2,3,4					X			L	INS		LC

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Taxon	Camp.	Migr. status	End.	Mgmt. Plan		Area			Sens.	Diet	Cons. status	
				AES	ASF	A1	A2	A3			SP	IUCN
Rhynchocyclidae												
Todirostrum cinereum (Linnaeus 1766)	1,2,4			X	X	X	X		L	INS		LC
Poecilotriccus plumbeiceps (Lafresnaye 1846)	1,3			X	X	X			M	INS		LC
Hemitriccus margaritaceiventer (d'Orbigny & Lafresnaye 1837)	1,2,3,4			X	X	X		X	M	INS		LC
Tyrannidae												
Hirundinea ferruginea (Gmelin 1788)	1,2,3					X	X		L	INS		LC
Euscarthmus meloryphus (Wied 1831)	1,2,3,4			X	X	X			L	INS		LC
Camptostoma obsoletum (Temminck 1824)	1,2,3,4			X	X	X	X	X	L	INS		LC
Elaenia flavogaster (Thunberg 1822)	1,2,3,4			X	X	X	X	X	L	OMN		LC
Elaenia chiriquensis (Lawrence 1865)	1,3,4	MPR		X	X	X	X	X	L	OMN		LC
Myiopagis viridicata (Vieillot 1817)	3	MPR				X			M	OMN		LC
Phaeomyias murina (Spix 1825)	1,2,3,4	ND		X	X	X			L	INS		LC
Phyllomyias fasciatus (Thunberg 1822)	4			X		X			M	INS		LC
Serpophaga subcristata (Vieillot 1817)	1,2,3,4			X	X	X	X	X	L	INS		LC
Myiarchus swainsoni (Cabanis & Heine 1859)	2,3	MPR		X		X		X	L	OMN		LC
Myiarchus ferox (Gmelin 1789)	1,2,3,4			X		X	X	X	L	OMN		LC
Myiarchus tyrannulus (Muller 1776)	1,2,3,4			X	X	X	X	X	L	OMN		LC
Casiornis rufus (Vieillot 1816)	1,2,3,4			X	X	X	X		M	INS	NT	LC
Pitangus sulphuratus (Linnaeus 1766)	1,2,3,4	MPR*		X	X	X	X	X	L	OMN		LC
Machetornis rixosa (Vieillot 1819)	3.4			X	X				L	INS		LC
Myiodynastes maculatus (Muller 1776)	1,3,4	MPR		X	X	X	X	X	L	OMN		LC
Megarynchus pitangua (Linnaeus 1766)	1,2,3,4			X	X	X	X	X	L	OMN		LC
Myiozetetes similis (Spix 1825)	1,2,3,4			X	X	X	X	X	L	OMN		LC
Tyrannus melancholicus (Vieillot 1819)	1,2,3,4	MPR		X	X	X	X	X	L	INS		LC
Tyrannus savana (Daudin 1802)	1,2,3	MPR		X		X	X	X	L	INS		LC
Empidonomus varius (Vieillot 1818)	1,3,4	MPR*		X	X	X	X	X	L	OMN		LC
Colonia colonus (Vieillot 1818)	1					X			L	INS		LC
Myiophobus fasciatus (Muller 1776)	1,2,3	MPR*		X	X	X	X		L	INS		LC
Cnemotriccus fuscatus (Wied 1831)	1,2,3,4			X	X	X			L	INS		LC
Lathrotriccus euleri (Cabanis 1868)	1	MPR		X		X			M	INS		LC
Xolmis velatus (Lichtenstein 1823)	1,2						X		M	INS		LC
Vireonidae												
Cyclarhis gujanensis (Gmelin 1789)	1,2,3,4			X		X			L	OMN		LC
Hylophilus amaurocephalus (Nordmann 1835)	1,2,3			X		X			L	OMN		LC
Vireo chivi (Vieillot 1817)	1,3,4	MPR		X	X	X			M	INS		LC
Corvidae												
Cyanocorax cristatellus (Temminck 1823)	1,2,3,4		CE	X	X	X	X	X	M	OMN		LC
Cyanocorax chrysops (Vieillot 1818)	1,2,3,4			X	X	X	X	X	L	OMN		LC
Hirundinidae												
Pygochelidon cyanoleuca (Vieillot 1817)	1,2,3,4			X	X	X	X		L	INS		LC

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continuation – Appendix 1
continuação – Apêndice 1

Taxon	Camp.	Migr. status	End.	Mgmt. Plan		Area			Sens.	Diet	Cons. status	
				AES	ASF	A1	A2	A3			SP	IUCN
Stelgidopteryx ruficollis (Vieillot 1817)	1,2,3,4	MPR		X	X	X	X		L	INS		LC
Progne tapera (Vieillot 1817)	1	MPR		X	X		X		L	INS		LC
Hirundo rustica (Linnaeus 1758)	4	MGT		X	X		X		L	INS		LC
Troglodytidae												
Troglodytes musculus (Naumann 1823)	1,2,3,4			X	X	X	X	X	L	INS		LC
Turdidae												
Turdus leucomelas (Vieillot 1818)	1,2,3,4			X	X	X	X	X	L	OMN		LC
Turdus amaurochalinus (Cabanis 1850)	1,3,4	MPR		X	X	X	X	X	L	OMN		LC
Turdus subalaris (Seebohm 1887)	1,3	MPR		X		X			L	OMN		LC
Mimidae												
Mimus saturninus (Lichtenstein 1823)	1,2,3,4			X	X		X		L	OMN		LC
Passerellidae												
Zonotrichia capensis (Muller 1776)	1,2,3,4			X	X		X	X	L	GRA		LC
Ammodramus humeralis (Bosc 1792)	1,2,3,4			X			X		L	GRA		LC
Arremon flavirostris (Swainson 1838)	1,2,3,4			X	X	X			M	INS		LC
Parulidae												
Setophaga pitiayumi (Vieillot 1817)	1,2,3,4			X	X	X		X	M	INS		LC
Basileuterus culicivorus (Deppe 1830)	1,2,3,4			X	X	X		X	M	INS		LC
Myiothlypis flaveola (Baird 1865)	1,2,3,4			X	X	X		X	M	INS		LC
Icteridae												
Icterus pyrrhopterus (Vieillot 1819)	2,3,4			X			X		M	OMN		LC
Molothrus bonariensis (Gmelin 1789)	1,4			X					L	OMN		LC
Thraupidae												
Pipraeidea melanonota (Vieillot 1819)	1			X		X			L	OMN		LC
Tangara sayaca (Linnaeus 1766)	1,2,3,4			X	X	X	X	X	L	OMN		LC
Tangara cayana (Linnaeus 1766)	1,2,3,4			X	X	X	X	X	M	OMN		LC
Nemosia pileata (Boddaert 1783)	1,2,3,4			X		X		X	L	OMN		LC
Conirostrum speciosum (Temminck 1824)	1,2,3,4			X		X	X		L	OMN		LC
Sicalis flaveola (Linnaeus 1766)	1,2,3,4						X		L	OMN		LC
Sicalis luteola (Sparrman 1789)	1,4						X		L	OMN		LC
Hemithraupis guira (Linnaeus 1766)	1,2,4			X		X			L	OMN		LC
Volatinia jacarina (Linnaeus 1766)	1,2,3,4			X	X		X	X	L	GRA		LC
Coryphospingus cucullatus (Muller 1776)	1,2,3,4			X	X	X	X		L	GRA		LC
Tersina viridis (Illiger 1811)	3	MPR*		X					L	OMN		LC
Dacnis cayana (Linnaeus 1766)	1,2,3,4			X		X	X		L	OMN		LC
Sporophila lineola (Linnaeus 1758)	4	MPR		X	X		X		L	GRA		LC
Sporophila caerulescens (Vieillot 1823)	1,3,4	MPR*		X	X	X	X	X	L	GRA		LC
Emberizoides herbicola (Vieillot 1817)	1,3						X		L	OMN		LC
Cardinalidae												
Piranga flava (Vieillot 1822)	1,3			X			X	X	L	OMN		LC
Fringillidae												
Spinus magellanicus (Vieillot 1805)	4						X			GRA		LC
Euphonia chlorotica (Linnaeus 1766)	1,2,3,4			X	X	X	X	X	L	OMN		LC

Appendix 2. Amphibians and reptiles registered on Assis State Forest in each campaign (1 - August 2017; 2 - May 2018; 3 - October 2018; 4 - January and February 2019), for each sampling area (A1 - Cerradao; A2 - One year restoration; A3 - Five-year restoration; A0 - Occasional encounters and anthropic areas). Endemism (CE = endemic to the Cerrado). Secondary Data (Mgmt. Plan = Recorded on Assis Ecological Station's (AES) Management Plan (Araujo e Cortez, 2010); AA = Araujo e Almeida-Santos (2011); BE = Bertoluci et al. (2007). Cons. status = Conservation status (SP/IUCN= EN = Ameaçado; LC = least concerned).

Apêndice 2. Anfíbios e répteis registrados na Floresta Estadual de Assis em cada campanha (1 - agosto 2017; 2 - maio 2018; 3 - outubro 2018; 4 - janeiro e fevereiro 2019), para cada área de amostragem (A1 - Cerradão; A2 - Restauração com um ano; A3 - Restauração com cinco anos; A0 - Encontros ocasionais e áreas antrópicas). Endemismo (CE = endêmico para o Cerrado). Dados secundários (Mgmt. Plano = Registrado no Plano de Gerenciamento da Estação Ecológica de Assis (AES) (Antunes Araujo e Cortez, 2010); AA = Araujo e Almeida-Santos (2011); BE = Bertoluci et al. (2007). Cons. status = Status de conservação (SP/IUCN= PT = Ameaçado; LC = menos preocupado).

Taxon	Camp.	End.	Area				Secondary Data			Cons. Status	
			A1	A2	A3	A0	Mgmt. Plan (AES)	AA	BE	SP	IUCN
Anura											
Bufonidae											
Rhinella diptycha (Cope 1862)	1, 3, 4		X		X	X	X	X	X		LC
Hylidae											
Dendropsophus minutus (Peters 1872)	1, 2, 3, 4			X		X	X	X	X		LC
Dendropsophus nanus (Boulenger 1889)	3, 4					X	X	X	X		LC
Boana albopunctata (Spix 1824)	1, 2, 3, 4			X		X	X	X	X		LC
Boana caingua (Carrizo 1991)	2					X	X	X			LC
Boana faber (Wied-Neuwied 1821)	3, 4					X	X	X	X		LC
Boana lundii (Burmeister 1856)	2, 3, 4	CE		X		X	X	X	X		LC
Scinax fuscomarginatus (Lutz 1925)	1, 3					X	X	X	X		LC
Scinax fuscovarius (Lutz 1925)	1, 2, 3, 4		X	X	X	X	X	X	X		LC
Leptodactylidae											
Leptodactylus furnarius (Sazima and Bokermann 1978)	1, 2, 3, 4	CE		X		X	X	X			LC
Leptodactylus fuscus (Schneider 1799)	3, 4		X	X		X	X	X	X		LC
Leptodactylus labyrinthicus (Spix 1824)	1, 3, 4			X		X	X	X	X		LC
Leptodactylus latrans (Steffen 1815)	1, 3, 4					X	X	X			LC
Leptodactylus mystacinus (Burmeister 1861)	1, 3, 4			X		X	X	X	X		LC
Leptodactylus podicipinus (Cope 1862)	1, 3, 4			X	X	X	X	X	X		LC
Physalaemus centralis (Bokermann 1962)	1, 3	CE				X		X			LC
Physalaemus cuvieri (Fitzinger 1826)	1, 3, 4					X	X	X	X		LC
Physalaemus marmoratus (Reinhardt & Lütken 1862)	1, 2, 3	CE			X		X	X	X		LC
Physalaemus nattereri (Steindachner 1863)	1, 3, 4	CE	X	X	X	X	X	X	X		LC
Microhylidae											
Elachistocleis bicolor (Guérin-Meneville 1838)	3				X	X	X	X	X		LC
Phyllomedusidae											
Phyllomedusa tetraploidea (Pombal and Haddad 1992)	1, 3, 4					X	X	X	X		LC
Phyllomedusa tetraploidea (Pombal and Haddad 1992)	1, 3, 4					X	X	X	X		LC

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continuation – Appendix 2
continuação – Apêndice 2

Taxon	Camp.	End.	Area				Secondary Data			Cons. Status	
			A1	A2	A3	A0	Mgmt. Plan (AES)	AA	BE	SP	IUCN
Reptilia											
Squamata											
Anguidae											
Ophiodes striatus (Spix 1824)	1, 2, 3, 4		X	X	X		X	X			LC
Mabuyidae											
Notomabuya frenata (Cope 1862)	4		X				X	X			LC
Teiidae											
Ameiva ameiva (Linnaeus 1758)	1, 2, 3, 4		X	X	X	X	X	X			LC
Ameivula gr. *ocellifera* (Spix 1825)	3, 4			X			X	X		EN	LC
Kentropyx paulensis (Boettger 1893)	4	CE		X						EN	LC
Salvator merianae (Duméril & Bibron 1839	3, 4		X		X		X	X			LC
Boidae											
Boa constrictor (Linnaeus 1758)	4		X				X	X			LC
Dipsadidae											
Dipsas indica (Laurenti 1768)	1			X							LC
Erythrolamprus poecilogyrus (Wied-Neuwied 1825)	4				X			X			NE
Oxyrhopus petola (Linnaeus 1758)	3					X	X	X			LC
Phalotris mertensi (Hoge 1955)	3					X	X	X			NE
Philodryas olfersii (Lichtenstein 1823)	1					X	X	X			LC
Philodryas patagoniensis (Girard 1858)	3			X			X	X			LC
Pseudoboa nigra (Duméril Bibron & Duméril 1854)	2					X					LC
Viperidae											
Bothrops moojeni (Hoge 1966)	1, 3		X				X	X			NE
Bothrops pauloensis (Amaral 1925)	2, 3	CE	X			X		X			LC
Crotalus durissus (Linnaeus 1758)	2, 3, 4		X			X	X	X			LC

Appendix 3. Mammals registered on Assis State Forest in each campaign (1 - August 2017; 2 - May 2018; 3 - October 2018; 4 - January and February 2019), for each sampling area (A1 - Cerradao; A2 - One year restoration; A3 - Five-year restoration; A0- Occasional encounters). Endemism (CE = endemic to the Cerrado; BR = endemic to Brazil). Mgmt. Plan = Recorded on (AES) Assis Ecological Station's (Port-Carvalho e Garrido, 2010) or on (AFS) Assis State Forest's (Max et al., 2007) Management Plan. Diet = main feeding guild according to Paglia et al. (2012) (OMN = omnivore; FRU = frugivorous; CAR = carnivore; HER = herbivore; INS = insectivore; GRA = granivore). CITES appendices (I, II, III). Cons. status = Conservation status (SP/IUCN; LC = least concern; NT = near threatened; DD = data deficient). * = small mammal (adult weighing less than one kilogram); † = exotic or invasive species.

Apêndice 3. Mamíferos registrados na Floresta Estadual de Assis em cada campanha (1 - agosto 2017; 2 - maio 2018; 3 - outubro 2018; 4 - janeiro e fevereiro 2019), para cada área de amostragem (A1 - Cerradão; A2 - Restauração com um ano; A3 - Restauração com cinco anos; A0 - Encontros ocasionais). Endemismo (CE = endêmico para o Cerrado; BR = endêmico para o Brasil). Mgmt. Plano = registrado no Plano de Manejo da Estação Ecológica de Assis (AES) (Port-Carvalho e Garrido 2010) ou da Floresta Estadual de Assis (AFS) (Max et al., 2007). Dieta = principal guilda alimentar segundo Paglia et al. (2012) (OMN = omnívoro; FRU = frugívoro; CAR = carnívoro; HER = herbívoro; INS = insetívoro; GRA = granívoro). Apêndices da CITES (I, II, III). Cons. status = Conservation status (SP/IUCN; LC = least concern; NT = near threatened; DD = data deficient). * = mamífero pequeno (adulto pesando menos de um quilograma); † = espécies exóticas ou invasoras.

Taxon	Camp.	End.	Mgnt. Plan		Area			Diet	CITES	Cons. status	
			AES	ASF	A1	A2	A3/ A0			SP	IUCN
Didelphimorphia											
Didelphidae											
Cryptonanus agricolai (Moojen 1943)*	2					X		FRU/ OMN			DD
Didelphis albiventris (Lund 1840)	1, 2, 4		X	X	X	X	X	FRU/ OMN			LC
Gracilinanus spp.*	4				X	X					
Cingulata											
Dasypodidae											
Cabassous unicinctus (Linnaeus 1758)	1, 2, 3, 4		X		X	X	X	INS			LC
Dasypus novemcinctus (Linnaeus 1758)	1, 2, 3, 4		X		X	X	X	INS/ OMN			LC
Dasypus septemcinctus (Linnaeus 1758)	3, 4				X	X	X	INS/ OMN			LC
Euphractus sexcinctus (Linnaeus 1758)	1, 2, 3, 4		X			X	X	INS/ OMN			LC
Pilosa											
Myrmecophagidae											
Tamandua tetradactyla (Linnaeus 1758)	1, 2, 3, 4		X	X	X	X		INS			LC
Rodentia											
Caviidae											
Hydrochoerus hydrochaeris (Linnaeus 1766)	1, 2, 3, 4		X	X		X	X	HER			LC
Cricetidae											
*Akodon spp.**	1, 2, 3					X	X				
Calomys tener (Winge 1887)*	1					X		FRU/ OMN			LC
*Cerradomys spp.**	3, 4				X						
Necromys lasiurus (Lund 1840)*	1, 3						X	GRA/ INS			LC
Oligoryzomys flavescens (Waterhouse 1837)*	1				X	X		GRA/ INS			LC
Oligoryzomys nigripes (Olfers 1818)*	1				X			GRA/ INS			LC
Dasyproctidae											
Dasyprocta azarae (Lichtenstein 1823)	1, 4		X	X	X		X	FRU/ GRA			DD

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continuation – Appendix 3
continuação – Apêndice 3

Taxon	Camp.	End.	Mgnt. Plan		Area			Diet	CITES	Cons. status	
			AES	ASF	A1	A2	A3/ A0			SP	IUCN
Myocastoridae											
Myocastor coypus (Molina 1782)	1, 3			X			X	FRU/ OMN			LC
Lagomorpha											
Leporidae											
Lepus europaeus (Pallas 1778)†	1, 2, 3, 4		X		X	X	X	HER			LC
Sylvilagus brasiliensis (Linnaeus 1758)	2, 3, 4			X		X	X	HER			EN
Carnivora											
Felidae											
Felis cattus (Linnaeus 1758)†	3, 4					X	X	CAR			
Leopardus pardalis (Linnaeus 1758)	1, 2		X	X	X	X		CAR	I	VU	LC
Leopardus spp.	3, 4				X	X	X	CAR			
Puma concolor (Linnaeus 1771)	1, 3, 4		X		X	X	X	CAR	I	VU	LC
Canidae											
Canis lupus familiaris (Linnaeus 1758)†	1, 2, 3, 4		X		X	X	X	CAR/ OMN			
Cerdocyon thous (Linnaeus 1766)	1, 2, 3, 4		X	X	X	X	X	INS/ OMN	II		LC
Procyonidae											
Nasua nasua (Linnaeus 1766)	1, 2, 3, 4		X	X	X	X	X	FRU/ OMN			LC
Procyon cancrivorus (G. Cuvier 1798)	3, 4		X		X	X	X	FRU/ OMN			LC
Mustelidae											
Eira barbara (Linnaeus 1758)	2, 3, 4		X	X	X	X	X	FRU/ OMN			LC
Artiodactyla											
Cervidae											
Mazama gouazoubira (G. Fischer 1814)	1, 2, 3, 4		X	X	X	X	X	FRU/ HER			LC