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Diversity and conservation of birds associated with an urban landscape in the southwest Brazilian Amazon

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Abstract

The Amazon presents an arc of deforestation which has expanded into natural areas and bird community studies in these areas are incipient for urban landscapes after transformation. Therefore, the bird community in an urban landscape in the southwest Amazonian region within an area in the arc of deforestation was investigated. The observations were performed through linear transects, during the wet and dry seasons of 2013. Records were obtained using binoculars and cameras. A total of 191 species of birds were recorded. The species accumulation curve was not reaching the asymptote, showing that new species can be recorded with a sampling effort increase. The community has low richness as a result of pressure on Amazonian environments and a high degree of anthropization. However, there is relevant composition, because nectarivores, insectivorous, carnivores, omnivores, and granivores were found in all environments, as well as endemic and threatened species.

Keywords: Community. Distribution. Fragmented areas. Arc of deforestation.

Introduction

The composition of the bird community is related to the landscape (MARTIN, 1985; ROTH, 1976) and intrinsic factors which are constantly changing. In the south of Amazon, this change is due to the increasing agricultural areas, pastures, road creation (DAVENPORT *et al.*, 2017; FERRANTE; FEARNSIDE, 2020), hydroelectric plants (FEARNSIDE, 2019), and later increasing urban agglomerations (CÔRTES; SILVA-JUNIOR, 2021), forming the arc of deforestation.

The region of the municipality of Juina is located in the amazon deforestation arc, in the middle portion of the Aripuanã and Juruena rivers, which are included in the Madeira Brazilian Shield and Tapajós-Juruena ecoregions (WWF; TNC, 2015). This area presents recent deforestation, with higher intensity occurring after 2000 (see methods in CASSATI *et al.*, 2020). There is a lack of knowledge of the bird community for the region, with few reports of birds being used to feed the indigenous community (COIMBRA, 1985).

One of the factors that most threatens bird diversity is the forest fragmentation process due to urbanization, as this environment does not return to its previous conditions (MARZLUFF; EWING, 2001), and this process gradually accompanies the growth of the human population (MEYER; TURNER, 1994) and all its impacts.

The number of studies of birds in urbanized environments has become increasingly common, mainly due to the expansion of these environments over tropical forests (e.g., VASCONCELOS *et al.*, 2013 and VOGEL *et al.*, 2016 to Atlantic Forest; AVILLA *et al.*, 2021 and RICO-SILVA *et al.*, 2021 to Amazon), showing that the bird community persists through behavioral and morphological flexibility to increase a population's ability to cope with anthropogenic hazards (AVILLA *et al.*, 2021). Therefore, the objective of this report is to describe and analyze the bird community in

green areas and others under the influence of the water system in an urban landscape in the southwest Brazilian Amazon.

Material and methods

The study was conducted in Juína city, northwest of Mato Grosso State, northern Brazil, in the Brazilian Amazon (11°26'49"S; 58°43'21" W, 315 m high). Juína spans more than 25,000 km^2 and has approximately 40,000 inhabitants. The economy is based on industrial and agricultural exploitation (IBGE, 2018). The climate is AW according to the Köppen classification (ALVARES *et al.,* 2013).

Each sampling area was performed twice by day and the observations occurred from 6 am to 9 am and 3 pm to 6 pm, ten days by month non-sequential, in the wet (January to March) and dry (June to August) seasons of 2013. Five sampling areas were chosen for observations (Figure 1), in which one linear transect of 500 m was determined, with an active search for animals, the presence of hearing, and viewing points of specimens. The areas were chosen because they include forest remnants, riparian forests, anthropized areas (abandoned pastures by five years), and environments under the influence of rivers (Table 1).

Regarding the study areas, point one is composed of a pasture area with approximately five years of abandonment, with the presence of plants in the shrub, herbaceous and arboreal strata of approximately 10 meters in height. Point two is formed of a secondary Amazonian Forest with low human intervention. The trees reach an altitude of approximately 30 to 35 meters and the forest is approximately 100 meters away from the riparian forest. Point 3 is formed by a lake surrounded by shrubby and herbaceous

Figure 1. Sites sampled in the urban landscape of the municipality of Juina, southeast of the Brazilian Amazon, northwestern of the Mato Grosso state.

Source: the authors.

Table 1. Sampling observation coordinates, altitudes, and descriptions of the collection sites in Juína, MT.

Sampling Area	Coordinates and altitude	Description
1	11°26'49"S/58º 43' 21" W 315m	Human modified areas
2	11°26'49" S/ 58°43'26" W 323m	Secondary forest fragment with native species
3	11°26'39" S/ 48°43'22" W 306m	Aquatic environment (lake)/marsh
4	11°26'56" S; 58°43'02"W 314m	Perdido River Riparian Forest, Amazon Forest Vegetation
5	11°26'24" S; 58°43'02" W 312m	Perdido River Riparian Forest, Amazon Forest Vegetation

Source: the authors.

vegetation. Points 4 and 5 are formed by riparian forests that accompany the main stream that crosses the municipality of Juína.

Valid bird species records were considered when the species were heard or seen within each area (ALEXANDRINO *et al.* 2016; UEZU *et al.* 2005). Records were obtained using Nikon 8 x 40 binoculars. We used a Canon EOS REBEL T1i camera to help record/sight the birds. The nomenclature used followed Piacentini *et al.* (2015) and conservation status followed the IUCN proposal.

A species accumulation curve to verify the sample sufficiency was generated using the EstimateS 7.0 program (COWELL, 2006) with 1000 randomizations, and the first-order Jackknife richness estimator was used, most common for matrices with low numbers of species records (BURNHAM; OVERTON, 1978). The similarity between sampling areas was obtained by the Jaccard index (VALENTIN, 2000) and the UPGMA method using the Primer & Permanova v.6 software program (ANDERSON, *et al.* 2008; CLARKE; GORLEY, 2006).

Results

A total of 191 species of birds were recorded (Table 2), allocated into 56 families, with the most representative families being Tyrannidae (16), Thraupidae (N = 16), Psittacidae (N = 15), and Accipitridae (N = 14). The species accumulation curve did not reach an asymptote, suggesting that other species will be registered with an increase in the sampling effort. The first-order Jackknife richness estimator showed that the area's richness is 230.6 species (Figure 2), so this study recorded 82.83% of the total diversity.

The similarity cluster and grouping between sampling areas demonstrated that sampling areas 1 and 2 have a similarity of 60%, while areas 4 and 5 were 72%, and area 3 had only 22% similarity compared to the other four areas (Figure 3). These results were already expected, as the landscapes of areas 1 and 2 are very similarly composed of anthropogenic areas, and areas 4 and 5 are composed of preserved Amazonian riparian forest areas. Area 3 is totally dissimilar from the others, being composed of lower-elevation swamp and lake areas.

The composition of the community in areas 1 and 2 includes birds that occur in both forested and anthropogenic areas, and even in other biomes in Brazil such as *C. squammata*, *P. cayana*, and *M. candidus*. Areas 4 and 5 are composed of specialist Amazonian species, even though they are located in an urbanized region, and among these representatives we can highlight: *A. weddellii*, *P. snethlageae*, *P. tuberosa*, and *O. hoazin*, among others. Area 3 is composed of specialists from aquatic and riparian environments, some of which are widely distributed in Brazil with similar landscapes, such as *N. dominicus*, *A. cocoi*, *P. ajaja*, and *H. fulica*. There were no significant variations in the community between the two seasonal seasons.

Table 2. List of bird species for an urban landscape in southern Brazilian Amazon, northwestern Mato Grosso state. Legends LC = Least Concern, VU = Vulnerable, and NT = Near Threatened.

Family	Species	Popular name	IUCN
Tinamidae	*Crypturellus cinereus* (Gmelin, 1789)	Cinereous Tinamou	LC
	Crypturellus strigulosus (Temminck, 1815)	Brazilian Tinamou	LC
	Crypturellus parvirostris (Wagler, 1827)	Small-billed Tinamou	LC
Anatidae	*Dendrocygna viduata* (Linnaeus, 1766)	White-faced Whistling-Duck	LC
	Cairina moschata (Linnaeus, 1758)	Muscovy Duck	LC
	Amazonetta brasiliensis (Gmelin, 1789)	Brazilian Teal	LC
	Nomonyx dominicus (Linnaeus, 1766)	Masked Duck	LC
Cracidae	*Penelope superciliaris*Temminck, 1815	Rusty-margined Guan	LC
	Penelope jacquacu Spix, 1825	Spix's Guan	LC
	Aburria cujubi (Pelzeln, 1858)	Red-throated Piping-Guan	LC
	Pauxi tuberosa (Spix, 1825)	Razor-billed Curassow	LC
Podicipedidae	*Tachybaptus dominicus* (Linnaeus, 1766)	Least Grebe	LC
Ciconiidae	*Jabiru mycteria* (Lichtenstein, 1819)	Jabiru	LC
	Mycteria americana Linnaeus, 1758	Wood Stork	LC
Phalacrocoracidae	*Nannopterum brasilianus* (Gmelin, 1789)	Neotropic Cormorant	LC
Anhingidae	*Anhinga anhinga* (Linnaeus, 1766)	Anhinga	LC
Ardeidae	*Tigrisoma lineatum* (Boddaert, 1783)	Rufescent Tiger-Heron	LC
	Nycticorax nycticorax (Linnaeus, 1758)	Black-crowned Night-Heron	LC
	Butorides striata (Linnaeus, 1758)	Striated Heron	LC
	Bubulcus ibis (Linnaeus, 1758)	Cattle Egret	LC
	Ardea cocoi Linnaeus, 1766	Cocoi Heron	LC
	Ardea alba Linnaeus, 1758	Great Egret	LC
	Pilherodius pileatus (Boddaert, 1783)	Capped Heron	LC
	Egretta thula (Molina, 1782)	Snowy Egret	LC
Threskiornithidae	*Mesembrinibis cayennensis* (Gmelin, 1789)	Green Ibis	LC
	Platalea ajaja Linnaeus, 1758	Roseate Spoonbill	LC
Cathartidae	*Cathartes aura* (Linnaeus, 1758)	Turkey Vulture	LC
	Cathartes burrovianus Cassin, 1845	Lesser Yellow-headed Vulture	LC
	Coragyps atratus (Bechstein, 1793)	Black Vulture	LC
	Sarcoramphus papa (Linnaeus, 1758)	King Vulture	LC
Accipitridae	*Chondrohierax uncinatus* (Temminck, 1822)	Hook-billed Kite	LC
	Elanoides forficatus (Linnaeus, 1758)	Swallow-tailed Kite	LC
	Gampsonyx swainsonii Vigors, 1825	Pearl Kite	LC
	Elanus leucurus (Vieillot, 1818)	White-tailed Kite	LC
	Ictinia plumbea (Gmelin, 1788)	Plumbeous Kite	LC
	Busarellus nigricollis (Latham, 1790)	Black-collared Hawk	LC
	Rostrhamus sociabilis (Vieillot, 1817)	Snail Kite	LC
	Heterospizias meridionalis (Latham, 1790)	Savanna Hawk	LC
	Urubitinga urubitinga (Gmelin, 1788)	Great Black Hawk	LC
	Rupornis magnirostris (Gmelin, 1788)	Roadside Hawk	LC
	Pseudastur albicollis (Latham, 1790)	White Hawk	LC
	Buteo nitidus (Latham, 1790)	Gray-lined Hawk	LC
	Buteo brachyurus Vieillot, 1816	Short-tailed Hawk	LC
	Spizaetus ornatus (Daudin, 1800)	Ornate Hawk-Eagle	NT
Aramidae	*Aramus guarauna* (Linnaeus, 1766)	Limpkin	LC
Rallidae	*Aramides cajaneus* (Statius Muller, 1776)	Gray-necked Wood-Rail	LC
	Laterallus exilis (Temminck, 1831)	Gray-breasted Crake	LC

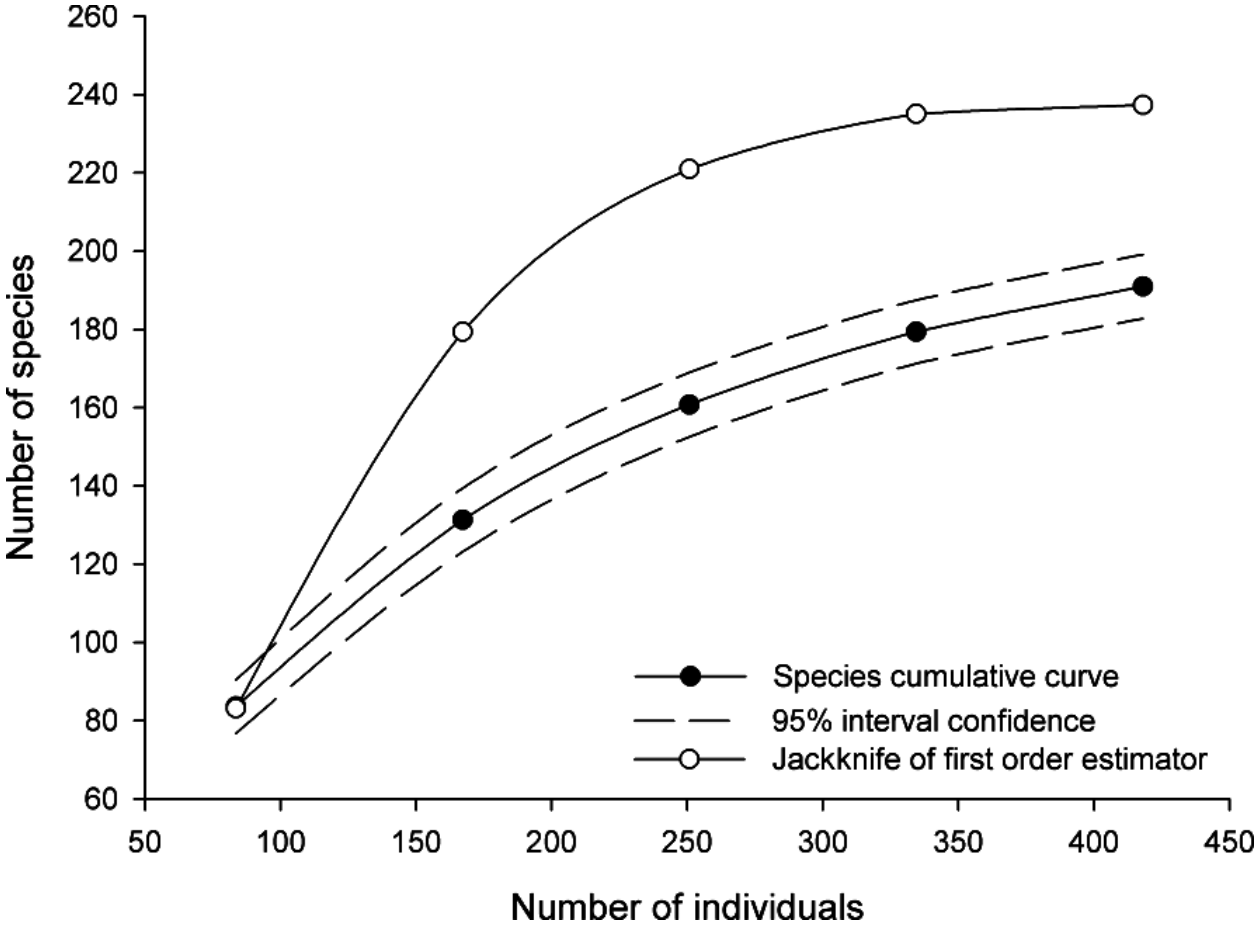
Family	Species	Popular name	IUCN
	Gallinula galeata (Lichtenstein, 1818)	Common Gallinule	LC
	Porphyrio martinicus (Linnaeus, 1766)	Purple Gallinule	LC
	Porphyrio flavirostris (Gmelin, 1789)	Azure Gallinule	LC
Heliornithidae	*Heliornis fulica* (Boddaert, 1783)	Sungrebe	LC
Charadriidae	*Vanellus chilensis* (Molina, 1782)	Southern Lapwing	LC
Haematopodidae	*Himantopus mexicanus* (Statius Muller, 1776)	Black-necked Stilt	LC
Scolopacidae	*Tringa solitaria* Wilson, 1813	Solitary Sandpiper	LC
Jacanidae	*Jacana jacana* (Linnaeus, 1766)	Wattled Jacana	LC
Columbidae	*Columbina talpacoti* (Temminck, 1810)	Ruddy Ground-Dove	LC
	Columbina squammata (Lesson, 1831)	Scaled Dove	LC
	Claravis pretiosa (Ferrari-Perez, 1886)	Blue Ground-Dove	LC
	Patagioenas picazuro (Temminck, 1813)	Picazuro Pigeon	LC
	Patagioenas cayennensis (Bonnaterre, 1792)	Pale-vented Pigeon	LC
	Zenaida auriculata (Des Murs, 1847)	Eared Dove	LC
Opisthocomidae	*Opisthocomus hoazin* (Statius Muller, 1776)	Hoatzin	LC
Cuculidae	*Piaya cayana* (Linnaeus, 1766)	Squirrel Cuckoo	LC
	Crotophaga major Gmelin, 1788	Greater Ani	LC
	Crotophaga ani Linnaeus, 1758	Smooth-billed Ani	LC
	Tapera naevia (Linnaeus, 1766)	Striped Cuckoo	LC
	Guira guira (Gmelin, 1788)	Guira Cuckoo	LC
Tytonidae	*Tyto furcata* (Temminck, 1827)	American Barn Owl	LC
Strigidae	*Glaucidium brasilianum* (Gmelin, 1788)	Ferruginous Pygmy-Owl	LC
	Athene cunicularia (Molina, 1782)	Burrowing Owl	LC
Nyctibiidae	*Nyctibius grandis* (Gmelin, 1789)	Great Potoo	LC
Caprimulgidae	*Podager nacunda* (Vieillot, 1817)	Nacunda Nighthawk	LC
Trochilidae	*Phaethornis ruber* (Linnaeus, 1758)	Reddish Hermit	LC
	Anthracothorax nigricollis (Vieillot, 1817)	Black-throated Mango	LC
	Thalurania furcata (Gmelin, 1788)	Fork-tailed Woodnymph	LC
	Heliomaster longirostris (Audebert&Vieillot, 1801)	Long-billed Starthroat	LC
Trogonidae	*Trogon curucui* Linnaeus, 1766	Blue-crowned Trogon	LC
Alcedinidae	*Megaceryle torquata* (Linnaeus, 1766)	Ringed Kingfisher	LC
	Chloroceryle amazona (Latham, 1790)	Amazon Kingfisher	LC
	Chloroceryle americana (Gmelin, 1788)	Green Kingfisher	LC
Galbulidae	*Galbula ruficauda* Cuvier, 1816	Rufous-tailed Jacamar	LC
Bucconidae	*Notharchus tectus* (Boddaert, 1783)	Pied Puffbird	LC
	Nystalus chacuru (Vieillot, 1816)	White-eared Puffbird	LC
	Monasa nigrifrons (Spix, 1824)	Black-fronted Nunbird	LC
	Chelidoptera tenebrosa (Pallas, 1782)	Swallow-winged Puffbird	LC
Ramphastidae	*Ramphastos tucanus* Linnaeus, 1758	White-throated Toucan	VU
	Pteroglossus inscriptus Swainson, 1822	Lettered Aracari	LC
	Pteroglossus castanotis Gould, 1834	Chestnut-eared Aracari	LC
Picidae	*Melanerpes candidus* (Otto, 1796)	White Woodpecker	LC
	Melanerpes cruentatus (Boddaert, 1783)	Yellow-tufted Woodpecker	LC
	Colaptes campestris (Vieillot, 1818)	Campo Flicker	LC
	Celeus elegans (Statius Muller, 1776)	Chestnut Woodpecker	LC
	Dryocopus lineatus (Linnaeus, 1766)	Lineated Woodpecker	LC
	Campephilus melanoleucos (Gmelin, 1788)	Crimson-crested Woodpecker	LC
Falconidae	*Daptrius ater* Vieillot, 1816	Black Caracara	LC
	Ibycter americanus (Boddaert, 1783)	Red-throated Caracara	LC

Family	Species	Popular name	IUCN
	Caracara plancus (Miller, 1777)	Southern Caracara	LC
	Herpetotheres cachinnans (Linnaeus, 1758)	Laughing Falcon	LC
	Falco sparverius Linnaeus, 1758	American Kestrel	LC
	Falco rufigularis Daudin, 1800	Bat Falcon	LC
	Falco femoralis Temminck, 1822	Aplomado Falcon	LC
Psittacidae	*Ara ararauna* (Linnaeus, 1758)	Blue-and-yellow Macaw	LC
	Ara macao (Linnaeus, 1758)	Scarlet Macaw	LC
	Ara chloropterus Gray, 1859	Red-and-green Macaw	LC
	Ara severus (Linnaeus, 1758)	Chestnut-fronted Macaw	LC
	Orthopsittaca manilatus (Boddaert, 1783)	Red-bellied Macaw	LC
	Primolius maracana (Vieillot, 1816)	Blue-winged Macaw	NT
	Psittacara leucophthalmus (Statius Muller, 1776)	White-eyed Parakeet	LC
	Aratinga weddellii (Deville, 1851)	Dusky-headed Parakeet	LC
	Pyrrhura perlata (Spix, 1824)	Crimson-bellied Parakeet	VU
	Pyrrhura snethlageae Joseph & Bates, 2002	Madeira Parakeet	VU
	Brotogeris chiriri (Vieillot, 1818)	Yellow-chevroned Parakeet	LC
	Pionus menstruus (Linnaeus, 1766)	Blue-headed Parrot	LC
	Amazona ochrocephala (Gmelin, 1788)	Yellow-crowned Parrot	LC
	Amazona aestiva (Linnaeus, 1758)	Turquoise-fronted Parrot	NT
	Deroptyus accipitrinus (Linnaeus, 1758)	Red-fan Parrot	LC
Thamnophilidae	*Myrmophylax atrothorax* (Boddaert, 1783)	Black-throated Antbird	LC
	Sakesphorus luctuosus (Lichtenstein, 1823)	Glossy Antshrike	LC
	Thamnophilus doliatus (Linnaeus, 1764)	Barred Antshrike	LC
	Thamnophilus palliatus (Lichtenstein, 1823)	Chestnut-backed Antshrike	LC
	Thamnophilus stictocephalus Pelzeln, 1868	Natterer's Slaty-Antshrike	LC
	Myrmoborus leucophrys (Tschudi, 1844)	White-browed Antbird	LC
	Cercomacroides nigrescens (Cabanis& Heine, 1859)	Blackish Antbird	LC
	Willisornis poecilinotus (Cabanis, 1847)	Common Scale-backed Antbird	LC
Dendrocolaptidae	*Sittasomus griseicapillus* (Vieillot, 1818)	Olivaceous Woodcreeper	LC
	Xiphorhynchus guttatoides (Lafresnaye, 1850)	Lafresnaye's Woodcreeper	LC
	Dendroplex picus (Gmelin, 1788)	Straight-billed Woodcreeper	LC
Xenopidae	*Xenops minutus* (Sparrman, 1788)	Plain Xenops	LC
Furnariidae	*Synallaxis albescens* Temminck, 1823	Pale-breasted Spinetail	LC
Pipridae	*Ceratopipra rubrocapilla* (Temminck, 1821)	Red-headed Manakin	LC
	Heterocercus linteatus (Strickland, 1850)	Flame-crowned Manakin	LC
Onychorhynchidae	*Terenotriccus erythrurus* (Cabanis, 1847)	Ruddy-tailed Flycatcher	LC
Tityridae	*Tityra inquisitor* (Lichtenstein, 1823)	Black-crowned Tityra	LC
	Tityra semifasciata (Spix, 1825)	Masked Tityra	LC
Cotingidae	*Lipaugus vociferans* (Wied, 1820)	Screaming Piha	LC
	Gymnoderus foetidus (Linnaeus, 1758)	Bare-necked Fruitcrow	LC
Platyrinchidae	*Platyrinchus platyrhynchos* (Gmelin, 1788)	White-crested Spadebill	LC
Rhynchocyclidae	*Myiornis ecaudatus* (d'Orbigny&Lafresnaye, 1837)	Short-tailed Pygmy-Tyrant	LC
Tyrannidae	*Attila spadiceus* (Gmelin, 1789)	Bright-rumped Attila	LC
	Legatus leucophaius (Vieillot, 1818)	Piratic Flycatcher	LC
	Myiarchus swainsoni Cabanis& Heine, 1859	Swainson's Flycatcher	LC
	Myiarchus ferox (Gmelin, 1789)	Short-crested Flycatcher	LC
	Pitangus sulphuratus (Linnaeus, 1766)	Great Kiskadee	LC
	Myiodynastes maculatus (Statius Muller, 1776)	Streaked Flycatcher	LC

Family	Species	Popular name	IUCN
	Tyrannopsis sulphurea (Spix, 1825)	Sulphury Flycatcher	LC
	Megarynchus pitangua (Linnaeus, 1766)	Boat-billed Flycatcher	LC
	Myiozetetes cayanensis (Linnaeus, 1766)	Rusty-margined Flycatcher	LC
	Tyrannus albogularis Burmeister, 1856	White-throated Kingbird	LC
	Tyrannus melancholicus Vieillot, 1819	Tropical Kingbird	LC
	Tyrannus savana Daudin, 1802	Fork-tailed Flycatcher	LC
	Empidonomus varius (Vieillot, 1818)	Variegated Flycatcher	LC
	Pyrocephalus rubinus (Boddaert, 1783)	Vermilion Flycatcher	LC
	Fluvicola albiventer (Spix, 1825)	Black-backed Water-Tyrant	LC
	Xolmis cinereus (Vieillot, 1816)	Gray Monjita	LC
Vireonidae	*Vireo chivi* (Vieillot, 1817)	Chivi Vireo	LC
Hirundinidae	*Atticora fasciata* (Gmelin, 1789)	White-banded Swallow	LC
	Stelgidopteryx ruficollis (Vieillot, 1817)	Southern Rough-winged Swallow	LC
	Progne chalybea (Gmelin, 1789)	Gray-breasted Martin	LC
	Tachycineta albiventer (Boddaert, 1783)	White-winged Swallow	LC
Troglodytidae	*Troglodytes musculus* Naumann, 1823	Southern House Wren	LC
	Campylorhynchus turdinus (Wied, 1831)	Thrush-like Wren	LC
	Pheugopedius genibarbis (Swainson, 1838)	Moustached Wren	LC
Donacobiidae	*Donacobius atricapilla* (Linnaeus, 1766)	Black-capped Donacobius	LC
Motacillidae	*Anthus lutescens* Pucheran, 1855	Yellowish Pipit	LC
Passerellidae	*Zonotrichia capensis* (Statius Muller, 1776)	Rufous-collared Sparrow	LC
	Ammodramus humeralis (Bosc, 1792)	Grassland Sparrow	LC
Parulidae	*Geothlypis aequinoctialis* (Gmelin, 1789)	Masked Yellowthroat	LC
Icteridae	*Psarocolius decumanus* (Pallas, 1769)	Crested Oropendola	LC
	Cacicus cela (Linnaeus, 1758)	Yellow-rumped Cacique	LC
	Icterus cayanensis (Linnaeus, 1766)	Epaulet Oriole	LC
	Molothrus oryzivorus (Gmelin, 1788)	Giant Cowbird	LC
	Molothrus bonariensis (Gmelin, 1789)	Shiny Cowbird	LC
	Sturnella militaris (Linnaeus, 1758)	Red-breasted Meadowlark	LC
Thraupidae	*Cissopis leverianus* (Gmelin, 1788)	Magpie Tanager	LC
	Schistochlamys melanopis (Latham, 1790)	Black-faced Tanager	LC
	Paroaria gularis (Linnaeus, 1766)	Red-capped Cardinal	LC
	Tangara mexicana (Linnaeus, 1766)	Turquoise Tanager	LC
	Tangara episcopus (Linnaeus, 1766)	Blue-gray Tanager	LC
	Tangara palmarum (Wied, 1821)	Palm Tanager	LC
	Volatinia jacarina (Linnaeus, 1766)	Blue-black Grassquit	LC
	Tachyphonus rufus (Boddaert, 1783)	White-lined Tanager	LC
	Ramphocelus carbo (Pallas, 1764)	Silver-beaked Tanager	LC
	Tersina viridis (Illiger, 1811)	Swallow Tanager	LC
	Dacnis flaviventer d'Orbigny&Lafresnaye, 1837	Yellow-bellied Dacnis	LC
	Dacnis cayana (Linnaeus, 1766)	Blue Dacnis	LC
	Sporophila nigricollis (Vieillot, 1823)	Yellow-bellied Seedeater	LC
	Sporophila caerulescens (Vieillot, 1823)	Double-collared Seedeater	LC
	Sporophila angolensis (Linnaeus, 1766)	Chestnut-bellied Seed-Finch	LC
	Saltator maximus (Statius Muller, 1776)	Buff-throated Saltator	LC
Fringillidae	*Euphonia chrysopasta* Sclater&Salvin, 1869	Golden-bellied Euphonia	LC
Passeridae	*Passer domesticus* (Linnaeus, 1758)	House Sparrow	LC

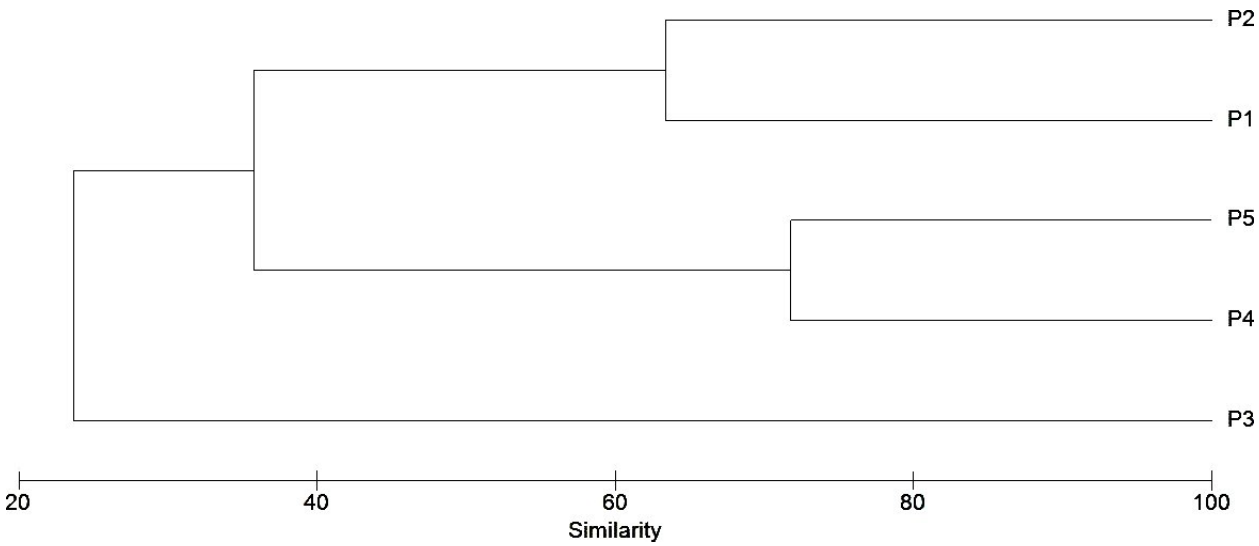
Source: the authors.

Figure 2. Rarefaction curve, confidence interval, and first-order Jackknife richness estimator for an urban landscape in southern Brazilian Amazonia, northwestern Mato Grosso state.



Source: the authors.

Figure 3. Similarity cluster and grouping between physiognomies (sampling areas) as a function of bird species composition for an urban landscape in southern Brazilian Amazonia, northwestern Mato Grosso state.



Source: the authors.

Discussion

Six species are threatened. We emphasize that the species classified in the "vulnerable" category are endemic to the Amazon region, and this status refers to their restricted occurrence area and the progress of deforestation (CARRERO *et al.,* 2020).

It is interesting to highlight that the threatened birds present in this study (*R. tucanus*, *P. perlata* and *P. snethlageae*) are species that have an ecology closely associated with the Amazon domain, occurring exclusively in this biome, showing the fragility of some elements of this bird community, that have other endemic species of the biome that are not yet in population decline or threatened, however, may in the future fall into some category of threat.

The avifauna richness is low as probably a result of pressure on Amazonian environments and the high degree of anthropization since some inventories found between 342 to 796 species (BEJA *et al.,* 2009; BORGES *et al.,* 2001; HENRIQUES *et al.,* 2003) for other Amazonian areas. However, the representativeness of the records of this study stands out, as it corresponds to an approximate richness of 10% of the species described for the country (PIACENTINI *et al.,* 2015).

Considering the proportion of species, the trophic structure did not vary between environments, since nectarivores, insectivorous, carnivores, omnivores, and granivores were registered in all sampling areas. However, it is worth noting that there is an absence of records of large predators which are common in the northern region of Brazil, such as *Harpia harpyja* (MOURA *et al.,* 2012). However, this fact might be related to the disturbance degree that the studied area has been suffering (urbanization), since *H. harpyja* is considered an indicator species of little disturbed landscapes (ALBUQUERQUE, 1995).

Four records of this study can be considered remarkable, namely that of *S. ornatus*, because in addition to being a near-endangered species (IUCN, 2020), it is considered rare in almost all Brazilian states (MENDONÇA-LIMA *et al.,* 2006), even though it is not yet on the world and national lists (MMA, 2014) of species threatened with extinction. In addition, the recently described *P. snethlageae* is considered to be endangered in the "vulnerable" category (IUCN, 2020), as well as *P. jacquacu* and *D. accipitrinus* which are endemic species in the Amazonian domain (SICK, 1997); due to their occurrences being restricted to this biome, they may be suffering anthropogenic pressures in the future due to the replacement of natural vegetation by soy cultivation areas, illegal logging, fragmentation and urbanization (MARGULIS, 2003).

We emphasize that studies in areas such as the one herein are extremely important, as conservation and management can play an important role in the maintenance of the entire ecosystem, enabling the dispersal of species and maintaining the biological flow in urban matrix areas (ARAUJO *et al.,* 2018).

Although there is a lack of characterization in the study area due to fragmentation and urbanization, the richness of the bird community is low as a result of pressure on Amazonian environments and the high degree of anthropization; however, some species occurring in the region which are more specialized were not registered in the present study.

Conclusions

Despite the wide lack of characterization suffered in the study area due to fragmentation and urbanization, the community of birds is low, as a result of pressure on Amazonian environments and the high degree of anthropization. This research can fill the knowledge gap about birds in the region because there are no previous studies on

avifauna in this location and even in this Amazon region, thus contributing to future Conservation Biology projects. New studies are suggested because the list of species (communities) is not static, but dynamic due to the changes in the landscape promoted by human actions.

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