



AVIFAUNA OF THE ECOTOURISM PARK CACHOEIRA DO URUBU: A FRAGMENT OF ATLANTIC FOREST IN THE PERNAMBUCO ENDEMISM CENTER, NORTHEASTERN BRAZIL

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Abstract: The forest fragments that persist within a landscape formed by sugarcane matrix are fundamental for the faunal maintenance. Here, we present the list of bird species found in the Ecotourism Park Cachoeira do Urubu (PECUB), an Atlantic Forest fragment inserted in a landscape consisted by a sugarcane matrix in northeastern Brazil. Our consolidated list includes 117 bird species, of which 106 were recorded during our systematic surveys and other 11 species from a preliminary survey and an online database. When compared to larger fragments located in the same region (Atlantic Forest of Pernambuco), PECUB stands out for its species richness in such a small area (30 ha), with just over 40% of the number of species found in fragments 20 times larger, such as Dois Irmãos State Park. PECUB has three endemic taxa to the Pernambuco Endemism Center (*Picumnus pernambucensis*, *Hemitriccus griseipectus naumburgae*, and *Tangara cyanocephala corallina*) and one endemic to the Atlantic Forest (*Chrysuronia leucogaster bahiae*). Our study demonstrated the importance of PECUB as a suitable habitat for birds in a region threatened by forest fragmentation.

Keywords: Bird community; Checklist; Ornithological inventory; Species Richness.

Historically, the Atlantic Forest covered about 1,315,460 km² of South American territory in its total extension, occupying almost all the eastern part of the continent (Galindo-Leal & Câmara 2005). However, the advance of urbanization and agriculture has caused several negative effects on species richness, occurrence, and distribution, mainly due to habitat loss, fragmentation and

environmental degradation that result in the reduction of available niches (Johnstone *et al.* 2014, Galetti *et al.* 2021).

Nowadays, the Atlantic Forest is one of the most threatened Brazilian biomes, being reduced to approximately 12-16% of its original extension, mostly in small (< 50 ha) fragments (Ribeiro *et al.* 2009). As if that were not enough, the remaining

forest fragments are still under intense anthropic pressure and imminent risk of extinction (Myers *et al.* 2000). The Atlantic Forest is the region of South America that has the largest number of endemic and endangered species (Jenkins *et al.* 2013). Currently, this biome is home to 891 species of birds, of which 213 (24%) are endemic and 120 (15%) are threatened with extinction (Lima 2013).

The northern portion of the Atlantic Forest above the São Francisco River is known as the Pernambuco Endemism Center (PEC) and has a high number of endemic species, both in animals and in threatened plants (Tabarelli *et al.* 2006). Regarding the birds, there are 27 endemic taxa in the PEC and 49 endangered species (Pereira *et al.* 2016). The Alagoas Curassow (*Pauxi mitu*) was considered extinct in the wild (with only one captive population), but was reintroduced, and three other species (*Cichlocolaptes mazarbarnetti*, *Phylidor novaesi*, and *Glaucidium mooreorum*) are considered extinct (Butchart *et al.* 2018). PEC is considered an important region for bird conservation in Brazil (Bencke *et al.* 2006); in contrast, it is also the most fragmented region of the Atlantic Forest (Tabarelli *et al.* 2006).

Most biodiversity inventories in the Neotropics are scarce in terms of their extent or are often not openly available for scientific use, which hinders major analytical progress and long-term monitoring (Barlow *et al.* 2007a). In this study, we present the results of the avifauna inventory of a fragment of Atlantic Forest located in the Pernambuco Endemism Center, an important area for the conservation of Atlantic Forest birds located in northeastern Brazil. This study will provide information that can be used in conservation actions and plans for the region. For example, in the construction of the park management plan (in progress by the Secretaria de Meio Ambiente de Pernambuco - SEMAS), as well as to understand which species use the park, since it is surrounded by a matrix of sugarcane. In addition, it can contribute to the knowledge of the distribution pattern and seasonality of species, including endemic taxa.

The Ecotourism Park Cachoeira do Urubu - PECUB (8° 18' 03.5" S; 35° 21' 26.5" W) is a municipal park, located in Primavera, Pernambuco (Figure 1). PECUB consists of 30 hectares of Atlantic Forest fragment inserted in the Ipojuca River basin, and has habitats of riparian forest, waterfall, and river,

in addition to buildings, which together make up an environment surrounded by a matrix of sugar cane. PECUB is an area heavily affected by, in addition to the surrounding sugarcane matrix, human constructions within the park area. Tourists also use the park for leisure, and this has an additional environmental impact due to the daily presence of people in the area, such as garbage left, possible chemical residues in the water from shampoos, sunscreen and noise pollution, for example.

In 2004, occasional records of bird species were made in the park, which resulted in a list of 57 species (MC Periquito and SM Dantas, unpublished data). Based on this, two field campaigns were carried out to systematically sample the local avifauna. The first campaign occurred in five field days from August 03 to 07, 2015, and the second was carried out from January 11 to 15, 2016, sampling in the rainy and dry seasons, respectively. The avifauna was sampled through two complementary methods: transects and capture of individuals. In the first method (adapted from Vielliard & Silva, 1990), an experienced observer walked a transect recording all species seen or heard in the area using 8x42 binoculars. The surveys were carried out from 05:00 to 09:00 and from 15:00 to 17:00, and after 22:00 to contemplate nocturnal birds. After five field days for each campaign, we obtained a total of 60 hours of observation. At the same time, we captured birds using ornithological mist nets (permission number 46663-2/SISBIO). To do this, we installed 10 mist nets measuring 2.5 x 12 m (36 mm mesh) that were arranged in units or pairs. The mist nets were opened for three consecutive days from 05:00 am and closed at noon, totaling 60 hours per day and 180 hours per campaign. We checked nets every 30 minutes, retaining birds for sampling prior to release at the site of capture.

Seeking to assemble a complete list for the study site, we obtained records in online databases (Wikiaves - <https://www.wikiaves.com.br/>; eBird - <https://ebird.org/home>; and Xenocanto - <https://www.xeno-canto.org/>). The nomenclature of bird species followed Pacheco *et al.* (2021), and the trophic niche classification was obtained from the AVONET dataset (Tobias *et al.* 2022). Regarding the conservation status, we followed the International Union for Conservation of Nature (IUCN 2022) for global status, and the Red Book of Threatened Brazilian Fauna (ICMBio/MMA, 2018).

From the systematic samplings, we recorded 106 bird species distributed in 39 families. In the first campaign, 85 species were recorded, 14 of which were exclusive to this campaign, while 76 species were recorded in the second campaign, 21 of which were exclusive species. In addition to the species recorded in our samplings, another eleven species were recorded exclusively in the preliminary survey or on the WikiAves website, since the eBird and Xenocanto databases did not have records for this area at the time of access. Thus, the general list of PECUB contains 117 species of birds (Table S1). Of the 57 species previously recorded, five of them were not recorded in the present study (see Table S1 for details).

Among the species, two are exotic (from other continents), being *Estrilda astrild* from Africa and *Passer domesticus* from Eurasia. The family with the largest number of species was Tyrannidae (16 species), followed by Trochilidae (12 species) and Thraupidae (12 species), which together represented

36.11% of all species recorded for PECUB. The other families had low representativeness, ranging from one (e.g., Anatidae) to four species (e.g., Rallidae) (Table S1). We highlight the record of *Picumnus pernambucensis* Zimmer, 1947 (Figure 2B), a species restricted to the Pernambuco Endemism Center. In addition, we emphasize others endemic taxa of the Atlantic Forest, like *Chrysuronia leucogaster bahiae* (Figure 2D), *Hemitriccus griseipectus naumburgae* (Figure 2C) and *Tangara cyanocephala corallina* (Figure 2A).

The species recorded were distributed in nine trophic niche when considering the main items of their diet: invertivore (46.15%) (e.g. *Synallaxis frontalis* and *Zimmerius acer*), nectarivore (11.11%) (e.g. *Heliothryx auratus* and *Chrysolampis mosquitos*), frugivore (9.40%) (e.g. *Euphonia violacea* and *Certhopipra rubrocapilla*), omnivore (9.40%) (e.g. *Vanellus chilensis* and *Guira guira*), aquatic predator (7.69%) (e.g. *Butorides striata* and *Ardea alba*), granivore (7.69%) (e.g. *Sporophila albugularis*

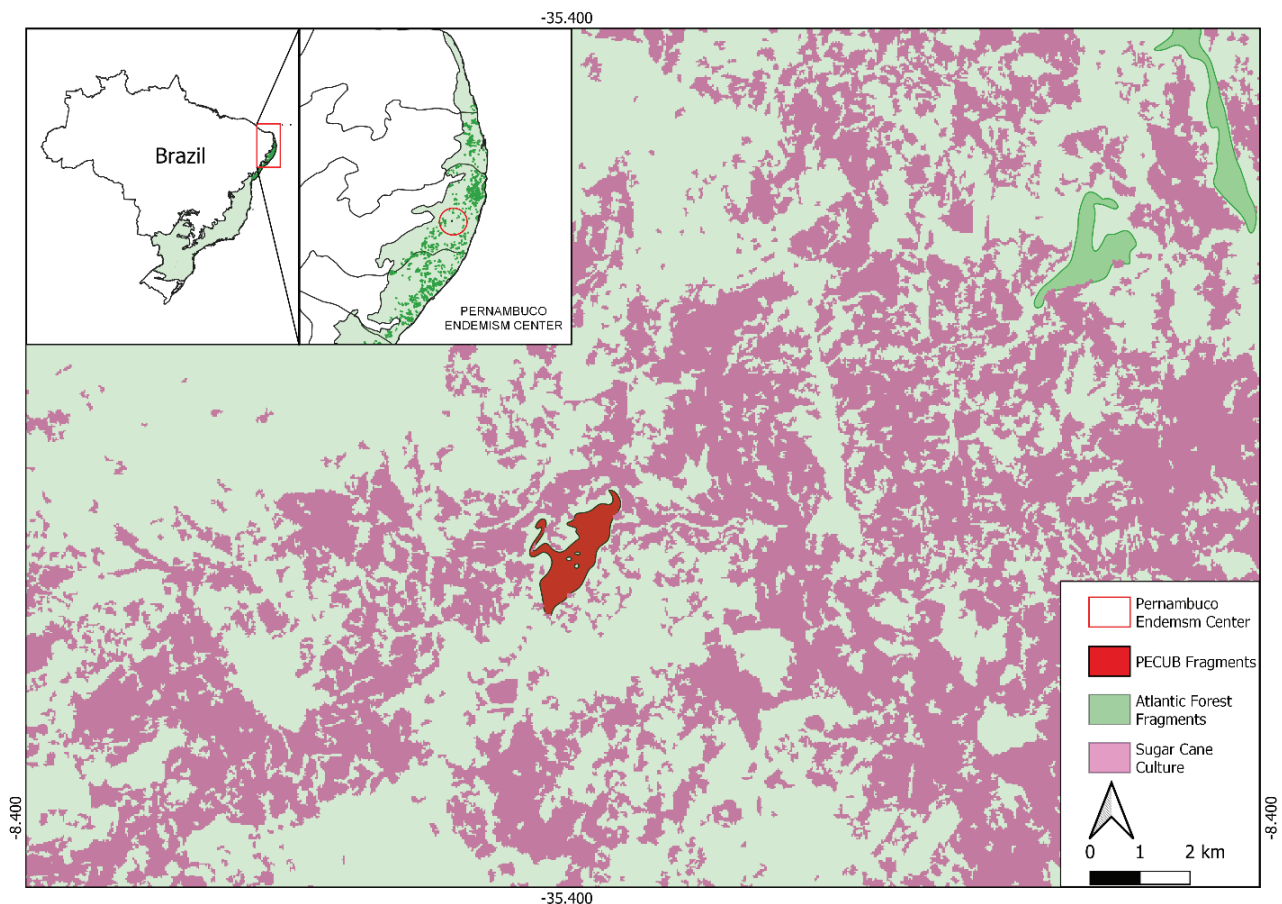


Figure 1. The Atlantic Forest fragment of the Ecotourism Park Cachoeira do Urubu (inside the red circle) is located within the Endemic Center of Pernambuco, a portion of the Atlantic Forest north of the São Francisco River (inside the red square). Sugarcane matrix taken from Mapbiomas (Souza *et al.* 2020)

and *Volatinia jacarina*), vertivore (3.41%) (*e.g.* *Rupornis magnirostris* and *Buteo nitidus*), aquatic herbivore (2.56%) (*e.g.* *Dendrocygna viduata*) and scavenger (2.56%) (*e.g.* *Cathartes aura* and *Cathartes burrovianus*).

The general list presented here corresponds to approximately 21% of the 535 bird species recorded in the state of Pernambuco (Farias *et al.* 2008) and represents about 28% of the birds in the PEC, which has 434 species (Roda 2003). This richness of bird species is representative when compared to those recorded in protected areas already established in the state of Pernambuco, such as the Caetés Ecological Station (166 species, Farias 2009), Tapacurá Ecological Station (263 species, Lyra-Neves *et al.* 2004), and Dois Irmãos State Park (199 species, Secretaria Estadual de Meio Ambiente

Management Plan 2014). It is important to consider the size of the forest fragments mentioned above, where the Caetés Ecological Station has 157 ha, the Tapacurá Ecological Station has 776 ha and the Dois Irmãos State Park 1158 ha, that is, they are much larger areas compared to the 30 ha of PECUB.

In northeastern Brazil, studies carried out in Atlantic Forest fragments showed a greater predominance of understory bird species (Roda 2003, Farias *et al.* 2007, Melo 2013). The bird community in this study proved to be very heterogeneous in terms of habitat preference; mixing open-area and understory species (see Table S1 for details). This variation between studies that found a predominance of understory species and our results with more species from open areas, may be due to the extension of the forest fragment, the

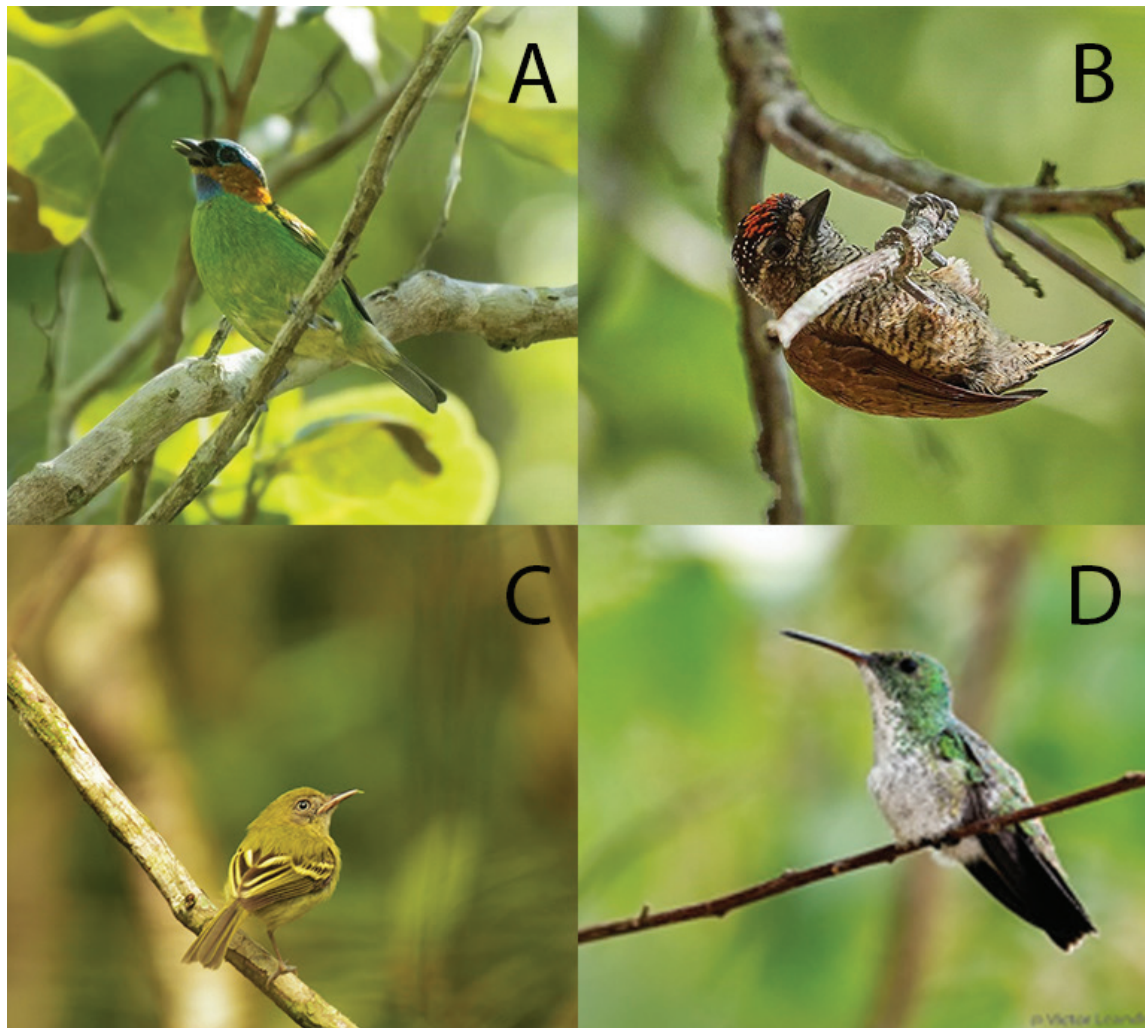


Figure 2. Endemic taxa of the Atlantic Forest recorded in Ecotourism Park Cachoeira do Urubu. A. *Tangara cyanocephala corallina*; B. *Picumnus pernambucensis*; C. *Picumnus pernambucensis* and D. *Chrysornis leucogaster bahiae*. Photos by Victor Leandro Silva (A, C and D) and Yuri Raia (B).

breadth of the inventory in several sampling, and/or due to the high degradation of this fragment, which in this latter case might have benefited species more adapted to open environments (Barros *et al.* 2021).

We found a higher predominance of species from the Tyrannidae family, mainly species typical of open areas, contrary to other studies carried out in the Northeast Atlantic Forest (e.g. Melo 2013, Martins 2007), which found a high representation of the Thamnophilidae family, composed mainly of forest species. In forest environments, species can use several trophic resources, where a greater number of strata can be exploited. According to Melo (2013), *Xenops minutus* and *Myiobius barbatus* can be frequently observed in the forests of the State of Pernambuco, however, in the present study, none of these species was recorded. The sugarcane matrix and other monocultures, make it challenging to conserve them (Barlow *et al.* 2007b), as well as generalist species from the open areas that use the forest edge may be competing for resources with forest species, and this competition intensified by the reduced size of the fragment.

All the forest fragments of the PEC, from the smallest to the largest, are important for the maintenance of the regional avifauna (Pereira *et al.* 2016). The species richness found in this study shows the importance of maintaining Atlantic Forest fragments, mainly above the São Francisco River, where historically it was and continues to be one of the regions under the greatest anthropic pressure. Fragments of secondary forest, such as the PECUB, are important in areas surrounded by a modified matrix (sugarcane in this case) especially when they reach more advanced successional stages (Aleixo 1999).

Among the recorded species, *Picumnus pernambucensis* (Figure 4B) is a species that requires attention, although it has not yet received conservation status at IUCN (it is still treated by IUCN as *P. exilis*). This species was part of the *P. exilis* complex and was elevated to full species in 2014 (Rêgo *et al.* 2014). While *P. exilis* is treated as “quite” common by Stotz *et al.* (1996), the current IUCN report when dealing with the species, points it out as in decline and with a population size not yet quantified (IUCN 2022). *Picumnus pernambucensis* should soon gain threatened status due to its restricted distribution and loss of habitat. *Tangara*

cyanocephalala corallina follows a path similar to that of *P. pernambucensis*. Recent studies show that the population of *T. c. corallina* is independent of the population found in the high forest below the São Francisco River (Bocalini *et al.* 2021).

The studied area of the Atlantic Forest is of great importance for the avifauna, becoming a refuge for biodiversity threatened mainly by the pressure of the surrounding sugarcane agriculture. However, the anthropogenic pressure suffered by this area, mainly the suppression of vegetation, has affected its bird community, favoring generalist taxa that are less dependent on forest environments, which can lead to a decline of more specialized species in the fragment. We concluded that the Ecotourism Park Cachoeira do Urubu - PECUB, in addition to denoting exuberant scenic beauty, is an important fragment of Atlantic Forest that occurs within the Pernambuco Endemism Center and can serve as a refuge for species of fauna that occur in the surroundings.

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AUTHORS' CONTRIBUTIONS

All authors participated in data collection and in the conception and design of the manuscript. VLS wrote the manuscript; VLS, MCP, and JLS identified the species; and JMSC contributed to the critical review by adding intellectual content.

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SUPPLEMENTARY FILES

Table S1. Bird species recorded in the Ecotourism Park Cachoeira do Urubu (PECUB), Pernambuco state, northeastern Brazil. Legend: Trophic niche: Aquatic herbivore (Ha), Aquatic predator (Ap), Omnivore (Om), Scavenger (Sc), Vertivore (Ve), Granivore (Gr), Invertivore (In), Nectarivore (Ne), Frugivore (Fr). Habitat: Degraded area (DA), Road (RO), River (RI), Banana plantation (BP), Ciliary Forest (CF), Building area (BA), and Waterfall (WA). Record: Species recorded by (T) transect method, (M) capture in ornithological mist nets, (DB) online database, and (PL) record in the preliminary list. ⁽¹⁾ Migrant, (*) Preliminary Record, and (**) other records from the website