BIRD COMMUNITIES IN TWO FRAGMENTS OF SEMIDECIDUOUS FOREST IN RURAL SÃO PAULO STATE

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(With 1 figure)

ABSTRACT

A quali-quantitative survey was done in two fragments (75 and 100 ha) of semideciduous forest in rural São Paulo State. The aim was to characterize the bird community according to richness, abundance, and occurrence frequency in these areas. The qualitative survey showed 145 species in the Estação Ecológica de São Carlos – EESCar (Brotas) – and 173 in the Fazenda Santa Cecília – FSC (Patrocínio Paulista), while the quantitative survey showed the presence of 60 and 72 species in EESCar and FSC respectively. The isolation and the lower environmental quality of the EESCar fragment may be responsible for the lower number of species in this area compared to that of FSC. Abundance index value analysis (IPA) showed that both areas have a large number of species with low IPA and few species with intermediate or high IPA compared to the pattern observed in other surveys. At FSC, a larger number of occurrences of species in danger of extinction in São Paulo State was also observed. Apparently, the FSC fragment had better environmental quality for sheltering a larger number of species, including the endangered ones. The study of the community of birds is important in planning management and conservation of natural areas.

Key words: bird community, semideciduous forest.

RESUMO

Avifauna em dois fragmentos de floresta estacional semidecídua do interior paulista

Foi realizado o levantamento quali-quantitativo de dois fragmentos (75 e 100 ha) de floresta estacional semidecídua do interior paulista. O objetivo foi caracterizar a comunidade de aves por intermédio da riqueza, abundância e freqüência de ocorrência nessas áreas. O levantamento qualitativo revelou 145 espécies para a Estação Ecológica de São Carlos – EESCar (Brotas) – e 173 para a Fazenda Santa Cecília – FSC (Patrocínio Paulista), enquanto o levantamento quantitativo mostrou a presença de 60 e 72 espécies para EESCar e FSC, respectivamente. O isolamento e a pior qualidade ambiental do fragmento da EESCar podem ser responsáveis pelo menor número de espécies dessa área em relação à FSC. Analisando o índice pontual de abundância (IPA), observa-se que ambas as áreas possuem grande número de espécies com baixo IPA e poucas espécies com IPA intermediário ou alto, conforme observações feitas em outros levantamentos. Na FSC foi observado também maior ocorrência de espécies ameaçadas de extinção no Estado de São Paulo. Aparentemente, o fragmento da FSC possui melhor qualidade ambiental para abrigar um maior número de espécies, inclusive as ameaçadas. O estudo da comunidade de aves é importante para a elaboração do plano de manejo e conservação das áreas naturais.

Palavras-chave: comunidade de aves, floresta estacional semidecídua.

INTRODUCTION

Semideciduous forests (SSF) of central São Paulo (Veloso *et al.*, 1992) have suffered intense devastation (Schlittler, 1999), and are now reduced and highly fragmented (Pires, 1999).

The remaining areas can, however, provide information about the original ecosystems of the State (Rodrigues & Shepherd, 1992), and should be preserved as genetic banks and opportunities for reforestation (Araújo & Teixeira, in press).

Reduction and isolation of fragmented areas (Andrén, 1994) result in decreases of species and bird populations (Laurance *et al*., 2000; Stouffer & Bierregaard, 1995). Many authors have emphasized the importance of studies of bird communities as indicators of ecosystem quality (Ramos, 1997; Moraes, 1997; Simon & Ribon, 1997), as birds constitute one of the most suitable animal groups for this purpose use as indicators environmental quality (Machado, 1995).

The present study characterizes (quali-quantitatively) the structure of bird communities as to richness, abundance, and frequency of occurrence of the species in two fragments of semideciduous forest in rural São Paulo State.

MATERIAL AND METHODS

Study area

Two remaining areas of the semideciduous forest (SSF) of São Paulo State were chosen for the present study: "Estação Ecológica de São Carlos" (EESCar) and "Reserva Ambiental da Fazenda Santa Cecília" (FSC) (Fig. 1).

EESCar is a conservation unit situated in the middle east of São Paulo State, in Brotas, between geographical coordinates 22º05' and 22º7'S and 48º00' and 48º05'W. An isolated fragment of 75.26 ha, it borders Santana Reservoir to the north; the other sides are bordered by sugarcane monoculture.

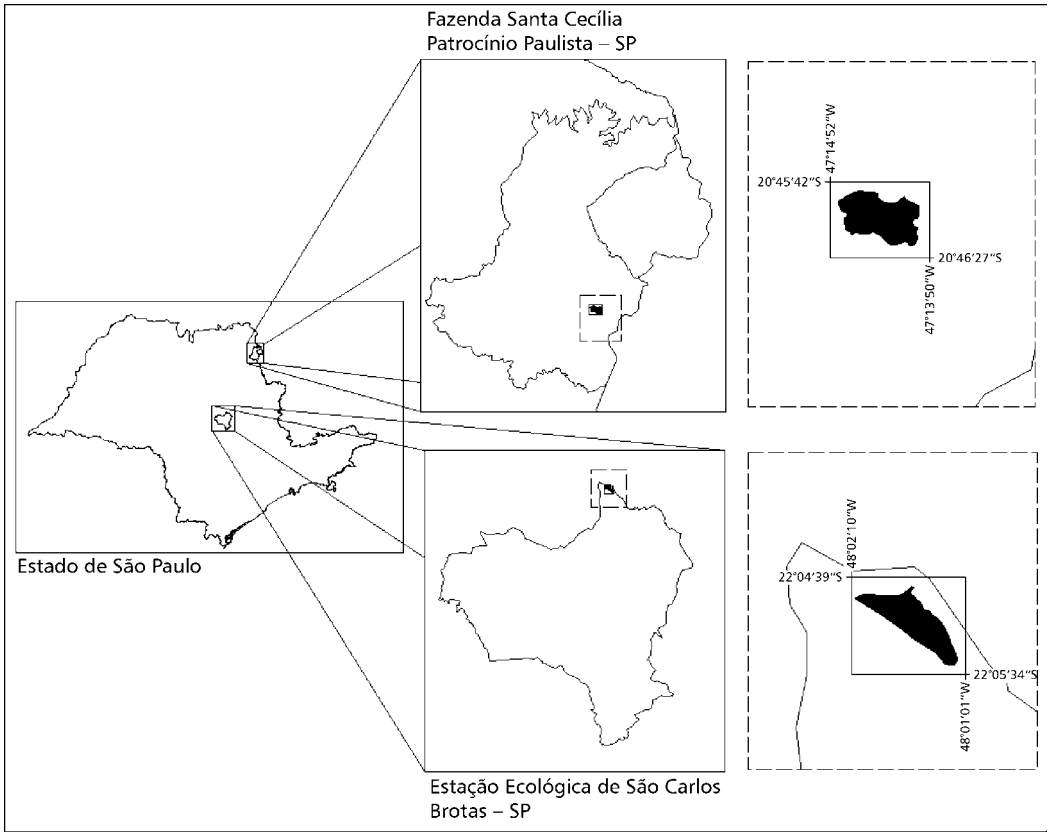

Fig. 1 — Localization of study areas.

This area was chosen because it is a preservation area close to UFSCar (30 km), where this study was developed.

The FSC is situated in Patrocínio Paulista, in northeastern of São Paulo State, between coordinates 20º46'2''S and 47º14'24''W. A remnant, it consists of 100 ha privately owned and preserved. The forest is bordered by 300 ha of *cerradão*, in addition to pastures and humid areas. This area was chosen because it is a major preserved area of northeastern São Paulo State.

Methodology

Quali-quantitative surveys were based on the sampling method by points (Vielliard & Silva, 1990).

In the period from September 2000 to August 2001, each studied area was visited 24 times, an average of 6 hours per visit, totaling 150 observation hours for each area (Table 1).

Quantitative survey

To carry out this survey, two tracks 600 m long each in each were used fragment. Five points were chosen along the tracks, 150 m distant from each other. The order of the sampling was established by raffle and the observation time in each point was 15 minutes, according to methodology adapted from Vielliard & Silva (1990). The species and respective number of individuals of each were identified auditorily and visually and noted. When doubts existed about the number of individuals, only one of each species was recorded to prevent overestimates. A mini tape recorder was used to record unknown vocalizations, for later identification. This survey was restricted to the points chosen along the tracks; it began at about 6.00 a.m.

Qualitative survey

The survey was carried out employing the same tracks used in the previous survey. The surrounding forest environment, including humid areas, pastures, *cerrado* and plantation areas were considered. All species observed, their locations, contact type (visual and/or auditory), and number of individuals were noted. All species observed in the quantitative survey were included in this survey.

RESULTS AND DISCUSSIONS

Qualitative survey

A total of 145 species were recorded in or near EESCar and 173 in FSC. The number of species recorded is significant when compared to that of other surveys using the same methodology and sampling time equal to or higher than ours (Table 2).

TABLE 1
Months and days of data assessment.

Months	2000 (days)		2001 (days)	
	EESCar	FSC	EESCar	FSC
January	–	–	8, 9	5, 6
February	–	–	7, 8	11, 13
March	–	–	3, 5	14, 23
April	–	–	9, 12	6, 7
May	–	–	21, 22	28, 30
June	–	–	1, 2	18, 19
July	–	–	10, 11	17, 18
August	–	–	22, 23	27, 30
September	22, 23	27, 28	–	–
October	18, 19	30, 31	–	–
November	21, 22	18, 19	–	–
December	12, 13	8, 9	–	–

TABLE 2
Table comparing the number of bird species and area size.

Place	Area (ha)	Number of species	Sampling time (months)
Santa Genebra, SP*	251	134	23
Santa Elisa, SP*	40	130	12
Morro Chato, SP*	30	151	12
EESCar, SP	75	145	12
FSC, SP	100	173	12

*Source: Almeida (1997).

In both areas of São Paulo State were identified endangered species (SMA, 1998). In FSC the following species were identified: *Crypturellus undulatus*, *Sarcoramphus papa*, *Propyrrhura maracana*, *Aratinga auricapilla*, *Amazona aestiva*, *Pteroglossus aracari*, *Antilophia galeata* and *Saltator atricollis.* In EESCar *Oryzoborus angolensis* was identified. The frequency of occurrence of these species as well as the maximum number of individuals recorded are in Table 3.

The occurrence of a large number of endangered species in FSC may indicate that this fragment presents better environmental quality than does EESCar and is an important area for feeding, reproduction, and resting of these species.

Frequency of occurrence

The frequency of occurrence (FO) relates the proportion of the days on which the species were found with the total number of survey days, allowing us to conclude if a given species can be regularly found or not (Vielliard & Silva, 1990). Species occurrence frequency was classified as shown in Table 4.

The FO above 75% includes resident species representing 4.8% of the species in EESCar and 20.35% in FSC.

A great part of the bird community (56.55% of EESCar and 41.86% of FSC) is composed of species with an FO inferior to 25%, appearing in less than six out of 24 visits. The lower FO or single occurrence of some species can be explained by their brief stay (rovers), such species may inhabit other environments and only occasionally exploit forest resources (occasional) or be they may migratory species.

The species recorded and their respective FO are in Table 5.

Quantitative Survey

Number of species

A total of 60 species was recorded for EESCar and 72 for FSC, with a total of 115 samples collected in each area.

TABLE 3
Percentage of species per class of frequency of occurrence.

Frequency of occurrence (%)	EESCar (%)	FSC (%)
< 25	56,55	41,86
25-49	23.45	22,09
50-74	15,17	15,70
75-99	4,83	18,60
100	0,00	1,75

TABLE 4
Species in danger of extinction observed in the study areas.

Fazenda Santa Cecília			
Specie	**Endangered class**	**Frequency of occurrence (%)**	**Maximum number of observed individuals**
Crypturellus undulatus	Vulnerable	33	2
Sarcoramphus papa	in danger	16	2
Propyrrhura maracana	in danger	45	10
Aratinga auricapilla	Vulnerable	54	17
Amazona aestiva	Vulnerable	91	5
Pteroglossus aracari	in danger	4	4
Antilophia galeata	in danger	16	2
Saltator atricollis	Vulnerable	8	2
Estação Ecológica de São Carlos			
Specie	**Endangered class**	**Frequency of occurence (%)**	**Maximum number of observed individuals**
Oryzoborus angolensis	Vulnerable	4	1

Class of endanger according to SMA (1998).

Number of contacts

In the115 sample total from each area, 630 contacts were recorded for EESCar with an average 5.4 contacts per sample, and 774 contacts in FSC for an average 6.7 contacts per sample.

Abundance index values (IPA) per species

The IPA per sampled species relates the average number of contacts of these species with the total number of samples. The IPA is a relative number but, like FO, it is comparable between measures of the same species for different dates, places, and communities (Aleixo & Vielliard, 1995). At EESCar the specific IPA varied from 0.008 (1 contact) to 0.408 (47 contacts); at FSC the IPA varied from 0.008 to 0.660 (76 contacts) (Table 5).

Both in EESCar and FSC few species had a high IPA and a great number of species showed intermediate and low numbers, compared to the pattern observed in other surveys (Vielliard & Silva, 1990; Aleixo & Vielliard, 1995; Almeida, 1997). Among species with a high IPA, some are conspicuous, like *Herpsilochmus atricapillus, Basileuterus culicivorus,* and *Vireo olivaceus* for far-reaching chant or constant vocalizations.

Some species presented a high IPA in one area and a low one in the other. This was the case with *Leptotila verreauxi, Cyclarhis gujanensis,* and *Pitylus fuliginosus,* which showed a high IPA in EESCar and a low one in FSC. On the other hand, *Chiroxiphia caudata* and *Synallaxis ruficapilla* presented a high IPA in FSC and a low one in EESCar. This could be because those species have larger populations in the areas where they presented a higher IPA, making their identification easier.

Other species were found in just one area, but with an intermediate/high IPA number. This was true of *Amazona aestiva* in FSC and *Baryphthengus ruficapillus* in EESCar. A possible explanation is that due to their non-homogenous distribution in the original environment, their territories were not included during the fragmentation process (Bierregaard *et al.*, 1992). This absence of given species in certain areas can also occur as a result of non-adaptation to a simplified environment or intensification of interspecific competition for limited or fragmented resources in their occurrence areas. Local extinction could also explain species lack in the studied areas, but real clarification depends on long-term studies on the ecology of these species.

TABLE 5

Systematic list (according to Sick, 1997) of the ornithological fauna of the forests in Estação Ecológica de São Carlos (EESCar) and Fazenda Santa Cecília (FSC), with frequency of occurency (FO = 4% – species observed on just one inspection) and abundance index values (IPA – one contact = 0.008). Habitat: F = forest, A = open areas, B = border, C = creeks and water zones.

Species	Habitat	FO (%)		IPA	
		EESCar	FSC	EESCar	FSC
Tinamidae					
Crypturellus undulatus	F	–	33	–	0.078
Crypturellus tataupa	F	29	4	0.017	0.008
Nothura maculosa	A	12	4	–	–
Phalacrocoracidae					
Phalacrocorax brasilianus	C	20	–	–	–
Anhingidae					
Anhinga anhinga	C	8	–	–	–
Ardeidae					
Casmerodius albus	C	29	–	–	–
Bubulcus ibis	A	–	50	–	–
Butorides striatus	C	16	8	–	–
Syrigma sibilatrix	A	54	16	–	–
Nycticorax nycticorax	C	4	–	–	–
Tigrisoma lineatum	C	4	–	–	–
Threskiornithidae					
Theristicus caudatus	A	–	83	–	0.052
Mesembrinibis cayennensis	C	20	12	–	0.034
Cathartidae					
Sarcoramphus papa	B	–	16	–	–
Coragyps atratus	B	25	83	–	–
Cathartes aura	B	–	4	–	–
Anatidae					
Dendrocygna viduata	C	–	12	–	–
Amazonetta brasiliensis	C	20	29	–	–
Accipitridae					
Elanus leucurus	A	–	4	–	–
Leptodon cayanensis	F	–	4	–	–
Ictinia plumbea	B	–	8	–	–
Buteo albicaudatus	A	–	20	–	–
Rupornis magnirostris	B	45	62	–	–
Buteogallus meridionalis	A	4	–	–	–
Falconidae					
Herpetotheres cachinnans	B	–	25	–	0.026
Milvago chimachima	A	8	16	–	–
Polyborus plancus	A	12	54	–	–
Falco femoralis	A	4	8	–	–
Falco sparverius	A	–	25	–	–

TABLE 5 (*Continued*)

Species	Habitat	FO (%)		IPA	
		EESCar	FSC	EESCar	FSC
Rallidae					
Aramides cajanea	C	4	–	–	–
Porzana albicollis	C	–	4	–	–
Gallinula chloropus	C	4	–	–	–
Cariamidae					
Cariama cristata	A	37	95	–	–
Jacanidae					
Jacana jacana	C	62	–	–	–
Charadriidae					
Vanellus chilensis	A	79	100	–	–
Scolopacidae					
Gallinago paraguaiae	C	–	37	–	–
Columbidae					
Columba picazuro	B	50	95	0.052	0.034
Columba cayennensis	B	4	8	0.026	0.043
Zenaida auriculata	A	25	25	–	–
Columbina talpacoti	B	83	100	–	0.017
Claravis pretiosa	B	–	4	–	–
Scardafella squammata	A	–	91	–	–
Leptotila verreauxi	B	83	45	0.356	0.052
Leptotila rufaxilla	F	4	16	0.026	–
Psittacidae					
Propyrrhura maracana	F	–	45	–	0.260
Aratinga leucophthalmus	B	12	62	–	0.017
Aratinga auricapilla	B	–	54	–	0.017
Aratinga aurea	A	4	66	–	–
Forpus xanthopterygius	B	16	45	–	–
Brotogeris chiriri	B	87	79	0.130	–
Pionus maximiliani	F	45	79	0.034	0.043
Amazona aestiva	B	–	91	–	0.278
Cuculidae					
Coccyzus melacoryphus	B	8	–	–	–
Piaya cayana	B	25	4	0.026	–
Crotophaga ani	A	58	87	–	–
Guira guira	A	4	62	–	–
Tapera naevia	B	8	–	0.017	–
Tytonidae					
Tyto alba	B	8	–	–	–

TABLE 5 (*Continued*)

Species	Habitat	FO (%)		IPA	
		EESCar	FSC	EESCar	FSC
Strigidae					
Speotyto cunicularia	A	4	62	–	–
Caprimulgidae					
Nyctidromus albicollis	B	16	4	–	0.008
Apodidae					
Streptoprocne zonaris	B	4	4	–	–
Trochilidae					
Phaethornis pretrei	B	16	25	0.008	–
Eupetomena macroura	B	29	37	–	–
Melanotrochilus fuscus	B	–	16	–	–
Colibri serrirostris	A	12	29	–	–
Chlorostibon aureoventris	B	8	45	–	–
Thalurania glaucopis	F	4	–	–	–
Amazilia fimbriata	B	54	58	0.069	0.069
Amazilia lactea	B	4	12	0.008	–
Trogonidae					
Trogon surrucura	F	37	16	0.139	0.026
Alcedinidae					
Ceryle torquata	C	33	–	–	–
Chloroceryle amazona	C	12	12	–	–
Momotidae					
Baryphthengus ruficapillus	F	58	–	0.147	–
Galbulidae					
Galbula ruficauda	B	8	8	0.017	–
Bucconidae					
Nystalus chacuru	A	–	4	–	–
Malacoptila striata	F	–	4	–	–
Ramphastidae					
Pteroglossus aracari	F	–	4	–	–
Ramphastos toco	B	25	75	0.017	0.078
Picidae					
Picumnus cirratus	B	45	4	0.017	0.017
Colaptes campestris	A	33	70	–	–
Colaptes melanochloros	A	8	–	0.008	–
Dryocopus lineatus	B	37	8	0.060	0.008
Melanerpes candidus	A	4	20	–	–
Veniliornis spilogaster	B	–	12	–	0.008
Veniliornis passerinus	B	12	–	–	–

TABLE 5 (*Continued*)

Species	Habitat	FO (%)		IPA	
		EESCar	FSC	EESCar	FSC
Thamnophilidae					
Hypoedaleus guttatus	F	–	4	–	–
Taraba major	B	58	12	0.095	0.008
Thamnophilus doliatus	B	83	58	0.086	0.060
Thamnophilus pelzelni	A	29	25	0.078	0.095
Thamnophilus caerulescens	F	33	8	0.095	0.034
Dysithamnus mentalis	F	41	41	0.200	0.191
Herpsilochmus atricapillus	F	58	87	0.373	0.660
Formicivora rufa	A	16	–	–	–
Conopophagidae					
Conopophaga lineata	F	62	62	0.121	0.147
Furnaridae					
Furnarius rufus	A	8	87	–	–
Synallaxis spixi	B	–	41	–	–
Synallaxis ruficapilla	F	8	75	0.034	0.182
Synallaxis frontalis	B	54	41	0.043	0.017
Synallaxis albescens	A	16	8	–	–
Certhiaxis cinnamomea	C	8	45	–	0.008
Anumbius annumbi	A	–	20	–	–
Automolus leucophthalmus	F	62	58	0.173	0.234
Dendrocolaptidae					
Sittasomus griseicapillus	F	8	12	0.008	0.026
Xiphocolaptes albicollis	F	4	4	0.008	–
Lepidocolaptes angustirostris	A	8	37	–	–
Lepidocolaptes fuscus	F	–	4	–	0.008
Tyrannidae					
Camptostoma obsoletum	B	4	12	–	0.017
Elaenia flavogaster	B	20	25	0.008	–
Elaenia spectabilis	B	29	33	0.008	0.017
Elaenia parvirostris	B	4	–	–	–
Serpophaga nigricans	C	–	8	–	–
Leptopogon amaurocephalus	F	4	–	–	–
Corythopis delalandi	F	37	95	0.104	0.539
Hemitriccus margaritaceiventer	B	4	4	–	–
Hemitriccus diops	F	4	–	–	–
Todirostrum cinereum	B	29	25	–	–
Tolmomyias sulphurescens	F	–	8	–	0.026
Platyrinchus mystaceus	F	29	29	0.060	0.043

TABLE 5 (*Continued*)

Species	Habitat	FO (%)		IPA	
		EESCar	FSC	EESCar	FSC
Tyrannidae					
Myiophobus fasciatus	B	12	4	–	–
Contopus cinereus	B	–	4	–	0.008
Lathrotriccus euleri	F	25	50	0.060	0.095
Cnemotriccus fuscatus	B	37	33	0.069	0.086
Xolmis cinerea	A	–	25	–	–
Xolmis velata	A	–	58	–	–
Knipolegus lophotes	A	4	50	–	–
Fluvicola nengeta	C	–	83	–	–
Arundinicola leucocephala	C	–	45	–	–
Colonia colonus	B	29	29	0.017	0.034
Gubernetes yetapa	C	8	70	–	–
Satrapa icterophrys	B	4	20	–	–
Hirundinea ferruginea	A	–	87	–	–
Machetornis rixosus	A	–	75	–	–
Myiarchus ferox	B	33	25	0.052	0.034
Myiarchus tyrannulus	B	50	45	0.095	0.017
Pitangus sulphuratus	B	58	83	0.043	0.026
Myiozetetes similis	B	16	54	0.017	0.008
Myiodynastes maculatus	B	20	29	0.008	0.026
Tyrannus savana	A	8	54	–	–
Tyrannus melancholicus	B	58	75	–	–
Pipridae					
Antilophia galeata	F	–	16	–	0.034
Chiroxiphia caudata	F	29	83	0.078	0.600
Hirundinidae					
Phaeprogne tapera	B	–	25	–	–
Progne chalybea	B	–	41	–	–
Notiochelidon cyanoleuca	B	29	91	–	–
Stelgidopteryx ruficollis	B	4	70	–	–
Corvidae					
Cyanocorax cristatellus	B	12	16	0.017	–
Troglodytidae					
Donacobius atricapillus	C	12	20	–	0.008
Thryothorus leucotis	B	16	–	–	–
Troglodytes aedon	B	12	95	–	–

TABLE 5 (*Continued*)

Species	Habitat	FO (%)		IPA	
		EESCar	FSC	EESCar	FSC
Muscicapidae					
Turdus rufiventris	B	4	20	–	–
Turdus leucomelas	B	66	95	0.104	0.147
Turdus amaurochalinus	B	–	20	–	–
Mimidae					
Mimus saturninus	A	45	83	–	–
Motacilidae					
Anthus lutescens	A	–	70	–	–
Vireonidae					
Cyclarhis gujanensis	B	66	50	0.408	0.086
Vireo olivaceus	F	45	45	0.373	0.339
Hylophilus amaurocephalus	B	–	4	–	–
Emberizidae					
Geothlypis aequinoctialis	C	16	8	–	0.017
Basileuterus flaveolus	B	58	54	0.086	0.208
Basileuterus culicivorus hypoleucos	F	66	58	0.339	0.469
Coereba flaveola	B	8	54	–	0.043
Schistochlamys ruficapillus	A	–	4	–	–
Hemithraupis ruficapilla	F	8	25	0.017	0.017
Hemithraupis guira	F	4	–	–	–
Nemosia pileata	B	16	4	0.008	–
Eucometis penicillata	F	4	8	–	0.008
Tachyphonus coronatus	B	16	20	–	–
Tricothraupis melanops	F	29	37	0.052	0.130
Habia rubica	F	70	50	0.391	0.286
Ramphocelus carbo	B	37	33	0.034	–
Thraupis sayaca	B	41	66	–	–
Thraupis palmarum	B	4	–	–	–
Euphonia chlorotica	B	33	75	0.043	0.026
Tangara cayana	B	8	41	–	0.026
Tersina viridis	B	–	12	–	–
Dacnis cayana	B	4	33	–	0.017
Conirostrum speciosum	B	20	4	0.052	0.017
Zonotrichia capensis	B	66	83	0.008	0.008
Ammodramus humeralis	A	29	20	–	–
Sicalis flaveola	A	–	79	–	–

TABLE 5 (*Continued*)

Species	Habitat	FO (%)		IPA	
		EESCar	FSC	EESCar	FSC
Emberizidae					
Volatinia jacarina	B	70	87	–	–
Sporophila lineola	B	–	37	–	–
Sporophila caerulescens	B	58	79	–	
Sporophila leucoptera	C	–	4	–	–
Oryzoborus angolensis	B	4	–	–	–
Arremon flavirostris	B	8	4	–	0.008
Coryphospingus cucullatus	A	79	33	–	0.008
Pitylus fuliginosus	F	50	16	0.156	0.026
Saltator similis	B	29	83	0.252	0.330
Saltator atricollis	A	–	8	–	–
Cacicus haemorrhous	B	–	8	–	0.017
Icterus cayanensis	B	–	12	–	–
Agelaius ruficapillus	A	4	25	–	–
Leistes superciliaris	A	–	4	–	–
Pseudoleistes guirahuro	A	8	58	–	–
Gnorimopsar chopi	A	4	75	–	–
Molothrus bonariensis	A	16	100	–	–
Passeridae					
Passer domesticus	A	–	87	–	–

It should be remembered that FSC is an area whose owners are always on the alert for harmful activity in this area, while EESCar lacks protection completely.

Even so, both areas are important for the conservation of bird communities and other animal groups. The current study can serve as a subsidy for management planning in these areas.

Fazenda Santa Cecília, which is environmentally protected, could be modified in order to become a conservation unit, governmental or private ("Reserva Particular do Patrimônio Natural") where as EESCar requires better management to qualify as a conservation unit.

Studies like this provide preliminary knowledge of fauna communities and a partial diagnosis of the environment quality of fragments studied. Further research can identify species and the fragments where they are found.

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