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Avifauna from a *campus* of Universidade Estadual do Centro-Oeste, Guarapuava, Paraná State, Brazil

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ABSTRACT. This study examined the structure and species richness of the avifauna in CEDETEG *campus* of Universidade Estadual do Centro-Oeste (Unicentro), in the urban area of Guarapuava, at Paraná State. Data were monthly taken from July 2006 to June 2007 using transects. A total of 125 bird species belonging to 42 families and 16 orders was recorded. The absence of large frugivorous species reveals the destabilization of native vegetation, evidencing that the current floristic structure does not support more specialized species. However, from the total amount of registered birds, 47 (38%) are related to the forest environment in the study area and 25 species (20%) are exclusive of this environment, pointing out the strong relevance of this *campus* for the conservation of these populations.

Keywords: avifauna, forest fragmentation, ombrophilous mixed forest.

RESUMO. Avifauna do *campus* da Universidade Estadual do Centro-Oeste, Guarapuava, Estado do Paraná, Brasil. Este trabalho objetivou analisar a estrutura e a riqueza da avifauna no *campus* CEDETEG da Universidade Estadual do Centro-Oeste (Unicentro), localizado no perímetro urbano do município de Guarapuava, Estado do Paraná. Os dados foram coletados mensalmente, entre julho de 2006 e junho de 2007, utilizando o método de transecção. Foi registrado um total de 125 espécies de aves, distribuídas em 42 famílias e 16 ordens. A ausência de grandes frugívoros acusa a desestruturação da vegetação nativa, demonstrando que a atual estrutura florística não comporta aves mais especializadas. Entretanto, do total de aves registradas, 47 (38%) estão relacionadas ao ambiente florestal, que ocorre na área de estudo, e 25 espécies (20%) do total são exclusivas deste ambiente, demonstrando a relevância do *campus* para a conservação destas populações.

Palavras-chave: avifauna urbana, fragmentação florestal, floresta Ombrófila Mista.

Introduction

Urban forest fragments play a relevant role in biodiversity maintenance. As an effect of the chaotic urban development, several bird species inhabiting forest fragments are exposed to ecological processes that affect their dependence relationship to the fragment. This relationship varies according to environmental traits and intrinsic species characteristics (GIMENES; ANJOS, 2003; VIANA et al., 1997; WARBURTON, 1997). Nevertheless, birds occurring in these locations generally represent new colonizations, since these areas are usually reforestation locations with strong human interference on composition and structure of the vegetation (ANJOS; LAROCA, 1989; KRÜGEL; ANJOS, 2000). Whitmore (1997) states that survival of several species in fragments may be of temporary occurrence, because their populations are usually very small and, thus, not viable in the long term. Other aspect to be considered is that birds depending on continuous forest environments do not present ecological traits that allow surviving in forest fragments (BLONDEL, 1991).

There are strong evidences that small forest fragments support only part of the original birds of the area, excluding species more sensitive to environmental changes (WARBURTON, 1997). Small fragments tend to be similar in fauna composition, sustaining those species more adapted to modified habitats. Small forest remnants are inclined to not be self-sustainable increasing the extinction chance of some species throughout time (GIMENES; ANJOS, 2003; VIANA et al., 1997).

Despite negative effects of fragmentation processes, small fragments also shelter high density

of some species and are used as resting areas or springboards for migratory bird species, acting as connection components among larger areas (FORMAN; GORDON, 1976). Furthermore, forest remnants may reduce the extinction rate of some species. Some natural populations may be structured in differentiated patterns, with extinction and recolonization cycles, compounding a mosaic of temporal populations interconnected by different migration degrees among them (HANSKY et al., 1996). For some species, all populations become ephemeral with distribution among forest remnants changing along the course of time. For others, the populations are characterized by one or more nuclear populations, stable in number and several satellite populations that fluctuate with the arrival of immigrants (WILLIS, 2006).

Besides the complexity intrinsic to forest fragmentation processes, frequently forest fragments are very close or inserted into urban environments. In Brazil, recent studies aim to verify the permanence of species established in environments modified by human activities. Currently, several researches have been conducted mainly in natural and modified areas situated close or in the dependences of universities (*campi*), as observed in Monteiro and Brandão (1995) and Philippsen et al. (2010). These areas commonly are urban and suburban zones comprising or not natural fragments (VOTTO et al., 2006) and studies regarding fragmentation effects in those areas have increasied (GIMENES; ANJOS, 2003). In Paraná State, new ornithological contributions were performed in forest remnants such as Galina and Gimenes (2006), Lopes and Anjos (2006) and Philippsen et al. (2010). However, for the Center-South region of the State, despite this region shelters an important forest formation, the Ombrophilous Mixed Forest, there is a considerable lack of ornithological studies. In accordance to Carvalho (1994), the Ombrophilous Mixed Forest originally covered about 40% of Paraná State. Currently, about less than 1% of this formation still remain in good conditions.

In this context, local studies are necessary to generate useful information for conservation programs of wild life and to understand processes of local extinction. Then, the present study accomplished a survey of bird species that occur in *campus* CEDETEG (Centro de Desenvolvimento Tecnológico de Guarapuava), of Universidade Estadual do Centro-Oeste (Unicentro), in Guarapuava (Paraná State) and evaluated the species composition and similarity among different habitats in the *campus*.

Material and methods

Study area

The study was performed in *campus* CEDETEG of Universidade Estadual do Centro-Oeste in Guarapuava, Paraná State, with an approximate area of 105 ha (Figure 1). Guarapuava (Paraná State) presents grassland as original vegetation (shortgrass steppe), with small remnants of Araucaria forests (MAACK 1981). Particularly inside the *campus* there is a fragment of Montane Ombrophilous Mixed Forest.

Climate in Guarapuava is under the domain of extratropical zone, resulting in mesothermic temperatures (THOMAZ; VESTENA, 2003). Annual mean temperature is 17.1ºC, with cold winter and mild summer. Temperature during warmer months is higher than 25°C and may be lower than 0°C in colder months, occurring from 10 to 20 frosts during winter. Rains are distributed over the year (mean annual rainfall close to 2000 mm), without a dry season (THOMAZ; VESTENA, 2003). The rainiest month is January and the driest month is August (MAACK, 1981). Mean altitude in the *campus* is 1,035 meters above sea level.

According to the aspects surveyed during the study in CEDETEG, different habitats were recognized: native field (NF) is the undergrowth or remaining local herbaceous vegetation; agricultural field (AF) is composed by the entire area used for experimental cultivation, then vegetation constantly changes according to crop rotation, such as *Zea mays* Lin. (corn), *Sorghum bicolor* Lin. (sorghum), *Avena sativa* Lin. (oats) and *Lolium multiflorum* Lam. (ryegrass); constructions and adjacencies (CA) that included all constructed areas in the *campus*, installations and buildings, where exotic vegetation was introduced; riparian forest (RF) that borders a stream inside the *campus* and is currently degraded with some forest clearings, but shelters native forest species of the region as *Schinus terebinthifolius* Rad. (Brazil pepper), *Dicksonia sellowiana* Hook. (fern) and *Araucaria angustifolia* (Bertol.) Kuntze (araucaria); the lake (LA) with approximately 2.08 ha of inundated area; vegetation in regeneration (VR) is the area that was burned out and deforested, then the vegetation is composed by pioneer species, *Baccharis myricaefolia* Dc. and *Baccharis dracunculifolia* Dc.; hygrophilous environment (HE), a flooded area close to riparian forest, which is constantly flooded, and after the frost period this area also suffers the harmful effects of burning; aerial space (AS), which is an artificial classification, created to represent the occurrence of species recorded only during the birds flight, moving among the different environments.

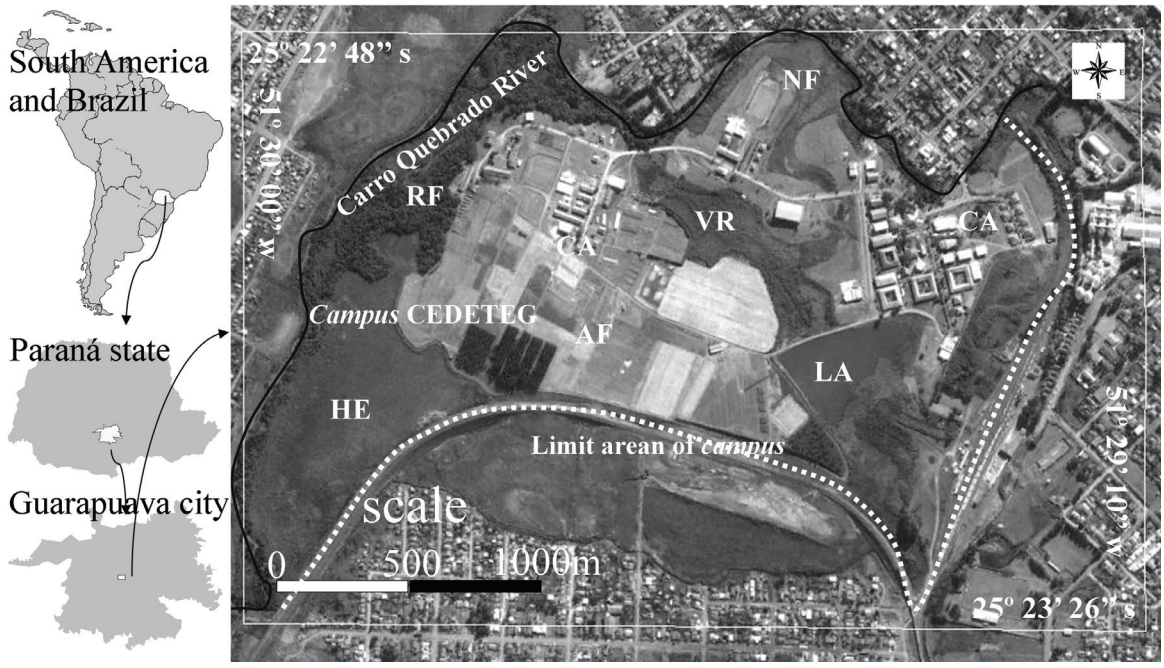

Figure 1. Location of the *campus* of the Universidade Estadual do Centro-Oeste, in Guarapuava, Paraná State, and habitats in the study area.

Sampling methods and analyses

The study area was sampled using transect methodology proposed by Bybby et al. (1993) and adapted by Zaca (2005). We chose existing roads and trails that included all habitats. Surveys were carried out monthly from July 2006 to June 2007, in the morning (7:00 - 12:00 hours), in the afternoon (13:30 - 18:00 hours) and at night (for one hour). Sampling effort summed about 130 hours of observation. Each environment was traveled an overage of 45 m, in six distinct locations, and at one forest environment (in this for approximately 2h), spending approximately 1h of displacement until the specific starting points of forest environment with a transect time similar to the other environments. The starting point was chosen through sortition, in order to minimize the effect of different times of the day on sampling. Considering that the area of each environment of the *campus* is different, qualitative analyses were performed for supplementary comparisons.

Through the qualitative survey we estimated the constancy of bird species, determined with the expression C = P x 100/Q (DAJOZ, 1983), where C = occurrence constancy of species; P = number of samples where the species occurred; Q = total number of samples taken. A species was considered constant when its frequency of occurrence was over 50%, accessory when between 25 and 50%, and accidental when under 25%. Observations were made using binoculars (7 x 35 mm). Species identification was undertaken through basic references about birds: Dunning (1987), Narosky and Yzurieta (1989) and Sick (1997). Species nomenclature and taxonomic sequence were based on the Brazilian Ornithological Records Committee (CBRO, 2008).

For trophic analyses applied to compare environments and describe the community, trophic groups were made based on Belton (1994) and Sick (1997), and adopted by Scherer et al. (2005), according to the following categories: Insectivorous – feeding mainly on arthropods; Carnivorous – feeding mainly based on vertebrates; Frugivorous - feeding mainly on fruits; Nectarivorous - feeding mainly on nectar; Necrophagous - feeding on dead animals; Omnivorous - feeding on fruits, arthropods and small vertebrates; Granivorous - feeding mainly on seeds; Piscivorous - feeding on fishes.

The classification regarding feeding strategy follows the designation of "functional group" and may be interpreted as a reflex of varied processes driving the observed species arrangement; moreover, it may be represented by the result of evolutionary processes (LUDWIG; REYNOLDS, 1988). Hence, the species were classified in regards to two types of functional groups, according to the concept developed by Wilson (1999): i) guilds of alpha type, defined in function of use of resources or diet: carnivorous, herbivorous, necrophagous, insectivorous, nectar-insectivorous, omnivorous; ii) guilds of beta type, corresponding to spatial distribution (*habitat*): open areas and/or anthropogenic, aquatic and/or paludal, border of forest, aerial space, forest and generalist, cited by Whittaker

(1977) and adopted by Magurran (1989). Jaccard similarity index was used to estimate similarity – cj = c/(a +b) – c, where cj = similarity index, a = species found in local *a*, b = species found in local *b* and c= species found in both locals (a and b), and species were grouped according to sampled environments creating *cluster* analysis using PAST software. A chi-square was also carried out to test the relationship between environments and trophic guilds.

Results and discussion

A total of 125 bird species, distributed in 42 families and 16 orders were recorded. The distribution of species by family is shown in the Figure 2. The richest families of birds not belonging to Passeriformes Order were: Columbidae with seven species (5.6%), followed by Anatidae and Ardeidae with five species (4%) from the total of species, while, Cuculidae and Picidae have four (3.2%). In Passeriformes Order, the Tyrannidae had the highest number of species $n=17$ (13.6), followed by Emberizidae $n=13$ (10.5%); further detailed results are given in (Figure 2) and (Table 1).

The breeding season for most species from Brazilian South region occurs from september to January (SICK, 1997). This fact, coupled to the arrival of migratory species, increased species richness in September (Figure 3). In addition, there was a stabilization trend in the species accumulation curve in subsequent months, because the avifauna had already been mostly registered. Despite the increase of observations, after 130 hours, there was a tendency to reduce the number of new records, despite the curve suffers eventual increase in species with low frequency of occurrence (WILLIS; ONIKI, 1981). Furthermore, the total curve of species by month decreases during non reproductive months.

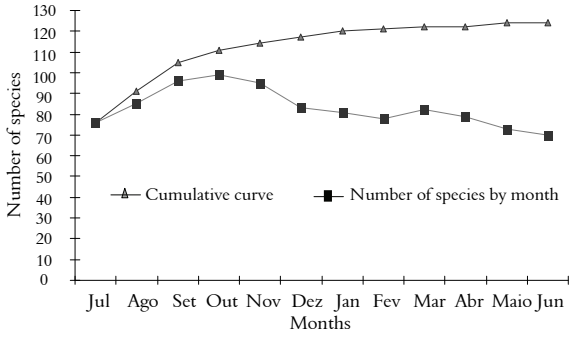

Figure 3. Species accumulation curve of avifauna monthly variation in species number and persistence of migratory species in the *campus* of Universidade Estadual do Centro-Oeste, Guarapuava, Paraná State.

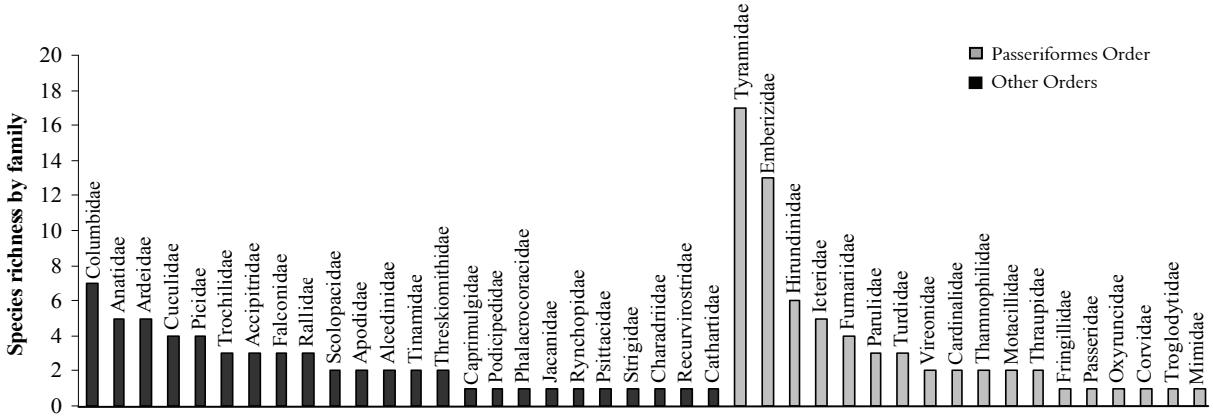

Figure 2. Species richness of each family recorded in the *campus* of Universidade Estadual do Centro-Oeste, Guarapuava, Paraná State.

Table 1. Bird species recorded in the *campus* CEDETEG, taxonomy and nomenclature are based on CBRO (2008).

Taxa	Habitats	Season FG	Sp	Su	A	W	FO%	G
Tinamiformes Huxley, 1872								
Tinamidae Gray, 1840								
Rhynchotus rufescens (Temminck, 1815)	AF/NF/HE	OTBA	x	x			66	ONI
Nothura maculosa (Temminck, 1815)	AF/NF	OTBA	x	x	x		83	ONI
Anseriformes Linnaeus, 1758								
Anatidae Leach, 1820								
Dendrocygninae Reichenbach, 1850								
Dendrocygna viduata (Linnaeus, 1766)	LA	HBAA					16	ONI
Anatinae Leach, 1820								
Cairina moschata (Linnaeus, 1758)	LA	HBAA	x				25	ONI
Anser anser (Linnaeus, 1758)	LA	HBAA	x	x	x	x	100	ONI
Anas boschas (Linnaeus, 1758)	LA	HBAA	x	x	x	x	100	ONI
Amazonetta brasiliensis (Gmelin, 1789)	LA	HBAA	x	x	x	x	100	ONI

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Taxa	Habitats	FG	Season Sp	Su	A	W	FO%	G
Podicipediformes Fürbringer, 1888								
Podicipedidae Bonaparte, 1831								
Podilymbus podiceps (Linnaeus, 1758)	LA	CGAP	x	x	x	x	100	ONI
Phalacrocoracidae Reichenbach, 1849								
Phalacrocorax brasilianus (Gmelin, 1789)	LA	CGAP	x	x	x	x	83	PIS
Ciconiiformes Bonaparte, 1854								
Ardeidae Leach, 1820								
Butorides striata (Linnaeus, 1758)	LA	CGAP	x	x	x	x	83	PIS
Ardea cocoi (Linnaeus, 1766)	LA/HE	CGAP	x			x	16	PIS
Ardea alba (Linnaeus, 1758)	LA	CGAP	x	x	x	x	75	PIS
Syrigma sibilatrix (Temminck, 1824)	HE	CGAP	x	x	x		83	PIS
Egretta thula (Molina, 1782)	LA	CGAP	x	x	x	x	91	PIS
Threskiornithidae Poche, 1904								
Mesembrinibis cayennensis (Gmelin, 1789)	RF	CGAP	x	x			25	ONI
Theristicus caudatus (Boddaert, 1783)	AF/CA/NF	CGAP	x	x	x	x	75	ONI
Cathartiformes Seebohm, 1890								
Cathartidae Lafresnaye, 1839								
Coragyps atratus (Bechstein, 1793)	AS	CGDT	x	x	x	x	41	NCO
Falconiformes Bonaparte, 1831								
Accipitridae Vigors, 1824								
Elanus leucurus (Vieillot, 1818)	NF/AS	CGBA	x	x	x		58	CAR
Elanoides forficatus (Linnaeus, 1758)	AS	CGBA	x	x			25	INS
Rupornis magnirostris (Gmelin, 1788)	AS/RF	CGBA	x	x	x	x	100	CAR
Falconidae Leach, 1820								
Caracara plancus (Miller, 1777)	AF/AS	CGBA	x			x	16	CAR
Milvago chimachima (Vieillot, 1816)	RF/NF/AS	CGBA	x	x	x	x	66	ONI
Falco sparverius (Linnaeus, 1758)	CA/NF/AS	CGBA	x	x			25	CAR
Gruiformes Bonaparte, 1854								
Rallidae Rafinesque, 1815								
Aramides cajanea (Statius Muller, 1776)	LA	OAPA	x			x	50	ONI
Aramides saracura (Spix, 1825)	RF	OAPA	x	x			16	ONI
Gallinula chloropus (Linnaeus, 1758)	LA	OAPA	x	x	x	x	100	ONI
Charadriiformes Huxley, 1867								
Charadrii Huxley, 1867								
Charadriidae Leach, 1820								
Vanellus chilensis (Molina, 1782)	LA/AF/CA/NF	CGAP	x	x	x	x	100	ONI
Recurvirostridae Bonaparte, 1831								
Himantopus melanurus Vieillot, 1817	LA	CGAP		x			8	ONI
Scolopaci Steijneger, 1885								
Scolopacidae Rafinesque, 1815								
Gallinago paraguaiae (Vieillot, 1816)	LA	CGAP	x	x			25	ONI
Calidris alba (Pallas, 1764)	LA	CGAP		x			8	ONI
Jacanidae Chenu & Des Murs, 1854								
Jacana jacana (Linnaeus, 1766)	LA	OAPA	x	x			25	ONI
Rynchopidae Bonaparte, 1838								
Rynchops niger (Linnaeus, 1758)	LA	CGAP	x				8	PIS
Columbiformes Latham, 1790								
Columbidae Leach, 1820								
Columbina talpacoti (Temminck, 1811)	AF/VR/NF/RF	HBAA	x	x	x	x	83	GRA
Columbina picui (Temminck, 1813)	AF/VR/NF	HBAA	x	x	x	x	58	GRA
Columba livia (Gmelin, 1789)	LA/AF/CA	HBAA	x	x	x	x	91	ONI
Patagioenas picazuro (Temminck, 1813)	LA/AF/RF	HBAA	x	x	x	x	83	FRU
Zenaida auriculata (Dês Murs, 1847)	LA/AF/CA/AF/NF/RF	HBAA	x	x	x	x	100	GRA
Leptotila verreauxi Bonaparte, 1855	RF	HBAA	x	x	x	x	50	GRA
Leptotila rufaxilla (Richard & Bernard, 1792)	RF	HEFL	x	x	x	x	58	GRA
Psittaciformes Wagler, 1830								
Psittacidae Rafinesque, 1815								
Pionus maximiliani (Kuhl, 1820)	CA	HEFL				x	8	FRU
Cuculiformes Wagler, 1830								
Cuculidae Leach, 1820								
Cuculinae Leach, 1820								
Coccyzus melacoryphus Vieillot, 1817	RF	CPBA		x			16	INS
Piaya cayana (Linnaeus, 1766)	RF	CPBA	x	x	x		50	INS
Crotophaginae Swainson, 1837								
Crotophaga ani (Linnaeus, 1758)	VR/NF/RF	CPBA	x	x	x	x	66	INS
Guira guira (Gmelin, 1788)	VR/NF	CPBA	x	x	x	x	75	INS
Neomorphinae Shelley, 1891								
Tapera naevia (Linnaeus, 1766)	RF	CPBA	x	x			16	INS
Strigiformes Wagler, 1830								
Strigidae Leach, 1820								
Athene cunicularia (Molina, 1782)	AF/CA/NF	CGBA	x	x	x	x	100	INS
Caprimulgiformes Ridgway, 1881								
Caprimulgidae Vigors, 1825								
Podager nacunda (Vieillot, 1817)	AS	CPBA	x	x		x	41	INS

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Taxa	Habitats	FG	Season Sp	Su	A	W	FO%	G
Apodiformes Peters, 1940								
Apodidae Olphe-Galliard, 1887								
Streptoprocne zonaris (Shaw, 1796)	AS	CPIA	x			x	33	INS
Chaetura meridionalis (Hellmayr, 1907)	AS	CPIA	x	x			16	INS
Trochilidae Vigors, 1825								
Trochilinae Vigors, 1825								
Colibri serrirostris (Vieillot, 1816)	CA/RF	NIFL	x	x		x	83	NEC
Chlorostilbon lucidus (Shaw, 1812)	CA/VR/RF	NIBA	x	x	x		41	NEC
Leucochloris albicollis (Vieillot, 1818)	CA/RF	NIFL	x	x			33	NEC
Coraciiformes Forbes, 1844								
Alcedinidae Rafinesque, 1815								
Ceryle torquatus (Linnaeus, 1766)	LA	CGAP	x	x	x	x	91	PIS
Chloroceryle amazona (Latham, 1790)	LA	CGAP	x	x	x	x	58	PIS
Piciformes Meyer & Wolf, 1810								
Picidae Leach, 1820								
Melanerpes candidus (Otto, 1796)	CA/NF	IEBA				x	8	INS
Veniliornis spilogaster (Wagler, 1827)	RF	IEFL	x	x	x	x	75	INS
Colaptes melanochloros (Gmelin, 1788)	RF	IEFL	x			x	33	INS
Colaptes campestris (Vieillot, 1818)	AF/CA/NF	IEBA	x	x	x	x	100	INS
Passeriformes Linné, 1758								
Tyranni Wetmore & Miller, 1926								
Furnariida Sibley, Ahlquist & Monroe, 1988								
Thamnophiloidea Swainson, 1824								
Thamnophilidae Swainson, 1824								
Thamnophilus caerulescens (Vieillot, 1816)	RF	CPIF	x	x	x	x	75	INS
Thamnophilus ruficapillus (Vieillot, 1816)	VR	CPBA	x	x			16	INS
Furnarioidea Gray, 1840								
Furnariidae Gray, 1840								
Furnarius rufus (Gmelin, 1788)	AF/CA/VR/NF	CPBA	x	x	x	x	100	INS
Synallaxis spixi (Sclater, 1856)	VR/RF	CPBA	x	x	x	x	66	INS
Leptasthenura setaria (Temminck, 1824)	RF	CPIF	x				8	INS
Certhiaxis cinnamomeus (Gmelin, 1788)	LA	CPBA	x	x	x	x	83	INS
Tyrannida Wetmore & Miller, 1926								
Tyrannidae Vigors, 1825								
Elaeniinae Cabanis & Heine, 1856								
Elaenia flavogaster (Thunberg, 1822)	RF	OFIB	x	x			25	ONI
Elaenia cf. *mesoleuca* (Deppe, 1830)	RF	OFIB	x	x			16	ONI
Camptostoma obsoletum (Temminck, 1824)	RF	CPBA	x	x			50	ONI
Serpophaga subcristata (Vieillot, 1817)	CA/VR/RF	OFIB	x	x	x		41	INS
Sublegatus modestus (Wied, 1831)	VR/NF/FR	OFIB	x	x	x		41	INS
Fluvicolinae Swainson, 1832								
Myiophobus fasciatus (Statius Muller, 1776)	CA/VR/RF	CPBA	x	x			33	INS
Machetornis rixosa (Vieillot, 1819)	AF/CA/NF	CPIV	x	x	x	x	91	INS
Pyrocephalus rubinus (Boddaert, 1783)	NF	CPIV				x	25	INS
Satrapa icterophrys (Vieillot, 1818)	AF/CA/NF	CPIV	x	x	x		50	INS
Xolmis cinereus (Vieillot, 1816)	AF/CA/NF	CPIV	x	x		x	58	INS
Tyranninae Vigors, 1825								
Pitangus sulphuratus (Linnaeus, 1766)	LA/AF/CA/VR/NF/HE/RF	CPIV	x	x	x	x	100	ONI
Myiodynastes maculatus (Statius Muller, 1776)	RF	OFIB	x	x			25	ONI
Megarynchus pitangua (Linnaeus, 1766)	CA	CPIV		x	x		25	ONI
Empidonomus varius (Vieillot, 1818)	RF	CPIV	x	x			50	INS
Tyrannus melancholicus (Vieillot, 1819)	CA	CPIV	x	x			50	INS
Tyrannus savana (Vieillot, 1808)	LA/AF/CA/VR/NF/HE/RF	CPBA	x	x			50	INS
Myiarchus tyrannulus (Statius Muller, 1776)	RF	CPIV	x	x			16	INS
Oxyruncidae Ridgway, 1906								
Oxyruncus cristatus Swainson, 1821	VR	CPBA	x				8	ONI
Passeri Linné, 1758								
Corvida Sibley, Ahlquist & Monroe, 1988								
Vireonidae Swainson, 1837								
Cyclarhis gujanensis (Gmelin, 1789)	RF	CPBA	x	x			50	INS
Vireo olivaceus (Linnaeus, 1766)	RF	CPBA	x	x			50	INS
Corvidae Leach, 1820								
Cyanocorax chrysops (Vieillot, 1818)	RF	OFIF	x	x			16	ONI
Passerida Linné, 1758								
Hirundinidae Rafinesque, 1815								
Tachycineta albiventer (Boddaert, 1783)	AS	CPIA	x	x			16	INS
Progne tapera (Vieillot, 1817)	AS	CPIA	x	x			25	INS
Progne chalybea (Gmelin, 1789)	CA/AS	CPIA	x	x	x	x	91	INS
Pygochelidon cyanoleuca (Vieillot, 1817)	CA/AS	CPIA	x	x	x	x	83	INS
Alopochelidon fucata (Temminck, 1822)	AS	CPIA	x	x			8	INS
Riparia riparia (Linnaeus, 1758)	AS	CPIA	x	x			25	INS
Troglodytidae Swainson, 1831								
Troglodytes musculus (Naumann, 1823)	CA/RF	CPBA	x	x	x	x	100	INS
Turdidae Rafinesque, 1815								

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Taxa	Habitats	FG	Season Sp	Su	A	W	FO%	G
Turdus rufiventris (Vieillot, 1818)	AF/CA/VR/RF	OFIB	x	x	x	x	100	ONI
Turdus leucomelas (Vieillot, 1818)	AF/CA/VR/RF	OFIF	x	x	x	x	100	ONI
Turdus amaurochalinus (Cabanis, 1850)	AF/CA/VR/RF	OFIB	x	x	x	x	100	ONI
Mimidae Bonaparte, 1853								
Mimus saturninus (Lichtenstein, 1823)	AF/CA/AF	OFIB	x	x	x	x	100	ONI
Motacillidae Horsfield, 1821								
Anthus lutescens (Pucheran, 1855)	AF	CPIV	x	x	x	x	66	INS
Anthus correndera (Vieillot, 1818)	NF	CPIV	x	x			50	INS
Thraupidae Cabanis, 1847								
Thraupis sayaca (Linnaeus, 1766)	CA/RF	OFIB	x	x	x	x	100	FRU
Thraupis bonariensis (Gmelin, 1789)	RF	OFIB	x	x	x		66	FRU
Emberizidae Vigors, 1825								
Zonotrichia capensis (Statius Muller, 1776)	AF/VR/RF	OGBA	x	x	x	x	100	ONI
Ammodramus humeralis (Bosc, 1792)	AF/NF	OGBA	x	x			66	GRA
Donacospiza albifrons (Vieillot, 1817)	VR	OGBA	x	x			66	GRA
Poospiza nigrorufa (d'Orbigny & Lafresnaye, 1837)	LA/NF	OGBA	x	x	x	x	83	ONI
Poospiza lateralis (Nordmann, 1835)	RF	CPIF	x	x	x	x	91	ONI
Sicalis luteola (Sparrman, 1789)	HE	OGBA	x				8	GRA
Sicalis flaveola (Linnaeus, 1766)	CA/NF	OGBA	x	x	x	x	83	GRA
Emberizoides herbicola (Vieillot, 1817)	AF/VR/NF/HE	OGBA	x	x		x	33	GRA
Embernagra platensis (Gmelin, 1789)	LA/RF/HE	OGBA	x	x		x	50	GRA
Volatinia jacarina (Linnaeus, 1766)	AF/VR/NF/HE	OGBA	x	x	x		66	GRA
Sporophila caerulescens (Vieillot, 1823)	AF/NF/HE	OGBA	x	x	x		66	GRA
Sporophila minuta (Linnaeus, 1758)	LA/HE	OGBA	x	x			16	GRA
Coryphospingus cucullatus (Statius Muller, 1776)	RF/HE	OGBA	x	x	x	x	100	GRA
Cardinalidae Ridgway, 1901								
Cyanocompsa brissonii (Lichtenstein, 1823)	VR	OFIB	x				8	GRA
Saltator similis (d'Orbigny & Lafresnaye, 1837)	RF	OFIB	x	x	x	x	100	GRA
Parulidae Wetmore, Friedmann, Lincoln, Miller, Peters, van Rossem, Van Tyne & Zimmer 1947								
Parula pitiayumi (Vieillot, 1817)	RF	CPIF	x	x	x	x	83	INS
Geothlypis aequinoctialis (Gmelin, 1789)	LA/VR/HE	CPBA	x	x	x	x	100	INS
Basileuterus leucoblepharus (Vieillot, 1817)	RF	CPIF	x	x	x	x	83	INS
Icteridae Vigors, 1825								
Cacicus haemorrhous (Linnaeus, 1766)	CA/RF	OFIF	x	x			50	ONI
Chrysomus ruficapillus (Vieillot, 1819)	LA/AF	OGBA	x	x			41	ONI
Pseudoleistes guirahuro (Vieillot, 1819)	AF	OGBA	x	x			41	ONI
Molothrus bonariensis (Gmelin, 1789)	LA/AF/CA/NF	OGBA	x	x	x	x	83	ONI
Sturnella militaris (Linnaeus, 1758)	AF	OGBA	x			x	33	ONI
Fringillidae Leach, 1820								
Carduelis magellanica (Vieillot, 1805)	VR/NF	OGBA	x	x	x	x	75	GRA
Passeridae Rafinesque, 1815								
Passer domesticus (Linnaeus, 1758)	LA/AF/CA/VR/NF/HE/RF	OGBA	x	x	x	x	100	ONI

LEGENDS: FG: Functional groups; OGBA= Omnivorous granivorous in borders and/or anthropogenic areas, CPBA= Carnivorous small insectivorous in borders and/or anthropogenic areas, CGAP= Carnivorous large aquatic and or/paludal, OFIB= Omnivorous frugivorous/insectivorous in borders and/or anthropogenic areas, CPIV= Small carnivorous in flight in borders and/or anthropogenic areas, HBAA= Herbivorous in borders and/or anthropogenic areas, CGBA= Large carnivorous in borders and/or anthropogenic areas, CPIA= Carnivorous small insectivorous from aerial space, CPIF= Forest carnivorous small insectivorous, OAPA= Omnivorous aquatic and/or paludal, OFIF= Forest omnivorous frugivorous/insectivorous, OTBA= Terrestrial omnivorous in borders and/or anthropogenic areas, IEBA= Trunk climber insectivorous in borders and/or anthropogenic areas, IEFL= Forest trunk climber insectivorous, HEFL= Forest herbivorous, NIFL= Forest insectivorous nectivorous, NIBA= Nectivorous insectivorous in borders and/or anthropogenic areas and CGDT= Carnivorous large detritivorous. Native field (NF), agricultural field (AF), construction (CA), riparian vegetation (RF), lake (LA), vegetation in regeneration (VR), hygrophilous environment (HE) and aerial space (AS). G: Trophic categories: omnivorous (ONI), granivorous (GRA), insectivorous (INS), frugivorous (FRU), carnivorous (CAR), necrophagous (NCO), nectarivorous (NEC) and piscivorous (PIS).

The greatest part of migratory species belongs to Tyrannidae. Some species of the genera *Tyrannus*, *Empidonomus*, *Myiarchus* and *Elaenia*, among others, present migratory habit, however, part of the population remains in the locality. Sick (1997) argued that some species may be considered as occasional within a given region and migratory in others. *Tyrannus melancholicus* and *Tyrannus savanna* were recorded from spring to the end of summer. *Myiarchus tyrannulus* occurred in small groups in the beginning of summer in riparian vegetation together with *Myiodynastes maculatus*. *Mesembrinibis cayennensis* (Green Ibis) is an important record for the region, since it is included in the red list of threatened fauna from Paraná State presenting vulnerable *status*. Besides this, we believe that this species is migratory because its frequency of occurrence was accessory (STRAUBE et al., 2004).

Moreover, feeding strategy is intimately associated to the environment and type of vegetation coverage that certain species explore (ZACA, 2005). The trophic structure evidenced the predominance of insectivorous species (36%), followed by omnivorous (32.8%) and granivorous (14.4%). Despite the great quantity of insectivorous, there were a few more specialized species, such as trunk and branch climbers (woodpeckers and woodcreepers), which suffer extensive impacts caused by fragmentation (SOARES; ANJOS, 1999). Similar data was obtained by Galina and Gimenes (2006). Actually, this category presented only three species with forest habits, indicating that the forest environment presents low capacity to support higher diversity of such birds, and species occurring are those more commonly found in altered environments.

The presence of omnivorous species may be considered as a buffering effect against resources fluctuation, mainly in environments under anthropogenic influence (BLAMIERES et al., 2001; D'ANGELO-NETO et al., 1998). As observed in this study, data evidenced that in the *campus*, in altered environment, there was predominance of species with a wide range of feeding habits, compared to those presenting omnivorous or insectivorous/frugivorous strategy (DONATELLI et al., 2007).

Regarding "functional group" strategy and environmental exploration, omnivorous/granivorous birds exploring borders of disturbed environments (14.4%, $n=18$) were predominant, followed by small carnivorous explorers of borders and disturbed environments (13.6%, $n=16$) and large carnivorous explorers of paludal environments (12.8%, $n=14$). So, when species are analyzed into functional groups, there is a high representativeness of omnivorous birds and species exclusive to forests tend to present a lower representativeness. The great amount of large carnivorous/aquatic species evidences the intense utilization of the lake in the *campus*. These species are attracted to this environment, probably because they depend on fish and amphibians occurring in that locality. At the same time, there is scarcity of studies about bird dynamics in the region, nevertheless, we believe that, despite birds visit the environment daily, they need a larger foraging area. Branco (2007) observed that in Ressaco da Fazenda a water body located in the bank of Itajaí-Açu river, abundance of heron species increased during winter. Therefore, these birds likely need environments like the lake in CEDETEG during this season, and they also visit other foraging areas.

The number of bird species was different among the studied environments ($X^2=60$, $p < 0.05$) with 47 species in riparian vegetation and 14 in hygrophilous environment. Performing the calculation discriminating the trophic guilds, we observed that the insectivorous, omnivorous and granivorous presented a distribution quite different among environments ($X^2=18.5$; 20.0 and 9.5, respectively; $p < 0.05$). On the other hand, the other guilds were more homogeneous or presented few species, sometimes lacking in some environments. In the same way, each sampled environment presented distinct proportions of species for each guild.

The result of constancy pointed that 77 (61.6%) of the species in the *campus* are resident, and that between accidental and accessories there was no numerical difference, with 24 species (19.2%) for each category, summing up 38.4%. These results are different from those pointed out by Philippsen et al. (2010) considering the resident species, which observed 46% from a total of 74 bird species in the *campus* of Universidade Estadual de Maringá, in Maringá, Paraná State. Notwithstanding, this result is expected since in *campus* CEDETEG there is a greater diversity of habitats. Regarding the representativeness of accidental species, a lower percentage was observed in comparison to the study performed by Philippsen et al. (2010).

From the total of registered birds, 47 (38% from the total) are related to forest environment, and 25 species (20%) are exclusive of this environment (Figure 4). This result emphasizes the extreme relevance of forest remnants for the local preservation of species. This environment presented few frugivorous species that are commonly found in more preserved environments. In the same way, the Trochilidae family presented only three species, *Colibri serrirostris* (White-vented Violet-ear), *Chlorostilbon lucidus* (Glittering-bellied Emerald) and *Leucochloris albicollis* (White-throated Hummingbird). In general, this family presents several species in urban areas that use floral resources of species employed in landscaping. An example of this may be verified in a survey carried out in the *campus* of Universidade Estadual de Londrina, where 13 species were registered (LOPES; ANJOS, 2006). The absence of native vegetation, in this survey, is interpreted as responsible for the low species richness in this family. Currently, the local flora has several introduced species not presenting floral resources, and considering that they are nectarivorous species, they are not adapted to the vegetation, and require a complete natural environment.

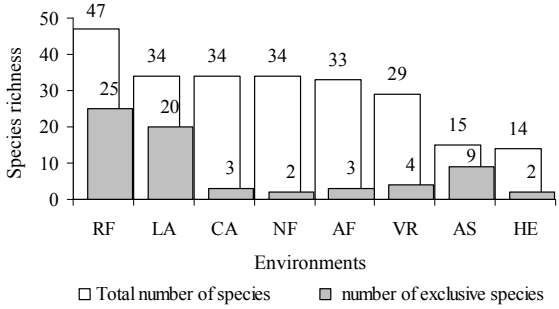

Figure 4. Number of species and environmental specificity in the *campus* of Universidade Estadual do Centro-Oeste, Guarapuava, Paraná State. Native field (NF), agricultural field (AF), construction (CA), riparian vegetation (RF), lake (LA), vegetation in regeneration (VR), hygrophilous environment (HE) and aerial space (AS).

The similarity analysis through Jaccard index, based on the presence/absence of species, indicated a

similarity of 0.46 between native and agricultural field mainly related to the occurrence of species with wide ecological plasticity. The similarity of 0.31 between native field and constructions was probably associated to the almost contiguous placement of these areas. The cluster analysis (Figure 5) evidences the graphic distance of the aerial space which is ascribed to the fact that this is an artificial category created to represent mainly Apodidae, Hirundinidae and Falconidae species. For feeding, these groups fly over the environments and during samplings they were observed only at flight. The group formed by the lake and hygrophilous environment was also expected due to the regular presence of several piscivorous species, such as representatives of the Ardeidae.

The lacustrine environment was intensely used, mainly by piscivorous species. Probably this aquatic fauna may reduce during winter months when food resource decreases, emphasizing the need of further studies focusing this subject. Additionally, some species as *Chrysomus ruficapillus* use the lake only for nidification during spring and summer.

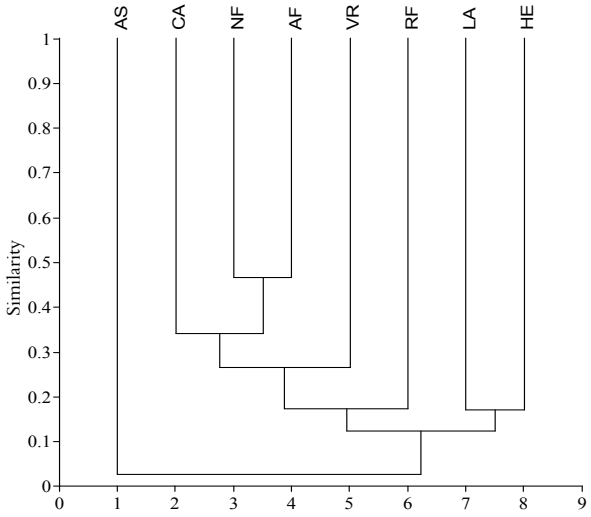

Figure 5. Cluster analysis based on the similarity of bird community in several sampled environments in the *campus* of Universidade Estadual do Centro-Oeste, Guarapuava, Paraná State. Native field (NF), agricultural field (AF), construction (CA), riparian vegetation (RF), lake (LA), vegetation in regeneration (VR), hygrophilous environment (HE) and aerial space (AS).

The Figure 5 shows that the construction, the native and the agricultural fields and the lake support a similar number of bird species. The presence of *Pionus maximiliani* in constructions is interesting; although it is a species with great mobility, it has already been considered a forest species in other studies (ZACA, 2005). Besides that, the presence of this species in constructions is associated to feeding on *Melia azedarach* (chinaberry) fruits, usually found in the *campus.* Other species only occurring in the neighborhood of the constructions is *Tyrannus melancholicus*, commonly observed using the electricity poles as observation point, from where they leave to capture insects at flight.

Among species exclusively recorded in agricultural field is *Anthus lutescens* (Pipit). This species was found between *Avena sativa* and *Lolium multiflorum*. Meanwhile, *Anthus correndera* (Correndera Pipit) only occurred in patches of native fields.

In humid vegetation, an important record was *Donacospiza albifrons* (Long-tailed Reed Finch) that occurs exclusively in this formation; only at locations where vegetation is lower. Hirundinidae includes the main representatives of aerial space that forage on several environments. Large groups of several species were observed, such as the swallow *Pigochelidon cyanoleuca* and *Progne chalybea*, mainly in the end of September, during termites swarm. The hygrophilous environment (swamp) shelters several Emberizidae species, mainly during spring and summer, such as *Sicalis luteola*. Other species observed in this environment was *Sporophila minuta* which is classified as vulnerable. Indeed, this area requires new specific researches in order to verify more specialized taxa in this environment, since vegetation diversity may influence species occurrence.

In general, most species are omnivorous, with a broad-spectrum diet, taking advantage of seasonal supply of resources and adapted to habitat fragmentation processes. During the studied period, the absence of large frugivorous, as well as mixed groups, indicates the community destabilization evidencing, thus, that the current vegetation does not sustain more specialized taxa. Meanwhile, the environment supports several accidental species, indicating the important value for the maintenance of populations under constant displacement. The great number of resident species also contradicts the fact that this environment would be completely degraded.

The records accomplished in 2008 denoting the presence of *Pyrrhocoma ruficeps*, *Buteo brachyurus, Penelope obscura* and *Ramphastos dicolorus* emphasize the importance of the *campus* as a possible strategic area for the maintenance of populations of these and other species. These records raise the number of species already occurring in the locality to 129 species. The results of the present study also indicate that part of the avifauna is associated to the paludal environment, demonstrating its importance both for food acquirement and for resting of birds during migratory route.

Conclusion

In summary, we may suppose that the *campus* CEDETEG is an environment under regeneration process, since soil use is in constant changes derived by experimental cultivations or even by a recent reforestation that tend to converge in regards to the number of species and community structure. This is the first study for the region emphasizing the importance of further studies. Considering its importance for the maintenance of the populations, there is still much to be investigated, but its relevance is evident as resting areas for birds during displacement, such as *Dendrocygna viduata* and even *Rynchops niger*, first recorded in the region.

At a regional level, the *campus* is an environment where conservationist initiatives may be undertaken to assure species maintenance, since the region is still going through a deforestation process and burnings threatens the viability of several bird species. Therefore, the herein registered bird species still encountered in the *campus* CEDETEG reasonable conditions for their survival and exploit this locality as escape area even with the negative effects of forest fragmentation.

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