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Bird community structure in riparian environments in Cai River, Rio Grande do Sul, Brazil

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Resumo

Estrutura da comunidade de aves em ambientes ciliares no Rio Cai, Rio Grande do Sul, Brasil. A urbanização produz mudanças nos ambientes ciliares, causando efeitos na estrutura das comunidades de aves, as quais respondem de forma diferenciada aos impactos. Comparamos riqueza, abundância e composição de aves em ambientes ciliares com diferentes características no Rio Cai, Rio Grande do Sul. Realizamos observações em ambientes de mata, campo e em área urbana, entre setembro de 2007 e agosto de 2008. Registramos 130 espécies de aves, 29 espécies exclusivas na mata e uma espécie ameaçada de extinção: *Triclaria malachitacea*. A abundância de aves diferiu entre os ambientes de mata (n = 426 indivíduos) e urbano (n = 939 indivíduos) ($F_{2,6}$ = 7,315; P = 0,025). A composição de espécies e as guildas alimentares diferiram significativamente na estrutura das comunidades de aves nos três tipos de ambientes ciliares. Nos ambientes campo e urbano houve mais insetívoros generalistas, enquanto que nos ambientes de mata encontramos mais insetívoros de folhas e tronco e frugívoros, sensíveis à antropização. Aves podem ser indicadoras biológicas e contribuem com funções relevantes no ecossistema. Com o conhecimento da estrutura das comunidades de aves e suas necessidades, é possível implementar práticas de manejo para restauração dos ambientes ciliares degradados.

Palavras-chave: Aves frugívoras; Aves insetívoras; Campo; Fragmentação de habitats; Mata ciliar

Abstract

Urbanization produces changes in riparian environments, causing effects in the structure of bird communities, which present different responses to the impacts. We compare species richness, abundance, and composition of birds in riparian environments with different characteristics in Cai River, Rio Grande do Sul, Brazil. We carried out observations in woodland, grassland, and urban environments, between September 2007 and August 2008. We listed 130 bird species, 29 species unique to woodland environment, and an endangered species: *Triclaria malachitacea*. Bird abundance differed from woodland (n = 426 individuals) to urban environments (n = 939 individuals) ($F_{2,6}$ = 7.315; P = 0.025). Species composition and feeding guilds differed significantly in the bird community structures among these three riparian environments. In the grassland and urban environments there were more generalist insectivorous species, while in the woodland environments we find more leaf and trunk insectivorous species and frugivorous species, sensitive to human impacts. Bird species can be biological quality indicators and they contribute to ecosystems performing relevant functions. With the knowledge on bird community structure and their needs, it is possible to implement management practices for restoration of degraded riparian environments.

Key words: Fragmentation of habitats; Frugivorous birds; Grassland; Insectivorous birds; Riparian woodland

Introduction

Urbanization processes introduce changes to environment. Compared to other vertebrates, bird communities present a mechanism to explore urban effects and a response to different environmental gradients through species composition (CHACE; WALSH, 2006). A study suggests, however, that bird communities in urban areas are dominated by few more generalist species with low frequency and maybe small population size (MANHÃES; LOURES-RIBEIRO, 2005) which present a response to urban environment and vegetation characteristics (ONEAL; ROTENBERRY, 2009). Poor habitat conditions produce some negative effects to bird populations and communities, such as low reproductive success, species loss, parasitism, diseases, and competitive interactions (MARINI, 2000; METZGER, 2003; RIBON et al., 2003; CHACE; WALSH, 2006). There are several urbanization effects, one of them is habitat fragmentation, creating complex environment gradients. Bird communities respond to environmental changes, often with decreased overall regional diversity (CROOKS et al., 2004) and community structure changes (NORES et al., 2005). Bird species that evolved in non-fragmented forests lack the ecological characteristics that allow them to survive in forest fragments (SICK, 1997). Moreover, the degree of tolerance of each species to its environment changes depends on its ability to adapt or broaden its niche in order to adjust to habitat conditions, so that birds exhibit a functional response to habitat configuration (NORES et al., 2008; GILLIES; CLAIR, 2010).

We can see that urbanization has important impacts on bird communities in many environments, especially riparian forest. Riparian forest is an important habitat for bird communities for many purposes, and it frequently serves as a corridor for bird species and support more species of breeding birds (SEKERCIOGLU, 2009). Riparian fragmentation is a severe consequence of urbanization and directly affects bird community structure, so that bird species richness and density decrease with urbanization increase and native vegetation reduction (ROTTENBORN, 1999).

Birds are ecological indicators, so that species richness, abundance, and group composition can indicate conservation state, forests degradation, or recuperation (STOTZ et al., 1996). Ultimately, the impact of increasing urbanization on birds in riparian environments depend on their sensitivity to variation of local habitat and surrounding ecosystem, as well as resources availability, so, it is necessary to acknowledge the local avifauna diversity (ONEAL; ROTENBERRY, 2009).

A study in the Atlantic Rainforest showed the importance of the riparian environments heterogeneity to bird communities, so, we expect to find more species richness in preserved environments (ANJOS et al., 2007). Along Uruguay River, in Southern Brazil, researchers found smaller bird richness in environments further away from riparian forest, showing that bird community structure is very different along riparian ecosystem gradient (NORES et al., 2005). In Sinos River, in Rio Grande do Sul, Brazil, a variation in bird communities in different gradients of anthropogenic alteration was also found (PETRY; SCHERER, 2008). Heavily impacted riparian environments had lower bird richness and abundance and more generalist and/or opportunistic species, a result of decreased resources availability for birds (PETRY; SCHERER, 2008). In the Paranhana River tributaries, in Rio Grande do Sul, Brazil, bird community structure varied among different characteristics of riparian environment, so that most preserved forests have more bird richness and feeding guilds, which are important to the natural economy (BRUMMELHAUS, 2008).

With the knowledge on bird species or groups affected by urbanization of riparian systems, it is possible to better predict species responses with the expansion of urbanization, and perhaps minimize its effects on bird communities. Therefore, we compare bird richness, abundance, composition, and trophic structure in woodland, grassland, and urban areas along the Cara Stream, in Cai River, Rio Grande do Sul, Brazil.

Materials and Methods

Study area

We carried out this study in riparian environments in the Cara Stream, in the town of Feliz (29°26'S;51°18'W), on the lower slope of Serra do Nordeste Hills, and bordering with Serra Gaucha Hills (Rio Grande do Sul, Brazil), an Atlantic Rainforest biome. This town has 12,359 inhabitants and 76% of its population live in urban areas; it is bounded by Cai River and some tributaries, among them the Cara Stream, which also has low lands and sometimes it forms flood plains (RAMBO, 1994; IBGE, 2010).

Topography consists of valleys, hills, and plains of 30m altitude (RAMBO, 1994). Sub-mountainous deciduous forest region is characterized by a high predominance of Euphorbiaceae species associated to Fabaceae, and a high frequency of Moraceae and Meliaceae individuals (TEIXEIRA et al., 1986). Although abundant, epiphytes and lianas don't have much species richness and palms are represented solely by Queen palm (*Syagrus romanzoffiana*) (TEIXEIRA et al., 1986).

Climate is temperate, with temperatures ranging from 5°C to 39°C and a mean annual temperature of 20°C. We have four well-defined seasons, with their inherent variations: Spring (September/December), Summer (December/March), Autumn (March/June), Winter (June/September) (CPTEC/INPE, 2011).

Sampling units

We randomized nine riparian environments: three open grasslands (grasslands); three open residentials (urban), and three riparian forests (woodlands). These environments were delimited along the Cara Stream banks, 1 to 5km away from each other. Grassland environments have typical Gramineae vegetation, proper for raising dairy cattle, always with pens for animals. Subsistence farming is observed, surrounded by fragments of riparian forest. Urban environments have human habitations arranged close to one another. A majority of these residences have sewage pipes emptying in the stream. A few industries are also found near the stream, along with a cargo transportation firm. Some points accumulate trash, despite the weekly trash collection provided by the municipality. Woodlands are composed by middle-size trees, with a sub-forest made up of bushes, vines, and lianas, as well as older trees with a higher canopy. Along the observation route, the areas have preserved vegetal coverage, with a width of 50m or more. There is human impact, with some residences nearby and the opening of roads for sports trails, agriculture, and forestry.

Bird sampling

We carried out eight samplings in each kind of environment between September 2007 and August 2008, twice for each season. We used four fixed points to determine bird richness and abundance in each environment, totaling 36 fixed points (VIELLIARD, 2000). Each point has a minimal distance of 200m between a point and another one (BIBBY et al., 2000). Sampling time at each point was 15min, with records made of all birds sighted and/or heard, performing visual observations through binoculars (8×40) (based on individuals detected within 50m). Watching was not carried out on days of intense wind, rain, or fog. Data collection was carried out in the morning, when birds are more active. Identification guides were consulted (LA PEÑA; RUMBOLL, 1998; SIGRIST, 2009). Taxonomic and systematic sequences were based on the Brazilian birds list standardized by the Brazilian Committee of Ornithological Records (CBRO, 2011).

The feeding guilds considered were frugivores, trunk insectivores, foliage insectivores, generalist insectivores, ground omnivores, canopy omnivores, nectarivores, carnivores, and granivores. The bird species classification into feeding guilds was based on the main feeding strategies described by Sick (1997), Belton (2003), Lopes and Anjos (2006), and La Peña (2006).

Data analysis

Variance analysis (ANOVA) and multivariate repeated measures analysis (GLM – General Linear Model) were used to test whether the mean abundance and species richness differed among seasons and different riparian environments, and among feeding guilds and environments. Post Hoc test through Tukey Multiple Comparisons was used to perform comparison probabilities of species richness and abundance. The Kruskal-Wallis test was used for non-parametric data (bird abundance of foliage insectivore, granivore, and ground omnivore). The level of significance for all results was set at $p < 0.05$. Cluster analysis through Euclidian distances was used to determine bird composition in different environments, considering species richness and abundance (MCGARIGAL et al., 2000). For all analysis we used the software Systat 13.

Results

Out of the 130 bird species listed in nine sampling areas (Appendix), we found 83 species in the woodland and urban environments and 87 species in the grassland environment. Twenty-nine species were unique to woodland, seven were unique to grassland and nine were unique to urban environments. There were no significant differences in mean species richness among the environments, unlike among seasons (Table 1; Figure 1). 2,086 individuals were listed: 426 in woodland, 721 in grassland, and 939 in urban areas. Mean abundance differed significantly between woodland and urban environments (Table 1; Figure 2).

We listed 26 foliage insectivorous species, 24 generalist insectivorous, 18 frugivorous, 12 granivorous, 11 canopy omnivorous, 11 soil omnivorous, 10 trunk insectivorous, 6 nectarivorous, 6 carnivorous, 4 piscivorous, and 2 scavengers (Appendix). In woodland, foliage insectivores had the greatest species richness, accounting for 31.3% of the community, followed by frugivores (20.5%) and trunk insectivores (12.1%) (Figure 3). In grassland, 23% of species were generalist insectivores, 14.8% were foliage insectivores, and 12.4% were frugivores. And in urban areas, generalist insectivores accounted for 26.5% of species, granivores accounted for 13.3%, and both foliage insectivores and frugivores accounted for 12%. We found significant differences in species richness and abundance among feeding guilds, as well as interaction between environments and feeding guilds (Table 1), and for many feeding guilds among different riparian environments (Table 2).

TABLE 1: Analysis of variance (ANOVA) and General Linear Models (GLM) for bird richness and abundance among different riparian environments and among bird feeding guilds of the Cara Stream, Feliz, Rio Grande do Sul, Brazil.

	Richness			**Abundance**		
	F	*df*	*P*	*F*	*df*	*P*
Environments	0.148	2.6	0.866	7.315	2.6	0.025
Seasons	10.146	3.18	< 0.001	0.615	3.18	0.614
Feeding guilds	33.350	8.48	< 0.001	13.652	8.48	< 0.001
Environments × seasons interaction	1.049	6.18	0.428	1.017	6.18	0.445
Envrinments × feeding guilds interaction	16.646	16.48	< 0.001	8.856	16.48	< 0.001

FIGURE 1: Bird richness mean in riparian environments and different seasons along the Cara Stream, Feliz, Rio Grande do Sul, Brazil.

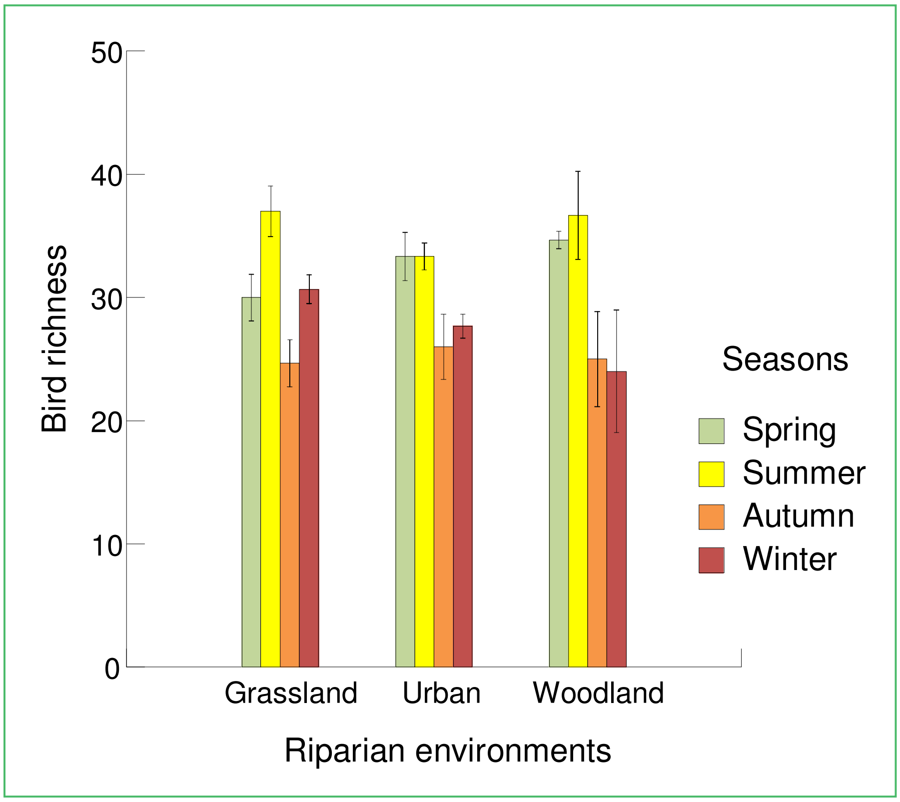


FIGURE 2: Bird abundance mean in riparian environments and different seasons along the Cara Stream, Feliz, Rio Grande do Sul, Brazil.

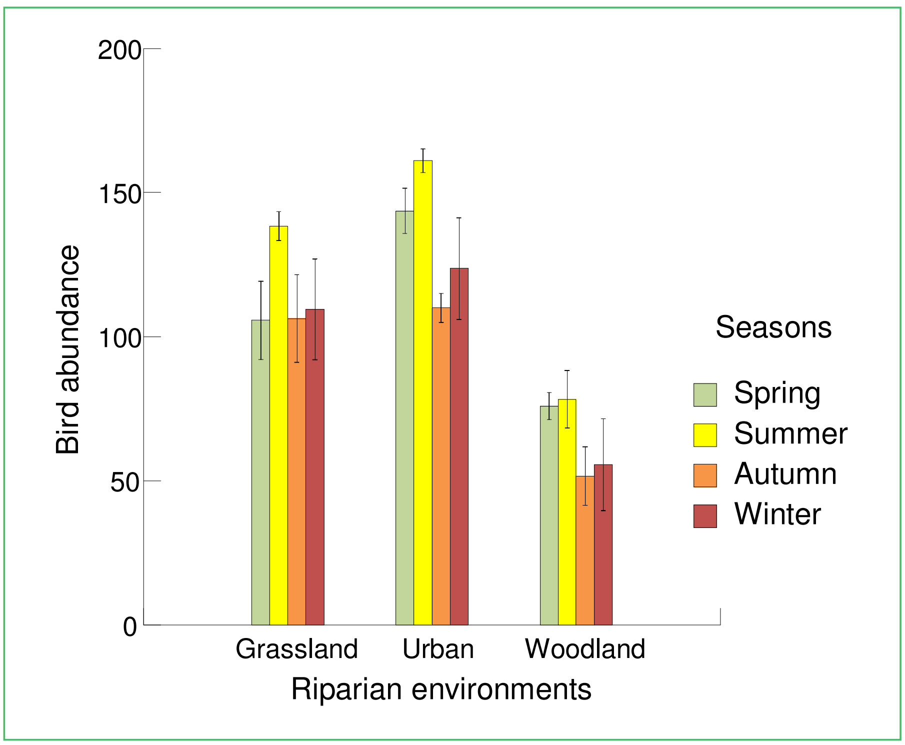
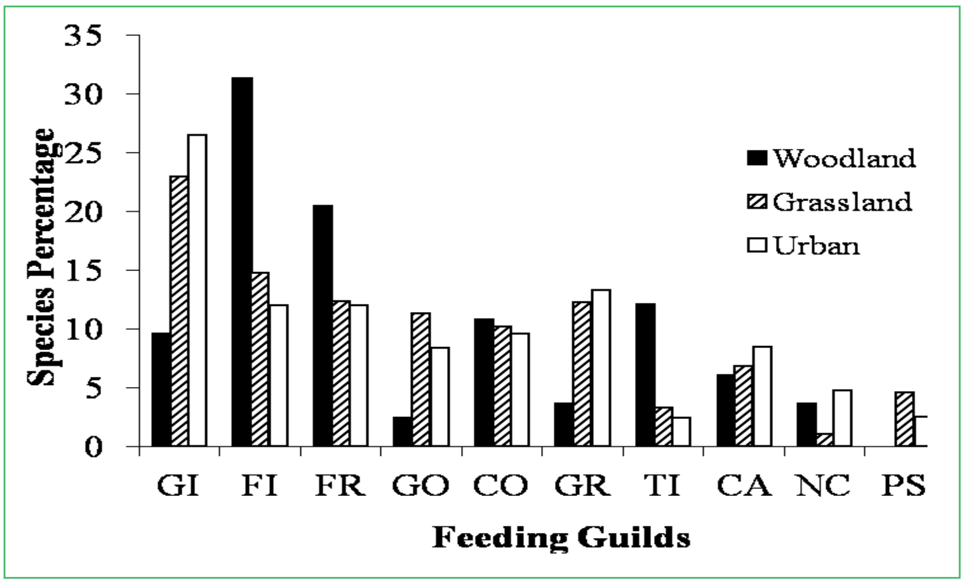


TABLE 2: Analysis of variance (ANOVA) and General Linear Models (GLM) for bird richness and abundance of feeding guilds among different riparian environments of the Cara Stream, Feliz, Rio Grande do Sul, Brazil. Post Hoc test through Tukey Multiple Comparisons was used to perform pairwise probabilities comparison among feeding guilds.

	Richness among environments			Abundance among environments			Post hoc test
	F	*df*	*P*	*F*	*df*	*P*	
Feeding guilds	16.646	16; 48	< 0.001	8.579	16; 48	0.002	
Frugivore	6.540	2; 6	0.031	2.954	2; 6	0.128	W – G
Trunk insectivore	20.727	2; 6	0.002	25.292	2; 6	0.001	W – G W – U
Generalist insectivore	28.034	2; 6	0.001	35.621	2; 6	< 0.001	W – G W – U
Foliage insectivore	20.324	2; 6	0.002	*H=5.647	*2	* 0.059	W – G W – U
Granivore	12.552	2; 6	0.007	*H=7.261	*2	* 0.027	W – G W – U
Carnivore	4.900	2; 6	0.055	68.561	2; 6	< 0.001	W – G W – U G – U
Ground omnivore	36.375	2; 6	< 0.001	*H=5.422	*2	* 0.066	W – G W – U
Canopy omnivore	1.091	2; 6	0.394	7.969	2; 6	0.020	W – G
Nectarivore	1.909	2; 6	0.228	2.683	2; 6	1.147	

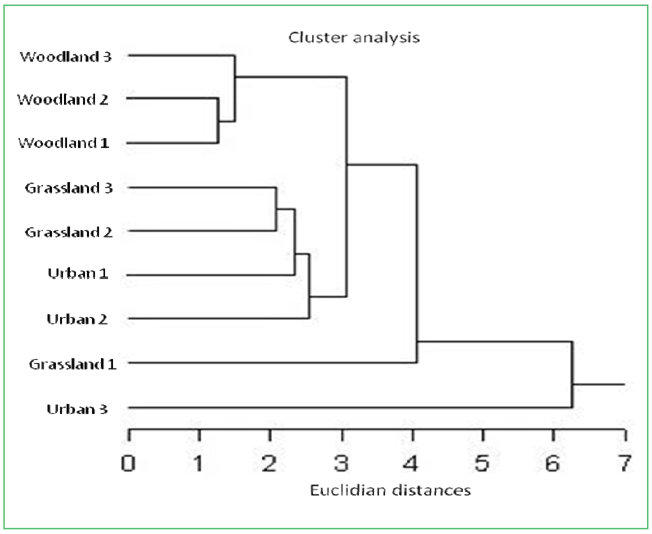
* Results of Kruskal-Wallis analysis for non-parametric data. G – grassland, W – woodland, U – urban.

FIGURE 3: Distribution of bird feeding guilds in riparian environments along the Cara Stream, Feliz, Rio Grande do Sul, Brazil. GI: generalist insectivorous; FI: foliage insectivorous; FR: frugivorous; GO: ground omnivorous; CO: canopy and sub-canopy omnivorous; GR: granivorous; TI: trunk insectivorous; CA: carnivorous; NC: nectarivorous; PS: piscivorous.



Cluster analysis revealed that woodlands had the greatest similarity to one another and differed from other environments (Figure 4). Grasslands 2 and 3, Urban environments 1 and 2 were similar to one another. Grassland 1 and Urban environment 3 had least degree of similarity to all other environments.

FIGURE 4: Similarity measures of Euclidian distance in different riparian environments along the Cara Stream, Feliz, Rio Grande do Sul, Brazil.



Discussion

Our results revealed no significant differences in bird richness, species number was similar between woodland, grassland, and urban environments, but there was a variation in the composition of bird species (Table 1; Appendix). Variation in avian community structure is closely related to many environmental variables associated with landscape changes (ROTTENBORN, 1999). Along the Cara Stream, we can see increasing urbanization as the main consequence to its original landscape change, directly affecting the bird community structure.

We observed in the environments less impacted by urbanization (woodlands) 29 unique species, indicating the great importance of these areas, where many bird species found their feeding and nesting resources and also protection (Appendix). This result also shows how urbanization can impact habitats through bird species richness loss, as well as to influence the whole ecosystem. Among exclusive species, we listed Blue-bellied Parrot (*Triclaria malachitacea*), which is a scarce resident classified as vulnerable in the category of threatened species, because habitat loss and degradation (BIRDLIFE INTERNATIONAL, 2000; MARQUES et al., 2002; BELTON, 2003; FONTANA et al., 2003). Seven trunk insectivorous species were listed, including Black-billed Scythebill (*Campylorhamphus falcularius*), which is found occasionally in woodlands (BELTON, 2003). Grassland and urban environments have more generalist bird species, which found their resources easily in changed habitats, as Picui Ground-Dove (*Columbina picui*) and Tropical Kingbird (*Tyrannus melancholicus*). It shows us that habitat selection by each species depends on its functional needs in response to environment configuration (ONEAL; ROTENBERRY, 2009; GILLIES; CLAIR, 2010), which indeed confirms the difference in bird communities structure in different riparian environments.

In addition, species richness increased mainly on Spring and Summer (Table 1; Figure 1), which is the beginning of the breeding season, favored by species migration to Rio Grande do Sul. Fork-tailed Flycatcher (*Tyrannus savana*), Swainson's Flycatcher (*Myiarchus swainsoni*), Boat-billed Flycatcher (*Megarynchus pitangua*), Streaked Flycatcher (*Myiodynastes maculatus*), and Red-eyed Vireo (*Vireo olivaceus*) are migrant Summer residents that nest in this state (BELTON, 2003) and they found their resources in most environments. In the other hand, White-winged Becard (*Pachyramphus polychopterus*), which also is a migrant Summer resident, was only observed in woodland preserved environments with reproduction evidences.

In Figure 2, we note a greater bird number in urban environments. There was also a significant difference between woodlands and urban environments (Table 1). In open areas, a large number of birds were sighted in vegetable gardens and yards, taking advantage of food source availability, as well as in empty lots with a large amount of grasses with seeds (Saffron Finch (*Sicalis flaveola*), Rufous Hornero (*Furnarius rufus*), Southern Lapwing (*Vanellus chilensis*), Picui Ground-Dove (*Columbina picui*), and Shiny Cowbird (*Molothrus bonariensis*)). This finding corroborates that described by Blake (1983), Ruszczyk et al. (1987), Anjos et al. (2007) and Chan et al. (2008), who state that bird abundance is influenced by food sources availability.

In open environments, such as urban and grasslands, generalist insectivores were found in a greater proportion of bird species, showing that they exhibit a greater plasticity. They were also listed in woodlands (Figure 3; Appendix). Ground omnivorous, carnivorous, and granivorous feeding guilds also showed that they are more tolerant to changes caused by human impact. Bird richness and abundance among these guilds have been influenced by the differences found among urban, grassland, and woodland environments (Table 1; Figures 3 and 4). In grassland and urban areas food remains associated with human or cattle are found, even as breeding sites near the buildings made by man. Southern Lapwing (*Vanellus chilensis*), Rufous-bellied Thrush (*Turdus rufiventris*), Rufous-collared Sparrow (*Zonotrichia capensis*), Roadside Hawk (*Rupornis magnirostris*), and other bird species present in grassland and urban environments showed that such areas have enough food sources and nesting opportunities for various populations. These species are well adapted to human presence and they find all resources necessary to their lifecycle in these environments. However, the carnivore Collared Forest-Falcon (*Micrastur semitorquatus*), which is considered rare in Rio Grande do Sul, Brazil, and whose resources are usually found in more preserved forests (BELTON, 2003), was heard only in urban environment. The ground omnivore Tataupa Tinamou (*Crypturellus tataupa*) was also listed in urban environment. Although being species with strong vocalization, which allows us to hear from a long distance, both bird species were listed in a forest corridor very close to urban environment (up to 50m from the fixed point), which has a connectivity with a more preserved forest. This shows the importance of preserved ecological corridors for birds, even close to impacted environments.

Although foliage insectivores have greatest number of bird species among feeding guilds (Figure 3), they prefer woodland environments where they find a greater availability of their foods and nesting sources. More than ten bird species of foliage insectivores were observed only in woodland environments during one year of observation, significantly contributing to difference in bird community structure in woodland, grassland, and urban environments (Table 2; Figure 4). Rufous-breasted Leaftosser (*Sclerurus scansor*) is one of such species. It is considered an uncommon resident in Rio Grande do Sul, Brazil, and feed only inside forests (BELTON, 2003). Even other foliage insectivorous bird species listed in grassland or urban environments were associated with scattered trees or shrubs. As we could detect, this guild responds negatively to food reduction or disappearance of invertebrates to the detriment of forest decrease (ROTTENBORN, 1999; SEKERCIOGLU et al., 2002).

Another feeding guild that favored differences in bird community structure in woodland, grassland, and urban environment is that of frugivores, whose bird species richness varied significantly among environments (Table 2). This guild was found especially in woodlands, something which demonstrates its greater sensitivity to environmental degradation. This is particularly true among larger frugivores, such as Blue-bellied Parrot (*T. malachitacea*) and Red-breasted Toucan (*Ramphastos dicolorus*), observed only in woodland environment, as described by Ribon et al. (2003) and Anjos et al. (2007). In anthropized environments (urban and grassland), we observed frugivores bird species with a smaller body, such as Sayaca Tanager (*Tangara sayaca*), Blue-and-yellow Tanager (*Pipraeidea bonariensis*), and Purple-throated Euphonia (*Euphonia chlorotica*), confirming the data from Nores et al. (2005), who detected birds with smaller body as the distance from riparian forest increases.

Trunk insectivores also demonstrate greater sensitivity to riparian fragmentation, because they need tree trunks, epiphytes, and different vegetation strata to search for prey and nest building, also, they have a low degree of colonization in small forest fragments (SOARES; ANJOS, 1999). Black-billed Scythebill (*Campylorhamphus falcularius*), which was listed only in one woodland environment, is very vulnerable to environment changes, as it requires specific substrates for feeding and nesting (POLETTO et al., 2004). Although Olivaceous Woodcreeper (*Sittasomus griseicapillus*) was found only in woodlands, something which demonstrates its preference for this kind of environment, it is a flexible species and tolerant to fragmentation (POLETTO et al., 2004). The same is true for White Woodpecker (*Melanerpes candidus*).

Riparian environments with distinct characteristics with regard to vegetal coverage and human impact offer different resources to a large abundance of bird species and restrict the living conditions of more sensitive bird species (LIM; SODHI, 2004; ANJOS et al., 2007; CHAN et al., 2008; ONEAL; ROTENBERRY, 2009). We demonstrated that species richness, abundance, and composition of bird communities are influenced by the preservation degree of riparian environments and consequent changes in availability of food and nesting resources. We agree with Crooks et al. (2004) when they say that bird communities in urbanizing environment are shaped by differential responses of individual species to development and habitat loss. Birds are considered of great importance in the natural economy, and the greater their specialization in feeding and reproduction, the more likely they are to suffer the consequences of habitat destruction (SEKERCIOGLU et al., 2011), affecting, in fact, the entire community structure.

Thus, some bird species are biological quality indicators, dependent upon their environments for survival, thereby demonstrating that the recuperation and preservation of riparian woodlands is an urgent need. Birds themselves are essential to the environmental restoration processes. Seed dispersal by frugivorous birds is an important process for reducing the cost of restoring degraded land; many insectivorous birds are specialized in providing ecosystem services, such as insect control (SEKERCIOGLU et al., 2011). Blue-bellied Parrot and Red-breasted Toucan are frugivorous and residents in Rio Grande do Sul, Brazil; they require extensive areas of preserved forest to find their food throughout the year, because the yield is spatially differentiated in the four seasons. At the same time, these species maintain their population size with plenty of food and breeding sites, contributing to processes of maintenance and recovery of riparian and forest ecosystems by dispersing seeds throughout the year. Other resident species present conservation interest, because they contribute to the maintenance of the ecosystem. Most foliage and trunk insectivorous that we observed in this study are residents and present ecological interest. They are second order food chain predators and they reflect the riparian environments condition. So, neither can be replaced by other taxa (SEKERCIOGLU et al., 2011).

Our study provides unpublished and relevant information on bird communities structure in riparian environments in a tributary of Cai River. Through this knowledge, one can implement management practices for riparian restoration of degraded environments in the region. Decisions on the riparian environments management should consider woodlands preservation in a minimum area over the streams and also forest corridors that allow connectivity to native forest, providing conditions and resources for feeding, nesting, and protection of bird communities, benefiting the whole ecosystem. Political actions should address benefiting riverine populations and encouraging the riparian forest restoration with planting and care for native plants seedling over the streams.

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APPENDIX: Bird species and feeding guilds observed in riparian environments of Cara Stream, Feliz, Rio Grande do Sul, Brazil.

	Environment			Feeding guilds
	G	U	W	
Tinamidae Gray, 1840				
Crypturellus obsoletus (Temminck, 1815)			X	Ground omnivore
Crypturellus tataupa (Temminck, 1815)		X	X	Ground omnivore
Cracidae Rafinesque, 1815				
Ortalis guttata (Spix, 1825)	X	X	X	Frugivore
Ardeidae Leach, 1820				
Butorides striata (Linnaeus, 1758)	X	X		Piscivore
Bubulcus ibis (Linnaeus, 1758)	X	X	X	Generalist insectivore
Ardea alba Linnaeus, 1758	X			Piscivore
Syrigma sibilatrix (Temminck, 1824)	X			Generalist insectivore
Egretta thula (Molina, 1782)	X	X		Generalist insectivore
Threskiornithidae Poche, 1904				
Phimosus infuscatus (Lichtenstein, 1823)	X	X		Ground omnivore
Cathartidae Lafresnaye, 1839				
Cathartes aura (Linnaeus, 1758)			X	Scavenger
Coragyps atratus (Bechstein, 1793)	X	X	X	Scavenger
Accipitridae Vigors, 1824				
Rupornis magnirostris (Gmelin, 1788)	X	X	X	Carnivore
Falconidae Leach, 1820				
Caracara plancus (Miller, 1777)	X	X		Ground omnivore
Milvago chimachima (Vieillot, 1816)	X	X	X	Ground omnivore
Milvago chimango (Vieillot, 1816)	X			Ground omnivore
Micrastur semitorquatus (Vieillot, 1817)		X		Carnivore
Rallidae Rafinesque, 1815				
Aramides saracura (Spix, 1825)	X	X	X	Ground omnivore
Charadriidae Leach, 1820				
Vanellus chilensis (Molina, 1782)	X	X		Ground omnivore
Jacanidae Chenu & Des Murs, 1854				
Jacana jacana (Linnaeus, 1766)	X			Ground omnivore
Columbidae Leach, 1820				
Columbina talpacoti (Temminck, 1811)	X	X	X	Granivore
Columbina picui (Temminck, 1813)	X	X		Granivore
Leptotila verreauxi Bonaparte, 1855	X	X	X	Granivore
Psittacidae Rafinesque, 1815				
Myiopsitta monachus (Boddaert, 1783)	X		X	Frugivore
Triclaria malachitacea (Spix, 1824)			X	Frugivore
Cuculidae Leach, 1820				

Piaya cayana (Linnaeus, 1766)	X	X	X	Carnivore
Crotophaga ani Linnaeus, 1758	X	X		Carnivore
Guira guira (Gmelin, 1788)	X	X		Carnivore
Tapera naevia (Linnaeus, 1766)	X	X	X	Carnivore
Strigidae Leach, 1820				
Athene cunicularia (Molina, 1782)	X	X		Generalist insectivore
Apodidae Olphe-Galliard, 1887				
Streptoprocne zonaris (Shaw, 1796)		X		Generalist insectivore
Streptoprocne biscutata (Sclater, 1866)		X		Generalist insectivore
Trochilidae Vigors, 1825				
Anthracothorax nigricollis (Vieillot, 1817)			X	Nectarivore
Stephanoxis lalandi (Vieillot, 1818)			X	Nectarivore
Chlorostilbon lucidus (Shaw, 1812)		X		Nectarivore
Thalurania glaucopis (Gmelin, 1788)		X	X	Nectarivore
Leucochloris albicollis (Vieillot, 1818)		X		Nectarivore
Trogonidae Lesson, 1828				
Trogon surrucura Vieillot, 1817	X	X	X	Frugivore
Alcedinidae Rafinesque, 1815				
Megaceryle torquata (Linnaeus, 1766)	X	X		Piscivore
Chloroceryle amazona (Latham, 1790)	X			Piscivore
Ramphastidae Vigors, 1825				
Ramphastos dicolorus Linnaeus, 1766			X	Frugivore
Picidae Leach, 1820				
Picumnus temminckii Lafresnaye, 1845	X	X	X	Trunk insectivore
Melanerpes candidus (Otto, 1796)			X	Trunk insectivore
Veniliornis spilogaster (Wagler, 1827)	X		X	Trunk insectivore
Colaptes melanochloros (Gmelin, 1788)	X	X	X	Trunk insectivore
Colaptes campestris (Vieillot, 1818)	X	X		Generalist insectivore
Celeus flavescens (Gmelin, 1788)			X	Trunk insectivore
Thamnophilidae Swainson, 1824				
Dysithamnus mentalis (Temminck, 1823)			X	Foliage insectivore
Thamnophilus ruficapillus Vieillot, 1816	X	X	X	Foliage insectivore
Thamnophilus caerulescens Vieillot, 1816	X	X	X	Foliage insectivore
Batara cinerea (Vieillot, 1819)	X		X	Foliage insectivore
Mackenziaena leachii (Such, 1825)		X	X	Foliage insectivore
Drymophila malura (Temminck, 1825)	X	X	X	Foliage insectivore
Conopophagidae Sclater & Salvin, 1873				
Conopophaga lineata (Wied, 1831)			X	Foliage insectivore
Formicariidae Gray, 1840				
Chamaeza campanisona (Lichtenstein, 1823)			X	Foliage insectivore
Scleruridae Swainson, 1827				

Sclerurus scansor (Ménétriès, 1835)			X	Foliage insectivore
Dendrocolaptidae Gray, 1840				
Sittasomus griseicapillus (Vieillot, 1818)			X	Trunk insectivore
Xiphorhynchus fuscus (Vieillot, 1818)			X	Trunk insectivore
Campylorhamphus falcularius (Vieillot, 1822)			X	Trunk insectivore
Lepidocolaptes squamatus (Lichtenstein, 1822)			X	Trunk insectivore
Furnariidae Gray, 1840				
Furnarius rufus (Gmelin, 1788)	X	X		Generalist insectivore
Lochmias nematura (Lichtenstein, 1823)	X	X	X	Generalist insectivore
Philydor rufum (Vieillot, 1818)			X	Foliage insectivore
Heliobletus contaminatus Berlepsch, 1885			X	Trunk insectivore
Synallaxis ruficapilla Vieillot, 1819			X	Foliage insectivore
Synallaxis cinerascens Temminck, 1823	X	X	X	Foliage insectivore
Synallaxis spixi Sclater, 1856	X	X	X	Foliage insectivore
Cranioleuca obsoleta (Reichenbach, 1853)			X	Foliage insectivore
Pipridae Rafinesque, 1815				
Chiroxiphia caudata (Shaw & Nodder, 1793)			X	Frugivore
Tityridae Gray, 1840				
Schiffornis virescens (Lafresnaye, 1838)	X		X	Foliage insectivore
Pachyramphus polychopterus (Vieillot, 1818)			X	Foliage insectivore
Cotingidae Bonaparte, 1849				
Carpornis cucullata (Swainson, 1821)			X	Frugivore
Platyrinchus mystaceus Vieillot, 1818			X	Foliage insectivore
Rhynchocyclidade Berlepsch, 1907				
Phylloscartes ventralis (Temminck, 1824)	X		X	Foliage insectivore
Poecilotriccus plumbeiceps (Lafresnaye, 1846)	X		X	Foliage insectivore
Tyrannidae Vigors, 1825				
Camptostoma obsoletum (Temminck, 1824)	X	X	X	Foliage insectivore
Elaenia flavogaster (Thunberg, 1822)		X		Frugivore
Elaenia mesoleuca (Deppe, 1830)	X	X	X	Frugivore
Serpophaga subcristata (Vieillot, 1817)	X		X	Foliage insectivore
Legatus leucophaius (Vieillot, 1818)		X	X	Frugivore
Myiarchus swainsoni Cabanis & Heine, 1859	X		X	Generalist insectivore
Tyrannidae Vigors, 1825				
Pitangus sulphuratus (Linnaeus, 1766)	X	X	X	Generalist insectivore
Machetornis rixosa (Vieillot, 1819)	X	X		Generalist insectivore
Myiodynastes maculatus (Statius Muller, 1776)	X	X	X	Generalist insectivore
Megarynchus pitangua (Linnaeus, 1766)	X	X	X	Generalist insectivore
Tyrannus melancholicus Vieillot, 1819	X	X		Generalist insectivore
Tyrannus savana Vieillot, 1808	X	X		Generalist insectivore
Empidonomus varius (Vieillot, 1818)	X	X		Generalist insectivore

Satrapa icterophrys (Vieillot, 1818)	X	X		Generalist insectivore
Vireonidae Swainson, 1837				
Cyclarhis gujanensis (Gmelin, 1789)	X	X	X	Canopy/sub-canopy omnivore
Vireo olivaceus (Linnaeus, 1766)	X	X	X	Canopy/sub-canopy omnivore
Corvidae Leach, 1820				
Cyanocorax caeruleus (Vieillot, 1818)	X		X	Canopy/sub-canopy omnivore
Hirundinidae Rafinesque, 1815				
Pygochelidon cyanoleuca (Vieillot, 1817)	X	X		Generalist insectivore
Stelgidopteryx ruficollis (Vieillot, 1817)		X		Generalist insectivore
Progne tapera (Vieillot, 1817)	X	X		Generalist insectivore
Progne chalybea (Gmelin, 1789)		X		Generalist insectivore
Troglodytidae Swainson, 1831				
Troglodytes musculus Naumann, 1823	X	X	X	Canopy/sub-canopy omnivore
Turdidae Rafinesque, 1815				
Turdus rufiventris Vieillot, 1818	X	X	X	Canopy/sub-canopy omnivore
Turdus amaurochalinus Cabanis, 1850	X	X	X	Canopy/sub-canopy omnivore
Turdus albicollis Vieillot, 1818			X	Canopy/sub-canopy omnivore
Mimidae Bonaparte, 1853				
Mimus saturninus (Lichtenstein, 1823)	X	X		Canopy/sub-canopy omnivore
Coerebidae d'Orbigny & Lafresnaye, 1838				
Coereba flaveola (Linnaeus, 1758)	X	X		Nectarivore
Thraupidae Cabanis, 1847				
Saltator similis d'Orbigny & Lafresnaye, 1837	X	X	X	Frugivore
Tachyphonus coronatus (Vieillot, 1822)	X		X	Frugivore
Lanio cucullatus (Statius Muller, 1776)	X	X		Granivore
Lanio melanops (Vieillot, 1818)		X	X	Foliage insectivore
Tangara sayaca (Linnaeus, 1766)	X	X	X	Frugivore
Tangara preciosa (Cabanis, 1850)	X		X	Frugivore
Pipraeidea melanonota (Vieillot, 1819)			X	Frugivore
Pipraeidea bonariensis (Gmelin, 1789)	X	X		Frugivore
Dacnis cayana (Linnaeus, 1766)			X	Foliage insectivore
Emberizidae Vigors, 1825				
Zonotrichia capensis (Statius Muller, 1776)	X	X	X	Granivore
Poospiza nigrorufa (d'Orbigny & Lafresnaye, 1837)		X		Granivore
Sicalis flaveola (Linnaeus, 1766)	X	X		Granivore
Embernagra platensis (Gmelin, 1789)	X	X		Granivore
Volatinia jacarina (Linnaeus, 1766)	X	X		Granivore
Sporophila caerulescens (Vieillot, 1823)	X	X		Granivore
Cardinalidae Ridgway, 1901				
Habia rubica (Vieillot, 1817)			X	Foliage insectivore

Cyanoloxia brissonii (Lichtenstein, 1823)	X			Granivore
Parulidae Wetmore, Friedmann, Lincoln, Miller, Peters, van Rossem, Van Tyne & Zimmer 1947				
Parula pitiayumi (Vieillot, 1817)	X	X	X	Generalist insectivore
Geothlypis aequinoctialis (Gmelin, 1789)	X	X	X	Generalist insectivore
Basileuterus culicivorus (Deppe, 1830)	X	X	X	Foliage insectivore
Basileuterus leucoblepharus (Vieillot, 1817)	X	X	X	Foliage insectivore
Icteridae Vigors, 1825				
Cacicus chrysopterus (Vigors, 1825)	X	X	X	Canopy/sub-canopy omnivore
Icterus cayanensis (Linnaeus, 1766)			X	Canopy/sub-canopy omnivore
Agelaioides badius (Vieillot, 1819)	X	X		Canopy/sub-canopy omnivore
Molothrus bonariensis (Gmelin, 1789)	X	X		Ground omnivore
Fringillidae Leach, 1820				
Sporagra magellanica (Vieillot, 1805)	X	X		Granivore
Euphonia chlorotica (Linnaeus, 1766)	X	X	X	Frugivore
Euphonia violacea (Linnaeus, 1758)	X			Frugivore
Passeridae Rafinesque, 1815				
Passer domesticus (Linnaeus, 1758)	X	X		Ground omnivore

G – grassland, U – urban, W – woodland.