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Rodent diversity and habitat use in a protected area of Buenos Aires province, Argentina

Diversidad y uso del hábitat por roedores en un área protegida de Buenos Aires, Argentina

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Abstract. Habitat use of rodents is associated to environmental variables, species requirements and biological interactions. The aim of this study was to analyse the macro and microhabitat use and spatial variation in the abundance of small wild rodents that inhabit Otamendi Natural Reserve, Argentina. We studied the rodent communities in 6 habitats: riparian forest, *Celtis tala* forest, lowland grassland, salt marsh and 2 highland grasslands. We captured a total of 153 individual of *Scapteromys aquaticus, Akodon azarae*, *Oxymycterus rufus*, *Oligoryzomys flavescens*, *Deltamys kempi* and *O. nigripes*, with a trapping effort of 3636 trap-nights. The species richness is maintained by the presence of different habitats that satisfy specific requirements from specialist and generalist species, using differentially the reserve and forming communities of different specific composition in each habitat. A differential macrohabitat use was observed by all species, and a certain level of selectivity at microhabitat scale was observed in individuals of 2 species. This study shows that the diversity of environments in the Otamendi Natural Reserve, which allows the maintenance of many wild species of small rodents; confirming the high ecological and conservational value of the reserves inside an urban region.

Key words: diversity, Natural Reserve, small rodents, use of habitat, vegetation structure.

Resumen. El uso del hábitat de los roedores está asociado a variables ambientales, requerimientos específicos e interacciones biológicas. El objetivo de este estudio fue analizar el uso del macro y microhábitat y la variación espacial en la abundancia de pequeños roedores que habitan la Reserva Natural Otamendi, Argentina. Estudiamos la comunidad de roedores en 6 ambientes: bosque ribereño, talares, pastizales bajos, pastizal salino y 2 pastizales altos. Capturamos 153 individuos de *Scapteromys aquaticus, Akodon azarae*, *Oxymycterus rufus*, *Oligoryzomys flavescens*, *Deltamys kempi* y *O. nigripes*, con un esfuerzo de 3 636 trampas-noche. La riqueza de especies se mantiene mediante la presencia de diferentes hábitats que satisfacen los requerimientos específicos tanto de especies especialistas como especies generalistas, usando diferencialmente la reserva y formando comunidades de diferente composición en cada ambiente. Se observó un uso diferencial a escala del macrohábitat de todas las especies y una selectividad a escala del microhábitat en individuos de 2 especies. Este estudio muestra que la diversidad de ambientes en la reserva natural permite el mantenimiento de especies silvestres de pequeños roedores, confirmando el valor ecológico y de conservación de la reserva situada dentro de una región urbanizada.

Palabras clave: diversidad, reserva natural, pequeños roedores, uso del hábitat, estructura florística.

Introduction

Composition and community structure, population density and habitat use of rodents are associated to environmental variables, availability of resources, species requirements; and biological interactions such as competition, parasitism, mutualism and predation (Bonaventura et al, 1992; Busch and Kravetz, 1992; Cittadino et al., 1994; Maitz and Dickman, 2001). Also, population density of rodents is influenced by the territory size and its carrying capacity. Not all the habitats or sites are useful for occupation, therefore, animals may select among the available habitats or sites. Differential habitat use is one of the principal relationships which permit species to coexist (Fretwell, 1972; Rosenzweig, 1981; Litvaitis et al., 1994; Morris, 1996; Smith and Smith, 2001). To reduce competition when resources are limited, individuals can use them in a different way at different scales. Macrohabitat is used to define the area where the organisms carry out their biological functions, though frequently associated with a plant community which results

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in species that use a particular type of habitat, such as forest, grassland or wet areas. While microhabitat is a term which refers to the structural and floristic characteristics of those locations actually perceived and finally chosen by an organism, which affect its behavior making a differential selection of sites inside the components of the habitat, such as trees, shrubs or open areas (Morris, 1987; Litvaitis et al., 1994; Cueto et al., 1995a; Cueto et al., 1995b; Cueto et al., 1996; Maitz and Dickman, 2001; Traba et al., 2010). In other words, habitat selection is a multiscalar process and it is a consequence of 2 decisions: first, where to live and establish the home range; and second, where to shelter and forage within a habitat (Johnson, 1980; Orians and Wittenberger, 1991; Morris, 1996).

Within the ecological requirements of rodent populations living in the delta of the Paraná River, it is known that vegetation cover is one of the variables that influence the spatial distribution and population density of cricetide rodents, because it is a very important resource in terms of availability of food, shelter from predators and nesting sites (Bonaventura et al., 1991; Cueto et al., 1995a; Cueto et al., 1995b; Altricher et al., 2004). Therefore, the protected areas as natural reserves and national parks would be favorable places for the establishment of rodents.

Protected areas are planned in order to conserve representative samples of the biodiversity, containing autochthonous species of fauna and flora; and to conserve different threatened environments due to transformation and habitat loss (Gibbs, 2000; Caro, 2001; Gotor and Martinez Sánchez, 2001; Haene et al., 2003; Harvey and Sáenz, 2008). Although there is information on the abundance and habitat distribution of birds and large mammals, little is known about habitat use by rodents in these places (Pereyra et al., 2003). The aim of this study was to analyse the macro and microhabitat use and spatial variation in the abundance of small wild rodents that inhabit a natural reserve in Buenos Aires, Argentina.

Materials and methods

Study area. The Otamendi Natural Reserve, located in the Buenos Aires province, Argentina (34º10’ S, 58º48’ W) was declared a protected area in 1990. This reserve comprises an area of approximately 3 000 hectares that includes a strong topographic gradient from the highland to low areas near the Paraná River. Otamendi Natural Reserve was created with the main goal of preserving 3 eco-regions: Paranaense, represented by a riparian forest along the Paraná River, the Pampean region with dominance of perennial grasses, and the Espinal, characterized by the presence of *Celtis tala* (Beccaceci, 2009).

We studied rodent communities in 6 habitats: a riparian forest (RF; 100.5 hectares), a *Celtis tala* forest along the slope (T; 23.4 ha), a lowland grassland with Cyperaceae species (C; 1879.2 ha), salty marshes (S; 680.7 ha), and 2 highland grasslands, 1 with a large invasion of *Ligustrum* sp. (L; 179.5 ha) and the other with livestock (G; 55 ha) which has recently been included in the protected area (Haene et al., 2003; Fig.1).

Rodent community. The rodent community inhabiting neighbouring areas is composed of 10 sigmodontine species: *Akodon azarae* Fischer 1829, *Oxymycterus rufus* Fischer 1814, *Deltamys kempi* Thomas 1917, *Oligoryzomys flavescens* Waterhouse 1837, *O. nigripes* Olfers 1818, *Holochilus brasiliensis* Desmarest 1819, *Scapteromys aquaticus* Thomas 1920, *Calomys laucha* Fischer 1814, *C. musculinus* Thomas 1913, *Bibimys torresi* Massoia 1979; and the caviidae *Cavia aperea* Erxleben 1777 (Bonaventura et al., 1991; Cueto et al., 1996; Udrizar et al., 2005; Francés and D`Elia, 2006).

Akodon and *Cavia* are characteristic genera of linear and less disturbed habitats of rural areas, of the low delta of the Paraná River and of Pampean grasslands (Mills et al., 1991; Busch and Kravetz, 1992; Bilenca and Kravetz, 1995); *Oligoryzomys* is a good colonizer of disturbed habitats, particularly grasslands and marshes (Sánchez López, 1998) and; *Scapteromys*, *Deltamys* and *Oxymycterus* are characteristic of habitats with an abundant supply of water such as freshwater marshes and riparian forests (Kravetz et al., 1987; Miño et al., 2001). Almost all species are low risk with minor concern in the status conservation, with the exception of *B. torresi* that is near threatened (Diaz and Ojeda, 2000).

Rodent surveys. Rodents were captured with Sherman live traps baited with a mixture of fat, oats and peanut butter. Three hundred traps spaced at 10 m intervals were placed in 6 habitats and actively set for 3 consecutive nights. Sampling was conducted seasonally in September-2007, December-2007, March-2008 and July-2008. For all captures we recorded the species (Redford and Eisenberg, 1992), date of capture and trap location. Each individual was marked with an ear tag with an individual number and released at the site of capture.

The relative abundance of each species per habitat was estimated with the Trap Success Index (TS) (Mills et al., 1991):

(1) $TS = (\text{number of individuals} / \text{number of traps} \times \text{nights}) \times 100$

To compare the TS of the 6 habitats among the seasons an Analysis of Repeated Measurement was used (Zar, 1996).

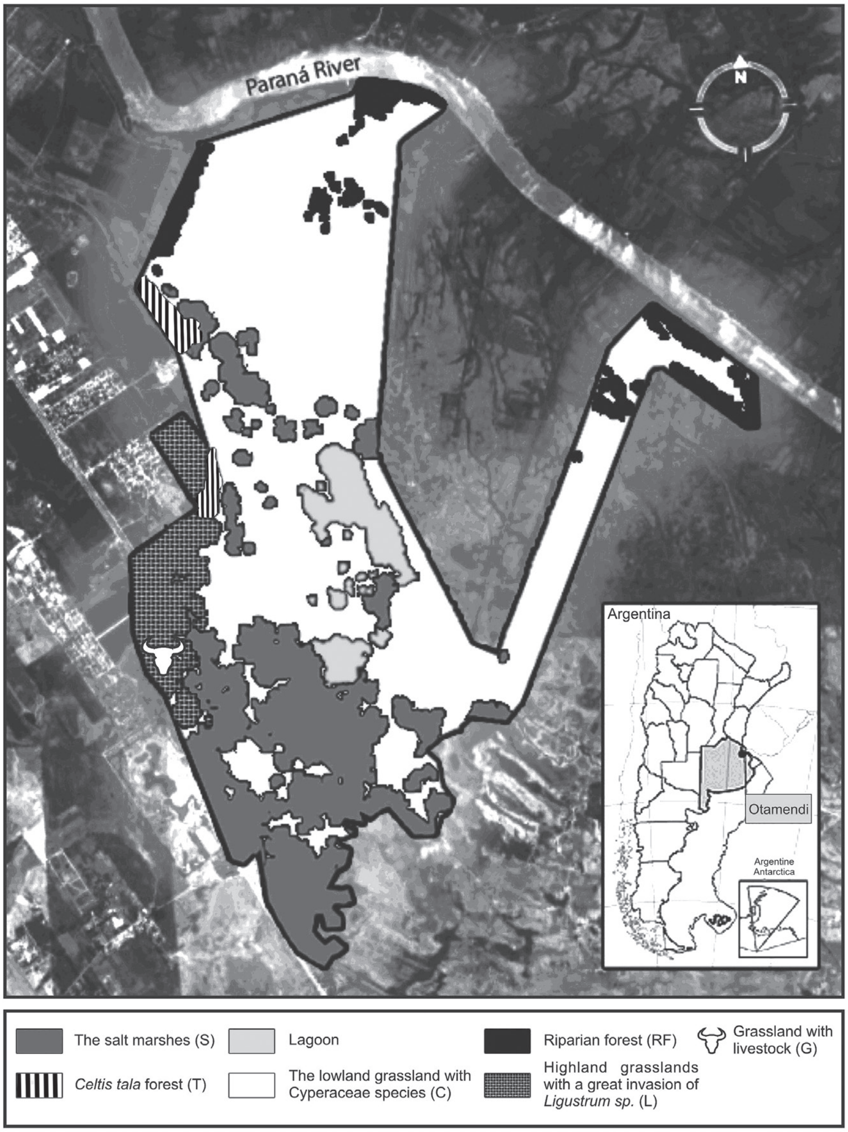

Figure 1. Habitats of Otamendi Natural Reserve, Argentina.

The density of each species in the Reserve (Rj) was estimated as the sum of the TS of the species j in the different habitats *i*, corrected according to the relative area of each habitat:

$$(2)\ Rj = \sum (TS_{ji} * area_i / \text{reserve area})$$

Vegetation surveys. In March 2008, habitat structure was described at the macrohabitat level for the different habitats and, within them, at the trap station level (microhabitat).

Vegetation structure and plant species composition were recorded in each habitat within 4 m^2 quadrants placed at all trap stations with captures (RF: 36, T: 12 and C: 13 quadrants) and in the same number of random selected trap stations without captures. In the salt marshes and 2 highland grasslands where we did not capture any rodents in March 2008, we placed 12 random quadrants per habitat and these were used to describe the characteristics of the vegetation at macrohabitat scale.

At each quadrant we estimated the vegetation cover of the different plant species as the percentage of the area of the quadrant covered. We also estimated the vegetation cover of life-forms, grouping the plant species into grasses (that included the family Cyperaceae and *Typha* sp.), broad-leaf herbs, epiphytes, vines, shrubs and trees.

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At macrohabitat scale the different habitats considered were described by the proportion of quadrants with presence of each plant species, the mean vegetation cover of each plant species and the mean vegetation cover of each life-form.

Relation between habitat characteristics and rodent captures. In order to assess if there was an association between the plant and rodent communities we compared the dissimilitude matrices (1-Jaccard Index) for rodent and plant data by a Mantel test (Manly, 1997). For each group we conducted a cluster analysis with simple linkage (Pielou, 1984).

In order to evaluate the relation between rodent captures and vegetation variables we conducted logistic regressions (McCullagh and Nelder, 1989; Nicholls, 1991; Crawley, 1993), using the GLM procedure of S-Plus 2000 (Insightful Corporation, 2002) at both macrohabitat and microhabitat scale. We assumed a binomial error distribution. Models were fitted by using a maximum likelihood method (McCullagh and Nelder, 1989). Variables were selected previously to the logistic regression in order to avoid including correlated variables by means of a Multiple Correlation test (Zar, 1996).

At macrohabitat scale we explored the relationship between annual trap success of rodent species per habitat (response variable), and the mean vegetation cover of each life form and proportion of quadrants with presence of each plant species (explanatory variables). We also explored the relationship between the presence or absence of captures of each rodent species at each quadrant (microhabitat scale) in March in the riparian forest (response variable) and the vegetation cover of each plant species and life form per quadrant (explanatory variables). At this level, we considered that it is not valid to assume that habitat variables do not change throughout the year. In the other habitats there were not enough captures to conduct this analysis.

Table 2. Jaccard Index among habitats, taking into account the presence of rodent (bold) and vegetation (parenthesis) species. RF: riparian forest; L: grassland with great invasion of *Ligustrum* sp.; T: *Celtis tala*, G: grazed grassland; C: grassland composed mainly by Cyperaceous species; S: salty grassland

	T	*L*	*C*	*S*	*G*
L	**0.33** (0.10)				
C	**0.50** (0.10)	**0.83** (0.12)			
S	**0.25** (0.08)	**0.66** (0.11)	**0.40** (0.54)		
G	**0.33** (0.10)	**0.33** (0.15)	**0.50** (0.18)	**0.66** (0.18)	
RF	**0.33** (0.03)	**0.83** (0.05)	**0.66** (0.05)	**0.66** (0.02)	**0.33** (0)

The macrohabitat-niche breadths (H) of the different rodent species were calculated using the Shannon-Weaver Diversity Index (Krebs, 1978), where p_i is the proportion of a particular species in the different habitats (6 habitats in this study).

$$H = -\sum_{i=1}^{6} \dot{p} \times \log \dot{p}$$

Results

Rodent surveys. We captured a total of 153 individual rodents of 6 different species with a trapping effort of 3 636 trap-nights. All rodent species detected were captured in the riparian forest, while the habitats with the lower number of species were the *Celtis tala* forest and the grazed grassland (Table 1, Fig. 2).

The riparian forest was also the habitat with the highest overall trap success followed by the grassland invaded by *Ligustrum* sp., the lowland grassland, the *Celtis tala* forest, the salt marsh and the grazed grassland (Table 1).

The most abundant species (taking into account the TS and the area covered by each habitat) in Otamendi Natural Reserve was *S. aquaticus* (R= 1.75), followed by *A. azarae*

Table 1. Annual trap success, rodent richness (S) and diversity index (H) for the different habitats studied. RF: riparian forest; L: grassland with great invasion of *Ligustrum* sp.; T: *Celtis tala*; G: grazed grassland; C: grassland composed mainly by Cyperaceous species; S: salty grassland

	TS								
	O.r.	*S.a.*	*A.a.*	*O.f.*	*D.k.*	*O.n.*	total	S	H
RF	5.72	6.90	0.59	0.79	0.59	0.59	**15.18**	6	1.26
L	2.22	0.23	1.01	0.12	0	0.21	**3.78**	5	1.08
C	0.19	2.23	0.74	0.37	0	0	**3.53**	4	1.01
S	0	0.20	0.99	0.20	0.39	0	**1.78**	4	1.15
T	1.51	0	0.38	0	0	0	**1.89**	2	0.50
G	0	0	0.34	0.17	0	0	**0.51**	2	0.64
total	**9.64**	**9.56**	**4.05**	**1.65**	**0.98**	**0.80**	**26.67**		

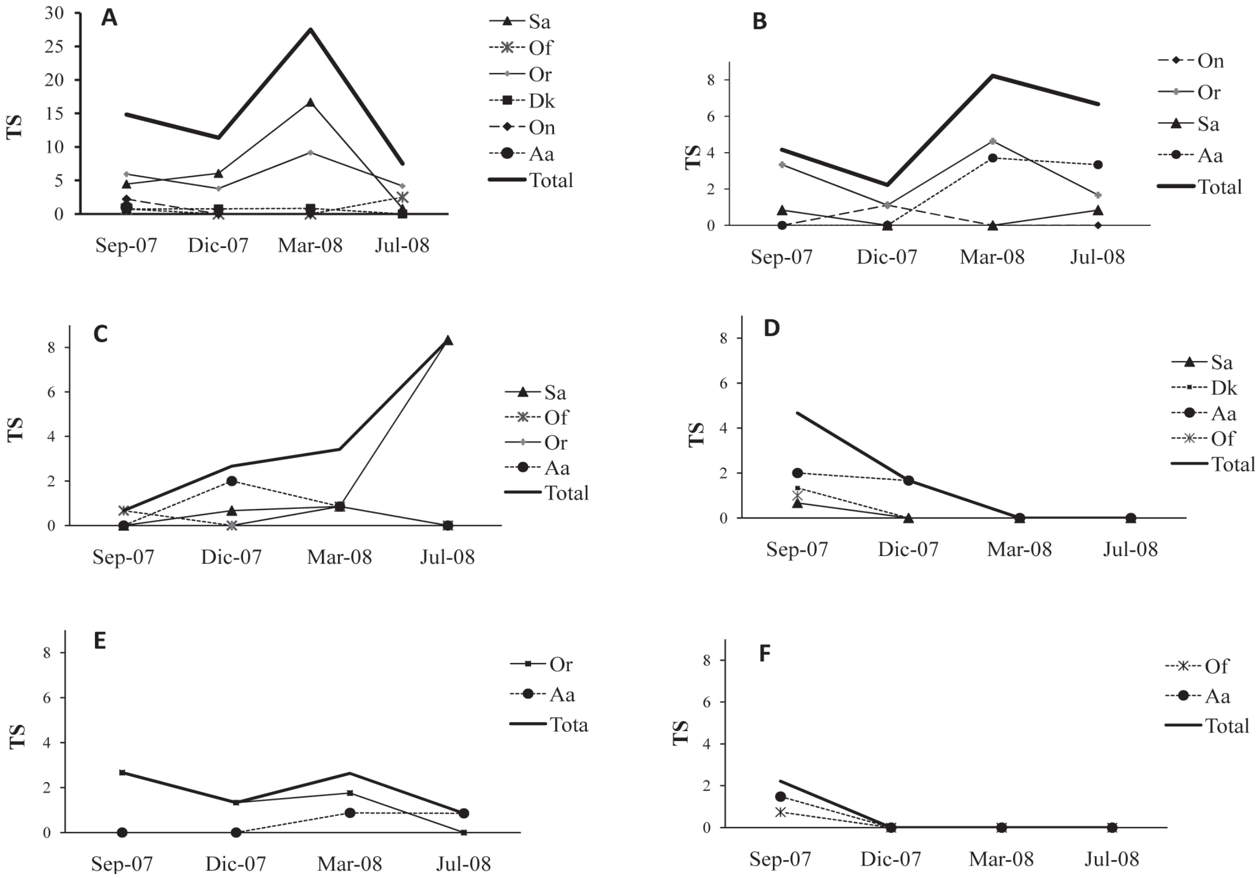

Figure 2. Total and specific trap success (TS) per habitat (a-RF, b-L, c-C, d-S, e-T, f-G) along the time. Sa: *Scapteromys aquaticus*; Of: *Oligoryzomys flavescens*; Or: *Oxymycterus rufus*; Dk: *Deltamys kempi*; On: *Oligoryzomys nigripes*; Aa: *Akodon azarae*.

Table 3. Plant species richness (S) and mean vegetation cover (percentage) of the different life-forms for each habitat. RF: riparian forest; L: grassland with great invasion of *Ligustrum* sp.; T: *Celtis tala*, G: grazed grassland; C: grassland composed mainly by Cyperaceous species; S: salty grassland

Habitat	*S*	*% grasses*	*% broadleaf herbs*	*% trees*	*% shrubs*	*% epiphytes*	*% vines*
RF	32	41	13	37	33	3	17
L	14	54	42	46	20	0	0
C	13	86	70	3	0	0	14
S	15	88	48	0	0	0	12
T	15	23	19	79	0	2	8
G	21	38	83	1	6	0	0

(R= 0.86), *O. rufus* (R= 0.60), *O. flavescens* (R= 0.33), *D. kempi* (R= 0.11) and *O. nigripes* (R= 0.05).

With the exception of *A. azarae*, which was more abundant in the highland grassland and in the salt marsh, all rodent species were more abundant in the riparian forest, resulting in the habitat with highest rodent richness and diversity (Table 1).

The riparian forest and the highland grassland were similar according to rodent species composition (J= 0.83); they shared all species except *D. kempi* which was absent in the highland grassland (Table 2). The highland grassland was also similar to the lowland grassland (J=0.83), but they differed in the absence of *O. nigripes* in the highland. *Deltmays kempi* was absent in both habitats.

The total TS of the habitats did not show significative differences along the year ($F_{3,18}$= 0.57; *p*= 0.64, Fig. 2) possibly due a great heterogeneity among habitats ($F_{6, 18}$= 6.33; *p*< 0.001; Fig. 2).

*Vegetation sampling.*The habitats present in Otamendi Natural Reserve differed in vegetation characteristics (Table 3, Appendix). The riparian forest showed a stratified vegetation with a lower layer dominated by herbs, an intermediate layer dominated by shrubs and a tree stratum that reached more than 3 m in height. The highland grassland was dominated by grasses, broadleaf herbs and *Ligustrum*. The lowland grassland was characterized by sedges of about 2 m in height. The salt marsh was dominated by a herb stratum with a dominance of grasses. In the *Celtis tala* forest there was only a tree layer due to the poorly developed understory and the soil was covered by litter. The grazed grassland presented 3 strata, with herbs of about 1 m high, shrubs and trees (Table 3, Appendix).

According to plant species composition the more similar habitats were the lowland grassland and the salt marsh (Table 2).

There was no significant association between rodent and vegetation dissimilitude matrices (r= 0.60; *p*= 0.15).

Macrohabitat use. Akodon azarae showed the greatest macrohabitat niche breadth (1.64), followed by *O. flavescens* (1.43), *O. rufus* (1.05), *S. aquaticus* (0.80), *D. kempi* (0.67) and *O. nigripes* (0.67).

Scapteromys aquaticus showed a major use of habitats with greater vine cover. This variable explained almost the totality of the variance in the abundance among habitats (84.45%) according to the following equation:

*TS ~ -9 + 0.37 * cover of vines* (t= 4.76, *p*= 0.002; t= 3.08, *p*= 0.014)

Oxymycterus rufus showed a major use of habitats with low broad leaf cover. This variable explained 58.98% of the variance in the abundance according to the following equation:

*TS ~ -2.74 – 0.05 * broad leaf cover* (t=5.23, *p*= 0.0007; t=2.92, *p*= 0.051)

Oligoryzomys nigripes showed major use of habitats with a low proportion of quadrants with *Carduus acanthoides.* This variable explained the 42.55% of the abundance variability among habitats according to the following equation:

*TS ~ -79.37 * proportion of quadrants with Carduus acanthoides* (t=5.18, *p*= 0.002)

Macrohabitat use of *O. flavescens, D. kempi* and *A. azarae* was not associated with any of the variables included in the present study. However, although we can not define an explanatory variable, a differential use of habitats, based on the different TS values was observed: *Oligoryzomys flavescens* was more abundant in the riparian forest; *A. azarae* in the grassland with *Ligustrum*, salty marsh and grassland with Cyperaceae and *D. kempi* in riparian forest and salty marsh (Table 1).

Microhabitat use in the riparian forest. Scapteromys aquaticus showed greater use of sites with low vegetation cover (coefficient= -0.01, t= 1.97; *p*= 0.028). This variable explains a 9.42% of the presence-absence of the individuals in the different trap stations.

O. rufus used sites with low grass cover (coefficient= -0.03; t= 2.64; *p*= 0.006). This variable explains a 77.32% of the presence-absence of the individuals in the different trap stations.

Deltamys kempi, O. flavescens, O. nigripes and *A. azarae* captures were not associated with any of the vegetation variables analyzed in the present study.

Discussion

In Otamendi Natural Reserve, the species richness is maintained by the presence of different habitats that satisfy specific requirements at macrohabitat level from specialist species such as *D. kempi* and *S. aquaticus* to more generalist species such as *A. azarae* and *O. flavescens,* using differentially the reserve and forming communities of different specific composition in each habitat (Litvaitis et al., 1994). The reserve conserves 6 sigmondontine rodent species characteristic of riparian forests and wetlands. The lack of captures of *Calomys laucha* and *C. musculinus*, typical of grassland in the Pampean region, may be due to the great invasion of woody species in the grasslands that probably do not provide a good habitat for these species.

The trap success, which may be interpreted as selection indices because they are directly dependent on local rodent densities (Traba et al., 2010), have demonstrated a differential macrohabitat use by all species. The macrohabitat use of half of the species would be predicted on basis of the vegetation variables studied that include both structural and species composition. For example, *S. aquaticus* carried out its biological functions in habitats with heavy vine cover, *O. rufus* in habitats with low broad leaf cover and *O. nigripes* in habitats with a low *Carduus acanthoides* cover. However, the variables that can predict the macrohabitat use are not necessarily the direct cause of the differential distributions, but are only associations between these variables.

The most used habitat was the riparian forest due to the great plant diversity, richness and cover. Therefore, this structural heterogeneity and the increased availability of resources would satisfy the requirements of several functional groups of small rodents. This result agrees with Pereyra et al. (2003) that found that the habitats with higher species richness for all mammal groups in Otamendi Natural Reserve were the riparian forest and the grassland.

In principle, we expected that habitats which present similar vegetation and, consequently, similar characteristics of food and shelter present the same rodent communities. However, the vegetation similarity among habitats was very low, and for this reason we did not detect any association between similar habitats based on rodents and vegetation.

At microhabitat scale we observed a certain level of selectivity in individuals of 2 species (*S. aquaticus* and *O. rufus*) that clearly perceive and choose specific sites within the components of the habitat in differential forms (Morris, 1987; Litvaitis et al.,1994; Maitz and Dickman, 2001; Traba et al., 2010). These species, contrarily to the others, would be specialists at microhabitat scale, which show different strategies of resource exploitation in habitats with great species richness as riparian forest (Bonaventura et al., 1991; Busch and Kravetz, 1992).

Therefore, the fact that the rodents differ at the level of habitat selection is the consequence that organisms often differ in their perception of the scale and degree of heterogeneity within the same landscape (Kotliar and Wiens, 1990; Orrock et al., 2000; Coppeto et al., 2006).

On the other hand, the rodent community is differentially impacted by high environmental stress accordingly if the disturbance is natural or caused by anthropic origin. This can be observed in salt marsh and grazed grassland habitats. The grazed grassland, which suffered anthropic stress, showed a lower rodent richness than the natural grassland. In spite of high vegetation richness, the cover and height of most plants was low and the soil was compacted by the cattle. Grazing causes loss of soil, loss and modification of vegetation and may decrease the quality of the environment, causing changes in the composition and abundance of rodents (Kufner et al., 2004). However, the salt marsh, which has a natural stress, showed the greatest rodent richness. This result shows the better adaptation of the animal community to natural than to anthropic disturbances.

In conclusion, this study shown that the diversity of habitats of natural reserves with different plant composition and structure allows the maintenance of many wild species of small rodents that make differential use of these habitats and confirms the high ecological and conservational value of reserves within an urban region.

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Appendix. Proportion of quadrants and cover mean per vegetal species and habitat (not included species with cover less than 5%).

Species	*RF*		*T*		*G*		*L*		*C*		*S*		*Category*
	%	*COVER*	*%*	*COVER*	*%*	*COVER*	*%*	*COVER*	*%*	*COVER*	*%*	*COVER*	
Acacia sp.					0.07	0.15							tree
aff. Ipomoea alba	0.22	0.15											vine
aff. Cyperaceae									0.75	0.63	0.25	0.63	grass
aff. Ambrosia tenuifolia					0.71	0.05	0.09	0.63			0.42	0.37	broadleaf herb
aff. Aster squamatus					0.14	0.37							broadleaf herb
aff. Eupatorium inulifolium							0.09	0.05					broadleaf herb
aff. Medicago sp.					0.14	0.37							broadleaf herb
Agrostis montevidensis							0.09	0.05					grass
Allophylus edulis			0.2	0.1									tree
Aster squamatus					0.07	0.05					0.17	0.1	broadleaf herb
Aternanthera phyloxeroides					0.07	0.05					0.08	0.05	broadleaf herb
Baccharis notosergila					0.64	0.63	0.36	0.37			0.08	0.05	broadleaf herb
Baccharis trimera					0.57	0.37	0.27	0.05					broadleaf herb
Carduus acanthoides					0.07	0.05			0.08	0.05			broadleaf herb
Celtis spinosa					0.21	0.37							shrub
Celtis tala	0.17	0.37	1	0.87									tree
Cissus aff palmata									0.5	0.15	0.17	0.15	vine
Conyza bonariensis					0.71	0.37			0.08	0.05	0.08	0.05	broadleaf herb
Cyperus aff entrerianus	0.3	0.63											grass
Deyeuxia viridiflavescens					0.7	0.05	0.18	0.05					grass
Diodia brasiliensis	0.17	0.26											shrub
Dipsacus sativus											0.33	0.26	broadleaf herb
Distichlis spicata									0.17	0.87	0.67	0.87	grass
Eryngium aff eburneum											0.17	0.1	broadleaf herb
Eucalyptus sp.	0.33	0.625											tree
Gleditsia triacanthos									0.08	0.37			tree
Hydrocotyle bonariensis									1	0.1	0.75	0.15	broadleaf herb
Hygrophyla costata	0.08	0.15											broadleaf herb
Ipomoea cairica	0.11	0.1											vine
Ligustrum lucidum	0.3	0.4					0.82	0.63					tree
Ligustrum sinense	0.61	0.37					0.55	0.37					shrub
Lonicera japonica	0.31	0.63											vine
Ludwigia elegans	0.28	0.37											broadleaf herb
Metastelma diffusum	0.19	0.05	0.2	0.15									vine
Muehlenbeckia sagittifolia			0.1	0.37									vine
Paspalum aff urvillei							0.73	0.15	0.08	0.05			grass
Pavonia sepium, subsp sepium			0.7	0.15									broadleaf herb
Phyla canescens					0.14	0.1							broadleaf herb
Polygonum aff acuminatum	0.06	0.15											broadleaf herb
Polygonum punctatum									0.42	0.15	0.25	0.37	vine
Polygonum stelligerum	0.3	0.15											broadleaf herb

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Appendix. Continues.

Species	*RF*		*T*		*G*		*L*		*C*		*S*		*Category*
	%	*COVER*	*%*	*COVER*	*%*	*COVER*	*%*	*COVER*	*%*	*COVER*	*%*	*COVER*	
Rubus aff nitidus	0.28	0.15											broadleaf herb
Rumex aff crispus									0.08	0.15	0.42	0.05	broadleaf herb
Salix sp.	0.3	0.37											tree
Sida rhombifolia					0.07	0.05							broadleaf herb
Solanum sp.							0.18	0.05					broadleaf herb
Solanum sp, *S. aff bonariense*	0.06	0.26											shrub
Spartina longispica	0.3	0.15							0.5	0.37	0.16	0.5	grass
Thypha sp.	0.06	0.37							0.17	0.5			grass
Tillandsia usneoides	0.19	0.15											epiphyte
Tripogandra elongata	0.08	0.37											broadleaf herb
Verbesina subcordata					0.07	0.37							broadleaf herb