

The International Biodiversity Agenda at the Local Level: the Case of Capybaras in Curitiba, Brazil

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Abstract: The capybara (*Hydrochoerus hydrochaeris*) is a South American native rodent with an outstanding capacity to colonize urban environments. In Curitiba, a city worldwide known for its urban planning, the capybara adaptation comprises an interesting case to better understand the challenges in addressing Aichi targets at the local level. Specialized literature, official data and interviews indicate that this species is spreading throughout parks interconnected by rivers. This study illustrates an intricate relationship between capybaras and the urban socio-ecological environment, suggesting that the city only partially addresses Aichi targets. Local authorities are likely to face several challenges for adopting a global agenda on biodiversity. Producing robust knowledge on the urban biota is one fundamental step towards this goal.

Keywords: Environmental policies; green areas; urbanization; urban biota

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Introduction

Cities are often solely perceived as drivers of environmental change. However, if well managed, they also offer substantial opportunities to reduce these impacts. An important aftermath of Rio+20 Conference was the recognition that cities can lead societies towards more sustainable pathways. Urban environmental sustainability is an important pillar of the New Urban Agenda (UN-HABITAT III, 2016), and urbanization has increasingly been recognized as key for sustainable development with impacts beyond urban borders.

However, a holistic approach to urban planning and management is needed. The vision shared by signatories of HABITAT III is that cities will be planned and managed to offer multiple benefits that can improve resource use efficiency and human life, offering an ample scope of ecosystem services, reduction of pollution levels and improved contact between humans and nature. Since natural systems are related with public health and human wellbeing (UN-HABITAT III, 2016), the preservation of natural assets both within and beyond urban areas is requirement for a sustainable urbanization (UN-DESA-PD, 2014).

This approach is crucial as urban population is expected to continue on the rise. The current world population of 7.6 billion is expected to reach 8.6 billion in 2030, 9.8 billion in 2050 (when 66% of the world's population is projected to be urban) and 11.2 billion in 2100 (UN-DESA-PD, 2014). Latin America and the Caribbean (LAC) lead with the highest levels of urbanization globally: 80% urbanized in 2014 and expected to achieve 86% by 2050. Within LAC, Brazil is ranked 12. The country was 83% urbanized in 2014, housing 173 million urban dwellers (UN-DESA-PD, 2014).

Besides that, cities are often situated in regions of high biodiversity and endemism, and significant biodiversity remains in urban areas globally (McDONALD et al., 2014). In Brazil, for example, the Atlantic Forest (AF) is a biodiversity hotspot (MYERS et al., 2000), where almost 60% of the Brazilian population live, housing 38 of the 50 biggest cities (IBGE, 2013, 2016). Not surprisingly, among others processes, the high rate of urbanization and urban sprawl have been important drivers of environmental change, to the extent that the AF is considered one of the most threatened tropical biomes (TEIXEIRA et al., 2009), with 12,4% of the original forest remaining (FSOSMA; INPE, 2019).

Despite the increasing awareness of these trends, there are few studies that make the complex interplay between human and ecological systems easily understandable for decision makers (OJIMA; MARTINE, 2012). In addition, conservation science has changed its initial focus from the protection of "nature for itself" to including a reciprocal dynamic relationship between people and nature (MACE, 2014). Therefore, this is a relatively new agenda for urban governance and creates challenges on the management of Biodiversity and Ecosystem Services (B&ES) at the local level.

The Aichi Targets, lunched in 2011 by the Secretariat of the Convention on Biological Diversity, aimed at providing a guide at both national and subnational levels to better conserve B&ES during a decade (until 2020). As the post-agenda is being discussed, it is timely to understand possible challenges local governments face in addressing Aichi targets.

As reference, Curitiba is a Brazilian city well known worldwide for its outstanding urban planning, helping to promote urban areas as fundamental to achieve environmental sustainability and the conservation of B&ES. Therefore, the city comprises an important case to analyze the linkages between local level policies and global environmental goals on B&ES.

Among various environmental issues, the sprawl of capybaras throughout the green-blue infrastructure of Curitiba allows to investigate strengths and limitations of urban environmental policies. These policies concern the management of urban biodiversity and its intricate relationship with citizens' perception. In summary, this work intends to stimulate the debate on how local management is showing adherence to a global agenda on B&ES conservation by checking its adherence to the Aichi Targets. To this end, we look at important aspects of the implementation of Aichi Targets (e.g.: people's awareness of the values of biodiversity; incentives for biodiversity conservation; loss, degradation and fragmentation of natural habitats; concerns towards threatened species; the knowledge needed to better conserve biodiversity) in Curitiba using specialized literature, official data, journalistic information and interviews.

Curitiba's strategies for the conservation of green areas and local biodiversity

The city of Curitiba, capital of the state of Paraná, is located in Southern Brazil. Its original vegetation consisted of fields interspersed with riparian forest and clumps, with dominance of the Parana pine - *Araucaria angustifolia* (KLEIN; HATSCHBACH, 1962). Founded in 1693, Curitiba occupies 432.17 km², housing 1,864,416 inhabitants (IPPUC, 2014).

The city is known worldwide for having created the Bus Rapid Transit system and for having established environmental protection measures in large public green areas. Curitiba has 64.5 m² of green area per inhabitant (CURITIBA CITY HALL, 2011), a high rate in Brazil. In general, these areas were created in a fragmented manner, taking advantage of remnant clumps and floodplains of rivers. These green areas were created aiming to provide one or more of following features: drainage (providing a river overflow location, in the case of wetlands), leisure and avoidance of illegal occupation (CURITIBA CITY HALL, 2016b).

Despite the challenges of population pressure, about 20% of the city's territory (78 km²) is covered by forested areas in good conservation conditions. Out of this, about 25% are in public areas, and the remainder belongs to private owners (BRUEL et al., 2013). The list of Curitiba's public Conservation Units includes: 25 parks, 16 woods, 7 Environmental Protection Areas, a Botanical Garden and an Ecological Station¹.

Since the reduction of natural habitat represents a major cause of global biodiversity loss (DIRZO; RAVEN, 2003), the presence of these conserved areas in Curitiba could be regarded as a result of policies aligned with the international agenda on B&ES. Despite

1 - Information provided by Luis Alberto Lopez Miguez, cartographer engineer, Municipal Secretariat for the Environment - interview by e-mail on Sept. 22, 2016.

of this, until 2013, there was little evidence that biodiversity conservation had inspired the creation of Curitiba's parks. Between 1993 and 2013, green areas protected under the Urban Biodiversity Conservation Woods category represented 2.5 km² but increased to 9 km² in 2016 (CURITIBA CITY HALL, 2016d). However, since 2006, when Curitiba hosted the Conference of the Parties of the Convention on Biological Diversity (CBD COP-8), biodiversity has been part of the city's agenda. In 2007, Curitiba hosted an international meeting on Cities and Biodiversity, resulting in the Curitiba Declaration on Cities and Biodiversity. In 2010, the city hosted the Second Curitiba Meeting on Cities and Biodiversity, marking the launch of the International Year of Biodiversity (LOCAL ACTION FOR BIODIVERSITY, 2010). These efforts paved the way for the recognition of the importance of local governments for the implementation of the Convention on Biological Diversity, including the reduction of biodiversity loss and improvement of ecosystem management (OLIVEIRA et al., 2014).

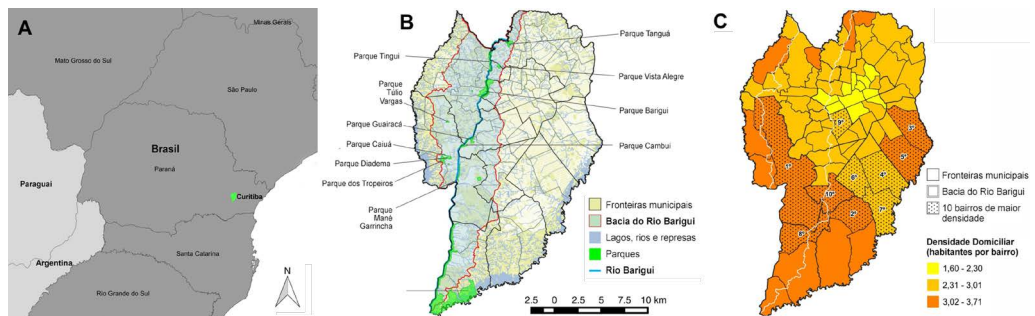
COP-8 was also the stage for discussions on how to conserve green areas in private plots in Curitiba. This culminated with the city adopting a biodiversity conservation program through the creation of Private Reserves of Municipal Natural Heritage (RPPNM²) (CURITIBA, 2006). The RPPNMs (with 21 units representing about 260,000 m², according to Associação dos Protetores de Áreas Verdes de Curitiba e Região Metropolitana, APAVE, the association promoting RPPNMs in Curitiba) aim to protect urban woodlots in private plots and to establish an access between them and public green areas, making biodiversity corridors possible (BRUEL et al., 2013).

This is also the objective of the Barigui River Park Project, a biodiversity corridor being gradually created along Barigui River through the integration of parks. Currently there are seven parks (Tanguá, Tingui, Barigui, Cambuí, Guairacá, Mané Garrincha and Rio Bonito) and one wildlife reserve (Bugio Reserve) (Figure 1) along the Barigui River. The aim is to restore vegetation, promote the conservation of the Barigui riverbank³ and avoid illegal occupation (CURITIBA CITY HALL, 2016a).

2 - According to the Municipal Law No. 12,080 of 2006, RPPNM is a permanent preservation unit of private domain, for conserving biological diversity.

3 - The territory along a river which coincides with the so-called Areas of Permanent Preservation ("Áreas de Preservação Permanente, APP") and which must be preserved even if not covered by native vegetation (BRANCALION et al., 2016).

Figure 1 - A) The position of Paraná and Curitiba within Brazil; **B)** Barigui basin⁴ limits within Curitiba presenting the Barigui River and the distribution of parks comprising the biodiversity corridor (once called the Barigui River Park Programme); the map also shows district borders within the city; **C)** Population density by district presenting three groups of densities (inhabitants/housing), the 10 densest districts and Barigui basin limits.



Source: the authors. Data obtained from the Institute of Research and Urban Planning of Curitiba - IPPUC (2016)

Such initiatives are of relevance since Curitiba occupies an area of original high biological diversity. Reports dating from the 17th century inform that the area housed over 80 native species of mammals and 200 species of birds (GEISSLER, 2004). Today, many exotic species cohabit the city. Amongst exotic mammals stand out the European hare (*Lepus europaeus*), the brown rat (*Rattus norvegicus*), the black rat (*R. rattus*), and the house mouse (*Mus musculus*). There are also records of native species from other parts of Brazil considered exotic to southern Brazil and which present risks to the local fauna. Examples are some species of small primates, such as black-tufted marmoset (*Callithrix penicillata*) and white-tufted marmoset (*C. jacchus*), which often prey on local birds and compete with native species for food and shelter (CURITIBA CITY HALL, 2016c).

Moreover, domestic animals (mostly abandoned dogs and cats) are also scattered throughout the city, including public green areas. In Curitiba, the animal control service responsible for abandoned dogs and cats was suspended in 2005. Since then, management measures have not been enough to avoid the establishment of packs of dogs in some parks, such as Tingui and Náutico⁵. These species can return to their feral state, threatening wildlife and citizen passers-by and present a potential risk of diseases' introduction, such as rabies (CURITIBA CITY HALL, 2016c; LEITE-PITMAN et al., 2002).

Other domesticated mammal present in some parks is the sheep. In the early 90s, the Curitiba Municipal Secretariat for the Environment (SMMA) led a project for having this species for pruning the grass in three parks: São Lourenço (Belem River Basin), Barigui (Barigui River Basin) and Náutico/Iguaçu (Iguaçu River Basin). Over time, the presence of these animals in parks were mainly valued due to the pastoral and bucolic picture cre-

4 - The area drained by a river and all its tributaries

5 - Information provided by Ana Silvia Passerina - phone interview on Oct. 2, 2014.

ated by their herds. For this reason, the city government met population resistance when it started the withdrawal of the herds, an initiative that was not successful. Currently, the parks host populations of female sheep exclusively as they are more docile than males. The herd is under management that includes identification and veterinary care⁶.

Another project developed by SMMA in the 90's regarding the management of fauna in municipal parks aimed the reintroduction of two native species: Azara's agouti (*Dasyprocta azarae*) and Ingram's squirrel (*Guerlinguetus ingrami*). The squirrel's reintroduction was not successful, although there are recent records of this mammal in some parks of Curitiba. On the other hand, the reintroduction of the agouti succeeded in parks protected by fences, which prevent the access of and predation by dogs⁷.

There are still some native species found in Curitiba's green areas, such as mid-sized mammals, as the white-eared opossum (*Didelphis albiventris*) and the black-eared opossum (*D. aurita*); insectivorous bats, such as the Brazilian free-tailed bat (*Tadarida brasiliensis*) and the Pallas's mastiff bat (*Molossus molossus*); frugivorous bats such as the great fruit-eating bat (*Artibeus lituratus*) and the little yellow-shouldered bat (*Sturnira lilium*); the guinea pig (*Cavia* sp.); the orange-spined hairy dwarf porcupine (*Sphiggurus villosus*); and the lesser grison (*Galictis cuja*) (CURITIBA CITY HALL, 2016c). In addition to these mammals there is the Araucaria tit-spinetail (*Leptasthenura setaria*), symbol bird of Curitiba and tightly associated with Curitiba's most important symbol, the *Araucaria angustifolia*, listed as a near threatened species (IUCN, 2017), primarily due to habitat loss (BIRD LIFE INTERNATIONAL, 2018).

Recently a middle-sized native herbivore has gained great visibility in Curitiba: the capybara (*Hydrochoerus hydrochaeris*) (Figure 2). In the parks of the Barigui River Basin the presence of capybaras has been recorded since 2003 (EL-KOUBA, 2005) but they can also be seen in parks in other river basins in the city (ALMEIDA; BIONDI; MONTEIRO-FILHO, 2012; ALMEIDA et al., 2013, 2014).

This species seems to be one of the most tolerant to environmental changes (ALMEIDA; BIONDI; MONTEIRO-FILHO, 2013; CAMPOS-KRAUER; WISLEY, 2011), being present even in large urban centers such as Sao Paulo (PEREIRA; ESTON, 2007). Its high adaptability is linked to some of its biological characteristics.

6 - Information provided by Ana Silvia Passerina - phone interview on Oct. 2, 2014.

7 - Information provided by Vinicius Abilhoa - phone interview on Oct. 13, 2014.

Figure 2 - Capybaras at Barigui Park, Curitiba, Brazil.



Source: Evandro Maia, 2018.

The biology of capybara and its relationship to anthropogenic environments

The capybara is the largest living rodent: weighs up to 90 kg and can reach 50 cm high. It lives in groups which abundance varies along the year, increasing during the rainy season. The group may include stable pairs, harems, or groups consisting of three males (a dominant one and two subordinate) and several females and cubs (ALMEIDA; BIONDI; MONTEIRO-FILHO, 2012, 2013; ALMEIDA et al., 2014).

Sexual maturity is between 15 and 24 months and longevity is 12 years in captivity. Females usually take care of the offspring and males compete for reproductive females. Reproduction occurs throughout the year, and there may be two offspring per year, with the number of cubs per brood ranging from one to eight (OLIVEIRA; BONVICINO, 2011).

Being territorialist, males protect their group from opportunistic intruders by using intimidating techniques such as vocalization and persecution. The group's vigilance is left to subordinate males (ALMEIDA; BIONDI; MONTEIRO-FILHO, 2012).

Water is the crucial landscape element for the establishment of capybaras as they feed on both terrestrial and aquatic vegetation (ALMEIDA; BIONDI, 2011; ALMEIDA; BIONDI; MONTEIRO-FILHO, 2012; ALMEIDA et al., 2013; CAMPOS-KRAUER; WISLEY, 2011). Their semi-aquatic habits demand that the habitat combines an open

field used for foraging; a forest for resting, shelter, refuge, thermal regulation and parturition; and a water body used for activities of reproduction, resting and to escape from predators (ALMEIDA; BIONDI, 2011; ALMEIDA; BIONDI; MONTEIRO-FILHO, 2012; ALMEIDA et al., 2014; PEREIRA; ESTON, 2007).

In order to feed they may move up to 500 meters away from the water, but they most often rest close to it in the hottest periods of the day. The pattern of their activities can vary according to the level of stress they experience, such as human presence and hunting pressure (ALMEIDA; BIONDI; MONTEIRO-FILHO, 2012, 2013).

The species is widely distributed in the Neotropics in both Central and South America, but today it is rare or extinct in many areas where once it was common. Despite of this, it rapidly proliferates and becomes abundant at favorable locations without natural predators and/or with the availability of plentiful resources (ALMEIDA et al., 2014; CAMPOS-KRAUER; WISLEY, 2011; FERRAZ et al., 2003; 2009; OLIVEIRA; BONVICINO, 2011).

These animals are tolerant to environmental changes (ALMEIDA; BIONDI, 2011) and their generalist habits enable adaptation to different conditions regarding climate and food. For example, capybaras seem to benefit from the conversion of forests into land for agriculture and pasture (CAMPOS-KRAUER; WISLEY, 2011), where they find abundant food. In some places in Brazil, capybaras are considered pests due to the damage they can cause to agriculture and areas of forest regeneration, especially when population densities are high (CAMPOS-KRAUER; WISLEY, 2011; FERRAZ et al., 2003).

Concurrently, agriculture expansion next to natural areas facilitates the spread of pathogens as human populations, domestic and wild animals (including capybaras) coexist in close proximity (EL-KOUBA et al., 2008). Since capybaras have high vagility⁸ along waterways, they can disseminate various diseases and potentially trigger the emergence of zoonosis (CAMPOS-KRAUER; WISLEY, 2011; EL-KOUBA et al., 2008).

Capybaras are hosts of the ticks *Amblyomma cajennense* and *A. dubitatum*, which are associated with *Rickettsia rickettsii*, the bacterium that causes Rocky Mountain spotted fever (CAMPOS-KRAUER; WISLEY, 2011). They can also house the trematode *Fasciola hepatica* that causes fasciolosis and which has many species of wild hosts - making eradication impracticable.

There have been records of liver fluke disease throughout Brazil (EL-KOUBA et al., 2008). Occurring mainly in animals, it accidentally affects humans, and is considered a rare and emerging disease that needs control (DiCYT, 2010). Capybaras' role in the epidemiological chain of liver fluke disease is relevant as they increase the potential risk of infection to other susceptible species (EL-KOUBA et al., 2008). This may also be true for other diseases, such as leptospirosis (*Leptospira interrogans*) (CHIACCHIO et al., 2014).

The fact that connectivity among environments allows the occupation of new areas by this species (ALMEIDA; BIONDI; MONTEIRO-FILHO, 2013) can raise public health concerns in urban areas. However, few studies exist on capybaras in urban environments

8 - Tendency of an individual or population to change their location or distribution over time (Biodiversidade RS, 2017).

(ALMEIDA; BIONDI; MONTEIRO-FILHO, 2012; ALMEIDA et al., 2014). This is also the case for Curitiba despite the importance of capybaras as one of the symbols of the city (ALMEIDA et al., 2014).

Influences of the urban environment of Curitiba on the capybara's population dynamics

In Curitiba, capybaras are mainly distributed throughout parks with rivers (ALMEIDA; BIONDI; MONTEIRO-FILHO, 2013). Among them, three parks in the Barigui River Basin (Parks Tanguá, Tingui and Barigui) seem to be favorable for their presence, as observed by Almeida, Biondi and Monteiro-Filho (2013) between 2003 and 2011 (Table 01).

Almeida et al. (2014) compared the three parks by the conditions they offer to capybaras. The following landscape elements found in each park were considered: aquatic habitats, forest, lawn and impermeable areas. Although these parks offer similar habitat conditions, the ratios between landscape elements seem to rank Tanguá Park as the less favorable for the presence of capybaras. Tingui Park has the highest amount of lawn and aquatic environments, and seems the most favorable of the three. Barigui Park, on its turn, is the largest and, potentially, the park that could support a larger population of capybaras.

Table 1 - Number of individuals observed in three parks of the Barigui River Basin by different surveys

Year	Tanguá Park	Tingui Park	Barigui Park	Author
2003	-	-	7	EL-KOUBA (2005)
2005	-	-	12	EL-KOUBA (2005)
2008	7	145	18	ALMEIDA et al. (2013)
2009	-	86	-	ALMEIDA, BIONDI, MONTEIRO-FILHO (2013)
2010	2	70	45	ALMEIDA et al. (2013)
2011	-	32	-	ALMEIDA, BIONDI, MONTEIRO-FILHO (2013)

Source: the authors. Data obtained from EL-KOUBA (2005); ALMEIDA et al. (2013); ALMEIDA; BIONDI; MONTEIRO-FILHO (2013).

Despite limitations regarding a systematic data collection on capybaras' populations, Almeida et al. (2013) argue that the proportion of adult sampled in their study for parks is equivalent to that found in the literature for natural and farming areas. This is a surprising finding since these environments have the potential to shelter a higher number of individuals than parks. However, it suggests that a large supply of feeding resources and a relatively lower hunting pressure by natural predators play an important role in defining suitable grounds (FERRAZ et al., 2003, 2009).

Despite the success of parks in housing a relative large population, the number of individuals in Tanguá and Tingui Parks decreased between 2008 and 2011 (ALMEIDA; BIONDI; MONTEIRO-FILHO, 2013; ALMEIDA et al., 2013). In 2009, 22 animals died (ALMEIDA; BIONDI; MONTEIRO-FILHO, 2013). They were mainly juveniles presenting marks of bites from dogs or perforations by bullets. Therefore, hunting (by dogs and humans) has played an important role between 2008 and 2010 (ALMEIDA; BIONDI; MONTEIRO-FILHO, 2013) in changing the trend of population growth. Despite forbiddance of hunting in Curitiba's parks this activity has been recorded in at least three green areas: Tingui (ALMEIDA; BIONDI; MONTEIRO-FILHO, 2013), Iguaçu (VALENTE et al., 2011) and Barigui Park (TONETTI; BIONDI; LEITE, 2016).

Curiously, in Barigui Park three individuals of alligators (*Caiman latirostris* and *C. yacare*) were illegally introduced and share the same water body with capybaras. Although capybaras are natural preys of alligators in the wild, no capybara predation by these alligators has been recorded there⁹.

Other relevant issue helping to shape the population of capybaras is the health of their habitat. As previously mentioned and reported for other Brazilian regions (CHIACCHIO et al., 2014; LABRUNA, 2013), the occurrence of parasites presents a risk to the health of capybaras in Curitiba. In a study conducted for Barigui Park in 2005, all sampled individuals ($n = 18$) were infected by *Fasciola hepatica* (EL-KOUBA et al., 2008). This parasite was also present in a study for Tingui Park in 2007, in which 92% of the sampled capybaras hosted at least one endoparasite (TRUPPEL, 2009).

The presence of infected animals shows that the biological cycle of the parasite is complete and capybaras may be functioning as reservoirs of etiological agents (TRUPPEL, 2009). Nevertheless, despite the relative high resilience of capybaras (they may present no clinical signs of infection), endoparasitoses in these animals may cause gastrointestinal and liver problems that can be fatal, especially when unfavorable environmental conditions affect their immune system (ALMEIDA; BIONDI; MONTEIRO-FILHO, 2013; TRUPPEL, 2009). This situation may be occurring in Curitiba.

The parks of the city inhabited by capybaras present different water quality conditions. The Environmental Institute of Paraná (IAP) examines the quality of water bodies through the Water Reservoir Quality Index (IQAR). The IQAR classify the water quality ranging from I (not impacted or slightly degraded) to VI (extremely polluted) (GOVERNMENT OF THE STATE OF PARANA, 2017). Compared to Barigui and Tingui Parks, Tanguá Park shows the best water quality (class III, moderately degraded) but the lowest record of capybaras (ALMEIDA et al., 2013). Water bodies in Barigui and Tingui Parks are considered critically degraded (class IV) (IAP, 2004), nevertheless host a greater number of capybaras.

The low quality of the water bodies in Curitiba has several causes. The sewage collection network of the city covers almost 90% of the properties, however, out of this, 35% of the properties are mistakenly connected to the drainage system (data from

9 - Information provided by Julio Leite - phone interview on Oct. 6, 2014.

Sistema de Informações e Gestão SANEPAR - 2012). Additionally, the water bodies of Curitiba have been further degraded by emerging contaminants (IDE et al., 2012), including hormones and active pharmaceutical ingredients, which negatively affect the biota (GHISELLI; JARDIM, 2007). Such emerging contaminants are present in different degrees in several rivers of the city (IDE, 2014), mainly due to its incomplete degradation in sewage treatment plants (TOGOLA; BUDZINSKI, 2007). The waters of Barigui, for example, show presence of pharmaceuticals such as diclofenac and paracetamol as well as feminine hormones (KRAMER, 2012). These pollutants are associated with anthropogenic environments, but little is known about their impact on the health of animals such as capybaras¹⁰.

Another factor regulating population size is the carrying capacity of the parks to accommodate capybaras needs. Almeida, Biondi and Monteiro-Filho (2012) reported that capybaras show a particular territorial behavior in Tingui park which may be associated with food scarcity. This scarcity could help promote the dispersion of individuals throughout Barigui basin. A possible evidence of this is the presence of capybaras on strips of land along Barigui River in-between Tingui, Tanguá and Barigui parks (ALMEIDA et al., 2013).

Citizens' perception on capybaras

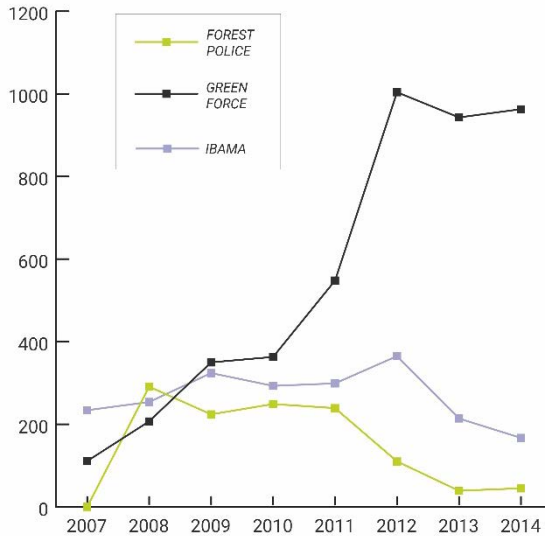
As mentioned, some studies point to the possible population decline of capybaras in Curitiba (ALMEIDA; BIONDI; MONTEIRO-FILHO, 2013; ALMEIDA et al., 2013, 2014). In 2007, however, local newspapers indicated populations in apparent growth (VÉGAS, 2007), while capybaras became increasingly popular among citizens.

As a reference of this popularity, the virtual profile of Curitiba on Facebook, with more than 840,000 followers, repeatedly posted images of the capybara as a mascot, especially along 2016. The animal is still present in environmental awareness campaigns, in products sold for the sponsorship of social programs and as boosters of people's participation in blood donation campaigns. This popularity, however, hide other aspects of the relationship between capybaras and Curitiba's citizens.

For example, in 2007, there were 345 calls to environmental agencies (Figure 3) concerning capybaras. This number increased towards its peak in 2012 with 1,479 calls, and then declined slightly to 1,175 calls in 2014. The calls include reports of animals on the move throughout the city. As an evidence, in 2012, an individual was found at the main bus station located in central Curitiba (ANÍBAL, 2012).

10 - Information provided by Gilda MS Tebet - interview by e-mail on Nov. 24, 2014.

Figure 3 – Number of calls yearly (2007 to 2014) to different environmental bodies concerning capybaras in Curitiba



Source: the authors. 156 System of Curitiba City Hall (2014).

Table 2 suggests that restricting capybaras to the green areas of the city is the major concern. The majority of calls addressed the presence of these mammals on urban roads, offering a potential risk of traffic accidents. This threat is confirmed in a general study by Dornas, Kindel and Freitas (2012) which shows capybaras as one of the most common animal victim of traffic accidents in Brazil.

Additionally, Tonetti, Biondi and Leite (2016) analyzed the influence citizens' opinion might have on the permanence of capybaras in Curitiba's parks. Through a questionnaire distributed among visitors of three parks (Barigui, Cambuí and Iguaçu-Náutico), the study concludes that, in general, while visitors appreciate their presence in parks they are aware of both risks which capybaras are subject (e.g. pollution, hunting) and possible threats towards humans (e.g. disease transmission) (TONETTI; BIONDI; LEITE, 2016).

Table 2 – Calls to environmental agencies on capybaras by theme and year (2009 to 2014)

Year	Month	Report
2009	November	capybaras rescue
	December	capybaras rescue
2010	May	free capybaras along Barigui river
	September	capybaras rescue
2011	February	injured capybara
	February	asks information about free capybaras in Barigui park
	May	free capybaras
2012	April	free capybaras on the street
	October	free capybaras on the street
2013	January	free capybaras
	January	free capybaras in Pinheirinho district
	March	requests information on the rescue of capybaras
	April	free capybaras
	September	injured capybara in Barigui park
	November	free capybaras
	December	capture of capybaras.
	December	capybara
2014	February	free capybaras

Source:

Discussion

Our data suggest that, depending on the urban socio-environmental context, there may be hidden challenges for the application of a global agenda on B&ES at the local level.

Capybaras are icons of a “green” Curitiba and popularly associated to a healthy environment. Despite some awareness of potential threats they can bring to citizens, parks’ visitors appreciate their presence within these places (TONETTI; BIONDI; LEITE, 2016). At a first glance, this could be an indicator of fulfillment of Aichi Target 1, which addresses people awareness of the values of biodiversity. However, this study suggests that the presence of capybaras in Curitiba’s parks is not a consequence of a successful urban environmental governance as there are few positive incentives for the conservation of biodiversity, issue addressed by Aichi Target 3. The establishment of capybara’s populations throughout the green areas of Barigui Basin is deeply related to the fact that Barigui River serves as a corridor connecting several parks that support minimum habitat requirements. This, at the same time, puts in check Aichi Target 1 and is a clear evidence that Aichi Target 5 (related to the degradation of natural habitats) is not met.

Moreover, even species with high adaptability in anthropogenic environments,

such as the capybara, can face challenges. Evidence of capybaras' populations decline reveals the immediate need for monitoring the population dynamics, as the species may be vulnerable to deleterious pressures that remain undetermined. For example, continuous stress caused by proximity to humans may result in physiological changes affecting the species survival. Besides that, among other anthropogenic influences, local water bodies are contaminated (IDE, 2014) affecting the achievement of both Target 8 (on pollution) and Target 11 (Integrity of Protected Areas including associated water systems). In this context, there is an additional reason to improve the quality of the city's rivers: to reduce the susceptibility of capybaras to diseases that can be transmitted to humans. Therefore, our study suggests that appreciation for these animals should be weighted against possible risks they can bring to human wellbeing. Only adequate public policies can guarantee a safe coexistence between humans and other species in urban areas.

Cities in developing countries, including those in biodiversity hotspots, have major challenges to overcome in traditionally priority areas of urban planning, such as housing and sanitation. However, there is an increasing awareness that local public policies should combine these traditional efforts with the maintenance of environmental services, largely related to local biodiversity and long-term human wellbeing (UN-HABITAT III, 2016). Despite of this, a B&ES toolkit, which can guide local managers in this still incipient agenda, is yet to be developed. It is, therefore, not surprising that Curitiba, despite its renowned environmental planning and its intention to be in the forefront of urban biodiversity conservation, still lacks management knowledge to properly accommodate this agenda. For example, the project for a biodiversity corridor along Barigui River was simply designed to serve as a physical connection between green areas where different species could circulate and inhabit. This approach does not take into consideration a systemic urban management of B&ES and its relation to human wellbeing. Therefore, Aichi Target 14, on the essential ecosystem services contributing to human well-being, is not fully met.

Moreover, as pointed out by Kujala, Burgman and Moilanen (2013), there are too many uncertainties about facts that we could but do not know. The shortage of urban biodiversity research, which can support sound decision-making, is among the major causes preventing a better environmental management at the local level. This characterizes a knowledge gap between science and management (RANIUS et al., 2017), which claims for a better dialogue, in which scientists and decision makers together identify and contextualize uncertainties, conflicting goals and divergent values (KUJALA; BURGMAN; MOILANEN, 2013), therefore aligning with Aichi Target 19 on improving biodiversity knowledge.

Due to the scarcity of more robust data on the subject of this work (e.g. systematic monitoring of fauna and flora, records of population dynamics and the interactions between species including humans), our considerations are presented in a qualitative and speculative way. However, while gaps on quantitative data remains, qualitative appreciation on uncertainties inherent to urban environmental management has the potential to help improve decision-making (KUJALA; BURGMAN; MOILANEN, 2013).

Conclusion

This paper presents insights on the limited knowledge regarding biodiversity and human well-being that affects the quality of urban management. We explore a case in which a specific species, the capybara, features an ambiguous relation with citizens of Curitiba, being at the same time highly regarded and a potential threat to human health. Aspects on the relationship between capybara's behavior in the urban area, the scientific knowledge available, local management practices and the perception of capybaras by citizens are analyzed in the light of the adoption of the Aichi targets at the local level. By doing so we attempt to stimulate the debate about the challenges to adopt a biodiversity agenda in urban management, especially in the Global South. Neither the current emphasis on traditional priority areas of urban management nor the fact that the urban biodiversity agenda is relatively new should shade the importance of an integrated approach to urban environment management and the relevance of science to support decision-making. After 10 years of the launch of the Aichi targets, Curitiba, a city well regarded for its environmental management, has only partially addressed the targets. This suggests that there is an urgent need to better scale down the international agenda on biodiversity based on more ambitious efforts.

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A Agenda Internacional de Biodiversidade no Nível Local: o Caso das Capivaras em Curitiba, Brasil

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São Paulo. Vol. 24, 2021

Artigo Original

Resumo: Capivaras (*Hydrochoerus hydrochaeris*) são roedores nativos da América do Sul com notável capacidade de colonizar ambientes urbanos. Em Curitiba, cidade mundialmente conhecida pelo planejamento urbano, a adaptação desta espécie compreende um interessante caso para melhor compreender os desafios em abordar as Metas de Aichi no nível local. Evidências em literatura especializada, entrevistas e dados oficiais indicam que a espécie tem se expandido através dos parques conectados por rios. Esse estudo demonstra as intrincadas relações socioecológicas entre as capivaras e o ambiente urbano, as quais sugerem que a cidade considera apenas parcialmente as Metas de Aichi. As autoridades locais enfrentam grandes desafios para adotar a agenda global de biodiversidade. A produção de conhecimento robusto acerca da biota urbana compreende um passo essencial para alcançar tais objetivos.

Palavras-chave: Políticas ambientais; áreas verdes; urbanização; biota urbana.

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La Agenda Internacional de Biodiversidad a Nivel Local: el Caso de los Chigüiros en Curitiba, Brasil

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Artículo original

Resumen: Los chigüiros (*Hydrochoerus hydrochaeris*) son roedores nativos de América del Sur con notable capacidad de colonizar ambientes urbanizados. En Curitiba, ciudad mundialmente conocida por su planificación urbana, la adaptación de los chigüiros comprende un caso interesante para entender mejor los desafíos para abordar los objetivos de Aichi a nivel local. Evidencias en literatura especializada, entrevistas y datos oficiales indican que esta especie se ha expandido a través de los parques conectados por ríos. Este estudio demuestra relaciones socioeconómicas entre esa especie y el ambiente urbano, que sugieren que la ciudad parcialmente considera las metas de Aichi. Las autoridades locales afrontan desafíos para adoptar la agenda global de biodiversidad. La producción de conocimiento robusto sobre la biota urbana comprende un paso esencial para alcanzar tales objetivos.

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