THE GRASS IS ALWAYS GREENER ON THE OTHER SIDE OF THE FENCE: THE FLORA IN URBAN BACKYARDS OF DIFFERENT SOCIAL CLASSES

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Outside the gate of the outer court there is a large garden of about four acres with a wall all around it. It is full of beautiful trees-pears, pomegranates, and the most delicious apples. There are luscious figs also, and olives in full growth. The fruits never rot nor fail all the year round, neither winter nor summer, for the air is so soft that a new crop ripens before the old has dropped. Pear grows on pear, apple on apple, and fig on fig, and so also with the grapes, for there is an excellent vineyard: on the level ground of a part of this, the grapes are being made into raisins; in another part, they are being gathered; some are being trodden in the wine tubs, others further on have shed their blossom and are beginning to show fruit, others again are just changing color.
The Odyssey, *book VII* (*Homer, approximately 800 B.C.*)

Introduction

The world's urban population surpassed the 50% mark and reached 79% in Latin America and in the Caribbean, in 2007. The set of impacts caused by the massive global urbanization on local, regional and global scale is striking. Over the past 50 years, the biosphere has been changed by humans more than it was at any other time in history. Nowadays, as well as in the next decades, the urbanization process will generate the most globally significant impacts, mainly on the tropics, if deep land use policy and planning changes are not implemented (GRIMM *et al, 2008;* CHAPIN III *et al,* 2009).

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The conservation biology has divided the world in pristine and degraded habitats for historical reasons. Nevertheless, it is necessary changing such mentality: the conservation biology should focus on the habitats where humans live in and produce knowledge on how to share these anthropogenic environments with wild species (ROSENZWEIG, 2001), as well as on how to maintain urban biodiversity and its ecosystem services.

It is also necessary equitably distributing the flora and its ecosystem services among the neighborhoods in Brazilian cities, which are often very heterogeneous in terms of family income. The richness of plant species in urban ecosystems is generally high in these cities, although poorly distributed among neighborhoods. Such fact configures an environmental injustice phenomenon, i.e., *an inequality in the access to environmental resources*, according to the definition by Aleixo et al. (2016). Neighborhoods with higher socioeconomic status often have greater plant diversity, either in their public spaces, such as parks and squares (which do not normally exist in poor neighborhoods), or in domestic gardens - a common land use in cities (ANGEOLETTO and SANTOS, 2015).

According to a Chinese saying, *it is better showing kindness near home than offering incense in a distant temple*. Given the enormous influence of cities on the biosphere, planning their growth has become one of the most important challenges of the 21st century (COHEN, 2006), since it has obvious repercussions on the conservation of species, ecosystems and biomes at global level. The aims of increasing the quality of human life, as well as the conservation of biological diversity in backyards are coincident (GALLUZZI *et al*, 2010).

The definition of "backyard" (or, *quintal* in Portuguese) varies in the technical literature. Gaston *et al.* (2005) defines it as a private space adjacent to the dwellings, which may hold, at varying levels, grass, polygons with ornamental and edible vegetation, water sources, paths and, sometimes, temporary constructions such as greenhouses. It may also be simply defined as *the remaining area after the house was built, in a private property* (SMITH *et al*, 2006b) - such definition was adopted in the current study. However, it is worth emphasizing that private home gardens are different from isolated vegetation fragments such as forests, because they are managed on an individual scale and because, although fragmented, they form a wide extension of adjacent spaces (SMITH *et al*, 2006a; SMITH *et al*, 2006b).

Even though backyards are apparently too small to be biologically significant, when they are added together they reach areas of considerable size, which are often bigger than areas occupied by squares and urban parks (RUDD, *et al*, 2002; GASTON *et al.,* 2005; LORAM *et al.,* 2007; MARCO *et al.,* 2008). For example, 19.5% of the urban area in Dayton City (USA) is occupied by backyards (DANIELS and KIRKPATRICK, 2006). The backyards account for 86.2% of the urban green areas in Léon (Nicaragua) (GONZÁLEZ-GARCÍA and SAL, 2008). The rate of areas covered by backyards in UK cities is also high: 22.6% in Nottingham, 27.6% in Leicester, 19% in Edinburgh, 23% in Sheffield, and 20% in London Metropolitan Region (GASTON *et al*, 2005).

Parks and reserves remain the main focus of conservation actions in urban ecosystems. However, household backyards provide an extensive and undervalued resource to increase urban biological diversity, as well as its ecosystem services (MAURER *et al*, 2000; GODDARD *et al*, 2010). The importance of private backyards to biodiversity conservation (including the preservation of endangered plant and animal species) has been increasingly acknowledged; however, there has been virtually no attempt to describe the biological diversity composition and distribution in these spaces (GASTON *et al,* 2005; THOMPSON *et al,* 2005; SMITH *et al,* 2006a; LORAM *et al,* 2007; MARCO *et al,* 2008; DAVIES *et al,* 2009; GODDARD *et al,* 2010; GALLUZZI *et al,* 2010; BEUMER and MARTENS, 2014).

The studies about urban flora are generally focused on forest fragments (HOPE *et al,* 2003), although the cultivated species are dominant in urban ecosystems and little is known about them (MARCO *et al,* 2008). This lack of data is particularly concerning because, since microclimates change and provide shelter, as well as nesting sites and food resources to a wide variety of organisms, the backyard vegetation plays a key role in supporting biodiversity in urban ecosystems (DAS and DAS, 2005; SMITH *et al*, 2006b; LORAM *et al*, 2008; BEUMER and MARTENS, 2014).

Most studies about urban backyards were conducted in developed countries (GODDARD *et al*, 2010), whereas those conducted in developing countries have generally failed to integrate ecological and socioeconomic principles (LUBBE *et al*, 2010). Indeed, studies about the urban flora composition that integrate environmental data and social, economic and cultural aspects remain largely scarce (DOW, 2000; MARTIN *et al*, 2004; HEEZIK *et al*, 2014).

The strong income and schooling differences between neighbors in Brazilian cities are an important factor influencing the urban flora diversity (ANGEOLETTO and SANTOS, 2015). However, it is necessary having a more in-depth understanding of these influences on the flora composition in home gardens. Therefore, Brazilian cities lack more information about the potential of backyards for urban biological diversity conservation and use (AKINNIFESI *et al*, 2010). Such knowledge has an enormous applicability in the elaboration of urban flora increment projects directed to these spaces.

Studied area: the Metropolitan Region of Maringá

The urban space of the current Metropolitan Region of Maringá was developed, from its genesis, through actions controlled by the real estate market, and such actions have reproduced social and environmental inequality processes in the territory. Since the market value in Maringá City is very high and the minimum lot area is 300 m^2, most low-income families have moved out to other counties in the RMM, mainly to Sarandi. The urban legislation in these counties is much less rigorous, and the land is cheaper, smaller, and located in precarious urbanization areas. Municipal public authorities have authorized entrepreneurs to put them in the market without providing basic infrastructure (RODRIGUES, 2010).

This spatial arrangement has segregated the poor in the counties around the RMM, and it allowed Maringá to maintain privileged urban features such as an abundant grove in public spaces (RODRIGUES, 2010). Thus, it is possible seeing the same Brazilian exclusionary and unequal urbanization pattern in the RMM, as it was emphasized by

Lago (2000), with one peculiarity: Maringá has no favelas, which are so typical of other Brazilian metropolitan regions. The favelas, which once occupied high-value central areas, were promptly dismantled by municipal public authorities in the 1970s and 1980s, and their residents were transferred to Sarandi or segregated in other peripheral spaces (ARAUJO, 2010).

Since the 1980s, it is possible seeing a clear conurbation process between Maringá and Sarandi, which comprises a continuous urban spot, whose population currently totals 440,000 people: 357,000 inhabitants in Maringá and 83,000 in Sarandi. Despite the conurbation, the socioeconomic differences between Maringá and Sarandi are striking. Maringá has ranked 23rd in the Municipal Human Development Index (MHDI) ranking in 2013, whereas Sarandi has ranked 2059th within a set of 5,570 cities (UNEP, 2013).

Methodology

The Brazilian cities show high heterogeneity when it comes to the social class prevailing in different neighborhoods. Therefore, the current study used non-linear social gradients encompassing a low-income neighborhood in Sarandi (*Conjunto Triângulo*), as well as a high-income neighborhood in Maringá (*Zona 02*). This methodological approach enabled the amalgamation of sociological and ecological data. Thus, it allowed differentiating biological diversity patterns between different social classes, as well as generating information with great potential to be applied to the management and planning of urban ecological systems (DOW, 2000; MCDONNEL and HAHS, 2008; LUBBE *et al,* 2010).

With respect to *Conjunto Triângulo*, which was planned and constructed by public authorities, the *Companhia Municipal de Urbanismo de Sarandi* (Municipal Urbanization Company of Sarandi) sought greater population density through backyard area decrease. On the other hand, *Zona 02* was planned by *Companhia Melhoramentos Norte do Paraná* (Northern Paraná Improvement Company). Since it was intended for high-standard housing, *Zona 02* is a neighborhood occupied by upper-middle-class families since its inception (MENEGUETTI, 2007).

The 895 dwellings in *Zona 02* are mostly occupied by upper-middle-class families. On the other hand, *Conjunto Triângulo* consists of 407 dwellings (and, therefore, 407 backyards) and is populated by low-income families. A simple random sample comprising 198 dwellings in *Conjunto Triângulo* and 269 dwellings in *Zona 02* was drawn using the Statistica 7 software. The sample size was obtained at 5% error estimation and 95% confidence.

The draw of the dwellings was preceded by an investigation (1:2000 maps) aimed at identifying the vacant lots in the herein studied neighborhoods. After the dwellings drawn in the neighborhood maps were identified, the families were visited according to the guided visit technique (FLORENTINO *et al*, 2007). A family member, aged 18 years or older, was chosen by the family as the greatest connoisseur of the flora in the backyard. He/she was invited to walk through the backyard during the interview and provide specific information about the uses of the plants found in such space. The interviews were conducted after the interviewees signed the informed consent form wherein they agreed to participate in the study and authorized the disclosure of the results.

In addition, the interviewees provided information concerning their household income in order to categorize their families as members of social classes A, B, C, D or E, according to the household income-based classification of social classes prepared by the Strategic Affairs Secretariat of the Brazilian Federal Government (SAE, 2014). According to this classification, families with incomes up to 1.73 minimum wages (MW) belong to social class E; those with income between 1.74 and 2.76 MW belong to social class D; those with income between 2.77 and 11.93 MW belong to social class C; and those with income between 11.94 and 15.55 MW belong to social class B. Finally, families with income above 15.55 MW belong to social class A.

The plant uses mentioned by the respondent were recorded. The mentioned species were listed in the following use categories: horticultural, fruit, medicinal and ornamental. With respect to their origin, the species were classified as exotic or native, according to consultations on the website "Flora do Brasil" (www.floradobrasil.jbrj.gov.br/). The mean number of species per backyard was calculated, as well as the mean number of shrub individuals per backyard and the mean number of arboreal individuals per backyard. Shrub individuals are herein understood as woody plants shorter than 4 meters and branched from their base, whereas arboreal individuals are understood as woody plants taller than 4 meters presenting well-defined main trunk and branched crown (LORENZI *et al*, 2003).

After this stage was concluded, the total area of the backyards, as well as their uncemented area, was measured. In addition, the percentage of fully cemented backyards (and, therefore, without vegetation) in the investigated neighborhoods was quantified. Data concerning plants cultivated in pots were not included in the current study. The botanical material was identified in the field, according to the methodology by Heezik et al. (2014). The species that could not be identified in the field were classified at family, gender and species level in the Herbarium of the State University of Maringá. The herein used taxonomic system was the APG III (THE ANGIOSPERM PHYLOGENY GROUP, 2009). The scientific names were checked at the *Plantminer* databases (SIVIERO *et al*, 2011).

All identified species were checked on the *Red List* website of endangered species of the International Union for Conservation of Nature - IUCN (http://www.iucnredlist.org) - in order to list the endangered species. In addition, the Brazilian species were also checked in the list of endangered species produced and published on the website of the Brazilian Ministry of the Environment (http://www.mma.gov.br/sitio); both websites were accessed in September 2014.

Measuring the biological diversity

The species richness in the investigated neighborhoods was quantified and the families that had the largest number of species were highlighted in order to calculate and compare the diversity of plant species between the studied neighborhoods. The Preference Value Index (PVI) was also calculated using the formula $PVI\% = Abu\text{-}Rel\% + Fre\text{-}Rel\%$, wherein *Abu-Rel%* is the number of individuals of a species, divided by the total number of individuals of all the species observed in each neighborhood, multiplied by 100; and *Fre-Rel%* is the number of dwellings holding a given species, divided by the total number of dwellings in the sample, multiplied by 100. The PVI indicates the percentage of places where a specific plant species occurs in, in addition to measuring the frequency of the species in the backyards, i.e., the index indicates the degree of importance and usefulness of the species grown in the backyards to the family (GOMES, 2010).

Bivariate correlations were calculated between the free backyard area and the number of species in the backyards; between the free backyard area and the total number of individuals cultivated in the backyard; and between the backyard area and the number of trees grown in the backyard, in order to verify if the free (uncemented) area had influence on the number of species and individuals in the backyard. Santos (2007) has proposed three correlation coefficients to distinguish the bivariate correlations, whenever they are found: *strong positive* ($0.8 \leq r < 1$); *moderate positive* ($0.5 \leq r < 0.8$); and *weak positive* ($0.1 \leq r < 0.5$).

After the mean number of trees per backyard of the studied neighborhoods was quantified, the planting potential of the two neighborhoods was estimated based on the mean number of trees per backyard and on the soil available for planting (mean free area of the backyards of each neighborhood, multiplied by the number of backyards in the neighborhood). It was done through the herein developed equation $PP = \{[sd\ (m^2)/9m^2] - nmap\}$, wherein: *PP* = planting potential; *Sd* = soil available for planting; and *nmap* = mean number of trees per backyard; 9 m^2 was considered an area suitable for the growth of a tree seedling.

Herbaceous and shrubby plants were not taken into consideration in the quantification of planting potentials, because these botanical types are not exclusionary. On the contrary, backyards with good vegetation cover present a herbaceous stratum, which is followed by a shrubby stratum and, finally, by an arboreal one. The 9 m^2 area is sufficient for the growth of medium-sized fruit trees such as *Psidium guajava*, *Eugenia uniflora* and *Citrus* spp., which are much appreciated and commonly found in Brazilian household backyards.

Results and discussion

The backyards in *Conjunto Triângulo* presented mean free area 70.3 m^2, whereas those in *Zona 02* presented mean free area 164.4 m^2. Zona 02 was the only neighborhood wherein the variables "number of species", "number of individuals" and "number of trees" showed (weak) correlation with the backyard area (Table 1).

Table 1. Bivariate correlations

Bivariate correlation	Conjunto Triângulo	Zona 02
Area x Number of species	0.0553; p=0.728*	0.4304. p<0.0001
Area x Number of individuals	0.0236; p=0.882*	0.4229. p<0.0001
Area x Number of trees	0.2133; p=0.673*	0.4592. p<0.0001

Source: prepared by the author. (*uncorrelated variables)

The current study has quantified 94 species cultivated in *Conjunto Triângulo*, as well as 381 species cultivated in the backyards of *Zona 02*. As for their uses, ornamental species prevailed in the backyards of *Zona 02*, an upper-middle class neighborhood, whereas utilitarian species (i.e., medicinal and food species) prevailed in the backyards of *Conjunto Triângulo*. Exotic species were dominant in the flora of both neighborhoods (Table 2).

Table 2. Species richness and rate of ornamental and exotic species

Neighborhood	Number of families	Number of genera	Number of species	Ornamental species rate	Exotic species rate
Conjunto Triângulo	52	87	94	23.4%	81.9%
Zona 02	108	278	381	70.1%	77.7%

Source: prepared by the author

The upper-middle class neighbors of *Zona 02* have shown mean cultivation 13.2 species per backyard; however, this value decreased to 6.1 species in *Conjunto Triângulo*. Nine-point-six percent (9.6%) of the backyards in *Conjunto Triângulo* were completely paved, i.e., they had no vegetation, with no possibility of future planting. On the other hand, this percentage declined by 1/3 (3.4%) in Zona 02. With respect to family income, 7.1% and 59.5% of the families interviewed *in Conjunto Triângulo* belong to social classes E and D, respectively. On the other hand, 19.3% and 65.4% of the families interviewed in *Zona 02* belong to social classes B and A, respectively (Table 3).

Table 3. Percentage of fully paved backyards, mean number of species per backyard and prevailing social classes in the neighborhoods.

Neighborhood	Paved backyards	Number of species per backyard	Prevailing social classes
Conjunto Triângulo	9.6%	6.1	D and E
Zona 02	3.4%	13.2	A and B

Source: prepared by the author

The most diverse families in Conjunto Triângulo were: *Asteraceae* (8 species); *Myrtaceae* (7 species); *Rutaceae* (6 species), and *Solanaceae* (6 species); whereas the most diverse families in Zona 02 were: *Araceae* (17 species); *Asteraceae* (17 species); *Arecaceae* (14 species) and *Euphorbiaceae* (13 species). The species cultivated in the backyards of the two neighborhoods presented low preference value index.

The mean number of trees per backyard was 2.6 in *Conjunto Triângulo* and 5.2 in *Zona 02*; whereas the mean number of shrubby individuals per backyard was 4.7 in *Conjunto Triângulo* and 31.5 in *Zona 02*. Knowing the mean planting potential of the backyards (i.e., the number of trees that could be still planted per backyard) allowed calculating the number of trees that could be planted according to the number of backyards in the neighborhoods (Table 4).

Table 4. Planting potential

Neighborhood	Mean area (m^2)	Number of backyards	Mean number of trees per backyard	Tree planting potential per backyard	Total tree planting potential
Conjunto Triângulo	70.3	407	2.6	5.2	2116
Zona 02	164.4	895	5.2	13.1	11725

Source: prepared by the author

The tree planting potentials in both fields of the social gradient investigated in the current study have shown the possibility of enhancing food security and conserving biological diversity through planting in backyards, preferably fruit trees. Food security (or lack thereof) in Brazil is an issue that transcends social classes. According to the Brazilian Institute of Geography and Statistics (IBGE, 2011), less than 10% of Brazilians aged 10 years or older consume 400 grams of fruits and vegetables on a daily basis, as recommended by the World Health Organization; however, the excessive consumption of sugars is recurrent in all social classes. It would be possible achieving a more effective consumption of fruits through the introduction of fruit trees in both investigated neighborhoods, because there is a direct correlation between the presence of such food resource and its consumption by family members (LEVKOE, 2006).

Eight (8) out of the species identified in *Conjunto Triângulo* and *Zona 02* were classified as endangered. One of them, *Araucaria angustifolia* was found in the two analyzed neighborhoods. The endangered species found in the backyards have low preference value indices, except for *Euterpe edulis*, which is relatively widespread in *Zona 02* (PVI 9.5%).

These results have shown the viability of the backyards in the metropolitan region of Maringá for *ex-situ* practices to conserve endangered plant species (Table 5). Indeed, although the percentage of protected areas has been increasing worldwide since 1990, the number of endangered species keeps on growing (PNUMA, 2011). Such facts highlight the urge to develop additional biological conservation mechanisms.

Table 5. Endangered species and PVI, *Conjunto Triângulo* and *Zona 02*

Endangered species (*Conjunto Triângulo*)	Preference value index
Araucaria angustifolia	2.5
Cedrela fissilis	1.7
(*Zona 02*)	
Araucaria angustifolia	1.2

Cupressus macrocarpa	1.6
Delonix regia	0.4
Dicksonia sellowana	2
Euterpe edulis	9.5
Heliconia angusta	2

Source: prepared by the author

Thus, what do the richness of species and the other backyard flora data obtained through the herein investigated social gradient mean?

Certainly, increasing the number of trees in the backyards should be the first planning aim, due to its spatial and temporal scale of socio-environmental benefits. Backyards planted with more trees are positively correlated with invertebrate species (LORAM *et al,* 2008; KENDAL, et al 2010; HEEZIK et al 2014), and many of them are pollinating species. Thus, is there a minimum area to assure higher tree density in these spaces? This is an open question regarding backyard ecology (GODDARD *et al,* 2010). According to Mitchell and Handstad (2004), the critical area to increase the number of trees in backyards was approximately 167 m^2, roughly the mean backyard area of the upper-middle class neighborhood *Zona 02*.

The species-area correlation is applicable to the backyard scale. The area is often related to species richness, as well as to soil cover heterogeneity [number of trees, polygons with ornamental vegetation, grasses, etc. (LORAM *et al,* 2008; GODDARD, *et al,* 2010)]. Nevertheless, such correlations are not universal, as shown in the results of *Conjunto Triângulo*.

Therefore, there should be a specific legislation to assure backyards with minimum unpaved area 170 m^2 available to the flora in the metropolitan region of Maringá. Small backyards often have less trees, mainly individuals whose crowns are higher than two meters, fact that may lead to economic, social, aesthetic and ecological damages (LORAM *et al*, 2008). Excessively small backyard areas could compromise, for example, the possibility of connectivity between urban and forest landscapes (DÍAZ *et al*, 2011), and, by extension, the possibility of gene flow between them.

Given the fragmented nature of the backyard flora, which is distributed in small, isolated habitat parts, the standard positive correlation between species richness and area, which often occurs in pristine environments, *is especially important in urban ecological systems*. Parts of larger habitats support larger and more stable bird populations. The same happens with other taxa living in cities, such as amphibians, mammals and carabids (GODDARD *et al*, 2010).

In some cases, backyards are points of introduction of exotic species that become invasive in pristine environments (TURNER *et al*, 2005). Twenty-one (21) invasive plant species were introduced in France through backyard cultivation, whereas 90% of the invasive plants in the Mediterranean region are ornamental species that managed to escape from the boundaries of gardens and colonize new habitats (MARCO *et al,* 2008).

However, since the vegetation of the investigated backyards is typically distributed as a pool of very few abundant species, as well as of many species with low populations (i.e., many species with low PVI), it is likely that the opportunities for most species to colonize habitats are very scarce (SMITH *et al,* 2006b). Nevertheless, it is recommended conducting periodic assessments in forest fragments in and around the cities of the RMM in order to detect possible invasive plant species dispersed from backyard cultivations.

Nowadays, the false dichotomy between the native and the so-called exotic species is overcome. With respect to the environmental services of both species, the question has shifted to what the cost of the opportunity to include them in plans to increase the flora of urban ecosystems would be. Thus, it is possible concluding that the risk of invasion or of other ecosystem damages is balanced by the utility in the generation of environmental services in the cities and it can be indicated through the use of alien species.

For example, exotic plant species are sometimes more resistant to urban stresses such as contamination and they also provide relevant services to citizens (DEARBORN and KARK, 2010; HEEZIK, *et al,* 2014). Similarly, from the *ex-situ* conservation perspective, there are species, such as those in the case under consideration, that have high conservation value. Thus, the conservation of both groups of species can be combined. Native species often support more consumers; however, the conservation value promoted by exotic species in urban ecosystems is not negligible. For example, associations between lichens and exotic plants appear to be more complex than those set between native species (FRENCH *et al*, 2005). According to Head and Muyr (2006), who conducted studies in the backyards of Australian cities, the exotic shrub *Lantana camara* (identified in *Zona 02*, low PVI) stood out because it houses native bird species whose habitats have been destroyed by urbanization.

The richness of plant species in urban backyards is often high, although it is currently poorly distributed. Neighborhoods with higher socioeconomic status usually present greater plant diversity in their backyards because their residents have more resources to introduce new species according to their preferences (GROVE *et al*, 2006). In addition to these backyards, it is possible having more area available to plant diversification (THOMPSON *et al*, 2004), as the current study found in the comparison between the plant diversity of backyards from different social classes.

However, the richness of species between both the poor and the upper-middle class neighbors in the current study follows a pattern: a few species with high PVI - i.e., common in backyards - followed by a dozen of others with low PVI. Such result is similar to that found by several authors (THOMPSON *et al,* 2004; SMITH *et al,* 2006a; MARCO *et al,* 2008). The low PVI of most species identified in *Zona 02* and *Conjunto Triângulo* could be a restriction factor to the feeding of more selective herbivores such as some insect species. However, a high proportion of herbivores - including insects - is adapted to feed on plants at higher taxonomic levels such as genus or even family (SMITH *et al*, 2006b).

There is a well-defined predominance trend to cultivate utilitarian species among the poor, as well as to cultivate ornamental species among neighbors of higher socioeconomic status (PEYRE *et al,* 2006; BERNHOLT *et al,* 2009; LUBBE *et al,* 2010). Such trend was also highlighted in the current study. Consistently with their lifestyle, the poor neighbors in Conjunto Triângulo have fewer (material, monetary and technical) resources and less area to manage the vegetation of their backyards. There is no *prestige ecology* materialized in the abundance of ornamental plants arranged through landscape architecture inputs among them, as it can be seen in upper-middle class neighborhoods (GROVE *et al*, 2006). There is just land available to the possibility of expanding their homes. Hope *et al.* (2003) have called such phenomenon the *lush effect* - the richest and most schooled people are surrounded by vegetation and use the flora to create landscapes in their homes.

The neighbors develop landscapes in their backyards (primarily in the front gardens, but also in open spaces behind the house) by following the lifestyle of the community they live in, although using species that reflect their personal tastes and choices. Thus, they show their socioeconomic status through the abundance of ornamental plants (BATHI, 2006; BUCHMANN, 2009).

In fact, the inequality in the access to the flora, as well as to its environmental services, is even more serious in *Conjunto Triângulo*, since the neighborhood has no green area, unlike *Zona 02* where there are two parks nearby. Thus, it is worth emphasizing the importance of increasing the vegetation cover, mainly that of arboreal nature, through planting projects. Backyards are strategic to the increment of green areas in neighborhoods where there is scarce vegetation (RUDD *et al*, 2002). It is not merely an aesthetic matter: several studies have correlated abundantly vegetated neighborhoods with the lower incidence of different types of diseases such as the respiratory ones (TZOULAS *et al*, 2007).

Conjunto Triângulo has almost three times (9.6%) the number of fully paved backyards found in *Zona 02* (3.4%). Weller and Jenerette (2009) have studied the relation among vegetation cover, housing density and income in the Metropolitan Region of Los Angeles and found that lower-income neighborhoods have more waterproofed soil and fewer trees. Richer neighborhoods, on the other hand, are positively correlated with wooded dwellings, as well as with the presence of green areas. Such situation is similar to that found in the neighborhoods studied in the Metropolitan Region of Maringá. Similar to what happens in Los Angeles, in addition to the economic difficulties, it is necessary emphasizing that the environmental deprivations the neighbors in *Conjunto Triângulo* are subjected to, due to the scarcity of trees, are an indication of environmental injustice.

Such environmental injustice between the neighborhoods in the metropolitan region of Maringá could be reduced through planting projects comprising arboreal plant species, preferably the native ones. It is worth highlighting that species introduction programs should be preceded by sociological investigations in order to identify the ways the native vegetation - generally less known than the exotic species - may be accepted and incorporated into the backyards. (KENDAL *et al*, 2010).

Conclusions

Brazilian backyards comprise hundreds of hectares in the cities. They are spaces available to receive vegetation able to provide greater food security and quality of life to the citizens. In addition, they can also sustain biological diversity and even *ex-situ* conservation by harboring endangered species such as *Araucaria angustifolia*, which is critically endangered and whose seeds are highly prized in the culinary of Southern Brazil. However, backyards are invisible to municipal authorities despite their potential. There is neither specific legislation in the cities in the metropolitan region of Maringá, nor systematized data to allow planning and managing the vegetation increase in these spaces – the current study was pioneer in the aim to portrait the plant diversity in the backyards of different social classes living in the RMM.

The backyards in *Conjunto Triângulo* are the only possibility to introduce green areas through tree planting. As it was shown in the present study, their planting potential is high - it would be possible planting approximately 2,200 trees in the backyards of the neighborhood. On the other hand, the planting potential in *Zona 02* is even higher - approximately 12,000 trees could be introduced in its backyards. For comparison purposes, the urban grove in Maringá City consists of approximately 130,000 trees.

Obviously, the backyard planting potential will never be totally used for several reasons. In the backyards of impoverished neighbors, for example, there is competition between very different uses such as increasing the built-up area of the dwellings. However, the results in the current study have shown that backyards are strategic places to increase the vegetation cover in cities and, by extension, to increase their ecosystem services. However, planting trees is the best way to increase the abundance of a wide range of invertebrate and vertebrate taxa in urban backyards (SMITH *et al,* 2006a; LORAM *et al,* 2008). In addition, wild animals living in trees are more protected against predation by domestic animals such as *Felis catus* (BAKER *et al*, 2014; THOMAS *et al,* 2014).

Thus, the successful planning of backyards will only be possible through previous studies able to help understanding the environmental, cultural and socioeconomic factors influencing these backyards' configuration. Therefore, the methodology used in the current study to compare neighborhoods could be periodically used to assess the biocultural, social, economic and structural conditions influencing these habitats on a metropolitan scale.

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THE GRASS IS ALWAYS GREENER ON THE OTHER SIDE OF THE FENCE: THE FLORA IN URBAN BACKYARDS OF DIFFERENT SOCIAL CLASSES

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Abstract: Home gardens have considerable biodiversity conservation potential. However, these spaces are unplanned, and there is little information about the flora diversity in the backyards of different social classes. The current study has quantified and compared plant diversity in the backyards of two neighborhoods located in the metropolitan region of Maringá - RMM (Paraná, Brazil), namely, *Conjunto Triangulo* and *Zona 02*. The diversity patterns were markedly different when the neighborhoods were compared. Therefore the present study has set some planning guidelines aiming at increasing the presence of woody vegetation, as well as at contributing to biodiversity conservation, including the conservation of endangered plant species, in the backyards of the RMM.

Keywords: urban ecology; home gardens; urbanization; urban biodiversity

Resumen: Patios tienen un potencial considerable para la conservación de la biodiversidad. Sin embargo, estos espacios no son planificados, y existe poca información sobre la diversidad de la flora presente en los patios de las diferentes clases sociales. Hemos cuantificado y comparado la diversidad vegetal de los patios de dos barrios de la región metropolitana de Maringá (Paraná, Brasil), a saber, el Conjunto Triangulo y la Zona 02 mediante la identificación de las especies y a través del cálculo de índices de diversidad, correlaciones bivariadas y del potencial de plantíos. Los estándares de diversidad son acentuadamente diferentes, cuando comparados los barrios, y por ello hemos trazado algunas directrices de planificación, con el objetivo de aumentar la presencia de la vegetación arbórea, y contribuir a la conservación de la diversidad biológica, incluyéndose la conservación de las especies de plantas en peligro de extinción, en los patios de la RMM.

Palabras clave: ecología urbana, patios, urbanización, biodiversidad urbana.

Resumo: Quintais urbanos possuem um considerável potencial para a conservação da biodiversidade. Não obstante, esses espaços são pouco planificados, e há pouca informação sobre a diversidade da flora presente nos quintais de distintas classes sociais. Quantificamos e comparamos a diversidade vegetal dos quintais de dois bairros da Região Metropolitana de Maringá, (Paraná, Brasil), a saber, Conjunto Triangulo e Zona 02. Os padrões de diversidade são distintos, pelo que esboçamos algumas diretrizes de planejamento, com o objetivo de incrementar a presença de vegetação arbórea, reforçar a segurança alimentar e contribuir para a conservação da diversidade biológica, incluindo-se a preservação de espécies vegetais ameaçadas de extinção.

Palavras-chave*:* ecologia urbana, quintais, urbanização, biodiversidade urbana.