

# Backyards Are a Way to Promote Environmental Justice and Biodiversity Conservation in Brazilian Cities

Gedeone Ferreira Lima <sup>1</sup>, Jeater Waldemar Maciel Correa Santos <sup>1</sup>, Ricardo Massulo Albertin <sup>1</sup>,  
Beatriz Martínez-Miranzo <sup>2,3</sup>, Franco L. Souza <sup>4</sup> and Fabio Angeoletto <sup>1,\*</sup>

<sup>1</sup> Programa de Pós-Graduação em Geografia, Universidade Federal de Rondonópolis, Rondonópolis 78736-900, Brazil

<sup>2</sup> Department of Biodiversity, Ecology and Evolution, Faculty of Biological Sciences, Complutense University of Madrid, Jose Antonio Novais, 12, 28040 Madrid, Spain

<sup>3</sup> Centro para el Estudio y Conservacion de las Aves Rapaces en Argentina (CECARA), Facultad de Ciencias Exactas y Naturales, Universidad Nacional de La Pampa, Avda. Uruguay 151, La Pampa, Santa Rosa 6300, Argentina

<sup>4</sup> Universidade Federal de Mato Grosso do Sul, Campo Grande 79070-900, Brazil

\* Correspondence: fabio\_angeoletto@yahoo.es

**Abstract:** Brazilian cities feature quite unequal neighborhoods. Middle-class neighborhoods have better infrastructure than those inhabited by low-income families. These inequalities are not limited to social and economic scopes; they also reach the environmental one. Tree cover in these neighborhoods is often correlated to residents' socioeconomic status. Injustice in access to trees deprives Brazilians of their ecosystem services. Furthermore, the scarcity of tree cover in the poorest neighborhoods means less support for biodiversity. Thus, backyards can be planned to form vegetation patches capable of providing urban populations with access to green areas, as well as working as wildlife habitats.

**Keywords:** backyards; urban biodiversity; environmental injustice; urban ecological corridors; urban ecology; Brazilian cities; Brazil



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Resources and power are not evenly distributed across cities. This is a consensual statement among sociologists, which is easily verifiable in the daily reality of any citizen. Urban ecology is a mandatory interdisciplinary science that combines theories and methodological approaches from both natural and social sciences [1]. Urban ecology researchers have shown that environmental resources, such as trees, as well as the power to make themselves heard by urban managers—which is an influence materialized in the most wooded neighborhoods—are also an inequality type, an environmental one [2]. In fact, neighborhoods' socioeconomic status in different Brazilian and Latin American cities is a proxy used to measure urban biodiversity [3].

The environmental injustice phenomenon, which is defined as inequality in access to environmental resources [4], widens the range of inequalities among residents in Latin American cities. Urban environmental injustice is a phenomenon that evolves from the unequal, unfair distribution of natural resources, hazards, burdens, and benefits. It is also understood as the process of the creation of unjust situations by decision making. And it is also a phenomenon that can be researched by the recognition and perception of the evolved injustices [5–7]. Brazilian cities are mostly horizontal, i.e., they are formed by neighborhoods subdivided into land lots, whose perimeters are partly occupied by houses' built-area and by an adjacent area called a backyard. Environmental injustice is also materialized in backyards: backyards in upper-middle-class families' homes have a larger number of plant species, individuals, plant habits and uses (for example, ornamental plants and fruit trees), as well as bigger areas than poor families' backyards [8]. The biodiversity of backyards is a theme that has been scarcely studied in Brazil [9], but some authors have pointed out that those differences in the vegetation of backyards of low-income and upper-middle-class

families are, unfortunately, a common phenomenon [8,10]. Environmental injustice in Brazilian low-income families' backyards prevents them from accessing ecosystem services provided by trees, such as the removal of atmospheric pollutants, which are mainly absorbed by leaf stomata [11]. Other ecosystem services provided by backyard vegetation include temperature regulation through cooling by shading and/or evapotranspiration; reduced perception of noise due to exposure to biodiversity (for instance, birds and their songs); food supply, i.e., backyard horticulture; and psychological, aesthetic and recreational benefits, as backyard vegetation reduces stress and promotes physical activity [12]. That inequality is also bad news for wildlife since broad low-income neighborhoods with poor vegetation cover provide less support to urban biological diversity [2].

One of the causes of unfair access to vegetation in Brazilian cities is the systematic inequality in access to resources and wealth. Such urban environmental inequality is global [13]. Peripheral neighborhoods, such as Brazilian cities' slums, often emerge in areas of little real estate interest and lack support from local governments [14]. However, the fact that these neighborhoods emerged from improvisations does not mean that they are unfeasible for both afforestation and biological diversity. Vegetation cover maximization in neighborhoods, without prior planning input, demands strategies to introduce vegetation in their public and private open spaces. Free spaces, such as squares and parks, are rare or do not exist at all in Brazilian cities' poor neighborhoods. Backyards in these urban spaces may be the only possibility of introducing a patch of relatively continuous vegetation, which is relatively permeable to faunal movements and capable of increasing the support provided to wild fauna.

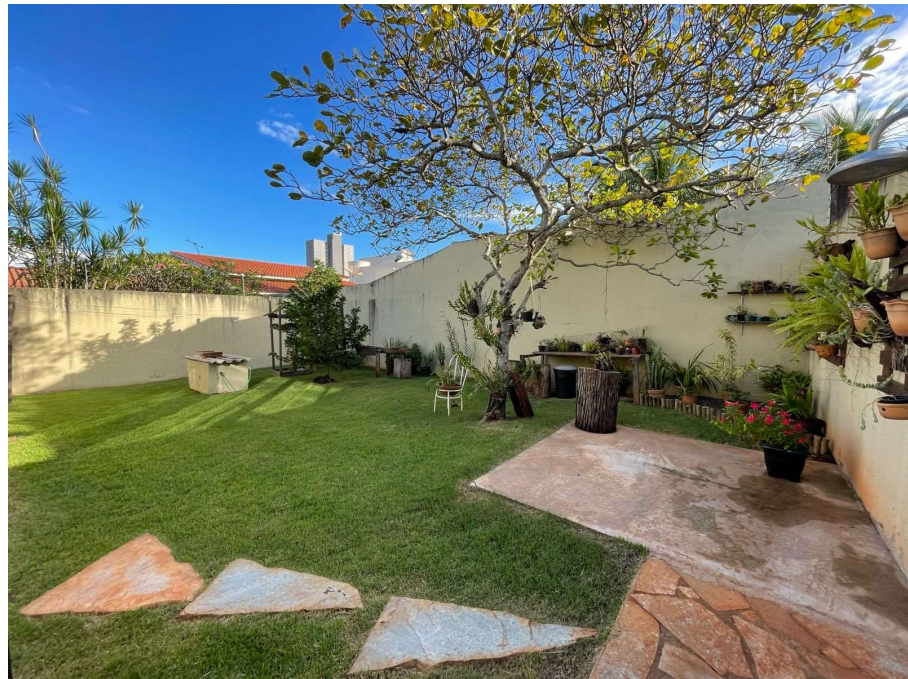
Rondonópolis is a medium-sized Brazilian city housing 222,000 inhabitants; it is located in the *Cerrado* biome, which is a global biodiversity hotspot. Biodiversity hotspots are environments rich in critically-endangered endemic species. At least 4800 plant and vertebrate species are endemic to the *Cerrado* biome, a tropical savanna. Its annual deforestation rate is 2.5 times higher than that of the Amazon biome, and its legally protected areas only cover 7.5% of that biome [15]. A likely conservation strategy to be applied to *Cerrado* lies in turning cities belonging to this region into more biodiversity-friendly places in order to help mitigate the devastation observed in that biome [15]. The city of Rondonópolis presents strong social contrasts; most of its citizens belong to low-income families, and the city holds approximately 62,000 backyards [10]. Backyards in upper-middle-class neighborhoods (Figures 1–3) account for more biodiversity than those located in poor neighborhoods (Figures 4 and 5), according to the study developed by the geographer Gedeone Lima [10]. Lima used statistical and geoprocessing techniques to measure and compare the amount of vegetation in the backyards of low-income and upper-middle-class families in Rondonópolis [10]. *Cerrado* birds, such as those belonging to the species *Ara ararauna*, whose population in pristine environments has declined [16], are found in wooded backyards located in middle-class neighborhoods in Rondonópolis (Figure 6). However, most backyards in Rondonópolis are located in poor neighborhoods and have scarce vegetation cover [10]. The socio-environmental reality of Rondonópolis demands a broad and urgent intervention in that city's backyards, through the planting of thousands of fruit trees in those habitats. Duarte and Leite (2019) [17] compiled a list of 64 tree species in the *Cerrado* biome that provide food resources for birds, mammals and arthropods. They could be easily cultivated in nurseries and some species (e.g., *Anacardium occidentale*, *Caryocar brasiliense* and *Psidium canum*) are consumed by Brazilians. They could also reinforce the food security of the citizens of Rondonópolis.



**Figure 1.** Upper-middle-class family backyard in Rondonópolis. The diversity of species, plant habits and uses (fruit trees and ornamental plants) are common in the backyards of upper-middle-class families in cities in Brazil.



**Figure 2.** Upper-middle-class family backyard in the city of Rondonópolis, Brazil.



**Figure 3.** Upper-middle-class family backyard in the city of Rondonópolis, Brazil.



**Figure 4.** Low-income family backyard in Rondonópolis City, Brazil. Usually, low-income families have fewer materials and monetary and technical resources to manage the vegetation in their backyards.



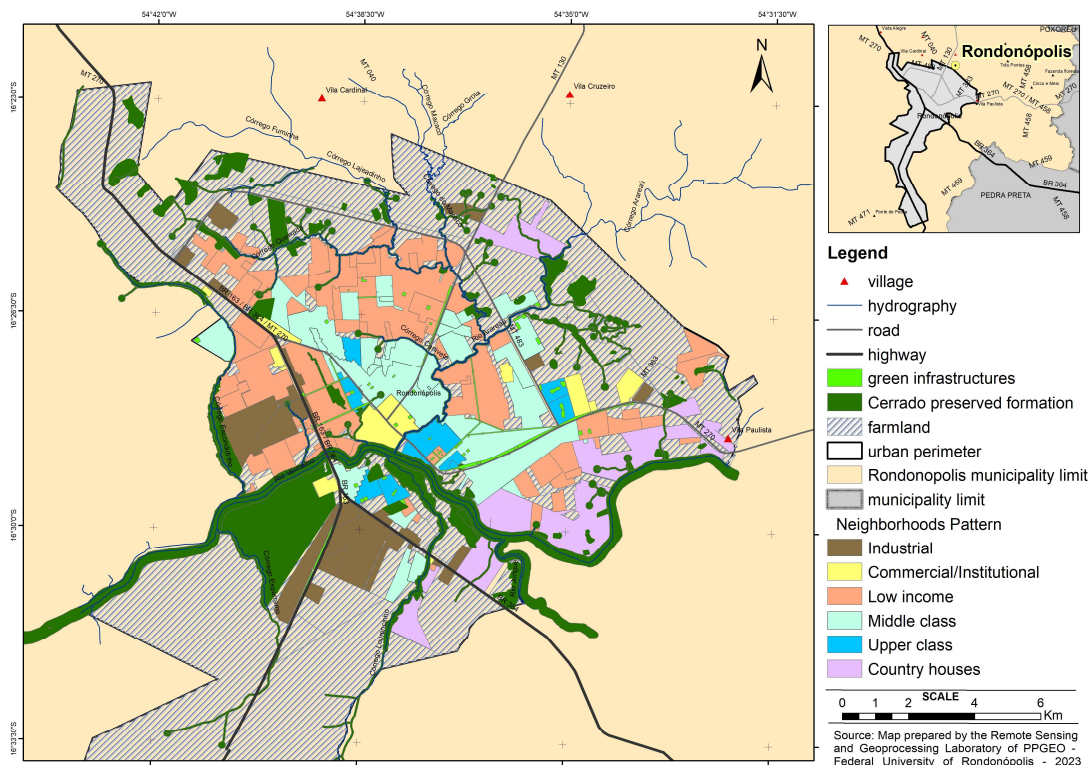
**Figure 5.** Low-income family backyard in the city of Rondonópolis, Brazil.



**Figure 6.** Blue-and-yellow macaws (*Ara ararauna*) in upper-middle-class family backyard in Rondonópolis City.

In addition to providing habitats for faunal and floral species, including endangered species [18], backyards can act as ecological corridors between native vegetation fragments isolated in urban matrices by promoting the flow of different species and genes [19]. Figure 6 shows hundreds of *Cerrado* fragments among poor, middle-class and upper-middle-class neighborhoods in the city of Rondonópolis. The potential to connect these fragments by introducing trees in backyards is evident. Furthermore, Figure 7 shows an urban expansion zone to the North. Rural areas (i.e., pastures and areas for planting

soybeans, among other crops) are in the process to be urbanized and to approach relatively conserved *Cerrado* fragments. The occupation pattern is of mixed nature since it comprises low-income and middle-class family neighborhoods. Planning the vegetation of backyards located in that urban expansion zone can help to avoid the isolation of *Cerrado* patches.



**Figure 7.** Dozens of *Cerrado* fragments in the city of Rondonópolis (dark green areas in the figure) could be connected through backyards' afforestation.

Promoting environmental justice in the city of Rondonópolis—and in other Brazilian cities—is an essential step towards increasing their ability to conserve their biodiversity. In fact, the simplistic paradigm previously used to classify cities as the antithesis of nature was replaced by a more intelligent approach, which advocates that cities should be planned as additional spaces for biological conservation [20–22], as well as that urban green spaces are important components in the complex challenge to conserve global biological diversity [22–25]. However, democratizing access to flora among Brazilian city residents is a complex task due to four hurdles that must be overcome. Backyards are ubiquitous in Latin American cities; they occupy a significant urban-sprawl area, sometimes more than 30% of it [26]. Despite this ubiquity, Brazilian city halls are unaware of these spaces: they lack data about the number of backyards, about their mean area and about the amount of soil available for plantations. In addition, there is insufficient specific legislation for the conservation of backyard vegetation, and it releases residents from planting or keeping trees in these spaces. The area available for vegetation in urban backyards can be subjected to other uses, such as enlarging houses' built area.

The case of Rondonópolis' green area planning practice and the situation and location of green spaces are representing the distributional and procedural environmental injustices. Preserving the backyard area available for fauna and flora is a complex demand, which can only be satisfied with an urban planning contribution. Unfortunately, there is no specific environmental policy for backyards in Brazilian cities. Finally, the economic cost of maintaining biodiverse backyards is usually a barrier to a greater presence of vegetation in the backyards of low-income families [27]. The lack of money to invest in backyards is allied to other shortages, such as the lack of technical support (what to plant?) and

time (upper-middle-class families have more time to take care of their plants, or they can hire gardeners). There are no simple answers for overcoming that barrier, but evidently overcoming it will depend on the development of specific municipal environmental policies to increase biological diversity in the backyards of Brazilian cities.

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