

**When we think of urban afforestation in Brazil, what comes to  
mind is a mouth that has lost its teeth**

**Quando pensamos em arborização urbana no Brasil, o que vem  
à mente é uma boca banguela**

**Quando pensamos en el arbolado urbano en Brasil, lo que nos  
viene a la mente es una boca chimuela**

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**Abstract:** The conservationist mentality of classifying pristine and degraded environments has given way to a more intelligent approach, that is, producing and applying knowledge to increase and support biodiversity in human habitats. Cities have a high potential for the conservation of biological diversity, but it is not fully feasible without considerable planning and management inputs. There are many ecosystem services provided by trees in urban ecological systems, whose positive impact on human well-being is consensual in the literature. Likewise, the capacity of urban flora, especially woody vegetation, to attract and support fauna has been proven in several studies. Tropical megadiverse countries whose cities are undergoing rapid urbanization such as Brazil face the double challenge of creating cities that can support biological diversity, with environmental justice. The most important tool for solving these demands is urban afforestation planning. However, the capacity of Brazilian cities to plan and execute tree-planting projects is low. In this essay, we discuss the main difficulties related to urban afforestation in Brazil and present some alternatives for increasing the number of trees and species and for the democratization of their benefits, especially in neighborhoods with low socioeconomic status.

**Keywords:** Biodiversity of tropical cities, Urban afforestation, Environmental justice, Global Hotspots of Biodiversity, Urban ecology

**Resumo:** A mentalidade conservacionista de classificar ambientes como prístinos ou degradados deu lugar a uma abordagem mais inteligente, ou seja, produzir e aplicar conhecimento para aumentar e sustentar a biodiversidade nos habitats humanos. As cidades têm um alto potencial para a conservação da diversidade biológica, mas que não é plenamente alcançável sem consideráveis insumos em planejamento e gestão. São muitos os serviços ecossistêmicos prestados pelas árvores nos sistemas ecológicos urbanos, cujo impacto positivo no bem-estar humano é consenso na literatura. Da mesma forma, a capacidade da flora urbana, especialmente da vegetação lenhosa, em atrair e sustentar a fauna tem sido comprovada em diversos estudos. Países tropicais megadiversos, cujas cidades estão em rápida urbanização, como o Brasil, enfrentam o duplo desafio de criar cidades capazes de dar suporte à diversidade biológica, com justiça ambiental. A ferramenta mais importante para solucionar essas demandas seria o planejamento da arborização urbana. No entanto, é baixa a capacidade das cidades brasileiras em planejar e executar projetos de plantio de árvores. Neste ensaio, discutimos as principais dificuldades relacionadas à arborização urbana no Brasil e propomos algumas alternativas para aumentar o número de árvores e espécies e democratizar seus benefícios, principalmente em bairros com baixo nível socioeconômico.

**Palavras-chave:** Biodiversidade de cidades tropicais, Arborização urbana, Justiça ambiental, Hotspots Globais de Biodiversidade, ecologia urbana

**Resumen:** La mentalidad conservacionista de clasificar los entornos como prístinos o degradados ha dado paso a un enfoque más inteligente: producir y aplicar conocimientos para aumentar y mantener la biodiversidad en los hábitats humanos. Las ciudades tienen un alto potencial para la conservación de la diversidad biológica, pero este potencial no se puede lograr por completo sin consideró los aportes de planificación y gestión. Son numerosos los servicios ecossistémicos proporcionados por los árboles en los sistemas ecológicos urbanos, cuyo impacto positivo en el bienestar humano es consensuado en la literatura. Asimismo, la capacidad de la flora urbana, especialmente la vegetación lenhosa, para atraer y sustentar la fauna ha sido probada en varios estudios. Los países tropicales megadiversos cuyas ciudades se están urbanizando rápidamente, como Brasil, enfrentan el doble desafío de crear ciudades capaces de soportar la diversidad biológica, pero con justicia ambiental. La herramienta más importante para resolver estos problemas es la planificación forestal

urbana. Sin embargo, la capacidad de las ciudades brasileñas para planificar y ejecutar proyectos de siembra de árboles es baja. En este ensayo, discutimos las principales dificultades relacionadas con la forestación urbana en Brasil y presentamos algunas soluciones para aumentar el número de árboles y especies y democratizar sus beneficios, principalmente en barrios de bajo nivel socioeconómico.

**Palabras clave:** Biodiversidad de ciudades tropicales, arbolado urbano, justicia ambiental, Hotspots mundiales de biodiversidad, ecología urbana.

## HOW TO OVERCOME THE UNSATISFACTORY BRAZILIAN CITIES' AFFORESTATION

Brazilian cities' afforestation is like a toothless mouth. Besides lacking trees, urban afforestation in Brazil is usually poor in species (Leite, 2018, Sartori et al., 2019). Ironically, Brazilian cities present many gaps in tree species, although the country accounts for the greatest plant diversity on the planet: 46,000 identified plant species (Wilson & Peter, 1988; BFG - The Brazil Flora Group, 2015).

The low status of Brazilian urban afforestation has many causes. Applied studies about the ecology of Brazilian cities remain scarce, although the Brazilian scientists have notably advanced in identifying plant species belonging to all six Brazilian biomes. However, we do not know which tree species of Brazilian flora would adapt to some characteristics of urban ecosystems, such as heat islands, soil fertility, and atmospheric pollution. Unfortunately, this paucity of data on the biotic and abiotic conditions of urban ecosystems is a global reality, and research that allows a more efficient choice of which tree species should be introduced into cities is urgent (Oldfield et al., 2013; Saldaña-Vázquez, Ferreyra-García & Vázquez-Domínguez, 2019; Szulkin et al., 2020; Fenoglio, Rossetti & Videla, 2020; Santangelo et al., 2022). Furthermore, could those species be easily reproduced in municipal nurseries? Our knowledge of how social, economic, environmental, and cultural factors influence urban flora remains quite poor; and this is a significant hitch in urban forest planning and management processes in Brazilian cities (Goddard et al., 2021).

The scarcity of knowledge about urban ecology causes the low technical skill of municipal governments, mainly in small- and medium-sized cities. Unlike the voracious metropolis depicted in the science fiction movie *Blade Runner*, which shadows the biosphere and is deprived of fauna and flora (where even snakes and owls are androids!), Brazilian small- and medium-sized cities have multiplied themselves and gotten urbanized faster than large cities. This urbanization pattern and the planning difficulties faced by smaller cities are a global issue (United Nations Population Fund [UNFPA], 2007).

There is also an academic conceptual blindness expressed in the catchphrase "native plants should be always kept; exotic species should be always eliminated". This cliché highlights a failure in the training of Brazilian environmental scientists: they do not understand that cultural factors have a significant influence on urban flora and that these factors should certainly be taken into consideration at the time to plan urban afforestation processes. For example, according to that approach, mango trees (*Mangifera indica*) should

be eradicated from Brazilian cities. However, those Asian trees are deeply entrenched in the food culture of Brazilian citizens since the 16th century. In addition, mango trees work as food sources for several animal species, such as bats (Souza & Vinzentin-Bugoni, 2020).

Afforesting cities with native species is indeed advisable (Santilli et al., 2018; Figueroa et al., 2018), but we advocate that adopting an impartial approach to exotic plants - i.e., checking to what extent they support the fauna in cities - is more intelligent than eliminating them on behalf of arguments coated with scientific varnish, but that are poorly supported by knowledge and information on urban ecology (Davis et al., 2011). As Oldfield et al. (2013) correctly claim, rather than fight or ignore invasive species, a third option is to investigate whether native and non-native species can provide ecosystem services side by side. Urban flora will always be a management issue, and more than that, a political issue: even the existence of native forest fragments such as parks depends on the political priority and technical capacity of municipal governments (Aronson et al., 2017; Figueroa et al., 2018; Silva et al., 2018; Lautert & Pippi, 2019; Lampinen et al., 2021; Souza, Fenoglio & Angeoletto, 2023).

Urban environmental injustice and unequal access to environmental resources also explain the “toothless” afforestation of Brazilian cities, whose poor neighborhoods have fewer trees and green areas, such as squares and parks. These features emphasize significant income differences between urban social classes, as well as the strongest influence of rich people on political decisions favoring their neighborhoods (Duarte et al., 2017; Leite, 2018, Sartori et al., 2019). The socioeconomic level of a given neighborhood is a proxy for the degree of support to biodiversity in Brazil, as well as in cities of other tropical megadiverse countries (Angeoletto et al., 2017; MacGregor-Fors & Escobar-Ibáñez, 2017).

The obstacles to increasing the number of species and trees in Brazilian cities need an immediate solution, given the important role played by trees in human health (Marselle et al., 2020) and urban biodiversity (Leveau & Leveau, 2020; Pena et al., 2017; Souza et al., 2019; Gomes et al., 2023), as well as their potential to sequester greenhouse gas emissions (Teo et al., 2021). Most of the 5,570 Brazilian cities are located in two global biodiversity hotspots, namely: Cerrado and Atlantic Forest biomes. The uncontrolled devastation of these biomes is another argument substantiating Professor Michael Rosenzweig’s idea (2003) that cities should be additional biological conservation spaces - this argument is particularly important for tropical urban ecosystems. A fundamental step to urban biodiversity conservation lies in developing and compiling studies on basic and applied tropical urban ecology. For instance, those conducted by 250 scientists from 32 countries, which will be published in the book *Ecology of Tropical Cities: Natural and Social Sciences Applied to the Conservation of Urban Biodiversity*, by Springer Nature in 2022 (Angeoletto et al., 2022a).

Brazilian cities’ low planning and management ability could be circumvented through formal partnerships among universities, municipal governments, and other institutions. The UFMT Post-graduation Programs in Geography and Environmental Technology in Rondonópolis City has established partnerships with institutions such as the Municipal Secretariat of the Environment and the State Public Prosecutor’s Office. These partnerships

resulted in studies used for biological diversity conservation. A 146-ha urban park was launched by these partnerships (Silva et al., 2018). Other examples of these partnerships comprise the revision applied to the Rondonópolis Municipal Master Plan in 2017, which mapped hundreds of Cerrado urban fragments, the biomonitoring of air pollution as well as the mapping of Cerrado rural fragments (Silva et al., 2017; Angeoletto et al., 2019; Vacchiano et al., 2019).

Urban afforestation in Brazil is often restricted to street afforestation; however, municipal governments must be more ambitious. Urban backyards account for hundreds of hectares available for tree introductions. Backyards of a single neighborhood in Maringá City - which comprises 75 neighborhoods, in total - could be planted with 12,000 trees, this corresponds to 9% of trees planted on the city streets (Angeoletto et al., 2017). However, tree-planting procedures should be preceded by studies focused on investigating the flora of those spaces, and how willing the residents are to accept the afforestation process. These plantings must be based on strategies to support fauna (Angeoletto et al., 2022b; Gomes et al. 2023). Trees grown in backyards should also help mitigate the widespread food insecurity among Brazilian citizens. Backyards in poor neighborhoods of Brazilian cities are usually the only spaces available for massive tree introduction, which could help democratize access to urban biological diversity and its benefits.

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