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How much importance is given to native plants in cities' treescape? A case study in Fortaleza, Brazil

Marcelo Freire Moro[a,*], Christian Westerkamp[b], Francisca Soares de Araújo[c]

[a] Universidade Estadual de Campinas, Departamento de Biologia Vegetal, Bloco M, Campinas, SP, Brazil
[b] Universidade Federal do Ceará, Campus do Cariri, Av. Tenente Raimundo Rocha s/n, Cidade Universitária, CEP 63000-000 Juazeiro do Norte, CE, Brazil
[c] Universidade Federal do Ceará, Centro de Ciências, Departamento de Biologia, Bloco 906, CEP 60455-760 Fortaleza, CE, Brazil

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ABSTRACT

Even though Brazil is a mega-diverse country, many Brazilian cities prioritize exotic plants in their treescapes. Aiming to evaluate how much the treescape in Fortaleza (the fifth largest city in Brazil) is aligned with the policy of valorization of native biodiversity, we sampled street and backyard trees surrounding one of the few vegetation fragments of the city, which is an area considered a priority for conservation. We used the vegetation fragment's flora as reference to compare the potential number of local native species with the actual number of native species in the treescape of the site. To account how much of the native flora was present in the surrounding treescape, we made an inventory of the trees in streets, squares and backyards around the vegetation and compared with the native flora of the vegetation fragment. We then compared the ratio of native to exotic species and checked how many native species of the fragment were also in the surrounding treescape. Exotics were prevalent in both number of species and number of individuals, comprising 70% of the species and 86% of the individuals of public spaces, and 79% of the species and 78% of the individuals of private spaces. Only 14% of the native species of the vegetation were also represented in the treescape, and, in general, they comprehended only a few individuals. We argue that the city's treescape should be re-evaluated in order to value native plants more. Native plants in the treescape could be used as an environmental education tool to publicize native biodiversity to citizens.

Introduction

The importance of street and garden trees to cities is much beyond esthetic benefits. Besides improving climate and psychological wellbeing for humans (Lombardo, 1985; Kweon et al., 1998), cultivated plants also integrate the ecology of cities (Gaston et al., 2005; Smith et al., 2006), being an important element of urban biodiversity. But landscaping and gardening can also bring negative effects when cultivated exotic plants escape cultivation and become invasive (Zipperer, 2002; Harrington et al., 2003; Christianini, 2006; Mondin, 2006; Mengardo et al., 2012). Most of the introduced exotic species do not cause any ecological problem (Richardson et al., 2000a,b), but the ones that manage to turn into invasive can cause considerable hazard to ecosystems and have a high cost to control (Zipperer, 2002; Guézou et al., 2010; Gardener et al., 2012; Mengardo et al., 2012).

Another aspect to be considered when planning the implementation of urban treescaping is that citizens of heavily urbanized countries will have more chance to know and appreciate trees that are cultivated in the urban environment. If those are native plants, treescaping could be used as a tool to present native plants to people and increase public's support for conservation (McKinney, 2002, 2006; Dearborn and Kark, 2010; Herzog, 2013). The use of characteristic, native species from local ecosystems would be beneficial also to provide a sense of place, connecting people with the particularities and species of their own region (Dearborn and Kark, 2010; Abendroth et al., 2012; Herzog, 2013). Although Brazil is deemed a mega-diverse country, with more than thirty thousand native plants (Forzza et al., 2010), many Brazilian cities give priority to exotics in their treescape (Rocha et al., 2004; Santos et al., 2008, 2009; Barros et al., 2010; Moro and Westerkamp, 2011), reducing the contact of people with native biodiversity. Moreover, some of the plants now behaving as invasive in Brazil were originally introduced as ornamentals (Mondin, 2006; Mengardo et al., 2012; Moro et al., 2013), reinforcing the necessity to re-evaluate the urban forestry model adopted in the country.

Thus, to quantify how much native plants are been ignored in Brazilian treescapes we performed a quantitative survey in Fortaleza, the fifth largest city in the country. We aimed at answering the following questions: (1) which are the most common species in the treescape of the city; and are the most common species native or

* Corresponding author.
E-mail addresses: bio_moro@yahoo.com.br (M.F. Moro), westerkamp@cariri.ufc.br (C. Westerkamp), tchesca@ufc.br (F.S. de Araújo).

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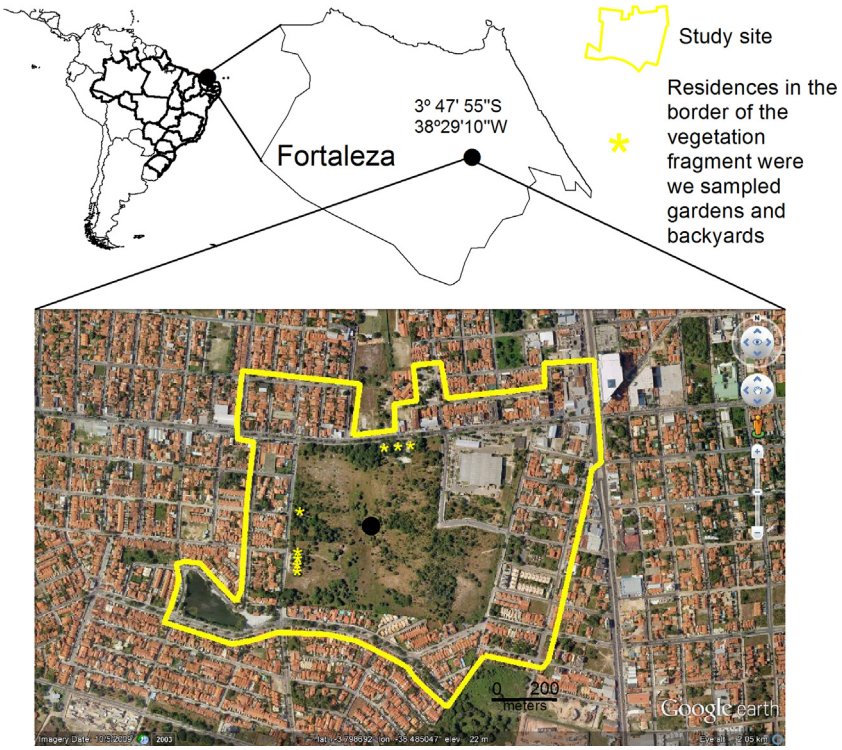

Fig. 1. Location of the study site in the city of Fortaleza. The sampling was made around the shown vegetation fragment in 2009 in both public spaces (streets and squares around the vegetation fragment, delimited by the yellow line) as well as in gardens and backyards located in the edge of the fragment (marked by asterisks). (For interpretation of the references to color in this figure legend, the reader is referred to the web version of the article.)
Satellite image source: Google Earth.

exotic? (2) Which is the share between native and exotic plants in public (streets and squares) and private (gardens and backyards) spaces? (3) How much is the native flora included as ornamental plants in the treescape? (4) Are exotic species from the treescape acting as invasive plants?

Methods

Fortaleza is located in the coastal region of the Ceará state in Northeastern Brazil. It is the fifth largest city in the country, with 2,452,185 inhabitants (IBGE [Instituto Brasileiro de Geografia e Estatística], 2010). Fortaleza grew in the 20th century from a city with less than 50,000 inhabitants to a city with more than two million people (IBGE [Instituto Brasileiro de Geografia e Estatística], 2010), resulting in a drastic loss of vegetation cover. Nowadays the city retains less than 10% of the original vegetated area and most remaining tracts are restricted to vegetation fragments within the urban matrix (Fortaleza, 2003). One of the few remaining vegetated areas within the city is a savannic site with 28 ha which was considered by the municipal law a conservation priority area to the city (Fortaleza, 2009; Moro et al., 2011) as a representative of the coastal savannas. Although geographically far from the Cerrado savannas from central Brazil, these coastal ecosystems have many Cerrado species which share space with species from other Brazilian biomes (Moro et al., 2011). Once more widespread (Figueiredo, 1997), coastal savannas of Ceará state are threatened by urban sprawl and the vegetation fragment focus of our study is probably one of the last survivors of this ecosystem type within the city (Fortaleza, 2003). In a situation where natural vegetation is enormously reduced, the contact of citizens with plant species is mostly restricted to cultivated plants, and native vegetation fragments could provide a reference list of potential native species for ornamental purposes, so we selected this area as a model.

To evaluate the extent to which native plants have been excluded from the city's treescape we used this conservation priority vegetation fragment as a reference. We sampled all trees and large shrubs (those with at least 2 m height) in the public spaces (street and squares) surrounding the vegetation fragment (Fig. 1). In the city block where the fragment is located there are a few residences in the edge of the vegetation. These residential plots located in the same block with the fragment are bounded by the vegetation, with gardens and backyards adjacent to the natural areas (Fig. 1). We also sampled all woody plants with at least 2 m height in these private plots (gardens and backyards). We then compared the species of the vegetation fragment listed by Moro et al. (2011) with the species found in the (1) public spaces surrounding the vegetation, and (2) in the gardens and backyards of private plots in the edge of the vegetation (Fig. 1).

All species sampled were classified as either "native" or "exotic". They were considered "native" if they naturally occur in the coastal ecosystems of Ceará or in the adjacent dry forest locally known as Caatinga. Plants not native to these ecosystems were classified as "exotic species" (sensu Richardson et al., 2000b). Zenni and Ziller (2011) presented a first preliminary list of invasive plants of Brazil. We informed for each exotic plant if they were recorded by these authors as invasive somewhere in Brazil. We also made observations throughout Fortaleza to determine whether the recorded exotic species were invading vegetation fragments in the city. We considered a plant as being invading if we could locate in vegetation fragments of the city individuals of these species established as naturalized or invasive plants, according to the concepts of Richardson et al. (2000a,b). Naturalized species were those exotic plants reproducing and establishing auto regenerating population in any ecosystem of the city, and invasive species were those that managed to spread from the original local of introduction to areas far apart (Richardson et al., 2000b).