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Short Communication

Urban forestry in the south area of Rio de Janeiro: the society, the species and the damage to urban infrastructure

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Abstract
The objective of this study is to inventory the tree species in the urban forestry of Humaitá district, which is an urban-planning model in the city of Rio de Janeiro. We aim to evaluate the phytosanitary status of each tree, potential popular uses and damages caused by trees to the infrastructure. Data collection was based on inventoring the trees on streets and squares of the neighborhood. Trees were identified and classified based on plant health, spinning damage, pavement damage, origin of the species and social use. In total, we sampled 1,203 individuals belonging to 88 species and 32 families. The most abundant species were *Pachira aquatica* and *Terminalia catappa*. Fabaceae and Arecaceae were the most commonly cultivated plant families. In total, 67% of the recorded species and 83% of the individuals registered were exotic. *Licania tomentosa* was the most damaging species to electric wires. *Licania tomentosa* and *Ficus benjamina* were the most damaging species to pavement. We conclude that few trees species are damaging the infrastructure. From a biodiversity perspective, there are too many exotic species and a lack of native species, as urban afforestation has strong impact on natural ecosystems of the City.
Key words: Humaitá-RJ, urban-arborization, urban-ecology, urban-infrastructure.

Resumo
A implementação adequada da arborização urbana é uma das formas de reduzir o impacto social ecológico do crescimento das cidades. O objetivo do presente estudo é inventariar a arborização urbana no bairro do Humaitá, que é um modelo de arborização urbana na cidade do Rio de Janeiro. Objetivamos registrar o status fitossanitário de cada árvore, potenciais usos populares e danos causados à infraestrutura urbana pelas plantas. A coleta de dados foi baseada no inventário das árvores nas ruas e praças do bairro. As árvores foram identificadas e classificadas com base em fitossanidade, impacto na fiação, pavimento, origem e uso. No total, foram contabilizados 1.203 indivíduos pertencentes a 88 espécies e 32 famílias. As espécies mais abundantes foram *Pachira aquatica* e *Terminalia catappa*. As famílias mais comumente cultivadas foram Fabaceae e Arecaceae. No total, 67% das espécies contadas e 83% dos indivíduos registrados eram exóticos. *Licania tomentosa* foi a espécie mais prejudicial à fiação. *Licania tomentosa* e *Ficus benjamina* foram as espécies mais danosas a pavimentação das ruas. Com base nos resultados, concluímos que poucas árvores são prejudiciais à infraestrutura da cidade. Do ponto de vista da biodiversidade, existem muitas espécies exóticas e falta um uso mais intensivo de espécies nativas, o que não é positivo dado que a arborização tem forte impacto nos ecossistemas naturais da cidade.
Palavras-chave: Humaitá-RJ, arborização urbana, ecologia-urbana, infraestrutura urbana.

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According to the United Nations Department of Economic and Social Affairs (2014), most of the world's population currently lives in urban areas and there is an accelerated and disordered vertical and horizontal growth of cities. This has led to drastic transformations in landscapes, a fact that has direct effect on ecosystem services (Johnson *et al*. 2015). Urban afforestation stands out among mitigation actions necessary to minimize anthropic impacts on cities, since it aggregates ecological functions and improves the socio-environmental quality in urbanized landscapes (Gong *et al.* 2013).

It is important to record the composition and phytosociology of urban forestry, since it does not only enhance aesthetic factors, but the socio-environmental (Nowak & Dwyer 2007) and ecological function (Alvey 2006) of the urban landscape. Such process is more evident when afforestation focuses on native species that generate resources to the fauna (Burivalova *et al*. 2014; Silva 2018), as well as work as ecological corridors to connect forest fragments (Ordóñez & Duinker 2013; Simmons *et al.* 2016) and increase richness and biodiversity (Locke & Baine 2015).

Overall, afforestation of urban areas in most Brazilian cities does not have prior planning, fact that leads to serious ecological issues (Almeida 2009). Among them, we highlight the overuse of exotic plant species (D'Antonio & Meyerson 2002). Many exotic plants initially chosen for their ornamental role (Zenni 2014) have shown to behave as invasive species and cause ecological damage to native biodiversity. A few examples in Brazil are *Roystonea oleracea* (Jacq.) O.F. Cook (Nascimento *et al.* 2013), *Azadirachta indica* A. Juss. (Moro *et al.* 2013) and *Archontophoenix cunninghamiana* H. Wendl. & Drude (Christianini 2006). Although these species often present rapid growth and vigor, which are advantageous features when cultivating the species in urban sites, these features also turn these species into potential invaders, since they can represent a competitive advantage to native species (Matos & Queiroz 2009). According to Gonçalves (1999), social, economic, aesthetic, political and ecological criteria must be evaluated when an urban afforestation is planned, since the issues to be mitigated are closely related to urban development. Thus, planning an urban afforestation means adopting technical-scientific criteria to maintain it for short-, mid-and long runs (Hoppen *et al.* 2014).

The study of urban green areas in Rio de Janeiro city has been intensified in recent years. However, the city presents such a social and geographical complexity that makes urban afforestation being more evident and well kept in richer neighborhoods than in low income favelas (Bergallo *et al.* 2021; Sartori *et al*. 2019). Therefore, if one takes into consideration that urban afforestation is determining to socioenvironmental health, it is also possible stating that it has direct influence on ecosystem services and presents the potential to work as ecological corridor (Mortberg & Wallentinus 2000; Briffett *et al*. 2004). It is essential knowing and evaluating tree constitution through inventories, as well as verifying the possible conflicts with other urban components (Gilsa *et al.* 2014). Thus, the objectives of this study are: 1) to record tree composition in public and private are of Humaitá neighborhood based on a census of all trees presented in the district; 2) to evaluate damages caused by tree to public wiring and pavement; 3) to classify the origin of each species (native or exotic to Rio de Janeiro state), the phytosanitary conditions and social use of each species; and 4) to relate tree size to damages to urban infrastructure.

The study was carried out in Humaitá district, Southern Rio de Janeiro City, at coordinates 22º57'18"S and 43º11'40"W (Fig. 1). The neighborhood has 13 thousand inhabitants and its territory cover 105 ha (IBGE 2010). The district is located on the border of Tijuca National Park and Morro da Saudade Environmental Protection Area, which are two forest fragments belonging to this district. Thus, Humaitá represents an urban matrix between two forest fragments and was chosen for the study because it has an urban-afforestation model neighborhood essentially developed by the government, among upper class districts in the county, with a high density of trees (Sartori *et al*. 2019).

Field data collection was carried out in 2016 through a census of all trees present in public open spaces of the district to find the parameters of quantitative and qualitative variables. All trees with diameter at breast height (DBH) $\geq$ 5 cm located on the streets and public squares of neighborhoods were recorded. Trees in private gardens were also measured, however, the neighborhood has few houses with gardens. Branched trees had the areas of each trunk section summed. The qualitative variables described in

Sartori & Balderi (2011) were recorded for each tree: damage to pavement, damage to public electric wires and the general health of the individual trees themselves (phytosanitary). This methodology uses the damage and phitosanitary classification between "1", with no damage to infrastructure or the plant being completely healthy, and "5", plants causing extreme damage to infrastructure or with fall risk. Intermediate classifications present different management needs without the need to remove the tree. The data was later transferred to an electronic spreadsheet and the complete set of data collected on each street and square is provided as an electronic supplement to this article in the FigShare repository <https://doi.org/10.6084/m9.figshare.12083991>.

The damage factor index by Sartori & Balderi (2011) was used to calculate the species with higher degree of conflit with urban infrastructure of the city; this index is based on the sum of the relative number of individuals belonging to each species that can damage paving and wires, multiplied by the aggression level to wires and paving.

The species were identified in the field by the authors. When this was not possible, the specie was identified by experts of the Rio de Janeiro Botanical Garden or we based our identification on consultations to the herbarium of Rio de Janeiro Botanical Garden. Species names was checked and updated according the Flora do Brasil website (BFG 2018). The species were classified in use, based on the main use that the population makes to that species. Each species was recorded regarding their origin as native to the state of Rio de Janeiro or exotic. The exotic species were categorized as invasive or not, based on the classification by Moro *et al.* (2012) (Tab. S1, available on supplementary material <https://doi.org/10.6084/m9.figshare.16864561.v1).

The DBH was measured with a measuring tape and the height of individual trees was estimated. For *Dypsis lutescens* (H. Wendl.) Beentje & J. Dransf. the basal area of individual was calculated and summed in a total basal area. The recorded variables for each species were diameter, height and number of individuals belonging to each species and family. Only 29 trees that were found in the gardens of buildings and houses.

The relation between tree size and the recorded number of trees was calculated. The mean size of the canopies was used to classify trees as large, medium sized or small. The mean distance between trees was evaluated and areas likely to present excess or lack of trees were pointed out.

We recorded 1,203 trees on its streets, squares, avenues and buildings. Of these, 97%

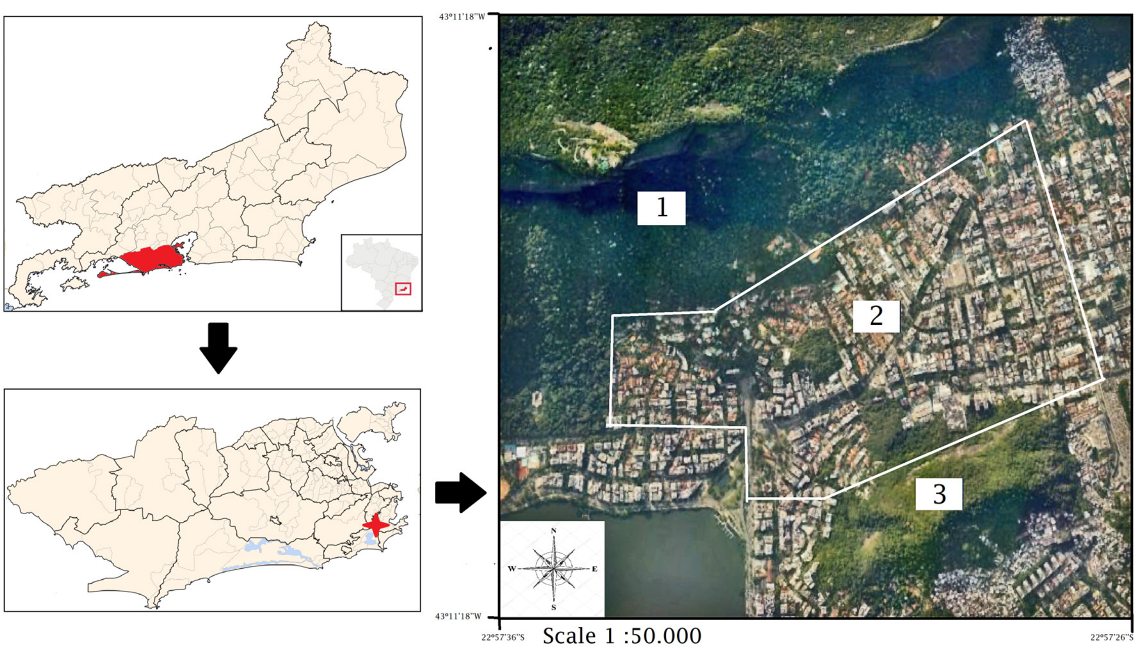

Figure 1 – Humaitá location in Southern Rio de Janeiro City, Brazil. Where: 1 = Tijuca forest; 2 = Humaitá; 3 = Saudade's Reserve.

of the individuals were found in public spaces and 3% in private plots, belonging to 88 species distruibuted into 32 botanical families (Tab. S1, available on supplementary material <https://doi.org/10.6084/m9.figshare.16864561.v1>). *Pachira aquatica* Aubl, with 168 individuals (14%), *Terminalia catappa* L., with 148 (12.3%), *Senna siamea* (Lam.) H.S. Irwin & Barneby, 117 (9.7%), and *Licania tomentosa* (benth.) fritsch, 81 (6.7%) were the species with greatest abundance. Together these four species accounted for 42.7% of the total number of individuals recorded. According to the Master Plan of Urban Afforestation of Rio de Janeiro (Município do Rio de Janeiro 2015), these species are the most commonly used by the local government. Sixty-nine (69) species, 78% of the total, accounted for 22% of the registered abundance. Only 1% of the total, were classified as rare species, with one or two individuos, and these species were likely planted by residents.

This scenario contrasts with that observed in the favelas, where plant species are mostly selected by residents based on their own interests rather than by the city hall (Sartori & Balderi 2011).

The neighborhood presents a great richness of species than poorer districts. However, most of the species had low abundance and were represented by just few individuals. The richness was higher than in the wealthy Leblon district recorded by Siqueira & Mendonça (2015), who recorded 20 species. However, the richness was lower than in a Favela in Rio sampled by Sartori *et al.* (2019), who found 148 species, and equal to two middle income districts sampled by Moro & Westerkamp (2011) in a work in Fortaleza, with 89 species.

Values recorded for the abundance of individuals were higher than numbers presented in other studies carried out in the state of Rio de Janeiro (1,203 individuals, 1,174 of theses on public roads and 29 in private gardens), mainly when they were compared to values shown by studies performed in poorer neighborhoods. According to Freitas *et al.* (2015), the tree inventory performed in four squares in Tijuca neighborhood, Northern Rio de Janeiro City, whose territory covers 3.62 ha, showed 360 individuals belonging to 36 species. Individuals' low density and poor distribution pattern oberved in the poorest neighborhoods of the city corroborates the scarce governmental investment in these sites (Pedlowski *et al*. 2002), and this scenario contrasts with the high investments made in Humaitá's urban afforestation planning.

The botanical families with the largest richness in Humaitá were Fabaceae (18 spp.); Arecaceae (10 spp.) and Bignoniaceae (7 spp.). When considering the number of individuals, the families recording the greatest abundance were Fabaceae, with 23.2%; Malvaceae, with 14.3% of them and Combretaceae, with 12.3% of the total. According to Santos *et al.* (2010) and Moro & Westerkamp (2011), Fabaceae is one of the families mostly used in urban arborization in Brazil, since several species in this group are chosen for landscaping purposes. Similar results were recorded by Silva & Almeida (2016) in a study conducted in Natal City and by Kramer & Krupet (2012) in a research carried out in Paraná state.

Families with the largest representations of individuals are not necessarily those with the largest number of species. For example, families like Combretaceae and Malvaceae have few species, but these were very abundant. *Pachira aquatica* (Malvaceae) and *Terminalia catappa* (Combretaceae) were highly cultivated, representing 14% and 12.3% of the total of registered individuals, respectively. According a recommendation of Milano (1988), the amount of each species adopted for urban afforestation must not exceed more than 10% of the total population of selected species; moreover, it is necessary respecting the biological characteristics of native populations and maintaining the richness of local species. Silva (2015) highlights the aesthetic and phytosanitary issues entailed by such high prevalence.

Besides the issues caused by the prevalence of few species (*P. aquatica* and *T. catappa*), the origin of these species requires attention. These two species are exotic in Rio de Janeiro. *P. aquatica*, popularly known as "Mugumba", was introduced in afforestation plans given its easy maintenance. This species is native to the Amazon and presents dense canopy crown; it is an evergreen species that can reach 14 meters tall (Jorge & Luzia 2012). *T. catappa*, known as "Amendoeira", is native to the tropical and subtropical regions of Asia and the Pacific, whose climate resembles Rio de Janeiro's. This species is associated with coastal, beach and rocky vegetation (Thomson & Evans 2006), and this factor turns it into a problematic invasive species in coastal areas (Talora 2007), like the coastal areas of Rio de Janeiro state. Moreover, it influences water flow in the city due to the large and leathery leaves that fall from its trees, mainly in the winter, which block sewer inlets and cause floods (Rocha *et al.* 2004). *T. catappa*'s fruit yield has turned them into one of the main food sources for urban bats (Ferreira *et al.* 2010). As a result, the population of native species whose dispersion depends on bats may be reduced due to this new mutualistic relationship emerged in urban ecosystem (Sartori *et al.* 2019).

Based on origin data, 33% of the species were native (29 spp.) and 67% (59 spp.) of them were classified as exotic; of the exotic, 22% (13 spp.) were considered invasive and 78% (46 spp.) naturalized, according to the classification by Richardson *et al* (2000) and Moro *et al.* (2012). In total, 83% (999 individuals) of all registered individuals were exotic, of which 29% (290 individuals) belonged to invasive species. Only 17% (205 individuals) of the individuals were native. Based on Lorenzi (2008), there is significant difference between native and exotic species in several Brazilian cities due to the use of exotic species in afforestation.

Using native species is important for the composition of urban forests, since it helps preserving their biodiversity (Ziller 2001; Vitule & Prodocimo 2012). On the other hand, exotic species that become invasive can compromise such biodiversity since they can change natural cycles in ecosystems, the physiognomy of natural landscapes and ecological processes (Ziller 2001). This negative effect is observed when representatives of these species adopt a different behavior from that observed in their original region, because they end up competing with native species and impairing their development (Richardson *et al.* 2000; Moro *et al.* 2012).

The use of exotic species as ornamental plants is one of the main forms of allowing the access of invasive species to forest remnants and to areas under natural regeneration, mainly when these sites are disturbed or degraded (Zenni 2014). Therefore, it is essential encouraging the replacement of exotic invasive species by native ones in afforestation.

The availability of fruits to the fauna is other topic related to exotic species use in urban afforestation projects (Mortberg & Wallentinus 2000). The use of exotic figs (*Ficus* spp.), such as *F. elastica* Roxb and *F. religious* L. is an example observed in the municipality of Rio de Janeiro. These species are more efficient in feeding the fauna than native fig species, and bats promote seed dispersal for these exotic species. Bats and birds mostly feed also of on exotic species; therefore, there is almost no dispersion of native species in these sites, fact that affects biodiversity and natural regeneration (Sartori *et al.* 2019).

Some exotic species also generate other problems apart from bioinvasion. *Murraya paniculata* (L.) Jack, *Lagerstroemia indica* (L.) Pers., *Couroupita guianensis* Aubl, among others, for example, are also considered worrisome (IBF 2015). *Murraya paniculata*, popularly known as Murta, is native to Asia and hosts the bacterium *Candidatus Liberibacter* ssp., which can be harmful to species belonging to genus *Citrus* and cause economic losses (Zhou *et al.* 2007) - that is the reason why this species is forbidden in São Paulo and Paraná states (Paraná 2008). *Lagerstroemia indica* cause strong impact on pavement and spinning (Roso 1994). *Couroupita guianensis* has large and heavy fruits with barochoric dispersal that damage sidewalks and cars due to their fall; therefore, its use is not in compliance with the guidelines by Gonçalves (1999), who highlights the need of taking into consideration the socio-environmental factors linked to urban afforestation.

Landscape projects guided by Glaziou in the late nineteenth century and by Burle Marx in the mid-twentieth century, both enthusiasts of the exotic flora, were the gateway to the access of these species to the city of Rio de Janeiro. However, it is imperative to reassess its use given its negative impact on public roads, such as damages to the power grid, to the infrastructure of roads and sidewalks, their economic and ecological impacts and even their impact on the health of native flora and fauna (Dantas & Souza 2004). Thus, urban afforestation extrapolates aesthetic matters in cities and has direct impact on their socio-environmental, economic and cultural aspects.

Some native species used in rehabilitation projects developed to degraded areas were found in the Humaitá neighborhood as *Schinus terebinthifolia*, *Syagrus romanzoffiana*, *Handroanthus chrysotrichus*, *Tabebuia roseoalba* and *Inga marginata* (Tab. S1, available on supplementary material <https://doi.org/10.6084/m9.figshare.16864561.v1>). There were not records of their planting for afforestation purposes, and such outcome endorses the regenerative potential of these species in this forest fragments.

The use of tree species in public roads is of greater interest in landscaping, mainly in areas inhabited by higher social classes. Ornamental plants are chosen due to their morphological characteristics, including flowers, leaves, colors, textures and shapes (Medeiros 2008).

Many architects, landscapers and biologists follow new lines of research in the landscaping field given the great concern with environmental conservation in recent years. These studies seek to replace the use of exotic species by ornamental native species (Medeiros 2008). Brazil is one of the major biodiversity holders of native plants with ornamental potential, among them one finds bromeliads, orchids and plants of the most diverse Brazilian biomes (Leal & Biondi 2006).

Thus, the replacement of exotic species by natives is possible and contributes to biodiversity gain and fauna attractiveness, mainly of birds and bats who disperse fruits and seeds (Silva 2015).

Species were classified based on their main use by people of the city and it resulted in a record of 1,093 individuals belonging to 64 species usually for ornamental use; and in 86 individuals belonging to 16 species used as food source (Tab. 1). Species *Latana camara* L., better known as "Cambará", belongs to family Verbenaceae and is used for medicinal purposes.

There were 16 species used as food source, Mango (*Mangifera indica* L.), Coconut (*Cocos nucifera* L.), Lemon (*Citrus limon* (L.) Osbeck), Jack tree (*Artocarpus heterophyllus* Lam.) and Common Guave (*Psidium guajava* L.) stood out among the most favorite in human diet.

Table 1 – List of use of species, in percentages (%) and absolute values (N), based in origins of individuals and species collected through the survey applied to the urban arborization of Humaitá District, RJ.

Use / Origin	Individuals				Species			
	Exotic		Native		Exotic		Native	
	%	N	%	N	%	N	%	N
Food	6.3	68	14.5	18	18.8	12	16.7	4
Medicinal	0	0	0.8	1	0	0	4.2	1
Ornamental	92.4	996	77.4	96	79.7	51	54.2	13
Spontaneous	1.3	14	7.3	9	1.6	1	25	6
Total geral	**100**	**1078**	**100**	**124**	**100**	**64**	**100**	**24**

Regarding the conflicts of trees with the urban structure, based on the damage index analysis, *Paquira aquatic*, *Terminalia catappa*, *Senna siamea*, *Licania tomentosa* and *Couroupita guianensis* (Tab. 2) were the species mostly commonly responsible for damages to urban infrastructure.

According to the classification of damages caused to wire networks, 60% of the registered individuals were in category "1", they do not cause any damage to them; 24% of individuals were in category "2", they have little contact with the wires; 13.4% were in category "3", with average risk of causing a short. Only 2.7% of individuals were in categories 4 or 5 and they could cause hard damages to the wire networks. This outcome is related to plant adequacy to the power grid - light and telephone companies are often pruning the trees on the sidewalks, since most of the tall trees stand by the wiring.

Ficus benjamina is another species with the potential to cause damages to infrastructure; it is a fig tree native to Southeastern Asia, China and Australia, whose growth is limited by the environment; however, it can be grown in pots like bonsai or reach up to 30 meters tall in the field (Santana & Santos 1999). Based on previous studies (Santana & Santos 1999; Rocha *et al.* 2004; Sampaio 2008; Calixto Júnior *et al*. 2009; Sartori & Balderi 2011), *F. benjamina* proves to be harmful to public roads, to destroy sidewalks and causse damages to power lines.

Regarding damages to the pavement, 54.8% of the registered individuals were classified in category "1", they did not pose risk to the pavement; 34.5% of them were classified in category "2", with small risk to pathways; 8.4% of the individuals were categorized as "3"; 2%, as "4" and only 0.1% of

Table 2 – Species used in urban afforestation that are responsible for causing hard damage to the infrastructure of Humaitá District, Rio de Janeiro. Wherein: N = number of registered individuals; DW = damage to the wiring; DP = Damage to pavement; ID = Damage index in %.

Species	N	DW	DP	ID
Pachira aquatica Aubl.	168	15.5	17.0	16.3
Terminalia catappa L.	148	13.6	16.8	15.2
Senna siamea (Lam.) H.S.Irwin & Barneby	117	10.7	13.1	11.9
Licania tomentosa (Benth.) Fritsch.	81	9.4	8.2	8.8
Couroupita guianensis Aubl.	49	4.8	4.9	4.8
Ficus benjamina L.	50	4.5	5.1	4.8
Cassia Grandis L.f.s	38	4.4	4.2	4.3
Dypsis lutescens (H.Wendl.) Beentje & J.Dransf.	49	3.3	2.8	3.0
Mangifera indica L.	28	2.2	2.2	2.2
Phanera variegata (L.) Benth.	23	2.3	1.6	2.0

them were in the extreme damage category, "5". *F. benjamina* and *L. tomentosa* were the most harmful species for the pathways.

Thus, it is recommended to avoid planting large species nearly of the street wiring. Species presenting large and heavy fruits, venomous leaves or that work as food source for the wildlife must be avoided since they threaten pedestrians' safety.

The heights of recorded trees varied from 1.5 to 40 meters. The district's trees were on average 9.3 meters tall. *Roystonea oleracea* had the greatests heights, reaching up to 40 meters, followed by *Cassia Grandis* Lfs, *Tamarindus indica* L. and *Couroupita guianensis*.

The DAP diameter ranged from 5 cm to 63.7 cm, with a mean diameter of 12.3 cm. *Ficus elastica* Roxb. *ex* Hornem were the trees with the largest mean diameters, followed by *Ficus religiosa* L., *Artocarpus heterophyllus* and *Roystonea oleracea*.

The Spearman correlations (rs) between damage rates recorded for wires due to height and diameter were not significant: rs = 0.14 e p = 0.45 and rs = 0.2 e p = 0.48, respectively. Correlations between classes of damages to the pavement due to height and diameter weren´t significant too; rs = 0.48 e p = 0.78 and rs = 0.4 e p = 0.69, respectively. Accordingly, it is not height that influences structural damages to the pavement, but diameter. This statement is corroborated by the fact that trees have their height managed in order to avoid having them touching the wiring and harming the urban infrastructure. However, the diameter can not be managed and it growth, dependind on the species in question, is related to the root size, wich can cause great damages to the pavement.

The canopy size analysis used street dimensions and the number of trees on them. It showed that the number of trees in the neighborhood could be increased by 27%. On some streets we also observed that there were very few trees on public spaces. Pavement is the biggest limitation for tree planting on Humaitá's streets, since they are narrow, have old pavement and only few trees. Alfredo Chaves Street is an example: the sidewalk on this street is 1.2 meters wide, on average, and the street is 200 meters long, but it only has two trees.

Regarding phytosanitary conditions of trees, 10.5% of individuals counted in Humaitá presented bad conditions or were in the eminence to die. The same pattern was diagnosed by Freitas *et al.* (2015) during a study conducted in Northern Rio de Janeiro City. Brun & Marlove (2006) showed the importance of phytosanitary control to mitigate pest outbreaks, to remediate diseases and to provide correct maintenance to avoid pest. Moreover, knowing the biological cycle of different species, pathogens, as well as biotic and abiotic factors, is essential to reach urban afforestation targets (SMAC 2015).

Rio de Janeiro City holds important Atlantic Forest remnants that demand constant maintenance, conservation projects and updated legislation. The National System of Conservation Units (SNUC) and the City's Sustainable Urban Development Master Plan describe the main areas where ecological corridors must be implemented. Among them ois the Humaitá neighborhood, that could connect vegetation fragments such as Morro da Saudade, Morro dos Cabritos and Tijuca National Park (Seoane *et al.* 2010).

It was possible conclude that exotic species have prevailed, and their surface roots have cause significant physical damages to the pavement. Therefore, phytosanitary control is essential, but results have shown lack of tree maintenance on the streets and poor knowledge about the morphology of the planted species. The lack of interaction between residents and the trees on the streets is noteworthy, since residents do not recognize the planted species and do not make use of them. The lack of planning can still be observed, mainly when it comes to biodiversity, plant maintenance and management. It is necessary carrying out further research about problems related to urban afforestation and the ways to manage them.

Here we suggest some native species with ornamental potential and that do not cause damage to the wiring: *Lafoensia glyptocarpa* Koehne, *Tabebuia roseoalba*, *Handroanthus chrysotrichus* and in open places: *Ceiba speciosa* (A.St.-Hil.) Ravenna, *Inga edulis* Mart. and *Inga laurina* (Sw.) Willd. Considering the wide biodiversity of the Atlantic Forest and the numerous studies on it, it is possible to reconcile such information with the city's urban afforestation plans.

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