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Legacy Effects and Shifts in Urban Planning: Comparing Old and New Public Squares in Belém, Northern Brazil

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Abstract. Background: Urban public squares play a vital role in the socio-environmental development and quality of cities. The city of Belém, Pará, Brazil, was initially afforested with mango trees (*Mangifera indica* L.) at the turn of the 19th to the 20th century in order to reduce air temperature and enhance urban aesthetics. This study evaluated the floristic composition of 10 public squares (5 old and 5 new) in Belém. Methods: All tree individuals with circumference at breast height (CBH) ≥ 16 cm were inventoried, and floristic composition, species richness, density, and diversity were analyzed. Results: A total of 767 individuals belonging to 51 species and 27 families were recorded, with 567 individuals found in old squares (37 species) and 200 in new squares (31 species). Fabaceae was the most frequent family. Exotic species predominated (55.5% in old squares and 36% in new squares), such as *M. indica*, reflecting the low incentive for the use of native species. Floristic similarity between old and new squares was confirmed by rarefaction analyses and nonmetric multidimensional scaling (NMDS); however, this similarity was mainly associated with *Handroanthus heptaphyllus* (Vell.) Mattos (a species not native to the Amazon) rather than *M. indica*. Conclusion: The reduction in urban tree cover over time was related to the lack of management and inadequate species selection. Thus, the persistence of exotic species highlights the continuity of the legacy effect and the devaluation of native species, indicating the need for public policies that prioritize native flora in order to ensure urban biodiversity and sustainability.

Keywords. Floristic Composition; *Handroanthus heptaphyllus*; *Mangifera indica*; Urban Green Areas; Urban Silviculture.

INTRODUCTION

Urban green areas are spaces containing natural or cultivated vegetation that are maintained for environmental, recreational, aesthetic, and health benefits, including parks, public gardens, urban forests, and public squares (Menezes and Reis 2013; Chen et al. 2020). These areas are essential for ensuring access to ecosystem services in urban contexts (Ministerio de Planificación y Presupuesto and Ministerio de Integración y Desarrollo Regional 2021). Among them, public squares play a fundamental role by supporting a wide range of social and environmental activities while also representing architectural and landscape features of great importance to the historical heritage of cities (Soares 2009; Vaz 2010; Latham and Layton 2019; Ecker 2020).

Rapid and often unplanned urbanization contributed to the loss of urban green areas worldwide and, consequently, to the intensification of the negative effects of global climate change (Siddique and Uddin 2022; Peroni and Pappalardo 2024). In the Brazilian Amazon, urbanized areas have expanded over time, parallel to the reduction of green areas in large Amazonian metropolises due to pressure from the real estate market and mobility infrastructure (Côrtes and da Silva Júnior 2021; Ribeiro et al. 2022). In the metropolitan region of Belém, Pará, Brazil, approximately 552 km² of natural areas became urbanized areas between 1985 and 2020 (Moraes et al. 2022). Moreover, in the city of Belém, more than 55% of households didn't have any trees in the surrounding streets in 2022 (IBGE 2022). This process has reduced

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the provision of ecosystem services and increased climate extremes such as urban heat islands (Brasil 1995; Tan et al. 2015; Anguellovski et al. 2019; Garcia-Lamarca et al. 2019; IPCC 2022; Furtado et al. 2024). The consequences of vegetation loss highlight the importance of green areas, especially public squares, for collective well-being and landscape quality in cities; thus, proper management of the floristic composition of these spaces is essential (Bonametti 2020).

In the current context of the global climate crisis, initiatives aimed at maintaining and expanding tree cover in public squares become even more important, as they can improve urban quality of life through the provision of ecosystem services (Gonçalves 2018). Despite the recognized importance of planned urban afforestation, the lack of adequate public management and landscape planning has contributed to an inefficient species selection process in public squares, leading to socioeconomic losses for both public authorities and the population (O'Herrin et al. 2020; Soares et al. 2021). For this reason, it is important to critically analyze which variables are considered within the planning process of public squares' floristic composition (Gomes et al. 2016).

In the Brazilian context, the presence of exotic species in urban areas reflects the earliest afforestation initiatives in the country, which sought to reproduce the landscape patterns of European cities (Barros et al. 2010; de Almeida and Rondon Neto 2010; Cupertino and Eisenlohr 2013). In Belém, the introduction of trees intended to reduce air temperature and enhance urban aesthetics took place between the late 19th and early 20th centuries. Initially led by the architect and naturalist Antônio Landi and later by the city administrator Antônio Lemos, this process promoted the widespread planting of *Mangifera indica* L. (mango tree) along streets and in public squares (Loureiro and Barbosa 2010). *Mangifera indica* is a large-sized species with voluminous fruits and vigorous growth. These morphological characteristics require careful consideration in urban environments, as they may create conflicts with urban infrastructure such as electrical networks and sidewalks, in addition to posing risks to pedestrians due to fruit fall (Lorenzi 2002).

The problematic use of species with limiting ecological and morphological characteristics in urban afforestation underscores the importance of botanical knowledge about species characteristics in decisions regarding the floristic composition, since factors such as crown diameter, tree height, and crown-height ratio directly influence the provision of ecosystem services or disservices (Pacheco et al. 2026). Beyond those variables, sociocultural aspects of each region must also be considered (Pinheiro and de Souza 2017). In this sense, despite its limitations for urban use, *M. indica* remains widely planted in the Brazilian city of Belém, which is known as the "city of mango trees" due to the abundance of the species in its urban tree cover. This context led to the legal recognition of *M. indica* as an important element to the city's historical and sociocultural heritage (Porto et al. 2013).

The use of *M. indica* in Belém's afforestation is an example of how public squares and their species composition can reflect historical and cultural dimensions of a city. This link between contemporary urban green environment characteristics and historical processes is called "legacy effect", and despite being considered by only a few studies, it is an important factor in shaping today's urban tree species composition and distribution, being also related to historical urban greening inequalities (Gerow et al. 2024). Legacy effect occurs due to trees' larger life cycle, which can depict management choices made a long time in the past as well as factors such as national and regional identities and colonial history (Roman et al. 2018).

Furthermore, the maintenance of historical public green spaces is essential for the landscape memory of a city, especially when its architectural and floristic characteristics are strongly linked to the city's history and biome (da Silva 2014). However, in Belém, public squares' environmental and sociohistorical importance are still disregarded, which leads to poor maintenance and a lower sense of collective responsibility (Miranda and Soares 2021). Hence, the study of public squares' floristic composition from a historical perspective is important to identify historical changes, continuities, failures, and successes, in order to further improve planning and management of green areas through informed decision making.

This work draws from the importance of afforestation in public squares to provide environmental comfort and sociocultural benefits in urban environments, as well as the influence of the legacy effect of historical processes in urban green spaces species composition, especially in global South cities (Shackleton and Gwedla 2021), to understand today's species composition of public squares in Belém, in order to fill the

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literature gap in urban environment-history relationships in global South cities.

The objective of this study was to evaluate the floristic composition and similarity of urban trees in old and new public squares in Belém and to evaluate whether these patterns are associated with the legacy effect of historical afforestation processes. To operationalize this objective, this work asks the following scientific questions: (Q1) Have floristic composition and tree density changed between 17th to 18th and 21st century public squares in Belém? (Q2) Which species contribute most to the floristic similarity among public squares in Belém? This work hypothesized that: (H1) More recently established squares (21st century) differ in floristic composition and present higher diversity and individual density compared to older squares (17th to 18th century). (H2) *Mangifera indica* is responsible for maintaining floristic similarity among squares, regardless of their period of establishment.

MATERIALS AND METHODS

Study Area

The study was conducted in the municipality of Belém, state of Pará, Brazil (01°27′21″S, 48°30′16″W) (da Silva 2015)(Figure 1). The municipality covers an area of 1,059.458 km² and has an estimated population of approximately 1,303,389 inhabitants (IBGE 2022). According to the Köppen climate classification, the region has an Af climate (hot and humid)(Alvares et al. 2013) with a mean annual temperature of 26 °C (Bastos et al. 2002). The predominant soil type is Yellow Latosol, with clayey texture, and the native vegetation is mainly composed of fragments of Dense Ombrophilous Forest (da Silva et al. 2011; IBGE 2012). The 10 public squares analyzed were selected based on their founding dates, comprising 5 old squares and 5 new squares (Figure 1), classified according to França and Bahia (2019). The old squares were Batista Campos (founded in 1904); República (founded

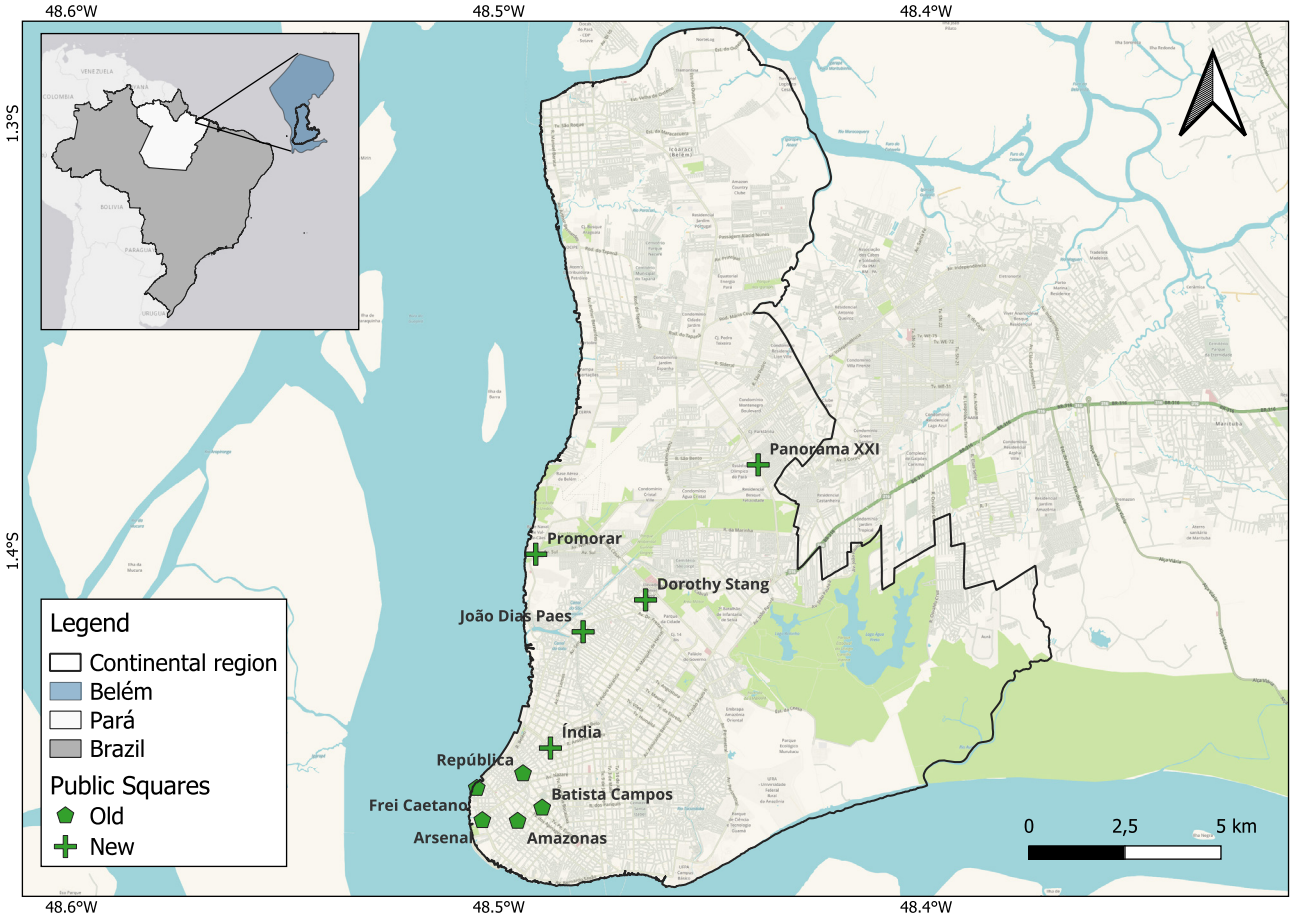

Figure 1. Old and new public squares evaluated for floristic composition in the municipality of Belém, Pará, Brazil.

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in the 18th century); Amazonas (founded in 1749); Frei Caetano (1619); and Arsenal Square (1750). The new squares included in this study were Dorothy Stang (2010); Índia (2020); Promorar (2013 to 2016); João Dias Paes (2001); and Panorama XXI (2021).

Data Collection

A floristic inventory was carried out for all tree individuals with circumference at breast height (CBH) ≥ 16 cm in 10 public squares in Belém (5 old and 5 new). Species identification was performed in situ or based on collected botanical material, which was compared with reference specimens from the Felisberto Camargo Herbarium (Universidade Federal Rural da Amazônia, Belém). Nomenclature followed the APG IV system (2016), with verification of scientific name spelling using the Missouri Botanical Garden database (Tropicos 2023) and the Flora e Funga do Brasil platform (Reflora 2025). Species origin (exotic to Brazil, exotic to the Amazon, or native to the Amazon) was classified based on the same references.

Based on the inventory data, individual density (Equation 1) was calculated according to Müeller-Dombois and Ellenberg (1974). Species richness was estimated using comparative analysis with sample-based rarefaction curves (Colwell et al. 2012), aiming to standardize sampling effort and allow comparisons among public squares of different sizes without bias caused by variation in the number of individuals (Clarke et al. 2011). To compare species diversity among squares, nonmetric multidimensional scaling (NMDS) was applied based on the Jaccard floristic similarity index, considering species presence–absence data (Brower et al. 1997).

$$D = NED \times NE \quad \text{(Equation 1)}$$

Where: D = individual density (ind. m²); $N = s$ the number of individuals; E = is the area of the public square (m²).

Data Analysis

The data were processed using Microsoft Excel 2016 (Microsoft Corporation, Redmond, WA, USA), applying descriptive statistics and generating tables to facilitate interpretation. Statistical analyses and graphical representations were performed using R software version 4.2.2 (R Development Core Team 2024). Density data were tested for normality and homoscedasticity using the Shapiro–Wilk and Bartlett tests, respectively, at a 5% significance level. After meeting these assumptions, mean densities between square categories (old and new) were compared using Student's t test ($P < 0.05$). Mean densities among species origin categories (exotic to Brazil, exotic to the Amazon, and native to the Amazon) were compared using Tukey's test following a significant analysis of variance ($P < 0.05$). Rarefaction curves were generated using the iNEXT package (Hsieh et al. 2016), while NMDS analyses were conducted using the vegan (Oksanen et al. 2022) and dplyr (Wickham et al. 2023) packages.

RESULTS

Floristic Composition

A total of 767 tree individuals were identified, distributed among 51 species and 27 families. Of these, 567 individuals were recorded in old squares (37 species and 16 families), while 200 individuals were found in new squares (31 species and 18 families). In old squares, the families with the highest species richness were Fabaceae (12 species), Bignoniaceae (4), Anacardiaceae (3), and Meliaceae (3). In new squares, Fabaceae (7 species), Meliaceae (4), and Myrtaceae (3) were the most representative families.

Mangifera indica was the most frequent species in old squares, accounting for 55.5% of all tree individuals, followed by two species of the genus *Handroanthus*, which together represented 10.7% of the individuals recorded in these squares. In new squares, the mango tree (*M. indica*) was also the most abundant species (36%), followed by *H. heptaphyllus* (Vell.) Mattos (pink trumpet tree), representing 19% of the individuals, and *Clitoria fairchildiana* R.A. Howard and *Terminalia catappa* L., each accounting for 6% of the tree individuals (Table 1).

Species Origin and Individual Density

Individual density by species origin (ind. m^{-2}) differed significantly among old squares ($F = 6.137$; $P = 0.015$). However, no significant differences in this variable were observed among new squares ($F = 1.6$; $P = 0.242$) (Figure 2). Additionally, no significant differences were detected between species of exotic origin from the Amazon ($F = 3.151$; $P = 0.114$); exotic origin from Brazil ($F = 1.997$; $P = 0.195$); and native origin from the Amazon ($F = 1.925$; $P = 0.203$) when comparing square age categories (old versus new)(Figure 2).

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Table 1. Floristic composition and species origin of old and new public squares evaluated in the city of Belém, Pará, Eastern Amazon, Brazil. E.B (exotic to Brazil); N.A (native to the Amazon); E.A (exotic to the Amazon).

Family	Species	Square	Origin
Fabaceae	*Cynometra cauliflora* L.	Old	E.B
Sapindaceae	*Sapindus saponaria* L.	Old	N.A
Fabaceae	*Cassia fistula* L.	Old	E.B
Verbenaceae	*Gmelina arborea* Roxb	Old	E.B
Oxalidaceae	*Averrhoa carambola* L.	Old	E.B
Fabaceae	*Clitoria fairchildiana* R.A.Howard	Old	N.A
Moraceae	*Ficus benjamina* L.	Old	E.B
Moraceae	*Ficus maxima* Mill.	Old	N.A
Fabaceae	*Paubrasilia echinata* (Lam.) Gagnon, H.C.Lima, and G.P.Lewis	Old	N.A
Combretaceae	*Terminalia catappa* L.	Old	E.B
Fabaceae	*Andira inermis* (W.Wright) DC.	Old	N.A
Bignoniaceae	*Handroanthus ochraceus* (Cham.) Mattos	Old	N.A
Fabaceae	*Hymenaea courbaril* L.	Old	N.A
Fabaceae	*Libidibia ferrea* (Mart. ex Tul.) L.P.Queiroz	Old	N.A
Rubiaceae	*Mussaenda erythrophylla* Schumach and Thonn.	Old	N.A
Anacardiaceae	*Anacardium occidentale* L.	Old	N.A
Bixaceae	*Bixa orellana* L.	Old	N.A
Meliaceae	*Carapa guianensis* Aubl.	Old	N.A
Salicaceae	*Casearia sylvestris* Sw.	Old	N.A
Fabaceae	*Cassia leiandra* Benth.	Old	N.A
Fabaceae	*Delonix regia* (Bojer ex Hook.) Raf.	Old	E.B
Fabaceae	*Inga edulis* Mart.	Old	N.A
Bignoniaceae	*Jacaranda mimosifolia* D. Don	Old	E.B
Malvaceae	*Pachira aquatica* Aubl.	Old	N.A
Clusiaceae	*Platonia insignis* Mart.	Old	N.A
Myrtaceae	*Psidium cattleyanum* Sabine	Old	E.A
Anacardiaceae	*Schinus terebinthifolius* Raddi	Old	N.A
Fabaceae	*Schizolobium parahyba* var. *amazonicum* (Huber ex Ducke) Barneby	Old	N.A
Fabaceae	*Tamarindus indica* L.	Old	E.B
Anacardiaceae	*Mangifera indica* L.	New	E.B
Bignoniaceae	*Handroanthus heptaphyllus* (Vell.) Mattos	New	E.A
Fabaceae	*Clitoria fairchildiana* R.A.Howard	New	N.A
Combretaceae	*Terminalia catappa* L.	New	E.B
Fabaceae	*Andira inermis* (W.Wright) DC.	New	N.A
Fabaceae	*Delonix regia* (Bojer ex Hook.) Raf.	New	E.B
Myrtaceae	*Syzygium malaccense* (L.) Merr. and L.M.Perry	New	E.B
Fabaceae	*Cassia fistula* L.	New	E.B

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Table 1. Continued.

Family	Species	Square	Origin
Fabaceae	*Bauhinia variegata* L.	New	E.B
Myrtaceae	*Syzygium cumini* (L.) Skeels	New	E.B
Rubiaceae	*Citrus ×latifolia* (Yu.Tanaka) Yu.Tanaka	New	N.A
Asparagaceae	*Dracaena steudneri* Engl.	New	E.B
Meliaceae	*Swietenia macrophylla* King	New	N.A
Meliaceae	*Azadirachta indica* A.Juss.	New	E.B
Malvaceae	*Ceiba pentandra* (L.) Gaertn.	New	N.A
Moraceae	*Ficus benjamina* L.	New	E.B
Bignoniaceae	*Handroanthus serratifolius* (Vahl) S.Grose	New	N.A
Chrysobalanaceae	*Moquilea tomentosa* Benth.	New	E.A
Rubiaceae	*Morinda citrifolia* L.	New	E.B
Annonaceae	*Annona muricata* L.	New	E.B
Oxalidaceae	*Averrhoa carambola* L	New	E.B
Bixaceae	*Bixa orellana* L.	New	N.A
Meliaceae	*Carapa guianensis* Aubl.	New	N.A
Caryocaraceae	*Caryocar brasiliense* Cambess.	New	N.A
Urticaceae	*Cecropia pachystachya* Trécul	New	N.A
Fabaceae	*Inga sessilis* (Vell.) Mart.	New	N.A
Clusiaceae	*Mammea americana* L.	New	E.B
Apocynaceae	*Plumeria pudica* Jacq.	New	E.B
Myrtaceae	*Psidium guajava* L.	New	E.B
Meliaceae	*Sandoricum koetjape* (Burm. f.) Merr.	New	E.B
Fabaceae	*Schizolobium parahyba* var. *amazonicum* (Huber ex Ducke) Barneby	New	N.A

Species Richness and Diversity

Extrapolated species richness showed high similarity between old and new squares after standardizing the number of sampled individuals (Figure 3).

Nonmetric multidimensional scaling (NMDS; stress = 0.109) revealed high floristic similarity between the two square categories as indicated by the overlapping of polygons. *Handroanthus heptaphyllus* was the only species present in all sampled squares and was identified as one of the main species responsible for maintaining floristic similarity among squares over time (Figure 4).

DISCUSSION

This study highlighted the floristic characteristics of urban afforestation in public squares classified as old and new in the city of Belém. The results indicate the need to revise public policies related to urban afforestation, with greater investment in research focused on evaluating the characteristics of native species in order to promote their inclusion in urban projects. Furthermore, replicating this study in other Amazonian cities may contribute to the identification of similar patterns and improve the understanding of urban afforestation processes, supporting future urban planning strategies aimed at enhancing ecological functionality and resilience of urban green areas.

The predominance of species from the Fabaceae family observed in this study has also been reported in other cities across different Brazilian biomes and may be associated with their high landscape potential. However, this pattern is likely influenced by

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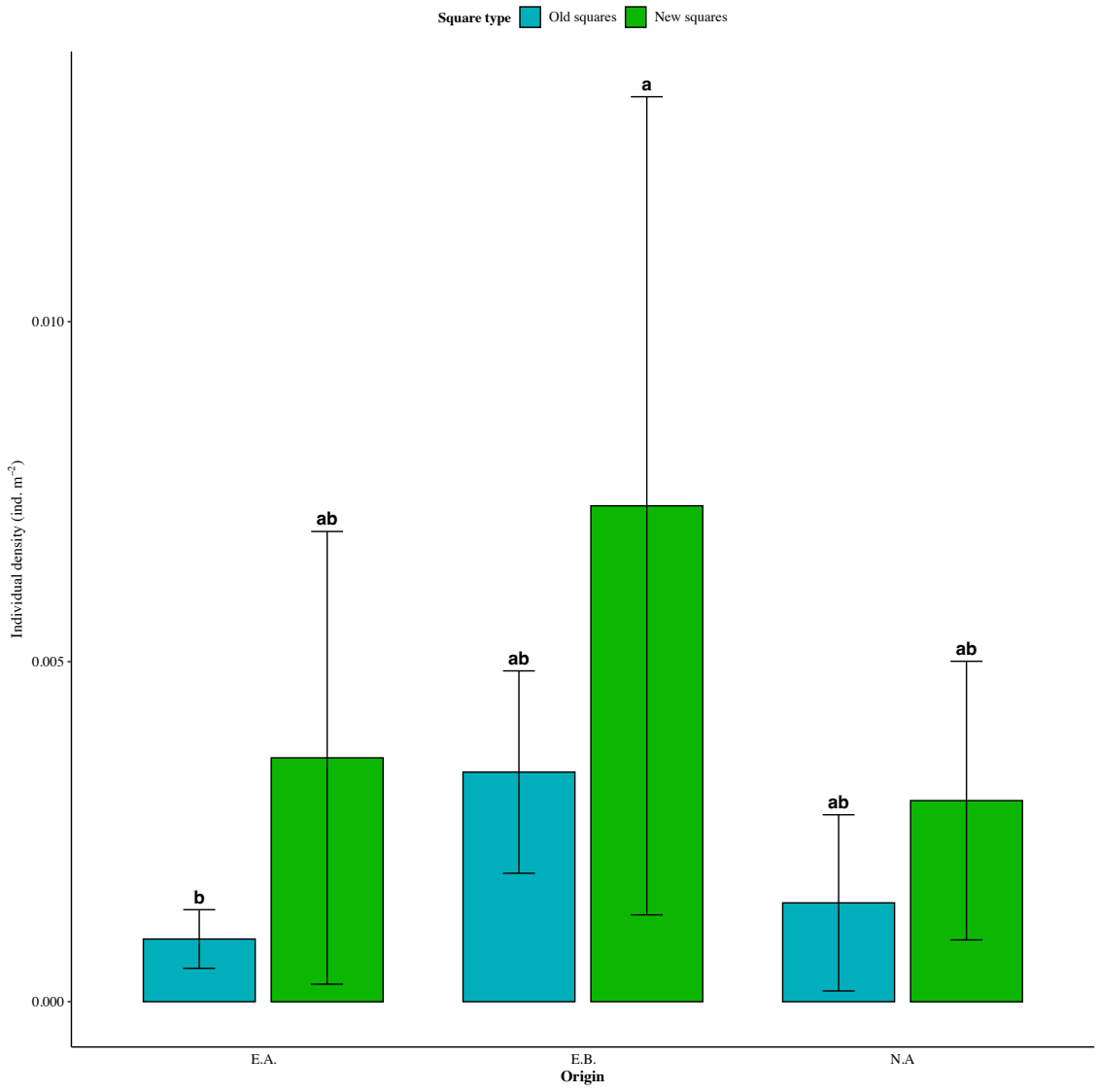

Figure 2. Mean ± standard deviation of individual density (ind. m^{-2}) in old and new public squares in the municipality of Belém, Pará, Brazil, according to species origin: exotic to Brazil (E.B), exotic to the Amazon (E.A), and native to the Amazon (N.A). Different letters (a, b, ab) indicate statistically significant differences among groups according to Tukey's test ($P \leq 0.05$), where groups sharing the same letter do not differ significantly. The graph indicates no statistically significant differences between individual density in new squares and the E.B, E.A, and N.A origin categories.

multiple factors, since Fabaceae is also one of the most species-rich plant families in Brazil, increasing its probability of occurrence in urban environments (Pacheco et al. 2023; Jimenez et al. 2024; Delfino et al. 2025). In addition, the predominance of exotic species in both old and new squares confirm the persistence of inadequate planning and limited recognition of the landscape potential of native Amazonian species (Soares et al. 2021). This scenario also results in losses related to the conservation of local biodiversity, including both flora and fauna, since native tree species often serve as better sources of food and shelter for local wildlife (Mendes and de Araújo-Hoffmann 2025).

Mangifera indica was the most abundant species in both old and new squares, corroborating findings from the urban afforestation in the municipality of Castanhal, Pará, Brazil, where this species accounted for more than 50% of the total number of individuals recorded in the analyzed squares (Gonçalves et al.

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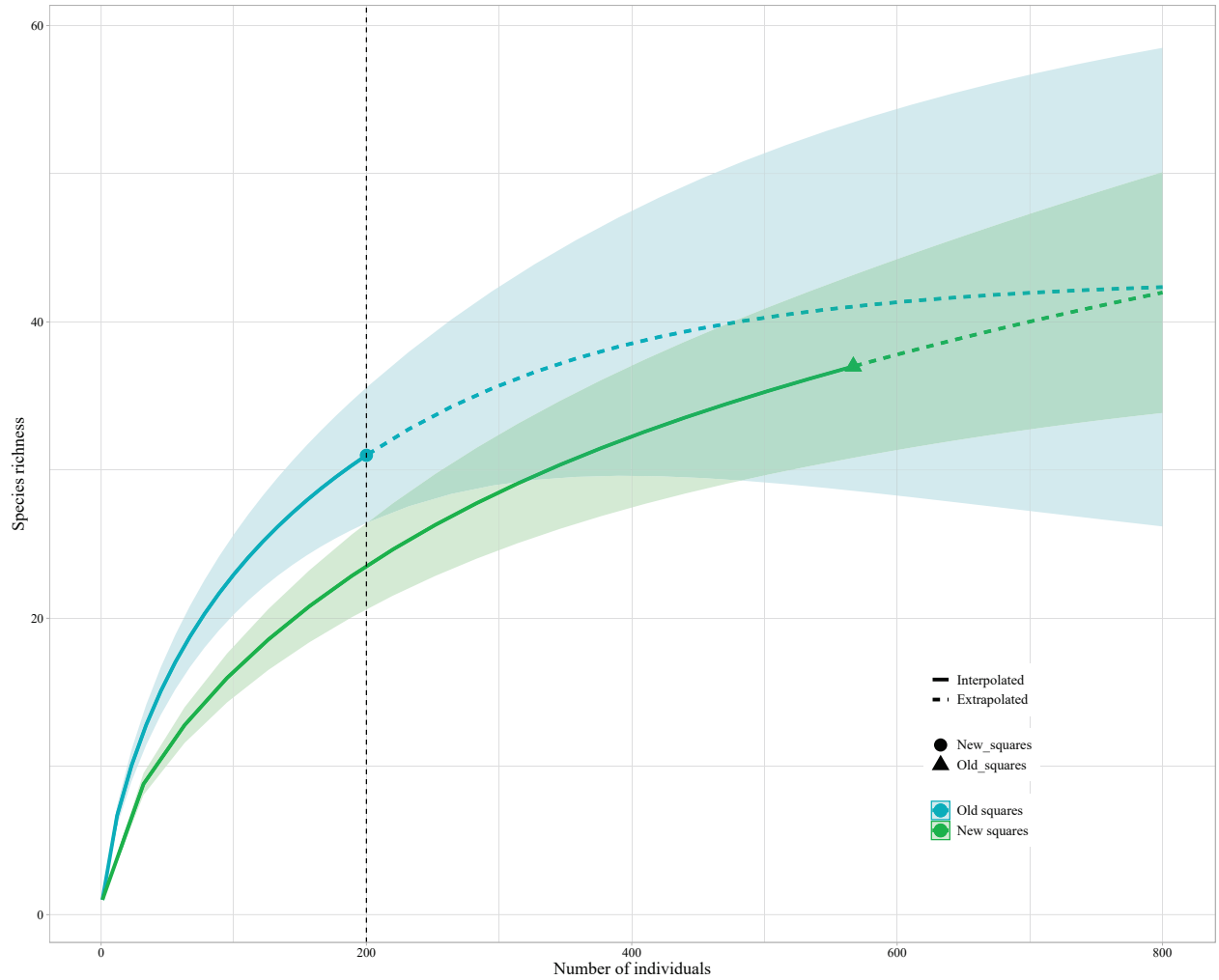

Figure 3. Species rarefaction curves comparing species richness similarity between old and new public squares in the municipality of Belém, Pará, Brazil.

2021). Similarly, qualitative and quantitative diagnostic studies of urban afforestation in Capanema, Pará, Brazil, revealed that *M. indica* represents 61.2% of the urban tree cover along the main streets of the city (Garcia et al. 2020; Gonçalves et al. 2021). The widespread presence of this species in Belém and other cities in Pará may be associated with the administration of Antônio Lemos between 1898 and 1911, as well as with major urban development projects, such as the construction of the Belém–Brasília highway. During this historical period, Belém became well afforested due to the implementation of an urban afforestation plan that emphasized exotic species, particularly *M. indica* (Lemos 1902; Sarges 2000; Lucarelli 2004). However, this extensive afforestation plan did not keep pace with the rapid urbanization process, which increased substantially from 47% in 1961 to 81.2% in 1991 (Lucarelli 2004).

Alongside this urban expansion, urban tree cover in Belém declined. According to data from the Municipal Secretariat for Urban Planning, the number of trees planted in public squares decreased from 24,976 seedlings in 1989 to only 4,480 in 1991 (Brasil 1995). Moreover, most of these seedlings were small-sized and died shortly after planting, likely due to low adaptability to urban conditions and inadequate public management (Brasil 1995; Wang et al. 2022). In this context, the implementation of species that are well adapted to the Amazonian urban environment is essential in order to reconcile the provision of ecosystem services with the maintenance of ecological functions, thereby conserving both faunal and floral biodiversity.

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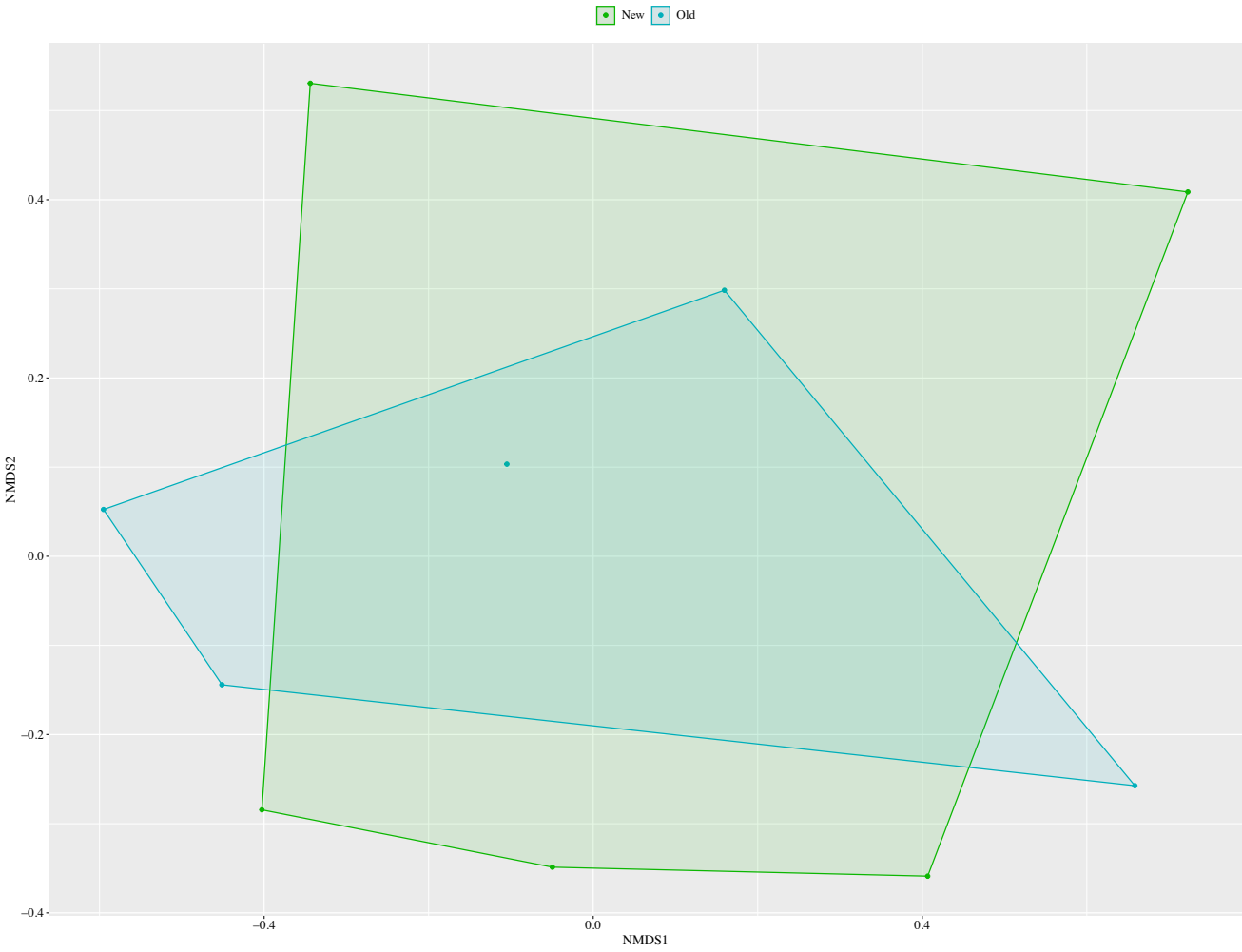

Figure 4. Nonmetric multidimensional scaling (NMDS) analysis of tree species composition in old and new public squares based on the Jaccard similarity index (stress value = 0.109).

No substantial increase in the implementation of native species in public areas of Belém has been observed (Soares et al. 2021). Despite the considerable time gap between the establishment of older and more recent squares, exotic species continue to predominate. This corroborates the legacy effect, suggesting that the planting of native tree species has not been incentivized in urban planning, which may be connected to previous decisions where exotic species were prioritized. In this context, Pacheco et al. (2026) found a predominance of exotic species for a wider range of public squares in Belém, also highlighting conflicts between species ecological and morphometric characteristics in relation to urban infrastructure. This scenario can potentially pose challenges to the ecological balance of green spaces, as exotic species may compete with native flora and negatively affect local biodiversity (Cupertino and Eisenlohr 2013). On the other hand, Zappi et al. (2022) revealed at least 49 native species that present adequate morphometric, ecological, and aesthetic parameters, such as height, resilience, and beauty of flowers, that could best fit urban afforestation of public squares in Belém and other Amazonian cities. This reality demonstrates that despite presenting adequate features, native species are historically and in present day not considered by urban planners in urban afforestation decision making.

In this study, the high similarity in species richness and diversity between old and new squares didn't corroborate our first hypothesis (H1), which was attributed to the presence of *H. heptaphyllus* (Vell.) Mattos in all sampled squares. However, this species

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is considered poorly suited for providing shade and thermal comfort in public squares, as it has an open, conical crown and a short flowering cycle, which represents a contradiction in its landscape use (Porto et al. 2013). The floristic similarity between old and new squares driven by *H. heptaphyllus* refutes the initial hypothesis (H2) that *M. indica*, an exotic species in Brazil, would be the main species responsible for the similarity among squares in Belém due to its historical context. Although *H. heptaphyllus* is also considered an exotic species in the Amazon, its dominance further reinforces the persistent undervaluation of native species in the Amazonian urban environment, even after long periods between the establishment of public squares.

It is therefore essential to encourage studies that deepen knowledge of the ecological and adaptive characteristics of native tree species for use in Amazonian public squares, aiming to expand their application in urban landscaping. Such efforts include floristic inventories, long-term monitoring, and awareness campaigns highlighting the importance of maintaining and improving urban green areas (Elias et al. 2020; Vieira and Panagopoulos 2020; Tavares et al. 2025). The lack of specific information on species adaptability limits the selection of suitable species for urban afforestation and perpetuates reliance on exotic species, which are often also affected by insufficient knowledge regarding proper management, ultimately reducing their ecological benefits in urban environments (Silva et al. 2020; Moraes et al. 2021; Paiva et al. 2022).

This study has limitations related to the sampling being restricted to old and new public squares in Belém. Although it does not represent the entirety of the city's urban afforestation, it provides a pioneering diagnosis of floristic composition in strategic public areas. The historical analysis, despite being based on fragmented documentary records due to the scarcity of municipal data, revealed critical patterns reflecting decades of afforestation policies. Although edaphic, microclimatic, and management variables were not included, these limitations and the results obtained highlight the urgency of integrating such factors into future public management plans. Future research should expand the geographic scope and incorporate abiotic variables, supported by government policies that promote data availability and monitoring.

CONCLUSIONS

High floristic similarity was observed between old and new public squares in the city of Belém, driven by the presence of *H. heptaphyllus* in all 10 squares evaluated, which acted as an indicator species of similarity among these urban green areas. In addition, new squares exhibited higher individual density than old squares, whereas old squares showed a higher density of exotic individuals compared to native species of the Brazilian flora. *Mangifera indica*, an exotic species in Brazil, was not identified as the indicator species of similarity among the public squares, thereby refuting the initial research hypothesis.

The presence of *H. heptaphyllus* in the evaluated squares raises concerns regarding the use of exotic Amazonian species in the urban afforestation of Belém, particularly due to the predominance of a single species. Given the similar floristic compositions observed, this pattern has persisted over time in the city and reflects a legacy effect in which past afforestation decisions continue to shape current species composition. Consequently, the results indicate a continued lack of consideration of botanical characteristics and species origin in urban planning decision making related to the floristic composition of public squares, as well as the persistence of historically established selection patterns. Therefore, the limited incorporation of native Amazonian species suggests the need to reorient species selection criteria in urban planning in order to overcome the constraints imposed by the legacy effect and improve the ecological adequacy of urban afforestation in Belém.

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Résumé. Contexte: Les places publiques urbaines jouent un rôle essentiel dans le développement socio-environnemental et la qualité de vie dans les villes. La ville de Belém, dans l'État du Pará, au Brésil, a été initialement reboisée avec des manguiers (*Mangifera indica* L.) au tournant des XIXe au XXe siècles afin de réduire la température de l'air et d'améliorer l'esthétique urbaine. Cette recherche a examiné la composition floristique de 10 places publiques (5 anciennes et 5 récentes) à Belém. Méthodes: Tous les arbres dont la circonférence à hauteur de poitrine (CHP) était supérieure ou égale à 16 cm ont été recensés puis la composition floristique, la richesse en espèces, la densité et la diversité ont été analysées. Résultats: Au total, 767 individus appartenant à 51 espèces et à 27 familles ont été inventoriés, dont 567 pour les anciennes places (37 espèces) et 200 dans les places récentes (31 espèces). La famille des Fabacées était la plus représentée. Les espèces exotiques prédominaient (soit 55,5% pour les anciennes places et 36% dans les récentes), comme *M. indica*, témoignant ainsi du faible intérêt pour le recours à des espèces indigènes. La similitude floristique entre les anciennes places et les récentes a été confirmée par des analyses de raréfaction et un positionnement multidimensionnel non métrique (PMNM) ; toutefois, cette similitude était principalement liée à *Handroanthus heptaphyllus* (Vell.) Mattos (une espèce non indigène de l'Amazonie) plutôt qu'à *M. indica*. Conclusion: La diminution de la canopée arborescente urbaine au fil du temps était liée à un manque d'entretien et à un choix d'essences inadéquat. Ainsi, la persistance des espèces exotiques met en évidence la continuité du système hérité et la dévalorisation des espèces indigènes, reconnaissant ainsi la nécessité de mettre en place des politiques publiques priorisant la flore indigène de manière à assurer la biodiversité et la durabilité urbaines.

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Zusammenfassung. Hintergrund: Öffentliche Plätze in Städten spielen eine entscheidende Rolle für die sozioökologische Entwicklung und die Lebensqualität in Städten. Die Stadt Belém im brasilianischen Bundesstaat Pará wurde um die Wende vom 19. zum 20. Jahrhundert ursprünglich mit Mangobäumen (*Mangifera indica* L.) bepflanzt, um die Lufttemperatur zu senken und das Stadtbild zu verschönern. In dieser Studie wurde die floristische Zusammensetzung von 10 öffentlichen Plätzen (5 alte und 5 neue) in Belém untersucht. Methoden: Alle Baumbestände mit einem Brusthöhendurchmesser (CBH) von ≥ 16 cm wurden erfasst, und die floristische Zusammensetzung, Artenreichtum, Dichte und Diversität wurden analysiert. Ergebnisse: Insgesamt wurden 767 Exemplare aus 51 Arten und 27 Familien erfasst, wobei 567 Exemplare auf alten Plätzen (37 Arten) und 200 auf neuen Plätzen (31 Arten) gefunden wurden. Die Fabaceae waren die am häufigsten vorkommende Familie. Exotische Arten dominierten (55,5% in den alten Parzellen und 36% in den neuen Parzellen), wie beispielsweise *M. indica*, was den geringen Anreiz für die Verwendung einheimischer Arten widerspiegelt. Die floristische Ähnlichkeit zwischen alten und neuen Plätzen wurde durch Rarefaction-Analysen und nichtmetrische multidimensionale Skalierung (NMDS) bestätigt; diese Ähnlichkeit stand jedoch hauptsächlich im Zusammenhang mit *Handroanthus heptaphyllus* (Vell.) Mattos (einer nicht im Amazonasgebiet heimischen Art) und weniger mit M. indica. Schlussfolgerung: Der Rückgang der städtischen Baumbedeckung im Laufe der Zeit stand im Zusammenhang mit mangelnder Pflege und einer unzureichenden Artenauswahl. Das Fortbestehen exotischer Arten unterstreicht somit die Kontinuität des Erbeffekts und die Geringschätzung einheimischer Arten, was auf die Notwendigkeit öffentlicher Maßnahmen hinweist, die der einheimischen Flora Vorrang einräumen, um die städtische Biodiversität und Nachhaltigkeit zu gewährleisten.

Resumen. Antecedentes: Las plazas públicas urbanas juegan un papel vital en el desarrollo socioambiental y la calidad de las ciudades. La ciudad de Belém, Pará, Brasil, fue reforestada con árboles de mango (*Mangifera indica* L.) a finales del siglo XIX y principios del XX para reducir la temperatura del aire y mejorar la estética urbana. Este estudio evaluó la composición florística de 10 plazas públicas (5 antiguas y 5 nuevas) en Belém. Métodos: Todos los individuos arbóreos con circunferencia a la altura del pecho (CBH) ≥ 16 cm fueron inventariados, y se analizó la composición florística, la riqueza de especies, la densidad y la diversidad. Resultados: Se registraron un total de 767 individuos pertenecientes a 51 especies y 27 familias, con 567 individuos encontrados en plazas antiguas (37 especies) y 200 en plazas nuevas (31 especies). Fabaceae fue la familia más frecuente. Predominaron las especies exóticas (55,5% en las plazas antiguas y 36% en las nuevas), como *M. indica*, lo que refleja el bajo incentivo para el uso de especies nativas. La similitud florística entre las plazas antiguas y nuevas se confirmó mediante análisis de rarefacción y escalamiento multidimensional no métrico (NMDS); sin embargo, esta similitud se asoció principalmente con *Handroanthus heptaphyllus* (Vell.) Mattos (una especie no nativa de la Amazonía) en lugar de *M. indica*. Conclusión: La reducción de la cobertura arbórea urbana a lo largo del tiempo se relacionó con la falta de gestión y la selección inadecuada de especies. Por lo tanto, la persistencia de especies exóticas resalta la continuidad del efecto legado y la infravaloración de las especies nativas, lo que indica la necesidad de políticas públicas que prioricen la flora nativa para garantizar la biodiversidad y la sostenibilidad urbanas.

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