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Urban Forestry in Mato Grosso do Sul: synthesis of knowledge

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Abstract

Objective: Our study aimed to show a synthesis of knowledge about the urban forestry of Mato Grosso do Sul to contribute to understanding the present scenario, investigate patterns and identify gaps of knowledge.
Methodology: We reviewed available articles in the leading scientific databases, cross-references and direct contact with all municipal offices to compile and analyze the information available on urban forestry of the municipalities.
Originality/Relevance: We draw a general panorama of knowledge upon the urban forestry of the state, including qualitative and quantitative aspects relevant for integrated planning and management of the urban forestry of the municipalities.
Results: Data on urban forestry were recorded for 13 municipalities, corresponding to 16.4% of the state. This information is available mainly for the northeast and the northwest, existing a big gap of knowledge for the southern region, under a strong influence of the Atlantic Forest. More than 280 plant species (56 families) have been utilized in urban forestry, with a predominance of exotic trees. Only *Moquilea tomentosa* was present in all surveyed municipalities and is often the species above the recommended percentage. The critical documented problems arise from root system outcrop and conflicts with the electric and telephone lines, which can be mitigated by selection and planting adequate species, appropriate management and access to information and technologies.
Management contributions: Knowing the present status of urban forestry is a fundamental prior condition for adequate planning and management, these shall occur dynamically and continuously to conserve biodiversity and ecosystem services. Our study presents a panorama of urban forestry in Mato Grosso do Sul state to subsidize those actions.

Keywords: Road forestry. Urban biodiversity. Urban forest. Urban infrastructure.

Arborização urbana em Mato Grosso do Sul: síntese do conhecimento

Resumo

Objetivo: O presente estudo visa apresentar uma síntese do conhecimento sobre a arborização urbana de Mato Grosso do Sul, de forma a contribuir para a compreensão do cenário atual, investigar padrões e identificar lacunas de conhecimento.
Metodologia: Foi realizada revisão de artigos disponíveis nas principais bases de dados científicas, referências cruzadas e através de contato direto com todas as secretarias municipais para que pudéssemos compilar e analisar informações disponíveis sobre a arborização urbana dos municípios de Mato Grosso do Sul.
Originalidade/Relevância: Traçamos um panorama geral do conhecimento sobre a arborização urbana do estado, incluindo aspectos qualitativos e quantitativos relevantes para o planejamento e gestão integrados da arborização urbana dos municípios.
Resultados: Dados sobre a arborização urbana foram registrados para 13 municípios de Mato Grosso do Sul, o que corresponde a 16,4% dos municípios do estado. Essas informações estão disponíveis principalmente para a região nordeste e noroeste, havendo uma grande lacuna de conhecimento para a região sul do estado, que está sob forte influência da Mata Atlântica. Mais de 280 espécies (56 famílias) foram registradas na arborização urbana de Mato Grosso do Sul, havendo predomínio de exóticas (62%). Apenas o oiti (*Moquilea tomentosa*) esteve presente em todos os municípios estudados e constitui frequentemente espécie acima do percentual recomendado. Os principais problemas documentados referem-se ao afloramento do sistema radicular e conflitos com a rede de energia e telefonia, os quais podem ser mitigados com a seleção de espécies e plantios adequados, gestão e manejo apropriados e acesso à informação e tecnologias.
Contribuições sociais/para a gestão: Conhecer o estado atual da arborização urbana é pré-condição fundamental para um planejamento e gestão adequados, e estes devem ocorrer de forma dinâmica e contínua visando a qualidade de vida e bem-estar da coletividade e contribuindo para a conservação da biodiversidade e dos serviços ecossistêmicos. Nesse estudo apresentamos um panorama da arborização do estado de Mato Grosso do Sul de modo a subsidiar essas ações.

Palavras-chaves: Arborização viária. Biodiversidade urbana. Floresta urbana. Infraestrutura urbana.

Forestación urbana en Mato Grosso do Sul: síntesis de saberes

Resumen

Objetivo: El presente estudio tiene como objetivo presentar una síntesis sobre el conocimiento de la forestación urbana en Mato Grosso do Sul, con el fin de contribuir a la comprensión del escenario actual, investigar patrones e identificar brechas de conocimiento.
Metodología: Se realizó una revisión de artículos disponibles en las principales bases de datos científicas, cruces y contacto directo con todos los departamentos municipales para recopilar y analizar las informaciones disponibles sobre forestación urbana en los municipios de Mato Grosso do Sul.
Originalidad/Relevancia: Trazamos un panorama del conocimiento sobre forestación urbana en el estado, incluyendo aspectos cualitativos y cuantitativos relevantes para la planificación y gestión integrada de la forestación urbana en los municipios.
Resultados: Se registraron datos sobre forestación urbana para 13 municipios de Mato Grosso do Sul, lo que corresponde al 16,4% de los municipios del estado. Esta información está disponible principalmente para las regiones noreste y noroeste, con un gran vacío de conocimiento para la región sur del estado, que se encuentra bajo una fuerte influencia de la Mata Atlántica. Más de 280 especies (56 familias) fueron registradas en la forestación urbana de Mato Grosso do Sul, con predominio de especies exóticas (62%). Solo oiti (*Moquilea*

tomentosa) estuvo presente en todos los municipios estudiados y frecuentemente es una especie por encima del porcentaje recomendado. Los principales problemas documentados se refieren al afloramiento del sistema radicular y conflictos con la red energética y telefónica, los cuales pueden ser mitigados con la selección de especies y plantaciones adecuadas, manejo y manejo adecuado y acceso a información y tecnologías.
Contribuciones sociales/de gestión: Conocer el estado actual de la forestación urbana es una precondición fundamental para una adecuada planificación y gestión, y estas deben ocurrir de forma dinámica y continua, visando la calidad de vida y bienestar de la comunidad y contribuyendo a la conservación de la biodiversidad y los servicios ecosistémicos. En este estudio, presentamos un panorama de la forestación en el estado de Mato Grosso do Sul para apoyar estas acciones.

Palabras clave: Forestación de calles. Biodiversidad urbana. Bosque urbano. Infraestructura urbana

Introduction

The state of Mato Grosso do Sul is located in Central-Western Brazil, covering 357.145 Km² and encompassing three important Brazilian biomes: Cerrado, Atlantic Forest and Pantanal, and the hydrographic basins of the Paraguay and Parana rivers. Thus, the state is a privileged region in biodiversity, receiving floristic influence from Amazonia to the Norwest and Chaco to the Southeast (Pott & Pott, 2003). Established in 1979, Mato Grosso do Sul is composed of 79 municipalities and has limits with five Brazilian states, Paraná (Southeast), São Paulo (East), Minas Gerais e Goiás (Northeast) and Mato Grosso (North). The state has frontiers with two South American countries, Paraguay (Southeast) and Bolivia (West). According to the last census, the state presents approximately 2.4 million people, over 85% being residents in urban areas (IBGE, 2010).

The urban spaces in Mato Grosso do Sul increased in the last two decades (Moreira Junior & Silva, 2017), and this expansion most often occurred without adequate urbanistic planning. It is essential to point out that the quality of life of people in urban areas is directly related to the infrastructure and economic, social and environmental development (Manfrin et al., 2018). However, the urban expansion caused changes in the local climate as well high production of residues that pollute soil and water. The high building density frequently leaves spaces with little or no trees and soil impermeabilization. Such factors affect the quality of life, distancing the inhabitants from a harmonic relationship with the natural environment (Shams et al., 2009; Manfrin et al., 2018).

One of the leading components of cities is urban forestry, defined as the set public or private areas with a predominance of arboreal vegetation in urban areas, including trees in streets and avenues, public parks and other green areas (Milano, 1988). Urban forestry has a primordial role in the quality of life of the population (Shams et al., 2009) once it promotes mental health, climatic stability and environmental comfort, reduces air, visual, and noise

pollution, helps conserve an ecologically balanced environment and reduces urban environmental impacts (Milano & Dalcin, 2000). The scientific survey of species is one of the critical issues to rationally inform about renewable natural resources (van den Berg, 1986). Identifying the species for urban forestry is one of the first and most critical steps to guide better decisions in urban planning (e.g., PDAU/CG, 2010; SEMAGRO, 2020).

Each plant species of the urban forestry presents particular characteristics, especially related to size, canopy architecture, stem diameter, growing time, type of leaves, flowers, fruits and seeds produced and resistance to pests. Such attributes are fundamental since they can conflict with urban aspects, mainly with the footpath and its width, electric wires, building retraction, traffic signs, street width, underground channels and solar orientation (PDAU/CG, 2010; SEMAGRO, 2020).

Based on our results from the identification and diagnosis of urban vegetation, the city administration has the means to elaborate strategic planning and direct actions to reestablish the plant cover in the suburbs with little or no green area and monitor suburbs that already have a good percentage of plant cover. Diagnosis and planning are part of a good management, favoring from the municipal to the state level, subsidizing the creation and implementation of programs and optimized utilization of resources, contributing to the environmental sector (PDAU/CG, 2010).

Therefore, our study aims to synthesize of the present knowledge on the urban forestry of Mato Grosso do Sul with compilation of species lists, plant health aspects and indication of the main conflicts with urban structures. Considering the growing bibliographic production on urban forestry, a review can collaborate in understanding the present scenario in this area, investigation of patterns, and systematizing and identifying knowledge gaps.

Methodology

This work consisted of a bibliographic review concerning the urban forestry of the state of Mato Grosso do Sul. Searches were done in the leading scientific databases: Web of Science (WoS), Scopus and Google Scholar (Orduna-Malea et al., 2015; Martín-Martín et al., 2018). Additionally, we included the cross-references available in the found articles and contacted the municipal secretaries to verify the existence of a Director Plan of Urban Forestry (DPUF). The time interval was configured as the first record in the databases until 2020. We utilized the following keywords (in Portuguese and English) “urban forestry” OR “road forestry” OR “urban forest” AND “Mato Grosso do Sul”, with a focus on selecting publications approaching in some degree or aspect the studied theme. The exclusion criteria were duplicated articles and documents without information on authorship or publication year, and we only included complete works. We did not consider private green areas, parks, forests,

urban conservation units, or institutional gardens. We determined the percentage of forestry of streets of those towns considering the last official census (IBGE, 2010).

Since the works were published in different years, the taxonomic systems varied, leading to the need for general standardization. The botanical families follow APG IV (2016), while scientific names follow Flora do Brasil (2020). In case of absent information, we adopted the nomenclature available at Missouri Botanical Garden - Tropicos© (https://www.tropicos.org). Without identification to the species level but the genus was already represented in the list, that publication was not catalogued. For origin classification, we considered native species originally recorded in Mato Grosso do Sul (Lorenzi, 1992, 1998, 2009; Flora do Brasil, 2020). We considered exotic from Mato Grosso do Sul (exotic-MS), the species native to Brazil but not in the state, and considered exotic in Brazil (exotic-BR), the species introduced from other countries.

Results and Discussion

We obtained information on urban forestry for 13 municipalities of Mato Grosso do Sul: Aquidauana (Massaranduba, 2020; Aoki, 2020; Sá et al., 2021), Anastácio (Rabelo et al., 2020), Bonito (Arbon, 2016; Zamproni et al., 2018), Campo Grande (PDAU/CG, 2010; Pestana et al., 2011), Cassilândia (Guilherme et al., 2018), Chapadão do Sul (Pelegrim et al., 2012), Corumbá (Lopo, 2014), Costa Rica (Guilherme et al., 2018), Coxim (Mota & Almeida, 2011), Dourados (PDAU/Dourados, 2019), Miranda (PDAU/Miranda, 2020), Paranaíba (Guilherme et al., 2018) and Três Lagoas (Santos, 2014) (Figure 1). Thus, the studies encompass only 16.4% of the municipalities and are concentrated in the Northeast and Northwest of the state. There is a gap of knowledge for southern municipalities, many in the Atlantic Forest domain, yet little studied in Mato Grosso do Sul (Damasceno-Junior et al., 2018).

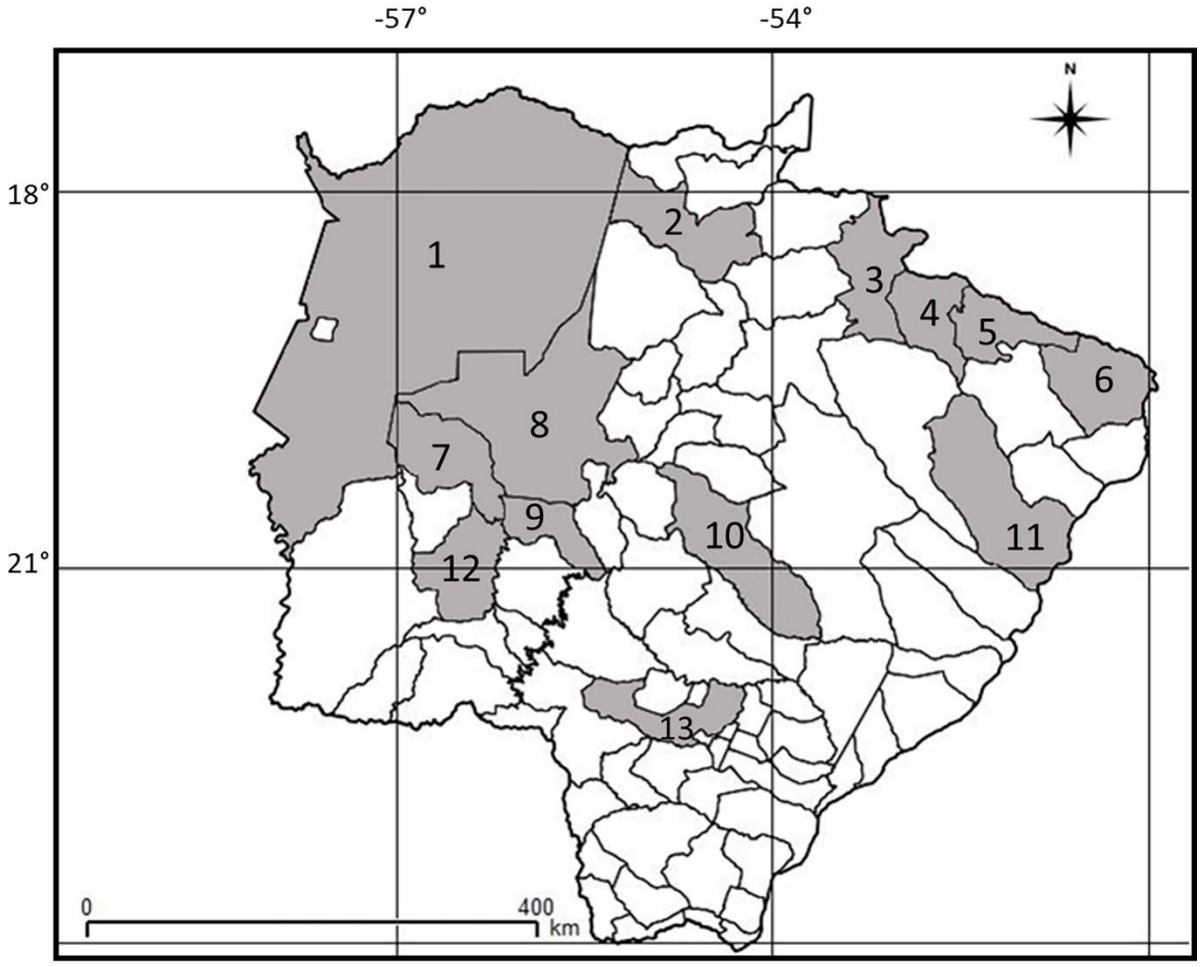
Most studies were about road forestry of cities, only two on squares, of Anastácio (Rabello et al., 2020) and Aquidauana (Aoki et al., 2020). They are floristic surveys and tree health diagnoses of one or several streets, suburb(s) or the whole town (through sampling). Such inventories and diagnoses of forestry are used to quantify costs, identify problems liable to redefine management guidelines and plan programs of awareness or environmental education, seeking support from the population (SEMAGRO, 2020).

The percentage of street forestry in the studied towns was high, above 92% (IBGE, 2010). That percentage means urban homes in front of a block with forestry divided by the total urban homes. The Municipal Plan of Urban Forestry (PMAU, in Portuguese) is a complementary tool to the Director Plan of the Municipality, which must be in agreement with the Organic Law and is a requirement of the Statute of Cities (Law 10,257 of 10.07.2001. Art.182 and 183) of the Federal Constitution (Urban Policy). The PMAU, in turn, is also a

complementary tool to the Director Plan of the Municipality. The cities of Bonito, Campo Grande, Dourados and Miranda count with Director Plans of Urban Forestry (PDAU, in Portuguese). Some towns have the PDAU in development process, approval or publication (e.g. Aquidauana, Camapuã and Maracaju). The PDAU is indispensable for the correct technical-administrative orientation (Pivetta & Silva Filho, 2002).

Figure 1

Municipalities with information on urban forestry in Mato Grosso do Sul. 1. Corumbá, 2. Coxim, 3. Costa Rica, 4. Chapadão do Sul, 5. Cassilândia, 6. Paranaíba, 7. Miranda, 8. Aquidauana, 9. Anastácio, 10. Campo Grande, 11. Três Lagoas, 12. Bonito, 13. Dourados



Source: Our work.

We recorded 283 plant species distributed in 56 families (Table 1). Fabaceae constitute the most represented in richness (66 species), followed by Arecaceae (19) and Malvaceae (14) (Figure 2). Twenty families contributed with a single species (*e.g.* Asteraceae, Calophyllaceae, Polygonaceae, Rhamnaceae and Salicaceae). Fabaceae include the "angelins", "angicos", cassias, sennas, and orchid trees, the most utilized family in urban

forestry in the country, consisting of one of the most numerous Angiosperm families worldwide, and also one of the main in economic value (Souza & Lorenzi, 2008). Arecaceae is the Family of palms, several of which are utilized in ornamentation, mainly for their architecture and foliage, a common element in the landscaping of streets, squares and residences (Souza & Lorenzi, 2008). Malvaceae is also a family with several ornamental species, standing out the hibiscus (*Hibiscus* spp.), silk-floss trees (*Ceiba* spp.) and “açoita-cavalos” (*Luehea* spp.) (Lorenzi, 1992; Souza & Lorenzi, 2008).

The species number varied greatly between municipalities (Table 2). Campo Grande (163), Dourados (121) and Aquidauana (114) contemplated the highest number of species; in indeed, Anastácio and Coxim showed the the lowest richness (7 and 17 species, respectively) and, certainly, the result is related to the analyzed spatial cut and the applied method. In Anastácio, for example, only the public squares were sampled (Rabello et al., 2020), and in Coxim, only the suburb Flamboyant (Pelegrim et al., 2012). In Campo Grande, Dourados and Aquidauana, the whole urban area was inventoried applying the sampling method (PDAU/CG, 2010; PDAU/Dourados, 2019; Massaranduba, 2020), and in Campo Grande and Aquidauana additional censi were made in specific suburbs (Pestana et al., 2011; Sá et al., 2021).

“Oiti” (*Moquilea tomentosa*) was the only species recorded in all municipalities (for Miranda was no available list). This species constitutes over 15% of urban forestry in most municipalities, thus, above the recommendations (Table 2). This species may have wide use in road forestry for its dense and perennial canopy, which gives excellent shading (Lorenzi, 1992) and deep root system. With known resilience to urban stressors, this species does not occur originally in Mato Grosso do Sul (Lorenzi, 1992) and, therefore, does not fit concept of a native tree. Other exotic species frequent in forestry (recorded in 11 municipalities) were mango (*Mangifera indica*), water chestnut (*Pachira aquatica*) and various citric species (ornanges, lemons, mandarines – *Citrus* spp.) The weeping fig (*Ficus benjamina*), “sibipiruna” (*Cenostigma pluviosum*) and orange jasmine (*Murraya paniculata*) were also highly frequent species (10 municipalities) (Table 1).

Table 1

Species utilized in urban forestry in the state of Mato Grosso do Sul, with their respective families, common names, municipalities and origin (native to MS, exotic to MS, exotic BR)

Family	Species	Common name	Municipalities	Origin
Anacardiaceae	*Anacardium humile* A.St.-Hil.	Cajuzinho-do-cerrado	Aquidauana	Nativa
Anacardiaceae	*Anacardium occidentale* L.	Cajueiro	Aquidauana, Cassilândia, Campo Grande, Costa Rica, Dourados, Paranaíba, Três Lagoas	Exótica MS
Anacardiaceae	*Astronium fraxinifolium* Schott	Gonçalo-alves	Aquidauana, Campo Grande	Nativa
Anacardiaceae	*Mangifera indica* L.	Mangueira	Aquidauana, Bonito, Cassilândia, Campo Grande, Chapadão do Sul, Corumbá, Costa Rica, Coxim, Dourados, Paranaíba, Três Lagoas	Exótica BR
Anacardiaceae	*Astronium urundeuva* (M.Allemão) Engl.	Aroeira	Aquidauana, Bonito, Campo Grande, Corumbá, Dourados	Nativa
Anacardiaceae	*Schinus molle* L.	Chorão	Bonito, Cassilândia, Campo Grande, Chapadão do Sul, Costa Rica, Dourados, Paranaíba, Três Lagoas	Exótica MS
Anacardiaceae	*Schinus terebinthifolia* Raddi	Aroeira-vermelha	Aquidauana, Campo Grande, Dourados	Nativa
Anacardiaceae	*Spondias dulcis* Parkinson	Cajá-manga	Dourados	Exótica BR
Anacardiaceae	*Spondias mombin* L.	Caiá	Campo Grande, Corumbá	Nativa
Anacardiaceae	*Spondias purpurea* L.	Seriguela	Aquidauana, Bonito, Campo Grande, Corumbá, Costa Rica, Paranaíba, Três Lagoas	Exótica BR
Anacardiaceae	*Spondias venulosa* (Mart. ex Engl.) Engl.	Cajá-graúdo	Dourados	Exótica MS
Annonaceae	*Annona cherimola* Mill.	Atemóia	Chapadão do Sul	Exótica BR
Annonaceae	*Annona coriacea* Mart.	Araticum	Aquidauana, Campo Grande	Nativa
Annonaceae	*Annona crassiflora* Mart.	Marolo	Aquidauana	Nativa

To be continued

Continuation

Family	Species	Common name	Municipalities	Origin
Annonaceae	*Annona muricata* L.	Graviola	Aquidauana, Cassilândia, Corumbá, Costa Rica, Paranaíba, Três Lagoas	Exótica BR
Annonaceae	*Annona squamosa* L.	Fruta-do-conde	Cassilândia, Corumbá, Costa Rica, Paranaíba, Três Lagoas	Exótica BR
Annonaceae	*Xylopia aromatica* (Lam.) Mart.	Pimenta-de-macaco	Campo Grande	Nativa
Apocynaceae	*Allamanda cathartica* L.	Alamanda	Chapadão, Costa Rica, Paranaíba	Nativa
Apocynaceae	*Hancornia speciosa* Gomes	Mangaba	Três Lagoas	Nativa
Apocynaceae	*Nerium oleander* L.	Espirradeira	Aquidauana, Cassilândia, Campo Grande, Chapadão do Sul, Corumbá, Costa Rica, Dourados	Exótica BR
Apocynaceae	*Plumeria pudica* Jacq.	Jasmim-da-venezuela	Aquidauana, Dourados	Exótica BR
Apocynaceae	*Plumeria rubra* L.	Jasmim-manga	Anastácio, Aquidauana, Bonito, Campo Grande, Corumbá, Dourados	Exótica BR
Apocynaceae	*Tabernaemontana divaricata* (L.) R. Br. ex Roem. & Schult.	Jasmim-café	Três Lagoas	Exótica BR
Apocynaceae	*Thevetia peruviana* (Pers.) K.Schum.	Chapéu-de-napoleão	Aquidauana, Bonito, Campo Grande, Chapadão do Sul, Corumbá, Costa Rica, Dourados	Exótica BR
Aquifoliaceae	*Ilex aquifolium* L.	Azevinho	Dourados	Exótica BR
Araliaceae	*Didymopanax macrocarpus* (Cham. & Schltdl.) Seem.	Mandiocão	Três Lagoas	Nativa
Araliaceae	*Heptapleurum actinophyllum* (Endl.) Lowry & G.M. Plunkett	Cheflera	Campo Grande, Dourados, Paranaíba	Exótica BR
Araliaceae	*Heptapleurum arboricola* Hayata	Cheflera	Campo Grande, Dourados, Paranaíba	Exótica BR
Araliaceae	*Polyscias guilfoylei* (W.Bull) L.H.Bailey	Árvore-da-felicidade-macho	Dourados	Exótica BR
Araliaceae	*Polyscias scutellaria* (Burm.f.) Fosberg	Arália	Campo Grande, Corumbá	Exótica BR
Araucariaceae	*Araucaria angustifolia* (Bertol.) Kuntze	Pinheiro-do-paraná	Campo Grande, Corumbá, Dourados	Exótica MS
Arecaceae	*Acrocomia totai* Mart. (citada como *A. aculeata* nas fontes consultadas)	Bocaiuva	Aquidauana, Campo Grande, Corumbá, Dourados, Três Lagoas	Nativa

Continuation

Family	Species	Common name	Municipalities	Origin
Arecaceae	*Archontophoenix alexandrae* (F.Muell.) H.Wendl. & Drude	Palmeira-real-australiana	Costa Rica	Exótica BR
Arecaceae	*Attalea phalerata* Mart. ex Spreng.	Acuri	Campo Grande, Corumbá, Dourados	Nativa
Arecaceae	*Attalea speciosa* Mart. ex Spreng.	Babaçu	Campo Grande	Nativa
Arecaceae	*Bismarckia nobilis* Hildebrandt & H. Wendl.	Palmeira-azul	Dourados	Exótica BR
Arecaceae	*Caryota mitis* Lour.	Palmeira-rabo-de-peixe	Campo Grande, Dourados	Exótica BR
Arecaceae	*Caryota urens* L.	Palmeira-rabo-de-peixe	Corumbá	Exótica BR
Arecaceae	*Cocos nucifera* L.	Coqueiro	Aquidauana, Bonito, Campo Grande, Dourados	Exótica BR
Arecaceae	*Copernicia alba* Morong	Carandá	Dourados	Nativa
Arecaceae	*Dypsis decaryi* (Jum.) Beentje & J.Dransf.	Palmeira-triângulo	Dourados	Exótica BR
Arecaceae	*Dypsis lutescens* (H.Wendl.) Beentje & J.Dransf.	Areca-bambu	Aquidauana, Bonito, Cassilândia, Campo Grande, Chapadão do Sul, Costa Rica, Dourados, Paranaíba	Exótica BR
Arecaceae	*Dypsis madagascariensis* (Becc.) Beentje & J.Dransf.	Areca-bambu	Aquidauana	Exótica BR
Arecaceae	*Elaeis guineenses* Jacq.	Palmeira-dendoeiro	Campo Grande	Exótica BR
Arecaceae	*Euterpe oleracea* Mart.	Açaí	Dourados	Exótica MS
Arecaceae	*Phoenix roebelenii* O'Brien	Palmeira-fênix	Aquidauana, Cassilândia, Campo Grande, Chapadão do Sul, Costa Rica, Corumbá, Dourados, Paranaíba	Exótica BR
Arecaceae	*Roystonea regia* (Kunth) O.F.Cook	Palmeira-imperial	Aquidauana, Bonito, Campo Grande, Chapadão do Sul, Corumbá, Dourados, Paranaíba	Exótica BR
Arecaceae	*Sabal maritima* (Kunth) Burret	Sabal	Chapadão do Sul	Exótica BR

Continuation

Family	Species	Common name	Municipalities	Origin
Arecaceae	*Syagrus oleracea* (Mart.) Becc.	Gueirova	Bonito, Campo Grande, Chapadão do Sul, Paranaíba, Três Lagoas	Nativa
Arecaceae	*Syagrus romanzoffiana* (Cham.) Glassman	Jerivá	Anastácio, Aquidauana, Campo Grande, Dourados	Nativa
Asparagaceae	*Beaucarnea recurvata* Lem.	Pata-de-elefante	Cassilândia	Exótica BR
Asparagaceae	*Cordyline australis* Hook. f.	Cordiline	Dourados	Exótica BR
Asparagaceae	*Cordyline fruticosa* (L.) A.Chev.	Cordiline	Bonito	Exótica BR
Asparagaceae	*Dracaena fragrans* (L.) Ker Gawl.	Dracena	Campo Grande, Dourados	Exótica BR
Asparagaceae	*Yucca guatemalensis* Baker	Iuca-elefante	Campo Grande, Dourados	Exótica BR
Asteraceae	*Gymnanthemum amygdalinum* (Delile) Sch.Bip. ex Walp.	Boldo-da-bahia	Dourados	Exótica BR
Bignoniaceae	*Crescentia cujete* L.	Coité	Campo Grande	Exótica BR
Bignoniaceae	*Cybistax antisyphilitica* (Mart.) Mart.	Ipê-verde	Campo Grande	Nativa
Bignoniaceae	*Handroanthus chrysotrichus* (Mart. ex DC.) Mattos	Ipê-amarelo-cascudo	Aquidauana, Cassilândia, Campo Grande, Chapadão do Sul, Corumbá, Costa Rica, Dourados, Paranaíba	Exótica MS
Bignoniaceae	*Handroanthus heptaphyllus* (Vell.) Mattos	Ipê-rosa	Aquidauana, Campo Grande, Corumbá	Nativa
Bignoniaceae	*Handroanthus impetiginosus* (Mart. ex DC.) Mattos	Ipê-roxo	Aquidauana, Bonito, Campo Grande, Corumbá, Dourados, Três Lagoas	Nativa
Bignoniaceae	*Handroanthus ochraceus* (Cham.) Mattos	Ipê-amarelo	Bonito, Campo Grande, Dourados, Três Lagoas	Nativa
Bignoniaceae	*Jacaranda cuspidifolia* Mart.	Caroba	Aquidauana, Bonito, Campo Grande, Corumbá, Dourados, Três Lagoas	Nativa
Bignoniaceae	*Jacaranda mimosifolia* D. Don.	Jacarandá-mimoso	Costa Rica	Exótica BR
Bignoniaceae	*Spathodea campanulata* P. Beauv.	Espatódia	Aquidauana, Cassilândia, Campo Grande, Chapadão do Sul, Costa Rica, Dourados	Exótica BR

Continuation

Family	Species	Common name	Municipalities	Origin
Bignoniaceae	*Tabebuia aurea* (Silva Manso) Benth. & Hook.f. ex S.Moore	Paratudo	Aquidauana, Bonito, Corumbá, Dourados	Nativa
Bignoniaceae	*Tabebuia* rosea (Bertol.) Bertero ex A.DC.	Ipê-rosa	Anastácio, Aquidauana, Cassilândia, Chapadão do Sul	Exótica BR
Bignoniaceae	*Tabebuia roseoalba* (Ridl.) Sandwith	Ipê-branco	Aquidauana, Bonito, Campo Grande, Chapadão do Sul, Corumbá, Dourados, Três Lagoas	Nativa
Bignoniaceae	*Tecoma stans* (L.) Juss. ex Kunth	Ipê-de-jardim	Bonito, Cassilândia, Campo Grande, Dourados, Paranaíba	Exótica BR
Bixaceae	*Bixa orellana* L.	Urucum	Aquidauana, Campo Grande, Paranaíba	Exótica MS
Boraginaceae	*Cordia africana* Lam.	Cordia-africana	Cassilândia	Exótica BR
Boraginaceae	*Cordia glabrata* (Mart.) A.DC.	Louro-preto	Aquidauana	Nativa
Boraginaceae	*Cordia naidophila* I.M.Johnst.	Louro-branco	Corumbá	Exótica MS
Cactaceae	*Cereus jamacaru* DC.	Mandacaru	Dourados	Exótica MS
Cactaceae	*Cereus repandus* (L.) Mill.	Cacto-do-peru	Dourados	Exótica BR
Cactaceae	*Opuntia ficus-indica* (L.) Mill.	Palma	Dourados	Exótica BR
Cactaceae	*Pereskia aculeata* Mill.	Ora-pro-nóbis	Campo Grande	Exótica MS
Cactaceae	*Pereskia grandifolia* Haw.	Ora-pro-nóbis	Campo Grande	Exótica MS
Calophyllaceae	*Kielmeyera* coriacea Mart. & Zucc.	Pau-santo	Aquidauana	Nativa
Caricaceae	*Carica papaya* L.	Mamão	Aquidauana, Corumbá, Dourados, Três Lagoas	Exótica BR
Caryocaraceae	*Caryocar brasiliense* Cambess.	Pequi	Aquidauana, Campo Grande, Dourados, Três Lagoas	Nativa
Chrysobalanaceae	*Licania humilis* Cham. & Schltdl.	Marmelo-do-campo	Aquidauana	Nativa
Chrysobalanaceae	*Moquilea tomentosa* Benth.	Oiti	Anastácio, Aquidauana, Bonito, Cassilândia, Campo Grande, Chapadão do Sul, Corumbá, Costa Rica, Coxim, Dourados, Paranaíba, Três Lagoas	Exótica MS

Continuation

Family	Species	Common name	Municipalities	Origin
Clusiaceae	*Garcinia gardneriana* (Planch. & Triana) Zappi	Bacupari	Dourados	Nativa
Combretaceae	*Combretum indicum* (L.) Jongkind	Rangoon	Cassilândia	Exótica BR
Combretaceae	*Combretum leprosum* Mart.	Carne-de-vaca	Bonito	Nativa
Combretaceae	*Terminalia argentea* Mart. & Zucc.	Capitão-do-mato	Aquidauana, Bonito	Nativa
Combretaceae	*Terminalia catappa* L.	Sete-copas	Aquidauana, Bonito, Cassilândia, Campo Grande, Corumbá, Costa Rica, Coxim, Paranaíba, Três Lagoas	Exótica BR
Cupressaceae	*Cupressus lusitanica* Mill.	Cipreste	Chapadão do Sul	Exótica BR
Cupressaceae	*Cupressus macrocarpa* Hartw. ex Gordon	Cipreste	Aquidauana, Campo Grande	Exótica BR
Cupressaceae	*Cupressus sempervirens* L.	Cipreste	Campo Grande	Exótica BR
Cupressaceae	*Juniperus chinensis* L.	Tuia	Anastácio, Aquidauana	Exótica BR
Cupressaceae	*Juniperus virginiana* L.	Tuia	Chapadão do Sul, Costa Rica, Paranaíba	Exótica BR
Cupressaceae	*Thuja occidentalis* L.	Tuia	Campo Grande	Exótica BR
Cycadaceae	*Cycas circinalis* L.	Cica	Cassilândia, Campo Grande, Chapadão do Sul, Costa Rica, Dourados, Paranaíba	Exótica BR
Cycadaceae	*Cycas revoluta* Thunb.	Cica	Corumbá	Exótica BR
Dilleniaceae	*Curatella americana* L.	Lixeira	Aquidauana	Nativa
Dilleniaceae	*Dillenia indica* L.	Flor-de-abril	Cassilândia, Campo Grande, Costa Rica, Dourados	Exótica BR
Euphorbiaceae	*Codiaeum variegatum* (L.) Rumph. ex A.Juss.	Cróton	Bonito, Chapadão do Sul, Costa Rica, Dourados	Exótica BR
Euphorbiaceae	*Croton urucurana* Baill.	Sangra-d'água	Aquidauana, Campo Grande	Nativa
Euphorbiaceae	*Hevea brasiliensis* (Willd. ex A.Juss.) Müll.Arg.	Seringueira	Campo Grande	Exótica MS

Family	Species	Common name	Municipalities	Origin
Euphorbiaceae	*Hura crepitans* L.	Assacu	Dourados	Exótica MS
Euphorbiaceae	*Jatropha curcas* L.	Pião-branco	Cassilândia	Exótica BR
Euphorbiaceae	*Jatropha gossypiifolia* L.	Pião-roxo	Aquidauana	Exótica BR
Euphorbiaceae	*Micrandra elata* (Didr.) Müll.Arg.	Leiteiro-branco	Campo Grande	Exótica MS
Euphorbiaceae	*Sapium haematospermum* Müll.Arg.	Leiteiro	Bonito	Nativa
Fabaceae	*Acacia arborea* (L.) Willd.	Brinco-de-índio	Dourados	Exótica BR
Fabaceae	*Acacia baileyana* F. Muell.	Cootamundra	Campo Grande	Exótica BR
Fabaceae	*Adenanthera pavonina* L.	Falso-pau-brasil	Aquidauana	Exótica BR
Fabaceae	*Albizia lebbeck* (L.) Benth.	Faveiro	Campo Grande, Três Lagoas	Exótica BR
Fabaceae	*Albizia niopoides* (Spruce ex Benth.) Burkart	Farinha-seca	Aquidauana, Bonito, Campo Grande, Dourados	Nativa
Fabaceae	*Albizia polycephala* (Benth.) Killip ex Record	Angico-branco	Campo Grande, Dourados	Nativa
Fabaceae	*Amburana cearensis* (Allemão) A.C.Sm.	Amburana	Aquidauana, Campo Grande	Nativa
Fabaceae	*Anadenanthera peregrina* (L.) Speg.	Angico-branco	Campo Grande, Corumbá, Dourados, Três Lagoas	Nativa
Fabaceae	*Andira anthelmia* (Vell.) Benth.	Angelim-amargoso	Campo Grande	Nativa
Fabaceae	*Andira cujabensis* Benth.	Morcegueira	Aquidauana, Campo Grande, Dourados	Nativa
Fabaceae	*Bauhinia curvula* Benth.	Pata-de-vaca	Aquidauana	Nativa
Fabaceae	*Bauhinia forficata* Link	Pata-de-vaca	Chapadão do Sul	Exótica MS
Fabaceae	*Bauhinia longifolia (*Bong.) Steud.	Pata-de-vaca	Três Lagoas	Nativa
Fabaceae	*Bauhinia variegata* L.	Pata-de-vaca	Anastácio, Aquidauana, Cassilândia, Campo Grande, Chapadão do Sul, Corumbá, Costa Rica, Dourados	Exótica BR
Fabaceae	*Caesalpinia pulcherrima* (L.) Sw.	Flamboyanzinho	Aquidauana, Campo Grande, Chapadão do Sul, Corumbá, Costa Rica, Dourados	Exótica BR
Fabaceae	*Cajanus cajan* (L.) Huth	Feijão-gandu	Campo Grande, Bonito, Dourados	Exótica BR

Family	Species	Common name	Municipalities	Origin
Fabaceae	*Calliandra brevipes* Benth.	Esponja	Campo Grande, Chapadão do Sul	Exótica MS
Fabaceae	*Calliandra tweedii* Benth.	Caliandra-vermelha	Campo Grande	Exótica MS
Fabaceae	*Cassia fistula* L.	Chuva-de-ouro	Aquidauana, Bonito, Cassilândia, Campo Grande, Corumbá, Costa Rica, Paranaíba	Exótica BR
Fabaceae	*Cassia grandis* L. f.	Cássia-rosa	Campo Grande, Três Lagoas	Nativa
Fabaceae	*Cassia javanica* L.	Cássia-rosa-de-java	Campo Grande	Exótica BR
Fabaceae	*Cassia leiandra* Benth.	Marimari	Três Lagoas	Exótica MS
Fabaceae	*Cenostigma pluviosum* (DC.) Gagnon & G.P.Lewis	Sibipiruna	Aquidauana, Bonito, Cassilândia, Campo Grande, Chapadão do Sul, Corumbá, Costa Rica, Coxim, Paranaíba, Três Lagoas	Nativa
Fabaceae	*Clitoria fairchildiana* R.A.Howard	Sombreiro	Aquidauana, Campo Grande, Três Lagoas	Exótica MS
Fabaceae	*Copaifera langsdorffii* Desf.	Copaíba	Aquidauana, Dourados	Nativa
Fabaceae	*Dahlstedtia muehlbergiana* (Hassl.) M.J.Silva & A.M.G.Azevedo	Timbó	Bonito	Nativa
Fabaceae	*Delonix regia* (Bojer ex Hook.) Raf.	Flamboyant	Aquidauana, Bonito, Cassilândia, Campo Grande, Chapadão do Sul, Corumbá, Coxim, Dourados, Três Lagoas	Exótica BR
Fabaceae	*Dimorphandra mollis* Benth.	Falso-barbatimão	Aquidauana, Campo Grande, Três Lagoas	Nativa
Fabaceae	*Dipteryx alata* Vogel	Cumbaru	Aquidauana, Campo Grande	Nativa
Fabaceae	*Enterolobium contortisiliquum* (Vell.) Morong	Tamboril	Aquidauana, Campo Grande, Corumbá	Nativa
Fabaceae	*Enterolobium timbouva* Mart.	Tamboril	Coxim	Nativa
Fabaceae	*Erythrina falcata* Benth.	Mulungu	Aquidauana	Nativa
Fabaceae	*Erythrina variegata* L.	Brasileirinho	Bonito, Campo Grande, Chapadão do Sul, Corumbá, Costa Rica, Dourados, Paranaíba	Exótica BR
Fabaceae	*Holocalyx balansae* Micheli	Alecrim-de-campinas	Campo Grande	Nativa
Fabaceae	*Hymenaea courbaril* L.	Jatobá	Aquidauana, Campo Grande, Coxim, Dourados	Nativa
Fabaceae	*Hymenaea stigonocarpa* Mart. ex Hayne	Jatobá	Aquidauana	Nativa

Family	Species	Common name	Municipalities	Origin
Fabaceae	*Inga edulis* Mart.	Ingá	Campo Grande, Chapadão do Sul	Exótica MS
Fabaceae	*Inga laurina* (Sw.) Willd.	Ingá-branco	Aquidauana, Campo Grande, Três Lagoas	Nativa
Fabaceae	*Inga vera* Willd.	Ingá	Aquidauana, Campo Grande, Dourados	Nativa
Fabaceae	*Leucaena leucocephala* (Lam.) de Wit	Leucena	Aquidauana, Bonito, Campo Grande, Corumbá, Costa Rica, Dourados, Paranaíba	Exótica BR
Fabaceae	*Libidibia ferrea* (Mart. ex Tul.) L.P.Queiroz	Pau-ferro	Campo Grande	Nativa
Fabaceae	*Machaerium acutifolium* Vogel	Jacarandá-do-campo	Aquidauana	Nativa
Fabaceae	*Machaerium nyctitans* (Vell.) Benth.	Jacarandá-bico-de-pato	Dourados	Exótica MS
Fabaceae	*Machaerium opacum* Vogel	Jacarandá-do-cerrado	Dourados	Exótica MS
Fabaceae	*Machaerium villosum* Vogel	Jacarandá-paulista	Dourados	Nativa
Fabaceae	*Macrolobium bifolium* (Aubl.) Pers.	Iperana	Dourados	Exótica MS
Fabaceae	*Melanoxylon brauna* Schott	Braúna	Campo Grande, Corumbá	Exótica MS
Fabaceae	*Mimosa caesalpiniifolia* Benth.	Sansão-do-campo	Aquidauana, Costa Rica	Exótica MS
Fabaceae	*Mimosa tenuiflora* (Willd.) Poir.	Jurema	Corumbá	Exótica MS
Fabaceae	*Myrocarpus frondosus* Allemão	Cabreúva	Paranaíba	Exótica MS
Fabaceae	*Myroxylon peruiferum* L.f.	Balsamim	Chapadão do Sul, Dourados	Nativa
Fabaceae	*Parkinsonia aculeata* L.	Espinho-de-jerusalém	Campo Grande	Exótica BR
Fabaceae	*Paubrasilia echinata* (Lam.) Gagnon, H.C.Lima & G.P.Lewis	Pau-Brasil	Campo Grande, Chapadão do Sul, Dourados, Três Lagoas	Exótica MS
Fabaceae	*Peltophorum dubium (Spreng.) Taub.*	Farinha- seca	Campo Grande, Dourados	Nativa
Fabaceae	*Platypodium elegans Vogel*	Amendoim-do-campo	Campo Grande, Dourados	Nativa
Fabaceae	*Pterogyne nitens* Tul.	Amendoim-bravo	Bonito, Corumbá	Nativa
Fabaceae	*Samanea saman* (Jacq.) Merr.	Farinha-seca	Corumbá	Exótica BR
Fabaceae	*Schizolobium parahyba* (Vell.) Blake	Guapuruvu	Campo Grande	Nativa

Family	Species	Common name	Municipalities	Origin
Fabaceae	*Senna macranthera* (DC. ex Collad.) H.S.Irwin & Barneby	Cássia-amarela	Campo Grande, Dourados	Nativa
Fabaceae	*Senna spectabilis* (DC.) H.S.Irwin & Barneby	Cássia-amarela	Aquidauana, Campo Grande	Nativa
Fabaceae	*Stryphnodendron adstringens* (Mart.) Coville	Barbatimão	Campo Grande	Nativa
Fabaceae	*Stryphnodendron rotundifolium* Mart.	Barbatimão	Aquidauana	Nativa
Fabaceae	*Tamarindus indica* L.	Tamarindo	Aquidauana, Campo Grande, Chapadão do Sul, Corumbá, Coxim, Paranaíba	Exótica BR
Fabaceae	*Tipuana tipu* (Benth.) Kuntze	Tipuana	Campo Grande	Exótica BR
Fabaceae	*Vachellia farnesiana* (L.) Wight & Arn.	Aromita	Corumbá	Nativa
Fabaceae	*Vatairea macrocarpa* (Benth.) Ducke	Angelim	Três Lagoas	Nativa
Lamiaceae	*Aegiphila lhotzkiana* Cham.	Tamanqueira	Campo Grande	Nativa
Lamiaceae	*Plectranthus barbatus* Andr.	Boldo	Aquidauana	Exótica BR
Lamiaceae	*Vitex cymosa* Bertero ex Spreng.	Tarumã	Corumbá	Nativa
Lauraceae	*Cinnamomum burmannii* (Nees & T.Nees) Blume	Falsa-canela	Chapadão do Sul, Dourados	Exótica BR
Lauraceae	*Cinnamomum verum* J.Presl	Canela	Bonito, Campo Grande, Dourados	Exótica BR
Lauraceae	*Endlicheria paniculata* (Spreng.) J.F.Macbr.	Canela	Campo Grande	Nativa
Lauraceae	*Nectandra lanceolata* Nees	Canela-amarela	Dourados	Nativa
Lauraceae	*Nectandra megapotamica* (Spreng.) Mez	Canelinha	Chapadão do Sul	Nativa
Lauraceae	*Ocotea pulchella* (Nees & Mart.) Mez	Canela	Campo Grande, Dourados	Exótica MS
Lauraceae	*Persea americana* Mill.	Abacateiro	Aquidauana, Cassilândia, Campo Grande, Chapadão do Sul, Dourados	Exótica BR
Lecythidaceae	*Cariniana estrellensis* (Raddi) Kuntze	Jequitibá	Campo Grande	Exótica MS
Lecythidaceae	*Couroupita guianensis* Aubl.	Abricó-de-macaco	Dourados	Exótica MS
Lecythidaceae	*Lecythis pisonis* Cambess.	Sapucaia	Costa Rica	Exótica MS

Family	Species	Common name	Municipalities	Origin
Lythraceae	*Lagerstroemia indica* L.	Resedá	Anastácio, Aquidauana, Bonito, Cassilândia, Campo Grande, Chapadão do Sul, Costa Rica, Corumbá, Paranaíba	Exótica BR
Lythraceae	*Punica granatum* L.	Romã	Aquidauana, Bonito, Campo Grande, Chapadão do Sul, Corumbá, Três Lagoas	Exótica BR
Magnoliaceae	*Magnolia champaca* (L.) Baill. ex Pierre	Magnólia-amarela	Cassilândia, Campo Grande, Dourados	Exótica BR
Magnoliaceae	*Magnolia grandiflora* L.	Magnólia-branca	Campo Grande	Exótica BR
Malpighiaceae	*Byrsonima coccolobifolia* Kunth	Murici	Três Lagoas	Nativa
Malpighiaceae	*Lophanthera lactescens* Ducke	Lofantera	Dourados	Exótica MS
Malpighiaceae	*Malpighia emarginata* DC.	Acerola	Bonito, Cassilândia, Chapadão do Sul, Corumbá, Costa Rica, Paranaíba, Três Lagoas	Exótica BR
Malpighiaceae	*Malpighia glabra* L.	Acerola	Aquidauana, Campo Grande, Dourados	Exótica BR
Malvaceae	*Ceiba boliviana* Britten & Baker f.	Barriguda	Corumbá	Exótica BR
Malvaceae	*Ceiba crispiflora* (Kunth) Ravenna	Paineira	Coxim	Exótica MS
Malvaceae	*Ceiba speciosa* (A.St.-Hil.) Ravenna	Paineira	Aquidauana, Campo Grande, Dourados, Três Lagoas	Nativa
Malvaceae	*Eriotheca cf. gracilipes* (K.Schum.) A.Robyns	Paina-do-campo	Campo Grande	Nativa
Malvaceae	*Gossypium barbadense* L.	Algodão	Corumbá	Exótica BR
Malvaceae	*Guazuma ulmifolia* Lam.	Mutamba	Bonito, Campo Grande, Dourados	Nativa
Malvaceae	*Hibiscus rosa-sinensis* L.	Hibisco	Aquidauana, Bonito, Cassilândia, Campo Grande, Chapadão do Sul, Dourados	Exótica BR
Malvaceae	*Hibiscus tiliaceus* L.	Algodão-da-praia	Três Lagoas	Exótica BR
Malvaceae	*Luehea divaricata* Mart.	Açoita-cavalo	Aquidauana	Nativa
Malvaceae	*Ochroma pyramidale* (Cav. ex Lam.) Urb.	Pau-balsa	Dourados	Exótica MS
Malvaceae	*Pachira aquatica* Aubl.	Munguba	Aquidauana, Bonito, Cassilândia, Campo Grande, Chapadão do Sul, Corumbá, Costa Rica, Coxim, Dourados, Paranaíba, Três Lagoas	Exótica MS

Family	Species	Common name	Municipalities	Origin
Malvaceae	*Pachira glabra* Pasq.	Castanha-do-maranhão	Campo Grande	Nativa
Malvaceae	*Sterculia striata* A.St.-Hil. & Naudin	Manduvi	Aquidauana, Campo Grande, Dourados	Nativa
Malvaceae	*Talipariti pernambucense* (Arruda) Bovini	Algodoeiro-da-praia	Aquidauana	Exótica MS
Melastomataceae	*Pleroma granulosum* (Desr.) D. Don	Quaresmeira	Aquidauana, Campo Grande, Chapadão do Sul, Costa Rica, Dourados	Exótica MS
Melastomataceae	*Pleroma heteromallum* (D.Don) D.Don	Orelha-de-onça	Campo Grande	Exótica MS
Melastomataceae	*Pleroma mutabile* (Vell.) Triana	Manacá-da-serra	Campo Grande	Exótica MS
Meliaceae	*Azadirachta indica* A.Juss.	Nim	Aquidauana, Cassilândia, Dourados	Exótica BR
Meliaceae	*Cedrela fissilis* Vell.	Cedro	Aquidauana, Campo Grande, Chapadão do Sul, Costa Rica, Dourados	Nativa
Meliaceae	*Guarea guidonia* (L.) Sleumer	Canjerana	Campo Grande	Nativa
Meliaceae	*Melia azedarach* L.	Cinamomo	Bonito, Campo Grande	Exótica BR
Meliaceae	*Toona ciliata* M.Roem.	Cedro-australiano	Cassilândia	Exótica BR
Moraceae	*Artocarpus heterophyllus* Lam.	Jaca	Aquidauana, Campo Grande, Chapadão do Sul, Corumbá, Dourados	Exótica BR
Moraceae	*Ficus auriculata* Loureiro	Figueira-de-jardim	Campo Grande	Exótica BR
Moraceae	*Ficus benjamina* L.	Ficus	Aquidauana, Bonito, Cassilândia, Campo Grande, Chapadão do Sul, Corumbá, Costa Rica, Coxim, Dourados, Paranaíba	Exótica BR
Moraceae	*Ficus calyptroceras* (Miq.) Miq.	Figueira	Corumbá	Nativa
Moraceae	*Ficus clusiifolia* Schott	Figueira	Cassilândia, Chapadão do Sul, Costa Rica, Paranaíba	Exótica MS
Moraceae	*Ficus elastica* Roxb.	Falsa-seringueira	Campo Grande	Exótica BR
Moraceae	*Ficus insipida* Willd.	Figueira-mata-pau	Campo Grande, Dourados	Exótica MS
Moraceae	*Ficus microcarpa* L.f.	Laurel-da-índia	Campo Grande	Exótica BR
Moraceae	*Ficus retusa* L.	Ficus-escuro	Campo Grande, Dourados	Exótica BR
Moraceae	*Ficus rubiginosa* Desf. ex Vent.	Ficus-claro	Campo Grande, Dourados	Exótica BR

Family	Species	Common name	Municipalities	Origin
Moraceae	*Morus nigra* L.	Amora	Aquidauana, Bonito, Campo Grande, Corumbá, Costa Rica, Dourados, Três Lagoas	Exótica BR
Moringaceae	*Moringa oleifera* Lam.	Moringa	Aquidauana, Cassilândia, Campo Grande, Dourados	Exótica BR
Muntingiaceae	*Muntingia calabura* L.	Calabura	Cassilândia, Corumbá, Paranaíba	Exótica MS
Myrtaceae	*Callistemon citrinus* (Curtis) Skeels	Escova-de-garrafa	Aquidauana, Campo Grande, Dourados	Exótica BR
Myrtaceae	*Callistemon viminalis* (Sol. ex Gaertn.) G.Don	Escova-de-garrafa	Bonito, Cassilândia, Chapadão do Sul	Exótica BR
Myrtaceae	*Eugenia dysenterica* (Mart.) DC.	Cagaita	Dourados	Nativa
Myrtaceae	*Eugenia sprengelii* DC.	Eugênia	Bonito, Campo Grande	Exótica MS
Myrtaceae	*Eugenia uniflora* L.	Pitanga	Aquidauana, Cassilândia, Campo Grande, Chapadão do Sul, Corumbá, Costa Rica, Coxim, Dourados, Paranaíba	Nativa
Myrtaceae	*Plinia edulis* (Vell.) Sobral	Cambucá	Coxim	Exótica MS
Myrtaceae	*Plinia peruviana* (Poir.) Govaerts	Jabuticaba	Aquidauana, Dourados, Paranaíba	Exótica MS
Myrtaceae	*Psidium guajava* L.	Goiabeira	Aquidauana, Bonito, Cassilândia, Campo Grande, Chapadão do Sul, Corumbá, Dourados, Paranaíba, Três Lagoas	Exótica BR
Myrtaceae	*Syzygium cumini* (L.) Skeels	Jamelão	Aquidauana, Bonito, Cassilândia, Campo Grande, Chapadão do Sul, Dourados, Paranaíba	Exótica BR
Myrtaceae	*Syzygium jambos* (L.) Alston	Jambo	Aquidauana	Exótica BR
Myrtaceae	*Syzygium malaccense* (L.) Merr. & L.M.Perry	Jambo	Campo Grande, Costa Rica, Paranaíba	Exótica BR
Nyctaginaceae	*Bougainvillea glabra* Choisy	Primavera	Campo Grande, Corumbá	Exótica MS
Nyctaginaceae	*Bougainvillea spectabilis* Willd.	Primavera	Aquidauana, Bonito, Campo Grande	Nativa
Oleaceae	*Ligustrum lucidum* W.T.Aiton	Alfeneiro	Campo Grande, Chapadão do Sul, Costa Rica, Dourados	Exótica BR
Oxalidaceae	*Averrhoa carambola* L.	Carambola	Aquidauana, Campo Grande, Corumbá, Costa Rica, Dourados, Paranaíba	Exótica BR
Pandanaceae	*Pandanus sp.*	Pandanus	Aquidauana, Dourados	Exótica BR

Continuation

Family	Species	Common name	Municipalities	Origin
Pinaceae	*Pinus echinata* Mill.	Pinus	Três Lagoas	Exótica BR
Polygonaceae	*Triplaris americana* L.	Pau-formiga	Campo Grande	Nativa
Primulaceae	*Myrsine umbellata* Mart.	Capororoca	Aquidauana, Campo Grande	Nativa
Proteaceae	*Grevillea banksii* R.Br.	Grevilha-anã	Bonito	Exótica BR
Proteaceae	*Grevillea robusta* A.Cunn. ex R.Br.	Grevílea	Campo Grande, Dourados	Exótica BR
Rhamnaceae	*Hovenia dulcis* Thunb.	Uva-do-Japão	Campo Grande	Exótica BR
Rosaceae	*Eriobotrya japonica* (Thunb.) Lindl.	Nespereira	Bonito, Campo Grande, Chapadão do Sul, Dourados	Exótica BR
Rubiaceae	*Calycophyllum multiflorum* Griseb.	Pau-mulato	Campo Grande, Corumbá	Nativa
Rubiaceae	*Coffea arabica* L.	Café	Aquidauana, Campo Grande	Exótica BR
Rubiaceae	*Gardenia jasminoides* J.Ellis	Jasmim	Campo Grande, Dourados	Exótica BR
Rubiaceae	*Genipa americana* L.	Jenipapo	Aquidauana, Bonito, Campo Grande, Coxim, Dourados	Nativa
Rubiaceae	*Morinda citrifolia* L.	Noni	Aquidauana	Exótica BR
Rubiaceae	*Mussaenda erythrophylla* Schumach & Thonn.	Mussaenda	Campo Grande, Chapadão do Sul, Costa Rica, Paranaíba	Exótica BR
Rutaceae	*Citrus spp.*	Cítricos	Aquidauana, Bonito, Cassilândia, Campo Grande, Chapadão do Sul, Corumbá, Costa Rica, Coxim, Dourados, Paranaíba, Três Lagoas	Exótica BR
Rutaceae	*Murraya paniculata* (L.) Jack	Murta-de-cheiro	Aquidauana, Bonito, Cassilândia, Campo Grande, Chapadão do Sul, Corumbá, Costa Rica, Coxim, Dourados, Paranaíba	Exótica BR
Rutaceae	*Zanthoxylum rhoifolium* Lam.	Mamica-de-porca	Aquidauana	Nativa
Rutaceae	*Zanthoxylum riedelianum* Engl.	Mamica-de-porca	Campo Grande, Dourados	Nativa
Salicaceae	*Salix babylonica* L.	Salgueiro-chorão	Aquidauana, Campo Grande, Corumbá, Dourados	Exótica BR
Sapindaceae	*Allophylus edulis* (A.St.-Hil. et al.) Hieron. ex Niederl.	Guajavira	Campo Grande, Dourados	Nativa
Sapindaceae	*Koelreuteria paniculata* Laxm.	Flor-da-china	Chapadão do Sul	Exótica BR

Family	Species	Common name	Municipalities	Origin
Sapindaceae	*Matayba guianensis* Aubl.	Mataíba	Campo Grande	Nativa
Sapindaceae	*Melicoccus lepidopetalus* Radlk.	Água-pomba	Bonito	Nativa
Sapindaceae	*Sapindus saponaria* L.	Saboneteira	Bonito, Chapadão do Sul, Corumbá, Costa Rica	Nativa
Sapindaceae	*Talisia esculenta* (Cambess.) Radlk.	Pitomba	Aquidauana	Nativa
Sapotaceae	*Chrysophyllum marginatum* (Hook. & Arn.) Radlk.	Pimenteira-de-arancuã	Campo Grande	Nativa
Sapotaceae	*Pouteria caimito* (Ruiz & Pav.) Radlk.	Abiu	Dourados	Exótica MS
Sapotaceae	*Pouteria ramiflora* (Mart.) Radlk.	Curriola	Aquidauana	Nativa
Sapotaceae	*Pouteria torta* (Mart.) Radlk.	Abiurana	Aquidauana, Três Lagoas	Nativa
Solanaceae	*Atropa acuminata* Royle ex Lindl.	Belladonna-branca	Campo Grande	Exótica BR
Solanaceae	*Cestrum diurnum* L.	Pau-de-sal	Campo Grande	Exótica BR
Solanaceae	*Cestrum nocturnum* L.	Dama-da-noite	Aquidauana, Campo Grande, Corumbá	Exótica BR
Solanaceae	*Solanum paniculatum* L.	Jurubeba	Aquidauana, Campo Grande, Chapadão do Sul, Bonito, Dourados	Nativa
Urticaceae	*Cecropia pachystachya* Trécul	Embauba	Aquidauana, Campo Grande	Nativa
Verbenaceae	*Aloysia gratissima* (Gillies & Hook.) Tronc.	Garupá	Aquidauana	Exótica MS
Verbenaceae	*Duranta erecta* L.	Pingo-de-ouro	Aquidauana, Corumbá, Coxim, Dourados	Exótica BR
Verbenaceae	*Duranta vestita* Cham.	Esporão-de-pomba	Dourados	Exótica MS
Vochysiaceae	*Qualea grandiflora* Mart.	Pau-terra	Aquidauana, Campo Grande	Nativa
Vochysiaceae	*Qualea parviflora* Mart.	Pau-terrinha	Campo Grande, Três Lagoas	Nativa
Vochysiaceae	*Vochysia divergens* Pohl	Cambará	Aquidauana, Corumbá	Nativa

Source: Our work.

Table 2

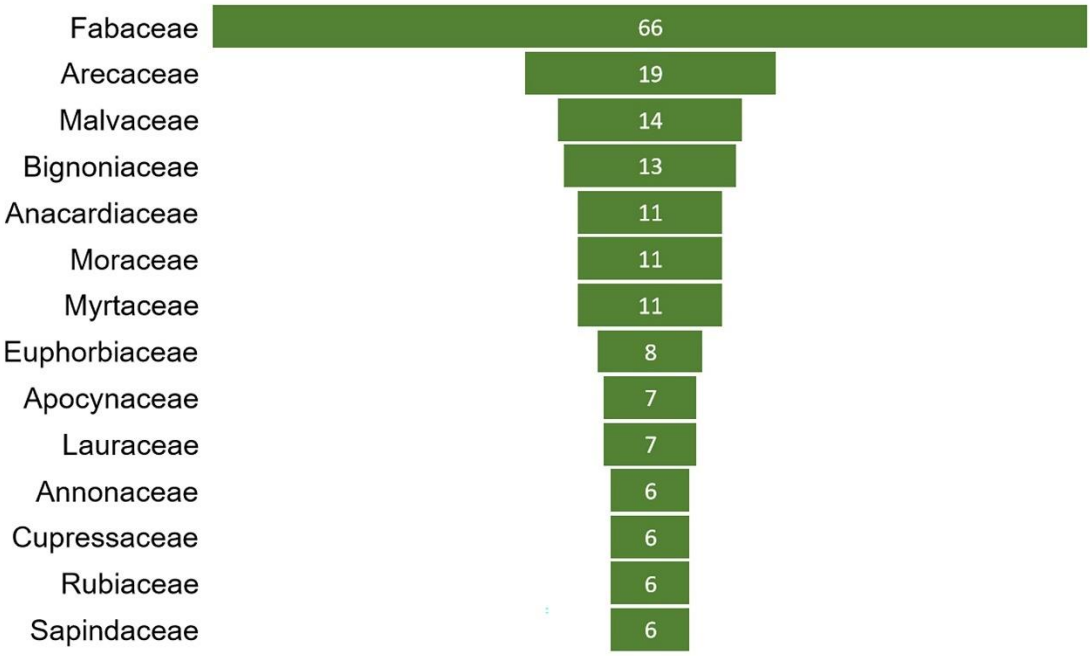
Municipalities of Mato Grosso do Sul with information on urban forestry of streets, avenues and squares, with the studied spatial cut, percentage of forestry of public ways (%AVP), total recorded richness (number of species) and species with abundance percentage above the recommended maximum (15%)

Municipalities	Studied spatial cut	%AVP	Number of species	Species Abundace>15%
Anastácio	Square	95,5	7	*M. tomentosa, P. rubra, T. rosea, S. romanzoffiana, L. indica*
Aquidauana	City	96	114	*M. tomentosa*
Bonito	City	99,1	55	*M. tomentosa*
Campo Grande	City	96,3	163	*M. tomentosa, F. benjamina*
Cassilândia	City	98,7	42	*M. tomentosa*
Chapadão do Sul	Neighborhood (Flamboyant)	95,5	56	*M. tomentosa, S. saponaria, M. paniculata*
Corumbá	City	96,6	66	*F. benjamina*
Costa Rica	City	92,7	45	*M. tomentosa*
Coxim	Neighborhood (São Judas Tadeu)	92,4	17	*M. tomentosa, C. pluviosum*
Dourados	City	96,9	121	*M. tomentosa*
Paranaíba	City	94,5	41	*M. tomentosa*
Miranda	-	95,8	-	-
Três Lagoas	City	95,6	43	*M. tomentosa*

Source: Our work.

Figure 2

Most represented families in species richness in urban forestry of Mato Grosso do Sul



Source: Our work.

Worldwide, urban forestry comprises native and exotic species (Alvey, 2006; Gaertner et al., 2017), with exotic species dominating urban green spaces in some cities. Particularly in South America, various floristic studies in cities showed that the richness and abundance of exotic species exceed that of the native (Méndez-Stroobandt, 2005; Córdova-Stroobandt, 2013; Moro & Castro, 2015; Figueroa et al., 2016; Gartner et al., 2017). That tendency is due to historical and ornamental criteria implemented in South America post-European colonization (McBride, 2017).

In Brazil, landscaping was shaped by French and English influences, which provided the elements for the composition of the traditional Brazilian gardens (Santos et al., 2010). Some African trees, such as flamboyant and sea almond, found a favorable clima tropical climate in Anastácio, Aquidauana, Miranda and Corumbá. Only after 1940, the Brazilian landscape architect Roberto Burle Marx start to value the colors and textures of native species, but still depended on the generalized use of exotic plants (Santos et al., 2008). That is a contradictory situation, considering that Brazil is a megadiverse country of the world, but, unfortunately, does not recognize or value its biodiversity (Moro & Castro, 2015).

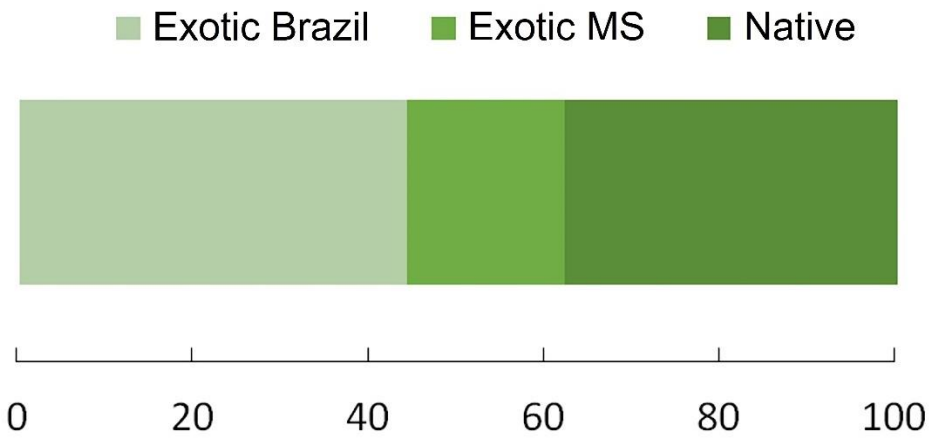
In Mato Grosso do Sul, we can observe the result of that historical process, with a predominance of exotic species in urban forestry, c. 62% of the utilized species do not have

original occurrence in the state (Table 1, Figure 3). That is a contradiction, once that for the state were recorded over 3,900 native species (Farinaccio et al., 2018), of which over 1,000 are trees and shrubs, 546 being from Cerrado (Bueno et al., 2018) and 497 from Seasonal Forests (Damasceno-Junior et al., 2018). Many of them are appropriate for urban forestry, *e.g.*, ornamental species such as native trumpet trees (*Handroanthus heptaphyllus*, *H. impetiginosus* and *Tabebuia roseoalba*) and "pau-santo" (*Kielmeyera variabilis*), threatened species or vulnerable to extinction or protected from logging, such as tonka beans (*Dipteryx alata*), souri nut (*Caryocar brasiliense*) and Argentine cedar (*Cedrela fissilis* and *C. odorata*). There are native species of different sizes, types of leaves, flowers and roots, with different growth speeds and resistance, which are adequate for the most varied urban conditions. It is important to consider the plant characteristics, the available physical space and the interaction with the urban environment to select the species.

The predominance of exotic species in urban forestry is certainly influenced by a lack of technical knowledge on the cultivation of native species (we highlight the tree guides by Lorenzi 1992, 1998, and 2009, which bring information about several Brazilian species). However, that question results from a lack of focus and effort in the study and use of native species, that in turn, offer more advantages for urban ecosystems from the point of view of biodiversity (Moro & Castro, 2015). Furthermore, the stimulus to the use of native plants helps to expend environmental awareness, recognition, valorization and sense of belonging. Building effective bonds between people and native biodiversity is a fundamental challenge of conservation, for which urban tree planting can contribute (Moro & Castro, 2015).

Figure 3

Percentage of species applied in urban forestry in Mato Grosso do Sul according to their origin. We considered native species only those occurring naturally in the state; Exotics MS for those native to Brazil, but originally do not occur in the state; Exotics Brazil, those originally not occurring in the country



Source: Our work.

The number of trees per kilometer footpath is available for four municipalities, Aquidauana with 55.7 trees/km of footpath (and 65 trees/km in the town center, according to Sá et al., 2021), Campo Grande with 49.1 trees/km and Chapadão do Sul with 106.6 trees/km and Dourados with 57.92 trees/km. Milano (1988) considers 120 trees/km an adequate index for good forestry, which means these municipalities stay below the recommended.

Trees below 5m tall were predominant in Bonito, Campo Grande and Corumbá. That can indicate that forestry is composed mainly of young specimens by selecting trees of small and medium size or also that drastic prunings or top cuts are recurrent. Prunings constitute, in fact, one of the most common problems of urban forestry once workers utilize outdated techniques with little or no skill, without previous planning and as short-term solutions for problems of different origins (Milano & Dalcin, 2000). That reflects the ineffectiveness of public services related to urban forestry management since it results from the lack of tree training-prunings. Drastic prunings reduce the lifespan of trees, then a high number of secondary roots reduces their effectiveness, besides exposing the damaged canopy to the attack of phytopathogens, termites and diseases as a function of the provoked physiological stress (Milano & Dalcin, 2000). Prunings also deform the architecture of the species and cause resprout of numerous vertical, more fragile branches (suckers). For example, flamboyant has

the natural shape of a broad umbrella-like canopy, and inadequate pruning can turn it into a "broom", esthetically questionable. Lesions on the base of the tree, by tools and "strangling" by cement, results in undesired basal sproutings and the entrance of wood-decay insects and fungi.

In several analyzed municipalities, for example, in Bonito, Campo Grande Coxim and Corumbá, the height of the first bifurcation was below the minimum recommendation (1.8-2m). That can be reflex of the low quality of seedlings utilized in street forestry and a sign that planting was made by the residents, who ignore technical rules (Zamproni et al., 2018). Indeed, in Corumbá, 43% of the interviewed stated that this contributes to planting trees on footpaths (Lopo, 2014). That can cause problems to free transit of pedestrians, mainly those with reduced mobility (Lima Neto et al., 2010). At the present reform in the central streets of Campo Grande, several meters tall saplings are being planted.

Among the conflicts, the most common in urban forestry in the state is footpath breakage by root uplifting. That was the main or one of the main conflicts in Aquidauana (9%), Chapadão do Sul (25.3%), Coxim (25.1%) and Dourados (48.6%). That conflict is directly related to a common situation identified by the researchers, the absence of free ground areas around trees. In Aquidauana, 15% of the evaluated trees had less than 10 cm in radium of uncovered area (Massaranduba, 2020); even worse was observed in Campo Grande (30%), Chapadão do Sul (60.9%), Corumbá (63%) and Coxim (43%). A factor contributing to this problem also is planting inadequate species, standing out *Clitoria fairchildiana* (butterfly pea tree), *Ficus benjamina* (wiping fig) and *Delonix regia* (flamboyant). Some species have more shallow roots, but the lack of soil volume causes lesions by contact with the curb and the pavement and also provokes this type of reaction in other trees. The ideal is a ground area equivalent to the projection of the canopy. The lack of space for the roots, that are hidden but give mechanical support to the aerial part, is the leading cause of tree fall in storms, aggravated by internal deterioration by lesions on the root collar and branches. Palms grow in diameter only when young, have fasciculate root system, can grow in less soil and are resistant to fall.

Another frequent conflict is with electric and telephone wires. In Chapadão do Sul, 21.3% of trees were in conflict with wires (Pelegrim et al., 2012). A similar situation was observed in Coxim (24.3%, Mota & Almeida, 2011). In Dourados, this was the second most common type of conflict, corresponding to 43.8% (PDAU/Dourados, 2019). In Corumbá, 95% of medium and adult large-size trees on footpaths under the powerline (low tension) conflict with wiring (Lopo, 2014). Part of these problems are due to planting inappropriate species to local conditions, part is due to lack or inadequate planning and management, to unavailability or inaccessibility to technologies (e.g. underground network), which could mitigate conflicts, besides other causes, many avoidable. Big trees too close to telephone cables and power lines inevitably lead to costs or result in removal. In counterpart, urban forests are vital tools to

provide well-being and health to the people; however, generalized tree prunings and removals hinder urban forests from reaching their full potential to benefit environmental quality and human health.

To know the present state of urban forestry of Mato Grosso do Sul, for example, its floristic composition, characteristics, and most common conflicts is a fundamental pre-condition for proper planning and management, which are dynamic and must be continuous. Furthermore, urban forestry shall not be seen as an isolated process. However, it shall have a close relationship with the other urban policies and municipal legislations (such as urban director plans, building codes, specific laws and rules concerning the environment). Urban forestry shall be approached as an urban infrastructure, such as all other infrastructures present in cities which it should not oppose but harmonize. That set primes for quality of life and well-being of the citizen collectivity and contributes to the conservation of biodiversity and ecosystem services. Campo Grande already was awarded the title of *Tree City of the World* for three consecutive years but can still improve its urban forestry; other municipalities of the state can also take part in this project, committed to adequately keeping its urban forests sustainably managed, focusing on social well-being and environmental quality (Tree Cities of The World, 2019).

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