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THE FLORISTIC COMPOSITION OF URBAN AFFORESTATION OF THE CITY ALTAMIRA, PARÁ STATE, BRAZIL.

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ABSTRACT

We inventoried the urban forest of the city of Altamira, Pará state, Brazil. For that purpose, we sampled all the public roads of 25 neighborhoods with the use of as specific questionnaire. We identified a total of 4,294 plants of 120 species, 105 genera distributed in 40 botanical families. The most frequent species was the ficus (*Ficus benjamina* L.), with a total of 1,062 specimens, accounting for 24.7% of the trees. The second more frequent species was the macharimbé (*Cenostigma macrophyllum*) with 793 specimens (18.5% of the total). Mangueira (*Mangifera indica)* was also found with 376 specimens (8.8%), followed by the jambeiro (*Syzygium malaccense*) with 345 specimens (8.0%), imperial palm tree (*Roystonea oleracea* (Jacq.) O. F. Cook) with 135 specimens (3.1%), murta (*Myrtus communis*), with 103 specimens (2.4%) and cashew tree (*Anacardium occidentale*) with 85 specimens (2.0%). The families with the largest number of species were Fabaceae with 27 species, Arecaceae with 10 species, Anacardiaceae with 6 species and the families Malvaceae, Myrtaceae, Moraceae and Bignoniaceae with 5 species each. The high diversity of species found the results is mainly attributed to the effective participation of the population in the urban afforestation of Altamira city.

Keywords*:* quantitative inventory, Amazonia, diversity, urban plants

COMPOSIÇÃO FLORÍSTICA DA ARBORIZAÇÃO DA CIDADE DE ALTAMIRA, PARÁ.

RESUMO

Foi realizado em 2010, um inventário da arborização da cidade de Altamira, Pará. Foram amostradas todas as vias públicas dos 25 bairros, com a utilização de uma planilha estruturada para a realização do censo total das espécies presentes nas vias. Foram identificadas 4.294 plantas de 120 espécies, de 105 gêneros e distribuídas em 40 famílias botânicas. A espécie mais frequente foi o ficus (*Ficus benjamina*), com um total de 1.062 espécimes que representaram 24,7% das árvores da cidade. A segunda espécie mais frequente foi o macharimbé (*Cenostigma macrophyllum*) com 793 espécimes (18,5% do total). Também aparecem a mangueira (*Mangifera indica*) com 376 espécimes (8,8%), o jambeiro (*Syzygium malaccense*) com 345 espécimes (8,0%), a palmeira imperial (*Roystonea oleracea* (Jacq.) O. F. Cook) com 135 espécimes (3,1%), a murta (*Murraya paniculata*), com 103 espécimes (2,4%) e o cajueiro (*Anacardium occidentale*) com 85 espécimes (2,0%). As famílias que apresentaram maior número de espécies foram a Fabaceae com 27 espécies, a Arecaceae com 10, Anacardiaceae com 6 e as famílias Malvaceae, Myrtaceae, Moraceae e Bignoniaceae apresentaram cada uma delas, 5 espécies. A grande diversidade de espécies encontradas resulta da participação efetiva da população na arborização da cidade de Altamira.

Palavras-chave: inventário quantitativo, avaliação, arborização urbana.

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INTRODUÇÃO

Urban afforestation is defined as the predominant tree vegetation found in a city that is planted in public areas (gardens and yards), squares, parks and road (SANCHOTENE, 1994).

Trees found in free public areas or that are planted along the road system play the role of an ecological corridor, interconnecting wooded areas inside and outside the urban perimeter, providing improvements to the environment, such as air purification, enhancement of the microclimate of the city, wind speed reduction, shelter for local fauna and noise reduction (RODRIGUES et al., 2002). At smaller proportions, smaller-sized trees also contribute to these functions, and in the absence of natural vegetation, they keep the vegetation cover that protects the soil against erosion, retaining its fertility and humidity (DENICH, 1989; KÜRTEN, 1998).

The urban afforestation of Altamira city started spontaneously from its residents in the 1970's, when trees, mainly fruit species, such as mangueiras (*Mangifera indica* L.), were planted in front of houses. At the end of the 1970's and beginning of the 1980's, many exotic species were planted, mainly Acácias (*Cassia sp.*) and Castanholas *(Terminalia catappa* L.), on the central streets of the city (UMBUZEIRO, 1999).

From the year 2000 onwards, the expansion of the urban afforestation process intensified, when new species (native and exotic) were introduced, namely Ipês amarelo and rosa (*Handroanthus* sp.), Nim (*Azadirachta indica* A. Juss), Acácia-mangio (*Acacia mangium* Willd.) and Cajueiro (*Anacardium occidentale* L.). However, many of these species were inappropriate for urban afforestation and planted in inadequate sites, because techniques for tree planting are not available for the public as a whole. At that time, there was an accelerated and disordered urban growth, with the creation of new neighborhoods without the basic planning, which generated many conflicts with the urban tree cover.

Just before the city of Altamira celebrated its 100th anniversary, on November 6, 2011, an inventory of the urban afforestation was carried out to assess the condition of the urban tree cover in the city to serve as a basis for urban planning of the municipality. This inventory was organized by the Municipal Secretariat for Environment and Tourism (SEMAT), with the collaboration of Universidade Federal do Pará (UFPA), Universidade do Estado do Pará (UEPA) and the Instituto Federal do Pará (IFPA) and State Public Ministry. This study aimed to analyze the floristic composition of the urban afforestation of Altamira City based on the inventory conducted in 2010.

MATERIALS AND METHODS

The city of Altamira is situated in a region of ancient colonization (18th century) and had a great boost in the last decades due to an initiate of the Federal Government started in the 1970's through the Project of National Integration (PIN) and a planned colonization process. Thus, from a city with less the 15 thousand inhabitants in 1970, the city has gone through a disordered growth, lacking a long-term planning, reaching the current 105 thousand inhabitants (IBGE, 2010). The city of Altamira is located at 03º12'00" S and 52º13'45" W. It is situated on the left bank of the Xingu River at 74 meters above sea level and distant from the Belém – state capital –, by 920 km via road and 1,857 km via river (MOURA; RIBEIRO, 2009).

The predominant soils in the municipality are Fluvisols located in the neighborhoods near the river and are affected by floods that reach the central avenues of the city (Independente II, São Sebastião, Downtown and Uirapuru neighborhoods). An association of Oxisols and Typic Yellow in the neighborhoods near the slopes in the

landscape form patches in the neighborhoods Independente I, Ibiza, Sudam I and Brasília. Alfisols predominate on the top of slopes as found in the neighborhoods Jardim Ipê, Jardim Altamira, Jardim Oriente and Bela Vista, classified according to the Brazilian System for Soil Classification (EMBRAPA, 2006).

The climate in municipality of Altamira is equatorial Am and Aw (Köppen classification). The equatorial Am predominates in the northern part of the municipality, where the urban area is located, and has average temperatures of 27.3ºC. The annual average of maximum temperatures reaches 32.4ºC and the average of minimum, 22.1ºC. The annual rainfall remains around 2.123 mm (SILVA et al., 2009). Due to the high monthly rainfall, the relative humidity is also high, hovering around 84% along the year. The period of lowest relative humidity, with significant reduction of rainfall, lasts from July to November, while the wettest period goes from February to April.

The inventory was carried out by the Municipal Secretariat for Environment and Tourism (SEMAT) and funded by the State Public Ministry and it inventoried all tree species on all public roads of the 25 neighborhoods in the municipality. The survey to count and number all trees in the study area was costly and time-consuming and was justified in the assessment of small areas and communities.

The study was conducted between September 2009 and November 2010 under the coordination of the faculty from the Universidade Federal do Pará (UFPA), with the participation of members from the Universidade Estadual do Pará (UEPA) and Instituto Federal do Pará (IFPA) as well as students from these institutions who participated as volunteers to count the tree population in the municipality and diagnose their general condition.

The volunteers were oriented in a training course regarding the following topics: botany, phytosanitary conditions, technical regulations of urbanism and afforestation and legislation.

We used structured spreadsheets to carry out the survey, which contained questions about the trees (popular and scientific names), developmental stage, phytosanitary conditions (different levels of severity), root problems (outcropping), need for pruning (in case crowns showed conflicts with electric wiring, lightning of street signs), distance from buildings (walls, houses and curbs), sidewalk sizes and free areas (median strips), height, breast height diameter (BHD), crown conditions and phenology. The information was collected *in loco.*

The results obtained are shown as follows: popular and scientific names, families, origin, number of individuals per species and relative density (Rd). Rd is the percentage between the number of individuals of a species and the total number of individuals of all species. Whenever possible, we surveyed the original area for species distribution following the nomenclature used by Costa and Lima and Silva Júnior (2010).

To survey and identify specimens and obtain their respective species (scientific name and botanical families), we adopted the following procedures: spreadsheets for identification prepared by specialists, with photographs, description, popular and scientific names *in loco*. Whenever the species was not found in this identification system, we collected and dissected samples of their vegetal and reproductive parts for further identification. We also used bibliographic consultation and identification keys to indentify the specimens.

Specimens not identified in these processes were herbalized, according to detailed techniques prescribed by Fidalgo e Bononi (1989), and sent to the following herbariums: IAN from Empresa Brasileira de Pesquisa Agropecuária – EMBRAPA Amazônia Oriental, in Belém city; Herbário MG Murça Pires from the Emílio Goeldi Museum of Pará state and identified taxonomically by specialists.

The specimens included in the inventory were classified in families, according to the sensu *Angiosperm Phylogeny Group II* (APG II, 2003), to verify binomials, rightful authors and families. To prevent possible botanical confusions, we used the database from the *Missouri Botanical Garden* (MOBOT, 2011) and confirmation of the species was made through consultation on the Internet of Species List of Brazil Flora (FORZZA et al., 2010).

RESULTS AND DISCUSSION

The results of the inventory of urban afforestation in the municipality of Altamira showed a total of 4,294 trees at different conditions and ages. The trees belong to 120 different species, distributed in 105 genera belonging to 40 botanical families. Among the most numerous botanical families, Fabaceae showed the most occurrences with 27 species, which corresponded to 22.5% of all species identified totaling 1,098 individuals, accounting for 25.6% of the trees used for urban afforestation. Other species that had good representation were: Arecaceae with 10 species; Anacardiaceae (6); Malvaceae, Moraceae, Myrtaceae and Bignoniaceae with 5 species each.

A great diversity of species was observed in public streets, however, only six species contributed to 2,814 trees, representing 65.5% of all trees used in the urban afforestation, which were: ficus (*Ficus benjamina*) with 1.062 individuals; macharimbé (*Cenostigma macrophyllum*) with 793; mangueira (*Mangifera indica*) with 376; jambeiro (*Syzygium malaccense*) with 345; palmeira imperial (*Roystonea oleracea*) with 135 and murta (*Murraya paniculata*) with 103 (Table 1). Among these species, the ficus accounted for 24.7% of the trees used in urban afforestation and it is found in all neighborhoods of the city. These results are no longer appropriate for urban afforestation. Santamour Júnior (1990) recommends a maximum of 10% of the same species to be used in urban afforestation, 20% of the same genus and 30% of the same family, which was not observed in the municipality of Altamira. The author argues that these rates prevent propagation of diseases among plants.

Table 1. Tree species, botanical families, origin, number of individuals and relative density of species found in the inventory of the municipality of Altamira, Pará state, Brazil, 2010

Species (popular and scientific names)	**Families**	**Origin**	**Number of trees**	**Rd**
Ficus (*Ficus benjamina* L.)	Moraceae	E	1.062	24.73
Macharimbé (*Cenostigma macrophyllum* Tul.)	Fabaceae Caesalpinioideae	Am	793	18.47
Mangueira (*Mangifera indica* L.)	Anacardiaceae	E	376	8.76
Jambeiro (*Syzygium malaccense* (L.) Merr & L. M. Perry)	Myrtaceae	E	345	8.03
Palmeira-imperial (*Roystonea oleracea* (Jacq.) O. F. Cook)	Arecacea	E	135	3.14
Murta (*Murraya paniculata* (L.) Jack)	Myrtaceae	E	103	2.40
Cajueiro (*Anacardium occidentale* L.)	Anacardiaceae	Am, Ma, Mg	85	1.98
Ipê-amarelo (*Handroanthus serratifolius* (Vahl.) S. O. Grose)	Bignoniaceae	Am, Ce, Mg	83	1.93
Nim (*Melia indica* (A. Juss.) Brandis)	Meliaceae	E	80	1.86
Duranta (*Duranta repens* L. 'aurea')	Verbenaceae	E	80	1.86
Açaizeiro (*Euterpe oleraceae* Mart.)	Arecaceae	Am	71	1.65
Goiabeira (*Psidium guayava* L.)	Myrtaceae	Mg	68	1.58
Acacia-mangio (*Acacia mangium* Willd.)	Fabaceae Mimosoideae	E	66	1.54
Oiti (*Liconia tomentosa* Benth.)	Chrysobalanaceae	Ca	50	1.16
Pião-roxo (*Jatropha gassgpiifolia* L.)	Euphorbiaceae	E	45	1.05
Coqueiro (*Cocus nucifera* L.)	Arecaceae	Am, Ma	44	1.02
Brasileirinha (*Erithrina indica* Picta)	Fabaceae Papilionoideae	E	39	0.91
Castanhola (*Terminalia catappa* L.)	Combretaceae	E	37	0.86
Areca-bambu (*Dypsis lutescens* H. Wendl.) Beentje & J. Dransf.)	Arecaceae	E	33	0.77

Mamoeiro (*Carica papaya* L.)	Caricaceae	E	28	0.65
Chapéu-de-napoleão (*Thevetia peruviana* (Pers.) Schum.)	Apocynaceae	E	24	0.56
Tento (*Ormosia paraensis* Ducke)	Fabaceae Papilionoideae	Am	24	0.56
Párkia (*Parkia platycephala* Benth.)	Fabaceae Mimosoideae	Am	24	0.56
Flamboyant-de-jardim (*Caesalpinia pulcherrima* (L.) Sw.)	Fabaceae Caesalpinioideae	E	23	0.54
Bouganville (*Bougainvillea spectabillis* Willd.)	Nictaginaceae	E	23	0.54
Laranjeira (*Citrus sinensis* (L.) Osbeck)	Rutaceae	E	22	0.51
Ameixeira (*Syzygium jambolanum* (Lam.) DC.)	Myrtaceae	E	22	0.51
Cacaueiro (*Theobroma cacao* L.)	Malvaceae	Am	20	0.47
Papoula (*Hibiscus rosa-sinensis* L.)	Malvaceae	E	20	0.47
Ingá-cipó (*Inga edulis* (Mart.) Kunth)	Fabaceae Mimosoideae	Am	19	0.44
Limoeiro (*Citrus lemon* (L.) Burm. f.)	Rutaceae	E	19	0.44
Sibipiruna (*Caesalpinia pluviosa* DC.)	Fabaceae Caesalpinioideae	Ma	19	0.44
Ipê-rosa (*Handroanthu ipe* (Mart ex K. Schum.) Standl.	Bignoniaceae	E	17	0.40
Jasmim-bogari (*Jasminum sambac* (L.) Aiton.)	Oleaceae	E	17	0.40
Carambola (*Averrhoa carambola* L.)	Oxalidaceae	E	16	0.37
Flamboyant (*Delonix regia* (Bojer ex Hook) Raf.	Fabaceae Caesalpinioideae	E	16	0.37
Resedá (*Lagerstroemia indica* Lam.)	Lythraceae	E	16	0.37
Jasmim-da-Índia (*Quisqualis indica* L.)	Combretaceae	E	15	0.35
Algodão (*Gossypium hirsutum* L.)	Malvaceae	E	15	0.35
Palmeira-rabo-de-peixe (*Caryota urens* L.)	Arecaceae	E	13	0.30
Cica (*Cycas circinalis* L.)	Cycadaceae	E	13	0.30
Leucena (*Leucena leucocephala* (Lam.) R. de Wit)	Fabaceae Caesalpinioideae	E	12	0.28
Esponjinha (*Calliandra brevipes* Benth.)	Fabaceae Mimosoideae	Ma, Mg	11	0.26
Jasmim-manga (*Plumeria rubra* L.)	Apocynaceae	E	11	0.26
Palheteira (*Clitoria racemosa* Benth.)	Fabaceae Papilionoideae	Am, Ce, Mg	10	0.23
Viuvinha (*Petrea subserrata* Cham.)	Verbenaceae	E	10	0.23
Amoreira (*Morus nigra* L.)	Moraceae	E	9	0.21
Ipezinho-de-jardim (*Tecoma stans* (L.) Juss. ex Kunth)	Bignoniaceae	E	9	0.21
Palmeira-leque (*Livistona chinensis* (N. J. Jacquin) R. Brown ex. Mart.)	Arecaceae	E	9	0.21
Cuieira (*Crescentia cujete* L.)	Bignoniaceae	Am	8	0.19
Tamarindo (*Tamarindus indica* L.)	Fabaceae Caesalpinioideae	E	8	0.19
Ata (*Annona squamosa* L.)	Annonaceae	E	7	0.16
Biribá (*Rollinia mucosa* (Jacq.) Baill)	Annonaceae	Am, Ma, Ca	7	0.16
Munguba (*Pachira aquatica* Aubl.)	Malvaceae	Am	7	0.16
Urucum (*Bixa orellana* L.)	Bixaceae	Am	7	0.16
Cassia-pingo-de-ouro (*Cassia fistula* L.)	Fabaceae Caesalpinioideae	E	6	0.14
Abacateiro (*Persea americana* Mill.)	Lauraceae	E	6	0.14
Ixora (*Ixora coccinea* L.)	Rubiaceae	E	6	0.14
Jaca (*Artocarpus integrifolia* L. f.)	Moraceae	E	6	0.14
Pata-de-vaca (*Bauhinia blakeana* Dunn)	Fabaceae Cercideae	E	6	0.14
Graviola (*Annona muricata* L.)	Annonaceae	Am	5	0.12

Cacto-mandacaru (*Cereus jamacaru* P. DC.)	Cactaceae	Ca	5	0.12
Feijão-guandu (*Cajanus cajan* (L.) Mill.)	Fabaceae Papilionoideae	E	5	0.12
Teca (*Tectona grandis* L. f.)	Verbenaceae	E	5	0.12
Taperebá (*Spondias mombin* L.)	Anacardiaceae	Am, Ce, Ma	5	0.12
Pupunheira (*Bactris gasipaes* Kunth.)	Arecaceae	Am	4	0.09
Abiu (*Pouteria caimito* Ruiz et Pav.)	Sapotaceae	Am	4	0.09
Ficus-variegata (*Ficus benjamina* L. var. variegata)	Moraceae	E	4	0.09
Ipê-verde (*Cybistax antisyphilitica* (Mart.) Mart.)	Bignoniaceae	Ce	4	0.09
Jucá (*Caesalpinia ferrea* Mart. ex Tul. var. *ferrea*)	Fabaceae Caesalpinioideae	Ma	4	0.09
Acerola (*Malpighia glabra* L.)	Malpighiaceae	E	3	0.07
Mamona (*Ricinus communis* L.)	Euphorbiaceae	E	3	0.07
Cassia-rosa (*Cassia grandis* L. f.)	Fabaceae Caesalpinioideae	E	2	0.05
Sena-verrugosa (Senna *multijuga* (Rich.) Irwin et Barn)	Fabaceae Caesalpinioideae	E	2	0.05
Falso-chorão (*Schinus molle* L.)	Anacardiaceae	Mg	2	0.05
Gmelina (*Gmelina arborea* Roxb.)	Verbenaceae	E	2	0.05
Jarana (*Holopydium jarana* (Huber) Ducke)	Lecythidaceae	Am	2	0.05
Mata-pasto (*Senna alata* (L.) Roxb.)	Fabaceae Caesalpinioideae	Am, Ce, Ma, Mg	2	0.05
Mogno (*Swietenia macrophylla* King.)	Meliaceae	Am	2	0.05
Murici (*Byrsonima crassifolia* (L.) Rich.)	Malpighiaceae	Am, Ca, Ce	2	0.05
Mussendra (*Mussaendra alicia* Hort.)	Rubiaceae	E	2	0.05
Pião-branco (*Jatropha curcas* L.)	Euphorbiaceae	E	2	0.05
Pinheiro (*Pinus caribaea* Morelet)	Pinaceae	E	2	0.05
Tangerina (*Citrus sinensis* (L.) Osbeck)	Rutaceae	E	2	0.05
Cássia-javanesa (*Cassia javanica* L.)	Fabaceae Caesalpinioideae	E	1	0.02
Algaroba (*Prosopis juliflora* (Sw.) DC.)	Fabaceae Mimosoideae	Ca	1	0.02
Ajurú (*Chrysobalanus icaco* L.)	Chrysobalanaceae	Am, Ma	1	0.02
Alfavaca (*Ocimum basilicum* L.)	Lamiaceae	Am	1	0.02
Bambu (*Bambusa vulgaris* Schrad. ex J. C. Wendl.)	Poaceae	E	1	0.02
Bananeira (*Musa paradisiaca* L.)	Musaceae	E	1	0.02
Buriti (*Mauritia flexuosa* L.)	Arecaceae	Ce, Am, Mg	1	0.02
Cajarana (*Spondias dulcis* Forst.)	Anacardiaceae	E	1	0.02
Canela (*Cinnamomum zeylanicum* J.Presl)	Lauraceae	E	1	0.02
Carnaúba (*Copernicia prunifera* (Miller) H. E. Moore	Arecaceae	Ca	1	0.02
Castanheira (*Bertholletia excelsa* Kunth)	Lecythidaceae	Am	1	0.02
Cipreste-comum (*Cupressus sempervirens* L.)	Cupressaceae	E	1	0.02
Dama-da-noite (*Epiphyllum oxipetalum* (DC.) Haworth)	Cactaceae	Am, Ma, Ce	1	0.02
Dracena (*Dracaena marginata* Lam.)	Ruscaceae	E	1	0.02
Embaúba (*Cecropia adenopus* Mart. ex Miq.)	Urticaceae	Am, Mg	1	0.02
Espirradeira (*Nerium oleander* L.)	Apocynaceae	E	1	0.02
Eucalipto (*Eucalyptus globulus* Labil)	Myrtaceae	E	1	0.02
Faveiro (*Balizia pedicellaris* (DC.) Barneby & J. W. Grimes)	Fabaceae Mimosoideae	Am, Ma	1	0.02
Fruta-de-macaco (*Andira* sp.)	Fabaceae	Am, Ce	1	0.02

	Caesalpinioideae			
Fruta-pão (*Artocarpus incisa* L.)	Moraceae	E	1	0.02
Girassol (*Helianthus annuus* L.)	Asteraceae	E	1	0.02
Guariroba (*Syagrus oleracea* (Mart.) Becc.)		Ca, Ce, Ma		
	Arecaceae		1	0.02
Jatobá (*Hymenaea courbaril* L.)	Fabaceae	Am, Ce	1	0.02
	Caesalpinioideae			
Ingá-do-mato (*Inga vera* Willd.) subsp. *affinis*	Fabaceae	Am, Ce,		
(DC.) T.D. Penn	Mimosoideae	Ma	1	0.02
Jurubeba (*Solanum paniculatum* L.)	Solanaceae	Am, Ca	1	0.02
Limão (*Citrus limon* (L.) Burm. f.)	Rutaceae	E	1	0.02
Pombinho (*Discophora guianensis* Miers.)				
	Icacinaceae	Am, Ce	1	0.02
Pau-ferro (*Caesalpinia leiostachya*	Fabaceae			
(Benth.) Ducke	Caesalpinioideae	Ma	1	0.02
Pitomba (*Talisia esculenta* (St. Hil) Radlk)				
	Sapindaceae	Am, Ma	1	0.02
Rosa-madeira (*Pereskia grandifolia* Haw.)				
	Cactaceae	Am, Ma	1	0.02
Sabugueiro (*Sambucus nigra* L.)	Adoxaceae	Ma	1	0.02
Sapucaia (*Lecythis pisonis* Camb.)	Lecythidaceae	Am, Mg	1	0.02
Siriguela (*Spondias purpurea* L.)	Anacardiaceae	Ca	1	0.02
Samaumeira (*Ceiba pentandra* (L.) Gaertn.				
	Malvaceae	Am	1	0.02
Trombeta (*Datura candida* Pasq.)	Solanaceae		1	0.02
Espécie desconhecida	-	-	5	0.12
TOTAL **120 SPECIES**	**40 FAMILIES**	**-**	**4,294**	**100.0**

During the sample collection and data analysis of the tree species, we observed the direct participation of the population in the introduction of the species to urban afforestation. The number of fruit species, generally, large-sized trees such as mangueira (*Mangifera indica*), with 376 trees; jambeiro (*Syzygium malaccense*) with 345; cajueiro (*Anacardium occidentale*) with 85; açaizeiro (*Euterpe oleraceae*) with 71; goiabeira (*Psidium guayava*) with 68 and coqueiro (*Cocus nucifera*) with 44 trees, which have morphologic characteristics (crown format, size and exchange of leaves, large fruits and surface root system) inadequate for road afforestation, mainly those trees that are conflicting with electric and telephone wiring, which shows the preference of the population for these species. Such fruit species account for 23% of the total trees planted in the municipality of Altamira (Table 1).

Very few species native to the Amazon (13.3%) were used in road afforestation in Altamira, probably because most population comes from other regions of Brazil and moved to the region after the establishment of the Transamazônica Highway (BR 230) in the 1970's. If we consider native species to the Amazon and to other regions in Brazil, the number rises to 30.8%, which is still small given the biodiversity in the Amazon.

We observed several conflicts (60%) among the species used in the urban afforestation of Altamira (walls, houses and sidewalks), as well as with electric and telephone wiring and street signs (17.3%). The lack of knowledge of technical recommendations and urban legislation by most of the population led to the indiscriminate planting of inappropriate species because of their physiologic characteristics (toxic species) and inadequate for their morphologic characteristics. Other factors that contribute to these conflicts are free spaces, such as median strips, which are too narrow, and mainly sidewalks that in their majority (39%), have insufficient width for the planning of large-sized trees.

Among the ten species that generated most conflicts in the public streets of Altamira, we emphasize ficus (*Ficus benjamina*), which is also the most abundant species on the streets, with a total of 1,062 individuals, accounting for 28.8% of the trees surveyed (Table 2). Mangueira with 376 trees and jambeiro with 345 trees, also accounted for many conflicts (78%) related to maintenance services such as pruning and technical repairs.

Table 2. Species that presented larger frequency of conflicts in the public streets of the municipality of Altamira, Pará state – Brazil –, 2010

Species (popular and scientific names)	**Families**	**Number of trees**	**Types of conficts***
Ficus (*Ficus benjamina* L.)	Moraceae	1.062	1, 2, 3, 4, 5
Mangueira (*Mangifera indica* L.)	Anacardiaceae	376	1, 3, 4
Jambeiro (*Syzygium malaccense* (L.) Merr & L. M. Perry)	Myrtaceae	345	1, 2, 3, 4
Nim (*Melia indica* (A. Juss.) Brandis)	Meliaceae	80	1, 3
Açaizeiro (*Euterpe oleraceae* Mart.)	Arecaceae	71	1, 3
Acacia mangio (*Acacia mangium* Willd.)	Fabaceae Mimosoideae	66	1, 3
Coqueiro (*Cocus nucifera* L.)	Arecaceae	44	1, 2, 3
Castanhola (*Terminalia catappa* L.)	Combretaceae	37	1, 3, 4
Tento (*Ormosia paraensis* Ducke)	Fabaceae Papilionoideae	24	1, 4, 5
Párkia (*Parkia platycephala* Benth.)	Fabaceae Mimosoideae	24	1, 4, 5

* Types of conflicts: 1= electric wiring; 2= constructions; 3= sidewalks and curbs; 4= lighting; 5= street signs.

A total of 2,501 (58.0% of the total) are planted near houses or wall and curbs. Most trees presented in Table 2 (1,800 trees – 41.9%) showed outcropping that causes damages to sidewalks. Pruning is required in 574 trees (13.4%) due to conflicts with electric wiring, street lighting and signs. For Pivetta and Silva Filho (2002), the electric wiring characteristics are important factors in the planning of urban afforestation and should be installed on just one side of the street, which is normally not found in the municipality of Altamira.

The damages caused by pests and diseases were frequently observed in 2,319 trees (54%), and the ficus showed more severe cases of infestations. In addition to the species mentioned in Table 2, because of the damage they cause to assets (public or private), we place special attention to chapéu-de-napoleão (*Thevetia peruviana*). This species presents latex that in contact with the skin or ingested mainly by children can be toxic. These species should be gradually removed or replaced by species more adequate for environmental and urbanistic purposes.

The species with greater acceptance by the Municipal Secretariat for Agriculture and the population was macharimbé (*Cenostigma macrophyllum*), which has an accelerated initial stage and slow growth at mature age with dense crown and flowers at the apexes of the branches. Among the most numerous species, it is the only native species with 793 individuals planted (18.5%), and mostly young plants. Another successful experience was that the introduction of ipê amarelo (*Handroanthus serratifolius*), which is a native species; however, the number of trees was 83 accounting for 1.9% of the total surveyed. Other species native to the region that can be diffused include andira-uchi (*Andira parviflora*) and palheteira (*Clitoria racemosa*).

The urban afforestation is not uniform. In the downtown area, we located and identified the greatest number of trees in comparison to the neighborhoods. This does not mean that there was priority for the downtown area to the detriment of the neighborhoods, but it is attributed to occupation to the area. Afforestation of the central areas occurred in the 1970's when the trees presented circa 50 cm of BHD and afforestation in the neighborhoods is more recent, at the end of 1980's and in the 1990's, when the trees showed 30 cm of BHD. Table 3 shows the neighborhoods with the largest number of individuals planted on the roads.

Table 3. Number of trees found in the neighborhoods, on public roads of the municipality of Altamira, Pará state – Brazil –, 2010.

NEIGHBORHOODS	Number of trees	NEIGHBORHOODS	Number of trees
Jardim Independente I	623	Ibiza	71
Uirapuru	521	Liberdade	55
Centro	450	Colina	51
Brasília	447	Jardim Altamira	44
Sudam I	396	Santana	43
Jardim Independente II	256	Sudam II	43
Mutirão	253	Jardim do Sol	15
Premem	228	Jardim Primavera	15
Aparecida	206	Jardim Oriente	13
São Sebastião	180	Bela Vista	8
Alberto Soares	167	Campos Cordeiro	2
Esplanada do Xingu	126	Parque Ipê	1
Boa Esperança	80		
Subtotal	**3,933**	**Total**	**4,294**

These results show that there was no planning for urban afforestation of the neighborhoods in the city, which should be prioritized in campaigns for future tree plantings, as Rocha et al. (2004) highlight in their studies, given that the knowledge of the social and environmental functions of trees is a basic pre-requisite for the planning and administration of urban areas that allow, therefore, basis for the decision-making process (SENNA et al., 2001) in the search for better life quality for city dwellers.

CONCLUSIONS

The great diversity of species in the study area results from the effective participation of the population the urban afforestation process of the municipality of Altamira.

Some species planted on the public streets should be gradually replaced by species due to conflicts with street signs, street lighting, or sidewalks or because of the susceptibility to pests and diseases such as the ficus species or toxic, such as chapéu-de-napoleão.

Macharimbé is the species that can be best diffused in the city because it is native to the region, medium-sized and does not require intensive maintenance nor cause conflicts.

Combined actions between Municipal Secretariats are required to prioritize urban afforestation in the neighborhoods of the municipality of Altamira.

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