

ASPECTS OF PRESERVATION, MAINTENANCE AND MANAGEMENT OF THE URBAN FOREST IN BRAZIL

by Maria do Carmo Conceicao Sanchotene

Abstract. This paper presents the treatment given to the urban forest in Brazil focusing on the legal, administrative, technical, educational and economical aspects. It lists some of the tree species most used in urban plantings in Brazil, their families and botanical names, as well as their average height on the streets. It also describes the creation of the Brazilian Society of Urban Forestry, its objectives and main programs.

Brazil is the fifth largest country in the world, with a territory of 8.5 million km². It is situated West of the Greenwich Meridian and is cut across in the North by the Equator. It has many climatic, vegetation and altitude differences, which lead to the formation of different landscapes.

Aproximately 60% of the Brazilian territory is situated in the tropics. It has 150 million inhabitants, with 75% concentrated in urban areas. The population growth, the disorganized occupation of the land, the economic and social problems, the real estate speculation, and the lack of an environmental preservation ethic all contribute strongly to the reduction of the remaining natural vegetation in urban areas. Presently, there is a growing awareness about environmental issues, and management and preservation of the urban forest have achieved a prominent position in Brazil.

Urban Forestry - Concept and Importance

The urban forest is the set of either public or private areas with a predominantly arboreal vegetation, or in its natural state in a city's landscape (7). It can also be defined as the set of either cultivated or naturally occurring arboreal vegetation in a city's landscape.

The urban forest is a main issue in urban planning because it defines and structures the space. It strongly affects the city's environmental quality, directly affecting public health. It promotes benefits to the environment such as:

- microclimate stability
- improvement of urban soil conditions.

- improvement of the hydrological cycle.
- decrease of atmospheric pollution. Well planted streets can retain up to 70% of the airborne dirt.
- reduction of costs of thermic conditioning in buildings.
- improvement of light and acoustic conditions.
- increase in the diversity and quantity of species of urban fauna.
- increasing property value through environmental landscape enhancement.
- options for recreation and leisure for the population, especially low income, in public areas such as parks, squares and gardens.

It is also important to mention that trees represent cultural values of the historic memory of the city. The urban forest has legal, administrative and technical aspects. In this context, the awareness and education of the population as to the importance of the preservation of the environment plays a major role. These issues are why the task of governmental bodies in charge of the management of green areas is so difficult.

Administrative and Legal Aspects

The concern with the urban forest is reflected in the creation of specific legislation in Brazil since the early seventies. The enforcement of vegetation protection is effectively supported by the Federal Law 4771/65, which created the Brazilian Forestry Code. This reads, in its second article: *"All forests and other forms of natural vegetation {public and private} located on tops of hills, foothills, nascent and banks of rivulets, streams and rivers and in the metropolitan areas, as defined by law, are provided permanent preservation."*

The Brazilian Institute for the Environment and Renewable Natural Resources, a federal department, has the responsibility for the enforcement of the Forestry Code in the country. However, in major cities it delegates this function to the local

authorities (municipal departments). Several municipalities have created and approved Master Plans for Urban Development, as well as laws and decrees even more restrictive than the Federal Law, according to their local circumstances. These instruments basically set the standards of preservation for the different kinds of public and private green areas.

Generally speaking, trees located on sidewalks and other public areas can only receive treatment by a public agency, even though in many cities the population often intervenes with the trees on sidewalks.

Trees located in private areas receive different treatment in different cities. In Curitiba, capital of the state of Parana, for example, the legislation requires a special permit for cutting trees with a trunk diameter 15 cm or greater for whatever the purpose. In Porto Alegre, capital of the state of Rio Grande do Sul, all trees are protected from cutting, and even the ones located on private property must have a Special Authorization from local authorities to be trimmed, removed or transplanted, when needed.

In the case of building in wooded areas, compensatory planting is mandatory in some capitals, and this is a procedure that tends to expand throughout the country. Presently, there is a great concern by public authorities to establish compensatory standards, emphasizing the use of native species for such. The issuance of Occupancy Permit documents for buildings is conditioned to the fulfillment of the legislation. For private residual woodlots within the urban net, a few cities have territorial and real estate tax exemptions.

Present legislation includes very strict penalties prescribing fines, compensatory planting and even jail terms for infractions, though mainly in the southern and southeastern regions of the country. In other regions, however, the legislation is still incipient.

Some species such as the native fig-tree, *Ficus* sp., *Erythrina falcata* (cork tree) and *Araucaria angustifolia* (Brazilian or Parana pine) receive special legal protection in Rio Grande do Sul since they are threatened of extinction.

The fulfillment of the legislation implies estab-

lishing administrative actions that: organize and facilitate the practical work of enforcement, preservation, and maintenance of the urban forest; provide a faster response to community demands; orderly record keeping to gather data and technical information that may help to establish guidelines to manage and plan the urban forest.

The municipalities that have specific legislation are the ones that stand out administratively. They have developed and issued documents such as Special Authorizations for trimming, transplanting and removal of vegetation, as well as Terms of Compensatory Planting and other regulatory procedures. Currently, only a few cities such as Porto Alegre and Curitiba are starting to computerize such procedures.

Technical Aspects

Planting. The planting of trees in Brazil is usually done from May through August in the South, Southeast and Middle-east regions and from December through April in the North and Northeast regions, which are, respectively, the seasons of lower temperatures and intensive rainfall.

Saplings with an average height of 1.8 to 2.0 meters are planted in 0.6 m x 0.6 m x 0.6 m holes usually adding organic fertilizer. They are staked using poles of *Eucalyptus* spp (eucalipt) and tied in a figure eight manner with sisal-grass rope. Whenever it is possible, open pervious soil of at least one square meter, is kept around the planted tree.

It is recommended that a minimum space be kept between trees depending on the characteristics of the species used. It is not advisable to plant trees near electric power poles, at a distance of less than two meters from garage entrances, hydrants and catch basins, and at a distance of less than five meters from street corners. When choosing the species, width of the street and sidewalk, building alignment, and existence of underground utilities and aerial lines should also be taken into consideration.

One of the great problems faced by municipalities is the volunteer planting, carried out by the general population without the necessary technical orientation. Regarding this, the blame goes to

public and private institutions that promote campaigns giving away seedlings, but do not educate the population about the characteristics of the tree species donated and the problems that might happen with an inappropriate use (see Table 1).

Pruning. Pruning is an old, methodic practice, used in order to attain regularity in the production of fruit. In the case of the urban forest, the objective is to maintain a crown as natural as possible, making the tree compatible with its surrounding space.

For many years, the idea of an annual practice of pruning during the winter, on street trees as well as in private gardens was observed. It was an almost mandatory procedure and passed on as the ideal of care, dedication, and neatness. In some cities one can observe the disastrous consequences of this procedure that gradually affected the individual's resistance by the entrance of water and pathogenic agents, resulting in extensive necrosis of the collar and trunk, making their removal and replacement necessary.

Presently, arborists engaged in urban forestry use the following kinds of pruning:

- Guiding and formation pruning is systematically done to young trees in order to encourage the crown to adapt to the urban environment.
- Correction pruning is done to remove branches that are not harmonious with the natural shape of the tree crown.
- Equilibrium pruning is done to stabilize a tree.
- Compatibility pruning is done to remove branches that are in conflict with urban elements.
- Regeneration pruning is a drastic pruning, done to reconstitute the top of declining trees.

Concerning the maintenance of the urban forest, the highest volume of work in Brazil corresponds to requests for pruning branches to free aerial electric power lines. The majority of the municipalities do not have the equipment and the resources needed to satisfy the demand and guarantee the safety conditions of pruning crews, mainly regarding the primary (high voltage) wires. In Brazil, this task has been performed mainly by

Table 1. Tree species commonly used in urban plantings in Brazil

Family	Botanical name	Common name	Average height
Anacardiaceae	Mangifera indica	Mangueira	20 m
Bignoniaceae	Jacaranda mimosifolia	Jacaranda	11 m
	Tabebuia avellaneda	Ipe roxo	10 m
	T.chrysotricha	Ipe amarelo	4 m
Bombacaceae	Pachyra aquatica	Manguba	10 m
Combretaceae	Terminalia cattapa	Amendoeira da praia	8 m
Leguminosae	Bauhinia variegata	Pata de vaca	5 m
	Caesalpinia ferrea	Pau ferro	15 m
	Delonix regia	Flamboyant	10 m
	Holocalyx balansae	Alecrim	12 m
	Tipuana tipu	Tipuana, tipa	15 m
Lithraceae	Lagerstroemia indica	Extremosa	5 m
Melastomataceae	Tibouchina mutabilis	Tibouchina	6 m
Moraceae	Ficus microcarpa	Benjaminzeiro	10 m
Oleaceae	Ligustrum lucidum	Alfeneiro	8 m
Rosaceae	Licania tomentosa	Oitizeiro	10 m
Palmae	Arecastrum romanzoffianum	Jeriva	15 m
	Cocos mucifera	Coco-da-Bahia	15 m
Proteaceae	Grevillea robusta	Grevillea	15 m

Source: Based on information received from regional vice-presidents of the Brazilian Society of Urban Forestry.

Electric Power Companies. These companies often use contract services which provide less than skilled workmanship. This situation adds to the damage inflicted on the urban forest.

Pruning is a procedure that demands technical skills and specialized workmanship. This concept has been conveyed to the Brazilian population, which has started to demand quality in the work performed by public departments.

This situation has positively influenced the market of equipment and tool manufacturers who have started to offer new materials, directed specifically to the maintenance of the urban forest. Other aiding materials, such as sealers and paints have been used on the cut surfaces resulting from pruning.

Root pruning. The interference of tree roots with urban elements often suggests that the pruning of roots will make them more compatible with underground sewers and water pipes, pavement, and dividing walls between residential lots, and sidewalks. This situation occurs due to the planting of inappropriate species in the wrong places, excessive pavement around a tree or because of soil compaction. The municipalities, generally, give instructions to the tax-payers, encouraging aeration by keeping the soil open near to the collar of the tree.

Root pruning of adult trees demands a careful and detailed study so as not to jeopardize the tree's survival and stability, thus avoiding hazards to the population. In Porto Alegre, there are records of trees of relatively large size, that were root pruned fifteen years ago, with apparent success, such as *Tipuana tipu*, *Melia azedarach* and *Jacaranda mimosifolia*.

Some arborists are totally against root pruning, preferring, according to each situation, to recommend the removal of the tree.

Dendrosurgery. (Cavity filling) This is a technique that aims at the recovery of trees, through the removal of dead or decayed tissue, especially on the trunk, with subsequent disinfection with the use of copper based fungicides. The resulting cavities, if deep and wide, are filled with masonry in order to stop the development of decay and to attain healing of the wound. Some species have responded positively to the treatment; as *Ficus*

organensis (fig tree), *Platanus occidentalis* (sycamore), *Salix babylonica* (weeping willow) and *Jacaranda mimosifolia* (jacaranda). Other species have rejected the treatment, even expelling the masonry bloc, as is the case of *Melia azedarach* and *Phitolacca dioica*.

It is also important to mention that there is no technical consensus about the efficacy of dendrosurgery.

Transplanting. Transplanting includes the seedling transplant in the nursery, to its transfer to containers of different sizes, to planting in a permanent place. The following discussion is focused on the transplanting of large trees. There is a lack of experimentation in this field, especially regarding the species most used in urban areas. Palm trees are usually the most commonly transplanted trees, since they have an average rate of success around 90%.

Other species, even of large size, react positively to transplanting, as is the case of the native fig trees, *Ficus organensis* and *Ficus enormis*. Seeds of these species often germinate under declining trees, on decomposing tissues, growing under them and establishing themselves in their place, many times near the sidewalks. Due to their ultimate large size, they cannot remain there, which is why they are frequently transplanted to parks and public squares.

Removal. The current legislation and the population's growing awareness of the importance of preservation of green areas have been causing a noticeable decrease in tree destruction. The Master Plans for Urban Development, suitable to the circumstances where they are applied, have been preventing the felling of trees, especially regarding land plotting activities and building construction. The southern and southeastern Brazilian states are more attentive to these aspects.

In Porto Alegre, the requests affecting trees in private areas undergo systematic inspections and technical examination before the approval or rejection of permits regarding pruning, removal or transplanting of trees located either in building-destined areas or in gardens and residential backyards.

The evaluation requires a good level of specific knowledge as well as good common sense. In

building-destined areas, especially, it is of extreme importance to observe items such as: a) survey of the existing trees and their plotting on the location and situation map, b) occupation rate intended for the building and its impact on existing vegetation, and c) identification of trees affected by the building and landscape development involving grading, filling, etc. as result of the proposed project. In this item, the following should be evaluated: health status of the trees; the species' natural regeneration ability; local growing conditions to adequate development; vegetation type and groups that might be present; and the viability of transplanting.

The technical decision should always reconcile the maximum preservation of the vegetation with the needs of the property owner. Frequently, the expected occupation rate for the area is increased, according to the city's Master Plan, when it comes to the construction of vertical condominiums to save existing vegetation. Modifications in proposed projects are sometimes unavoidable for that purpose, especially regarding horizontal condominiums, which have highly devastating effects to the existing vegetation.

Compensatory planting. Compensatory replacement is required depending on the trees whose removal have been authorized by public officials. The plantings are usually made within the same property area, in environmentally degraded areas, or in public areas, according to the project and technical instructions from the appropriate municipal department. Regulations for these plantings are controlled by law and vary from state to state. However, a great incentive for planting native species is observed especially in Rio Grande do Sul.

This attitude has stimulated preservation and use of native species in landscape projects, encouraging their production and commercialization. As a result, seedling quality for native species used in private areas is gradually increasing, creating new attitudes in the consumer and producer market, considerably increasing their commercial value and availability.

Inventory and planning. Some state capitals have been trying to develop inventories of the urban forest, as a way of developing directives for its management and expansion. Inventories are a

goal to be attained, beginning with the systematic recording of routine activities of public agencies. It is recommended that all the information regarding trees should be cross-checked with those in the register of public open spaces (streets, parks, etc.), waterworks, sewer system, traffic signs, electric power and telephone lines, public illumination spots, sidewalk condition and building location. As the inventory develops and problems with the recorded vegetation are observed, immediate intervention to give the trees an adequate treatment is highly recommended.

General guidelines for production of seedlings. Presently, with the importance given to the urban forest and the indication of need for development plans defining the expansion directives of green areas in cities, there is a concern to produce trees suitable to the country's different regions. Generally, the tree species produced in public nurseries, are closely related with personal preferences of their managers. However, in the last few years, there has been a trend for nursery production that satisfies recommendations for different cities. This is based on the knowledge of frequency of use of different species on streets, avenues, parks, public squares and gardens, their botanic characteristics and ecophysiology, as well as the physical characteristics of places where they will be planted.

Educational Aspects

The city is the place where people have a major impact on the environment. The maintenance and improvement of the quality of the environment are a responsibility of public departments, private institutions, and also of the general population. In fact, environmental quality has to do with education. Conscientious people seek the preservation of this quality. Therefore, it is more and more necessary to invest in education.

The majority of the efforts developed in Brazil, focused on the preservation of the urban green, have been directed at the elementary school level. More recently, there has been great concern with pre-school children.

What stands out at first is the importance that has been given to the preservation of native trees, and dissemination of knowledge about them. The

strategies used to achieve this objective are established around the circumstances and situations close to the student. Projects directed at the preservation of mangroves, cerrados (Brazilian savannah woodland), hillsides, reforested public areas, incentive to residential planting, etc. are developed to reach broader communities through the schools. At the university level, the efforts are predominantly directed to the preservation of conservation units (parks and reserves).

SBAU

Urban forestry in Brazil is living a historical moment. The effects of environmental education and community awareness programs about green preservation carried out for many years can finally be felt. The population has firmly reacted against depredation of green areas. Besides that, since 1985, when the 1st National Conference on Urban Forestry was held, many professionals from fields such as agronomy, biology, forestry, architecture, geography, sociology, and medicine have shown a growing interest in the interdisciplinary nature of urban forestry.

Presently, we are on the way to the 5th National Conference and the 2nd Brazilian Congress on Urban Forestry, both supported by the Brazilian Society of Urban Forestry (SBAU). SBAU, which was founded on September 16, 1992, has its headquarters in Curitiba, Parana and operates in the Open University for the Environment. Its objectives are to support and stimulate technical, scientific, political, and administrative efforts in the urban forestry field; promote efforts toward its development, such as meetings and publications; promote the exchange and mutual cooperation among individuals and institutions that operate in the urban forestry field.

The Society has five vice-presidencies, regionally located in the South (Maringá, Parana), Southeast (Botucatu, Sao Paulo), North (Belem, Para), Northeast (Sao Luis, Maranhao) and Middle-east (Cuiaba, Mato Grosso). Its objective is to establish an effective communication system among the many different Brazilian states, cities and towns.

The schedule of activities for the 93-94 biennium foresees the publication of a newsletter and a

technical magazine. It is also planned to hold regional events to arouse interest in less active regions in Brazil, leading arborists and institutions to participate, and develop efforts related to their local circumstances.

It is the intention of SBAU's Board of Directors, at the upcoming Congress, to promote its integration with "MERCOSUL" (a new common market formed by Brazil, Uruguay, Paraguay and Argentina) to promote exchange of experiences and mutual cooperation in Urban Forestry issues.

SBAU would like to establish a technical cooperation exchange program with ISA and its membership. This exchange program would help the growth of SBAU and the knowledge of Brazilian trees around the world.

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Biologist

*President of the Brazilian Society of Urban Forestry
Rua Sargento Nicolau Dias de Farias,
384 Porto Alegre - RS - Brazil
91.900 - 250*

Résumé. Cet article présente le traitement donné à la forêt urbaine du Brésil en mettant l'emphase sur les aspects légal, administratif, technique, éducationnel et économique. On y énumère certaines des espèces d'arbres les plus utilisées dans les plantations en milieu urbain brésilien tout comme leur hauteur moyenne dans les rues. On y décrit aussi la création de la Société brésilienne de foresterie urbaine, ses objectifs et ses principaux programmes.

Zusammenfassung. Diese Studie stellt die Behandlung eines Stadforstes in Brasilien dar, unter besonderer Berücksichtigung der rechtlichen, administrativen, technischen, forstbildungsbezogenen und ökonomischen Aspekte. Einige der am häufigsten genutzten Baumarten in städtischen Pflanzungen in Brasilien und auch ihre durchschnittliche Höhe in den Straßen sind aufgelistet. Sie beschreibt auch die Gründung der Brasilianischen Gesellschaft des Stadforstwesens, ihrer Ziele und dem Hauptprogramm.

Our 1993-1994 President



The current President of ISA is Dr. J. James Kielbaso. Jim is a Professor of Forestry at Michigan State University in East Lansing. He teaches arboriculture and urban forestry; researches maple manganese deficiency, Cytospora cankers, resident preferences for trees, and national urban forest management policies; and also directs graduate students. He has authored several articles that have appeared in the Journal of Arboriculture.

Jim has several goals for the coming year. They include developing a new 5-year strategy for ISA, continuing our international growth, expanding and improving relationships with green industry organizations and allied agencies, and broadening the influence of ISA on professional tree care around the world. He believes that the most important thing that ISA can do is communicate; communicate with members, chapters, tree care professionals and the public. He welcomes your suggestions. Write to Department of Forestry, Michigan State University, East Lansing, MI 48824 or call (517) 355-7533.