THE PHENOLOGYCAL, LOCATIONAL AND SOCIAL ASPECTS OF URBAN FORESTS
Ciro Guilherme Gentil Croce 1 2; Iraê Amural Guerrini3; Osmar de Carvalho Bueno4

ABSTRACT

This study proposes an adaptation model to urban areas for the choice of species, substrates, implantation sites and local community participation. It was implemented on Dr. Vital Brasil Avenue, in the city of Botucatu, São Paulo, Brazil. We planted the species Jacaranda mimosifolia on the avenue median and Tibouchina mutabilis on the sidewalks. The project was divided into three parts that complemented each other in the tree-planning process. The choice of species took into account locational aspects of the survey, the involvement of local residents in the acceptance and preservation of the trees, and the use of urban and industrial wastes as substrates for the seedlings planted. The results show that the community demonstrates satisfactory approval, the location of the seedlings will bring comfort to the environment and the substrate waste used was as effective as the conventional substrates previously used.

Keywords: urban afforestation, Jacaranda mimosaeoflia, Tibouchina mutabilis, municipal and industrial waste.

ASPECTOS FENOLÓGICOS, LOCACIONAIS E SOCIAIS NA ARBORIZAÇÃO EM VIA PÚBLICA

RESUMO

O projeto de pesquisa “Aspectos fenológicos, locacionais e sociais na arborização urbana em via pública” propõe um modelo de adequação à arborização urbana na escolha de espécies, substratos, locais de implantação e participação da comunidade local. Foi implantado na Avenida Dr. Vital Brasil, na cidade de Botucatu, SP como modelo para a cidade. Foi utilizada a espécie Jacaranda mimosaefolia, no canteiro central da avenida, e a Tibouchina mutabilis nas calçadas. O projeto foi dividido em três partes que se complementaram no processo de planejamento e escolha das espécies com o levantamento dos aspectos locacionais, o envolvimento dos moradores locais para aceitação e preservação do plantio e utilização de resíduos urbanos e industriais como substratos para as mudas implantadas. Como resultado teve-se uma aprovação da comunidade satisfatória, a localização das mudas trará maior conforto para o ambiente e o substrato de resíduos utilizado foi tão eficiente quanto os convencionais utilizados anteriormente.

Palavras-chave: arborização urbana, Jacaranda mimosaefolia, Tibouchina mutabilis, resíduos urbanos e industriais.

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INTRODUCTION

Cities grow producing goods, concentrating services and generating opportunities. However, for distinct reasons such as the high air pollution levels, climatic changes or inadequate transportation conditions, it is common for cities to become contradictors to life quality (MILANO, 1996).

The effect of the environment on human behavior is not analyzed in isolate, but it considers the context it occurs. A reciprocal relation is suggested, i.e., the environment influences behavior as much as behavior is influenced by the environment (OKAMOTO, 2002).

Urban afforestation offers several services to urban populations, such as improvement of the microclimate, reduction of wind speed, wildlife shelter, buffer for noises, welfare due to the presence of vegetation cover, shade for vehicles, pedestrians and bicycle lanes, and areas for rainwater absorption reducing soil impermeabilization (CRESTANA, 2007). We also mention the sequestration of carbon dioxide released by motor vehicles and factories, as well as O2 emissions, both processes carried out by photosynthesis. Moreover, tree forests offer beautification of the landscape, valuation of real estate, soil aeration provided by tree roots, protection against erosive processes, and increase of relative humidity and regulation of the hydric process (GOUVÊA, 2001).

In this context, the current study discussed the tree-planting process on streets with a criterious assessment of the landscape regarding seedling plantings, awareness of the local community of the importance to implement an afforestation project using residential and industrial waste as substrate in replacement of conventional ones.

MATERIALS AND METHODS

The current study was carried out on Vital Brasil Avenue in the city of Botucatu, central-western region of São Paulo State, Brazil at 22°53'09" south latitude and 48°26'42" west longitude. The city is 804 m above sea level and the climate of the region is tropical of altitude with mild winters and hot summers. The Vital Brasil Avenue connects the highway Marechal Rondon to the bus station in the city. There are several important businesses along it, such as supermarkets, restaurants, car dealers, hotels and residential buildings. This avenue was chosen for its importance to the city and the need to reorder the urban afforestation project already implemented to the city.

Site aspects:

Site aspects are related to physical characteristics of the area where the survey on the street trees and urban assets was carried out. The survey was carried out

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using a formulary designed for the current study that contained information on items related to blocks, such as width of sidewalks and streets and type of wiring grid, which were tabulated horizontally in the form next to the letterhead. In vertical, we obtained specific data on each existing tree, such as location, height, DBH (Diameter at Breast Height), height of the first forking, root conditions, trunk conditions, phytosanitary problems, distance to light poles and sewers and distance to the street corner. These data allowed to identify the locations for planting new trees proposed for the avenue, reducing problems with urban elements ensuring uniformity and adequacy to the landscape.

Social aspects (commitment of local community):

We carried out two surveys, one prior to tree planting and another after it. The first survey contained questions about the “population x tree” relationship applied in the first meeting with the local residents. The second survey was applied directly in the study area aiming to collect opinions of residents and storekeepers, as well as users of the avenue. Questions were related to the results of the first tree planting.

After the tree planting, signs were affixed in public places to promote awareness to the importance of urban afforestation in the city.

Each sign contained the program name “Green Road” followed by a question: “Did you know that?”

Phenological aspects:

To evaluate the phenological aspects, 48 large-size trees were planted on the median of the avenue with specific fertilization. We made groves of 0.40m x 0.40m x 0.40m according to the characteristics of the seedlings. We used the species Jacaranda mimosaefolia popularly known in Brazil as “Jacarandá Mimoso”. The seedlings selected for planting were between 2.0 and 2.5 m high.

We carried out measurements of plant height, CBH (Circumference at Breast Height) and at trunk basis to monitor seedlings growth. We also performed chemical analyses of the leaves of each tree planted. For fertilization at planting, the City Hall of Botucatu uses, as a standard procedure, 500g of chemical fertilizers 4-14-8, 500g of dolomitic limestone and 18 liters of manure. In the current study, the chemical fertilizer 4-14-8 was kept at the same ratio for all treatments. As variables, we used dolomitic limestone (PRNT= 90.50%) and industrial waste from the enterprise VSB/Mannesman (PRNT 40), denominated as silicate, due to the large amount of Ca and Mg (Table 1) used in this waste pH correction. Another variable used was manure (Table 3) or sewage sludge obtained from the Sewage Treatment Plant of the city of Jundiaí, São Paulo State, Brazil, as organic material.

Therefore, the treatments showed the following variables: manure + silicate (ES); manure + limestone (EC); sewage sludge + silicate (LS) and sewage sludge + limestone (LC). We implemented 12 blocks distributed along Vital Brasil Avenue where the treatments were placed randomly.
Figure 1. Signs for environmental education affixed along Vital Brasil Avenue, in Botucatu City, São Paulo State, Brazil.

- An adult tree may transpire up to 400 liters of water per day.
- Afforested cities have lower risks of floods.
- Urban preserve fauna of the region.
- There are adequate tree species for each type of sidewalk.
- Areas without vegetation cover generate 80% more heat.
- Trees regulate air temperature and humidity.
- Trees absorb carbon released by motor vehicles and factories.
- Afforested regions have milder temperatures.
- Afforested cities have lower levels of air, visual and sonic pollution.
- Afforested cities have healthier populations.

Figure 1^5

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^5 Tradution Figure 1: Program: green roads; Did you know that; afforested cities have lower risks of floods?; Secretariat for Environment; Municipal Government of Botucatu; Botucatu: city friends with trees.
RESULTS AND DISCUSSION

Location aspects:

Data on location aspects (Table 1) allowed to determine the species to be planted in partnership with Municipal Secretariat for the Environment. The data recommended the planting of large-size tree species in the median of the avenue and small and medium-size individuals on sidewalks where all types of wiring grids are located.

The study also helped to survey the existing species in terms of location in the urban environment and phytosanitary conditions of roots and trunks, providing data to avoid urgent removal of a tree individual, which would otherwise transmit to the local population lack of preparation of the public power for implementing the project.

We also defined with the technicians committed to the project, the planting of *Jacaranda mimosifolia*, popularly known as Jacarandá mimoso, on the median of the avenue and, on sidewalks, we planted *Tibouchina mutabilis*, popularly known in Brazil as Manacá-da-serra.

*Jacaranda mimosifolia* is an ornamental species that belongs to the Bignoniaceae family, a large-size species that reaches up to 15 m high. The crown is thin and this species is deciduous, losing its leaves in the winter. It flowers fully and magnificently from spring until summer. It is largely used in urban afforestation projects, because its roots are deep and do not damage sidewalks. For Jean Irwin Smith, because blue the rarest color found in flowers, a tree covered with blue flower draws public attention.

*Tibouchina mutabilis* is a medium-size tree species with white and purple flowers and commonly found in the south and southeast of Brazil for its ornamental features (LORENZI, 2000).

<table>
<thead>
<tr>
<th>Number of blocks</th>
<th>Primary wiring grid (%)</th>
<th>Secondary wiring grid (%)</th>
<th>N_e of existing trees</th>
<th>Permeable sidewalk (%)</th>
<th>Sidewalk width &gt;2m (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>39</td>
<td>34.9</td>
<td>100%</td>
<td>87</td>
<td>7.7</td>
<td>71.8</td>
</tr>
</tbody>
</table>

Data on the current condition of the street trees, on the sidewalk structure and electric wiring grid allowed the technical team from the Municipal Government of Botucatu City and the group of researchers, as well as local residents to decide about the adequate location to plant large-size trees and small-size trees to be used in the project.

The trees already existing on the avenue were surveyed on and their locational conditions were maintained for further studies.

The landscape proposal of this study is to create a tree corridor with purplish flowers in certain periods of the year.

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Social aspects:

The surveys analyzed different aspects regarding the perception and importance of tree plantings on the avenue after the approval for the implementation of the project, in addition to helping increase awareness about the issue. They also helped in the engagement of residents and storekeepers in the process of implementing and maintaining the seedlings. According to Bueno and Souza (2002) and Couto (1994), population’s engagement should start at the beginning of the afforestation process, including data collection and final decisions regarding plating locations.

According to the survey conducted before the planting process, 100% of the respondents liked trees; however, 33% did not want to have trees in front of their properties and 66% said that trees had already caused them some problems. Sommer et al. (1990) indicate that trees may cause problems to properties in different locations. However, 85% of the respondents believe that it is important to plant more trees in the city and 50% agrees that trees should be planted regardless the acquiescence of home or business owners.

Malavasi and Malavasi (2001) observed similar situation regarding the environmental advantages and benefits provided by urban afforestation. Such factors conflict with the results cited by Dias (1996) that affirms that importance of urban afforestation for city dwellers vary from city to city and its intensity is cultural.

In the survey conducted after the tree-planting process, 79% of respondents said that they had noticed the planting of the trees on the avenue; however, 70% were unaware of the project. Machado (1993) conducted a study on the population’s perception of the environment and stated that it is possible to obtain relevant information from the interaction between the population and the urban environment, proposing to take into account reflections and aspirations of local residents for a sustainable management of urban afforestation.

In the survey, 71% of respondents approved of the tree-planting project, while 10% objected to it. For the other respondents, the project was indifferent. The results show that 47% had no idea what the avenue would look like in the future. Bueno and Souza (2002) cite that, despite the small number, studies show that community’s perception of several aspects of urban afforestation has been increasing recently, mainly regarding street afforestation.

For the process of environmental awareness, 42% liked the educational signs about the benefits provided by trees and 36% did not notice the signs. Regarding acceptance after the tree planting, 78% of the respondents agree that the afforestation project will benefit all the population and 84% believe that the project should be implemented on other streets of the city.

Phenological aspects:

Results on growth and circumferences of the planted trees on the medians of Vital Brasil Avenue in the one-year period were practically linear for all treatments (Table 5). The variables analyzed were sewage sludge with limestone (LC), manure with limestone (EC), sewage sludge with silicate industrial waste (LS) and manure with silicate waste (ES). The results did not show significant changes for increase at DBH and diameter at trunk basis of the trees.

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For height increase, the initial average of the plants was 2.24 m and after one year, the growth average was 2.87 m. The seedlings in the treatment with sewage sludge with silicate industrial waste (LS) showed a significantly statistical growth reaching an average of 3.10 m of height (Table 5).

For DBH, the average of the seedlings used at planting was 10.68 cm and after a year, this diameter practically doubled reaching 20.26 cm. The circumferences at trunk basis showed similar results and had similar growth for the variables analyzed individually.

This result may be connected to the cycling and decomposition of the organic matter, which is a process difficult to start in degraded soils, but it occurs rapidly with the use of sewage sludge (SEAKER and SOPPER, 1988; HARRISON et al, 2003). The use of industrial waste may increase the Si content available in the soil helping plant growth or even reflecting in the yield of crops that accumulate this element, for example, rice (CARVALHO-PUPATTO, BÜLL & CRUSCIOL, 2004). The same condition is applied to the use of sewage sludge, which although it has not yet been largely tested in Brazil, it shows promising results for the production of seedlings of forest species (MORAIS et al., 1997) or reforestation projects (GONÇALVES et al., 2000). Studies on the use of sewage sludge are advanced in other countries including its commercial application by forestry enterprises (COLE et al., 1986).

CONCLUSIONS

The technical data obtained from the locational surveys showed important results for the future of the urban environment studied. The current study presented to the local population a better understanding and perception about the need for urban afforestation in the city of Botucatu, São Paulo State, Brazil. The study also showed the importance to develop environmental education programs to be implemented before and after tree-planting projects in order to have more commitment of the population for acceptance and maintenance of street trees. The phonological aspects referring to substrates allowed to use urban and industrial waste in urban afforestation. It is clear that similar projects should be developed by specialized technicians and the population, given that urban forests are common assets that will reflect in the welfare for all city residents.

REFERENCES


