

Urban Greening in Brazil: a Case Study

1. INTRODUCTION

The green areas management of a given town does not imply in pre-established models and cannot either be approached in a generalizing way, as a mere reproduction of experiences that took place elsewhere.

Towns consist of sceneries structured by man and impregnated by his presence. It is his duty to outline his very characteristics in the townscape, whereas the latter shapes different realities from case to case. Thence it follows that the town management should adopt an appropriate particular policy, able to cope with all its peculiarities in a broad sense (LARUSSO,1993).

Brazil - the case study at issue - presents particularities that render its study completely different from the greater majority of other Latin American countries. Owing a continental magnitude and unlike regional scenarios regarding climate, natural resources, population density, education levels and income distribution, the country turns out to be intangible at the first glance.

In order to build up a reference scheme to approach urban greening in Brazil, it becomes necessary to analyze several urban ecosystems that better represent each of the main country's regions. In this way, this paper comprises case studies concerning some of the biggest Brazilian cities located in different regions, focusing on São Paulo, presently regarded as the world's third greatest city.

2. PRELIMINARY COMMENTS

The urban greening theme arose with the modern town planning. Tony Garnier (1869-1948), one of the renowned town planners of this century, emphasized the importance of green spaces and their strategic role amongst the town functions.

As a result of the worldwide ongoing sped-up process of urban growth, man is experiencing a considerable wearing of his physical and mental energies, daily consumed in the hectic environment of great towns. Since such an environment is characterized by the gathering of great population contingents, concentration of buildings, irritating unquietness and noise caused by traffic, dirtubances brought by industrial plants, and alike typical activities of urban centers, the green spaces achieve thus a fundamental importance in the man's psychological and physical health restoring (LARUSSO,1993).

In conceptual terms, urban greening can be regarded as both public and private lands presenting vegetal cover and located within a town. In this way, it is then possible to subdivide urban greening as well in public and private, what raises correlate matters as to land ownership and the extent of benefits shared by the population as a whole (MILANO, 1991).

3. LEGAL, INSTITUTIONAL AND OPERATIONAL FRAMEWORK

•INTRODUCTION

As stated in the report *Urban environmental management: strengthening capabilities at local level. The city of São Paulo - Brazil*, presented at the International Symposium on Local and Regional Development Planning and Management, held in São Paulo from 28 to 30 June 1995, and organized by the United Nations Centre for Regional Development, "the Brazilian federal constitution of 10/05/88 demonstrates the worries about the environment and its management, especially when it enforces the role to be played by the municipalities.

Before the issue of this new constitution, the law 6938 of 08/31/81 already established a national policy for the environment, through the creation of the National Environment System - SISNAMA - which, encompassing the three government levels, federal, state and municipal, put them to an integrated action. Also the Ministry for the Environment, Water Resources and Legal Amazonia (its new name) has already been founded, with its consultive and deliberative agency called National Council for the Environment - CONAMA, in which several representatives of the Brazilian society participate. The Ministry acts through its Coordination Secretariats and has, as a linked entity, the Brazilian Institute for the Environment - IBAMA.

As to São Paulo State, its new constitution, dated 10/05/89, is concerned with environmental issues. The State political-managerial structure was anyway previously preparing itself to face those issues with the creation of the State Secretariat for the Environment - SMA - in 1986, and its respective consultive and deliberative body, named State Council for the Environment - CONSEMA - created even before, in 1983. Such a structure has also an environmental operating agency, the Environmental Protection Agency - CETESB, which since 1975 works as the State Agency for the environmental control regarding water, air and soil quality. Finally, the local action in the city of São Paulo is represented by the creation of the Municipal Secretariat for the Green and the Environment in 1993.

Nevertheless, the set of legal tools and the institutional framework are not enough to deal with the specific environmental problems in Brazilian metropolitan regions. Such regions, due to the intricacies of issues faced and their wide territory, require new legal-institutional ways specific to the solution of their problems“.

As a consequence of the intense urbanization process that occurs in metropolitan areas and the resulting predominance of a highly densified occupation model, land turns into a precious, scarce good. In this *battle* for space, there are few chances to strive for an effective green areas system and of enough size to assure the environmental balance within the urban ecosystems (DEPAVE, SEMPLA, 1992).

It is a common procedure in land parcelling projects to solely design as green areas those devaluated public lands along creeks, which are also those ones susceptible to invasion by squatter settlements, greater responsible agents for the direct discharge of sewage into the creeks.

The struggle for life quality has led town planners to continuously search for innovative tools in their plans so as to warrant the environment conservation, controlling on the one hand the predatory action of unconscientious entrepreneurs, and the pressures and social demands

deriving from the increasing housing shortage as well as the country-wide unemployment on the other hand.

In face of these problems (mostly unsovable in the scope of urban policies), besides the territorial scale constraints of metropolises in general, there is at present a trend to fight the environmental problems at local level guided by the motto: "Think globally, act locally".

The "local action" has been adopted by non-governmental organizations in their environmental awareness and education proposals, as well as in the pressures they have made on polluting enterprises and/or nature damaging agents, basing their attitude on the assumption that if each one does his/her share, the entire planet can be saved (DEPAVE, SEMPLA, 1992).

● **CONSOLIDATING THE LOCAL ACTION**

"The creation of the Municipal Secretariat for the Green and the Environment - SVMA - represents, as previously stated, an example of the local government action concerning the environment, which was determined by the National System for the Environment - SISNAMA. This was the redefinition and redistribution of environmental obligations between the public and private sectors, with the strengthening of local power.

This Secretariat has responsibilities in the solution of environmental problems of the municipality, including in its actions, intersectorial areas such as Education, Planning, Housing, Land Use, Urban Transport, Traffic System, Health and others, as well as the improvement and conservation of the remaining natural environment in the city, the control of environmental quality, and the implementation and maintenance of green areas.

The administrative framework created by the above mentioned law encompasses the Secretariat's Office, a Municipal Council for the Environment and Sustainable Development - CADES; three technical departments, responsible for the actions of the Secretariat: Parks and Green Areas Department - DEPAVE; Environmental Education and Planning Department - DEAPLA; Environmental Quality Control Department - DECONT.

CADES, the consultive and deliberative council is in charge of recognizing problems along with society, leading to feasible solutions, being constituted by representatives of the three government levels, civil society, non-governmental environmental organizations, unions, industrial and commercial sectors, university and professional entities. The Secretariat has the following duties: to control and supervise the environmental quality, enforcing standards of air, water and soil quality; to develop actions aiming the implementation and maintenance of parks and green areas; to promote the urban arborization; to coordinate programs concerning the development of public policies which integrate environmental issues; to plan the urban and rural environment, and to develop programs in the environmental education area.

With the existence of the Secretariat and the Municipal Council for the Environment, the municipality begins to have legal competence to review requests for environmental impact assessments, as well as environmental licensing to real state projects to be implemented in its territory. As a result of it, professionals working for the municipality as a whole have been induced to sectorial recycling, deepening their knowledge in specific topics such as soil,

drainage, fauna, flora, etc., tending to adopt in their studies and proposals a global approach, based also on a structure of interdisciplinary teams.

São Paulo City, forecasting the need of human resources skilled in the environmental area, has developed through SVMA, together with the University of São Paulo (USP), a comprehensive and multidisciplinary program of human resources, aiming to prepare and/or specialize the municipal technical teams, which will be acting in the environmental area. Currently there are three courses of specialization held at the USP School of Public Health: Environmental Control, Environmental Education and Environmental Management, for 30 students with 450 hours each. Presently 90 professionals are graduating. Each course is to be repeated at least twice in order to provide the necessary specialization to the work teams.

With the technical-institutional structure created, plans are being developed in order to create a strategic planning to face the city's environmental issues, through plans, programs and projects, as well as a work method which values the horizontal integration of its units.

In this way, several environmental actions have been implemented, with programs such as: 1 Million Trees, Environmental Control of Valley Areas, Urban Silence, Local Agenda 21, Fructify Project, amongst others.

Local government has helped implementing other programs concerning environmental issues, under the responsibility of other Municipal Secretariats, such as slums reurbanization - Projeto Cingapura - as well as the recovery of water resources protection areas - Projeto Guarapiranga and S.O.S. Mananciais. These programs have been implemented with municipal, State or federal resources, as well as with other resources from international financing agencies or even with the private enterprises.

One can see the importance of local government facing its environmental responsibilities. The institutionalization of the environmental area through a municipal agency can collaborate both for better coordination of environmental programs, along with other sectors of the administration, and for the insertion of the environmental component in several public policies adopted by the municipalities.

It is worthy mentioning the need to have a local environmental council in order to get the participation not only of the society, but also of the many governmental sectors in the political decision process, which will gradually lead to the introduction of new patterns for the urban environmental management.

At present, with the increase of environmental valorization, new partners - "former villains" - can give effective collaboration to the local public power actions. The real state operations aiming to establish urban projects, with legal and/or economic incentives which encourage the conservation and maintenance of water, soil, fauna and flora, for instance, must be devised and fostered.

Urban operations, common in the developed countries, where the right to build and the duty to preserve are negotiated, must finally be put in practice.

However, no one expects such changes to occur spontaneously. Those actions must be directed by and for the society itself, which must manage its urban environmental asset, so as

to obtain an increasing rate of economic optimization for the environment and the quality of life.

The way adopted by the city of São Paulo to face its environmental issues is the first and important step towards the establishment of an integrated environmental management. The measures and strategies used by the municipality show quite adequate conditions to the strengthening of the urban environmental issue at the local level“ (PHILIPPI Jr., A., PRANDINI, F. L., ELIAS, E. O., et al, 1995)

● *A CLOSER APPROACH ON THE LEGAL FRAMEWORK: CRITICS AND COMMENTS*

Regarding the specific topic of urban green areas, not only municipal legal instruments are encharged with it, but also further Federal and State laws. Since the end of last century, several municipal laws and decrees have been issued on matters concerning the need of streets arborization, the trees pruning and cut standardization, and last but not least, the minimum share of green areas on urban plots.

The municipality shows therefore to be supplied with many legal tools to assure the implementing of green areas and their arborization. Nevertheless, the governmental worries towards their preservation seem to face hindrances imposed by the legislation itself, which conceptually, either presents contradictions or works ineffectively in this respect.

That is the reason why the urgency for a legislation review has lately been at issue more and more often amongst those involved with the urban greening matter. The demand for a review in all municipal legal tools directly or indirectly related to the urban green areas was recently officially registered in the **Local Agenda 21** of São Paulo City. The Agenda 21 is a document representing the commitment of the São Paulo Municipality towards the sustainable development and the inclusion of the environmental concern in all fields and levels of political action, firmed in the Global Forum held in Manchester, England, 1994. This document is designed to define public environmental-related policies and subsidize the municipal environmental planning.

The Local Agenda 21 constitutes also part of a compromise assumed by Brazil during the UNO International Conference on Development and Environment - ECO 92, held in Rio. This international meeting produced a final document entitled Agenda 21, of which Brazil is a signatory country, summarizing the main guidelines to be followed by the member countries in pursuit of the sustainable development. The formulation of the Agenda 21 for São Paulo, main metropolitan center in the south hemisphere, means a progress of the city's commitment in relation to several items of the Global Agenda 21 and also a precious contribution to the National Agenda 21 formulation process. Its items concerning urban greening are presented in Part 6 - *PLANNING*.

The materialization of this attempt in reviewing the municipal legislation has led to the elaboration of the project for a new *São Paulo Municipal Environmental Code*, already approved by CADES (Municipal Council for the Environment and Sustainable Development) and to be submitted to the House of Council for approval. Its main points regarding urban greening are listed below:

- Art. 173** - Regards all types of green areas as a citizens' common interest asset.
- Art. 176** - The approval of new land parcelling projects to be allocated on areas covered by arboreal vegetation must be previously subjected to the appreciation of the Municipal Secretariat for the Green and the Environment.
- Art. 177** - New land parcelling projects that do not comprise streets and parking lots arborization as well as green areas cannot be approved.
- Art. 179** - Each and every urban plot occupied by constructions should keep a minimum of 15% of its area free from any kind of paving and designed to shelter arboreal vegetation.
- Art. 180** - Any type of trees felling either on public or private lands depends on previous authorization of the competent authority.
- Art. 181** - It is totally prohibited by any means to damage, cut or prune arboreal vegetation on public or private lands without governmental allowance, and also to cut and prune tree in ways that disregard legal procedures standards, even though an allowance for the cut and pruning has been granted.
- Art. 182** - Any flora sample or small flora assemblages can be declared for permanent conservation by the competent authority.
- Art. 183** - The São Paulo Municipal Government shall promote, according to its own judgement, reforestation or vegetal rehabilitation in certain areas aiming at the protection of steep hillsides and water resources. The reforestation of native species in public areas and their nurseries creation and management shall also be encouraged.
- Art. 185** - The construction potential of a plot covered by vegetation of permanent conservation can be transferred to another plot by a governmental legal instrument and through previous authorization granted by the mayor.
- Art. 188** - The arborization must be compatible with the urban, architectural, historic, and landscape local characteristics, and regard the pedestrians flow as well as the vehicles traffic volume. Priority should be given to native species that can also attract the fauna.
- § 1 - The arborization must be preceded by proper planning, analysis and approval of the competent authorities;
- § 2 - The urban infrastructure to be implemented must be compatible with the existing arborization;
- § 3 - The arborization on public and private lands must obey the arborization standards defined by the competent authorities.
- Art. 189** - The central sidewalks on urban roads, deprived of fences and presenting a width bigger than 1.0 meter, must be grassed and, whenever appropriate, gardened rather with compatible arboreal species.

4. PUBLIC INVOLVEMENT

•HISTORIC BACKGROUND

Jordi Borja, in his article entitled "The Cities and Strategic Planning: an European and Latin American Reflexion " (In *Gestão Contemporânea*, FISCHER, 1996), comments that "the political democratization and State decentralization processes that took place in Latin America in the 1980s reinforced the cities and local governments' role. However, the intrinsic

limitations of such processes, the social effects brought by the adjustment policies, the historically inherited inequalities, and finally, the cities' weak socio-cultural framework added to the serious shortages of technical and social infrastructure have retarded the cities' performance as protagonists of political decisions in the national scenario, and delayed as well, the progressive inserting of public involvement in the decision making processes of local range.

According to the author, this situation has been changing in the 1990s. On the one hand, the economic warming up has fostered the implementation of large scale urban projects (in some cases also favored by the increasing cooperation with the private sector) and dynamized the civil construction sector. On the other hand, the inherited contradictions and needs become sharpened: lack of physical and telecommunication infrastructure, insufficiency of public resources and of the local governments' performance, weak social integration in the city and scarce public-private cooperation. Moreover, the internal democratical processes consolidation and the increasing external economic opening have greatedened the social demands and enhanced the functional crisis awareness in big cities.

The intensity and visibility of urban problems (traffic jams, criminality, air and water pollution, housing and services shortage) clearly confirm the crisis. At the same time, the economic dynamics (warming up), social dynamics (involvement), and political dynamics (democratization) have brought forth proper circumstances for the solutions generation. And they are not few: approval of political and financial reform projects in significative cities like Mexico, Bogota, and Buenos Aires; the issue of a new Federal Constitution awarding greater autonomy to local governments in Brazil); outstanding political and dealing performance of great cities' mayors, converted in true national leaders; elaboration of economic, social and urban strategic plans, based on a large public participation; local governments descentralization; implementation of large scale urban projects undertaken either by the government alone or by public-private partnerships; cooperation between the public and private sectors; etc."

The great Latin American cities assume in the 1990s decisive political and economic roles. The consolidation of such a process, in accordance with Borja's thinking, "will depend on the possibility of promoting great urban projects that incorporate an active participation of the main public and private agents and that attain a wide civic agreement".

• ***PRESENT SITUATION: THE CASE OF SÃO PAULO CITY***

****THE MUNICIPAL COUNCIL FOR THE ENVIRONMENT AND SUSTAINABLE DEVELOPMENT (CADES)***

As reported in the introduction of Part 1 (***LEGAL, INSTITUTIONAL AND OPERATIONAL FRAMEWORK***), CADES, the Municipal Council for the Environment and Sustainable Development, represents a landmark regarding public involvement in the decision making processes at local level.

"This consultive and deliberative council is responsible, along with society, for the identification of environmental problems and the proposal of feasible solutions, being composed by representatives of the three government levels, civil society, non-governmental organizations, unions, industrial and commercial sectors, university and professional entities.

CADES has also played an important role during the Local Agenda 21 formulation process, conducted under the responsibility of a committee assigned by the Local Government and coordinated by the Municipal Secretariat for the Green and the Environment (SVMA). This committee involved all municipal secretariats, CADES, as well as the organized civil society representatives. The public involvement and collaboration have not only been enabled through the committee, but also by means of meetings and seminars performed in close contact with the community, in order to give the diverse social groups the opportunity to evaluate and criticize the proposals which were also being in the meantime formulated and appreciated by the committee itself.

****PROCAM - PROCAV II: PROGRAM FOR THE CANALIZATION OF STREAMLETS,
INSERTION OF STREETS, AND ENVIRONMENTAL AND SOCIAL RECLAIMING OF
VALLEY REGIONS***

Further occasions in which the public participation is made possible seem to be related rather to specific urban greening projects than through councils or meetings encharged with policies and plans working up. A typical example is the current PROCAM, environmental component of PROCAV II - Program for the Canalization of Streamlets, Insertion of Streets, and Environmental and Social Reclaiming of Valley Regions, constitutes an important example of intersectorial work, involving several agencies of the municipal administration and, within the scope of SVMA, enjoins technical teams of planning, environmental control and implementation of green areas.

Such a program will benefit the population living in the affected areas representing circa 2,67 million families of which 3,870 families are to be removed and resettled, aside from public and private institutions existing in the region. This program induces an improvement in the population's health conditions, through the elimination of agents causing diseases; the organization of the housing site; the implementation of green and recreational areas, and the canalization of deteriorated streamlets. PROCAM will be implemented in 13 micro-watersheds in the city's east and north zones, through close collaboration between local government and communities.

Amongst the foreseen measures, we can point out the project for Environmental Education which comprehends aspects related to the recovery of the natural environment and of the socially built spaces, as well as the cultural interrelationships there produced, aiming at a change of behavior pertaining to the environment as a whole. The program includes a project of green areas to protect the channels, using vegetation to be planted bordering the riverbeds; the establishment of recreational facilities in public areas and the establishment and/or remodelling of remaining green areas existing in the watershed.

****FRUCTIFY PROJECT***

Special emphasis has been laid on environmental education programs, both formal and informal. One such program is the "Projeto Frutificar" (Fructify Project). This is an environmental education project based on school children's activities. It involves the use of a kit containing trays and tubes, organic composte and seeds. The municipal schools receive the

material and guidelines to implement gardening activities for the planting of fructiferous trees by the students. They will be responsible for the planting, maintenance and follow up of the trees development.

***“GREEN WATCHERS PROGRAM“**

Similarly, and integrating a wider environmental project, the “Vigilantes do Verde“ (Green Watchers) program aims, through the use of environmental education coupled to the trees planting in schools and neighborhoods, at creating the School/Community awareness towards the environment and its conservation importance, and changing in this way the current behavior where little value is given to the Green.

As an intersecretarial program, the “Green Watchers“ comprises the participation of the Municipal Secretariat for the Green and the Environment (SVMA), the Municipal Secretariat for Education (SME), and lastly, the Regional Administrations Secretariat (SAR). The program is developed in two steps: the first one involves five schools, each one represented by 10 students belonging to the same neighborhood, to whom instructions are given as to how to be “Green Watchers“, according to the *Neighborhood to Neighborhood Program*, created by the City Hall of São Paulo. The second step, in its turn, increases the schools involvement up to the point where the whole community participates.

The training of the “Green Watchers“ is given by teachers specialized in environmental issues (including biologists, botanists, agronomists), who provide information concerning health and quality of life and its relationships with the Green. This coupled to planting and maintenance practices, ranging from the knowledge of the species, their origin and use, as well as planting methods and correct seasons for planting, to the earth preparation, irrigation, fertilization, pruning, and lastly, measures to be taken in case of the occurrence of special events such as vandalism or natural accidents.

***“ONE MILLION TREES PROGRAM“**

Considering the difficulties to implement new green areas in a metropolis such as São Paulo, SVMA has instituted, with the private sector’s participation, the “One Million Trees Program“. It foresees the arborization of the city through the trees planting, including fructiferous ones, particularly along the city’s streets and avenues. There will be more than 18,000 km of streets which will be receiving, at a first stage, about 300 species of trees, compatible with their localization and which will play an important role in the improvement of the community’s quality of life.

The benefits are many, and in the medium- and long-terms, as the project is being implemented, it is expected a decrease in the greenhouse effect, in the air and noise pollution, allied to the return of birds and other small animals to urban areas, promoting thus an improvement in air and weather quality, together with further environmental and aesthetic benefits.

The tree protectors shall have a proper space for advertisements and educational messages to be used either by the private sector or by citizens themselves, so as to fund part of the program as well as to protect the saplings.

***“GREEN AGENDA“**

Finally, it is worthy mentioning that the Municipal Secretariat for the Green and the Environment (SVMA) has created a special way to allow the exchange of information with the community using computers: the *Green Agenda* (or “Agenda Verde“, as it is called in Portuguese). This telematic resource has been implemented in association with PRODAM - São Paulo’s Data Processing Company, through the São Paulo City’s Bulletin Board System. The Green Agenda is responsible for transmitting data and information belonging to environmental issues of the city; programs, projects, acts, and events of the Secretariat; its institutional framework and the services it renders, besides creating an e-mail system called VIP Mail in order to answer citizens’ queries and connect them through a direct channel to the Secretariat.

During the year, SVMA also organizes traditional events involving the whole community to promote the environment and the environmental education, such as “Festa do Verde“ (Green Festival), “Festa da Primavera“ (Spring Festival) and “Semana do Meio Ambiente“ (Environment’s Week). Such festivals represent an outstanding means through which the community can participate and involve itself with the environmental issue by attending conferences, shows, programs developed for schools and general people, as well as by visiting municipal parks, exhibits, plant shows, etc.“ (PHILIPPI Jr., A., PRANDINI, F. L., ELIAS, E. O., et al, 1995).

5. BENEFITS OF URBAN GREENING

• BENEFITS OVERVIEW

As Heliana Maria Silva Brasil postulates in *Caracterização da arborização urbana : o caso de Belém* (1995), “it is possible to regard the urban greening as the transposal to the city of the countryside life benefits. Such benefits proceed from several forms of green areas possible to be located within the urban grid.

Richter, quoted by CAVALHEIRO (1991), refers to the urban greening as the sum of different green elements and diverse free spaces isolated in urban-industrial settlements. The author classifies the urban greening into the following categories: decoration and representation gardens; vicinage parks; neighborhood parks; sectorial or district parks; metropolitan parks; environmental protection areas; traffic system follow up greening; cemeteries and special use areas; botanical or zoological gardens, amongst others.

Gardens belonging to houses, residential buildings and further private constructions, although limited, concur to the urban environment upgrading, and that is why authorities ought to encourage the private green conservation and expansion, in a way to allow it continuing on contributing to the betterment of life quality and performing its important role on the urban landscape (SANCHONETE, 1992).

The urban parks, in view of their considerable extent, some times with natural vegetal cover, either located in central areas or in the outskirts of a town, are rather demanded for active and passive recreational purposes“ (SILVA BRASIL, 1995). “According to Mc NEELY and DOBIAS (1991), the green areas in a general way are not only important due to the fact that they meet leisure, recreational and tourism activities demands, but also because they can concur to conserve a natural historic asset of a region. These same authors state that the users search them moved by a `natural impetus`, for they spontaneously identify themselves with such areas“ (MORERO, 1996).

“The private buildings squares and gardens are as well important components of the urban greening, being mostly found however in an unbalanced way within the urban boundaries, what limits to a certain extent their regular visiting. On the other hand, the streets, avenues and roads arborization can cover the whole city surface. NUNES (1992) emphasizes the importance of streets as a potencial space to shelter urban greening as well as their efficiency in scattering vegetal cover uniformly throughout the city“ (SILVA BRASIL, 1995).

“In accordance with LOUREIRO (1979), until the 1970s the mismanagement in the urban sprawling and the absence of defined social goals that should follow the growth processes led to accumulated deficiencies, transforming most part of the Brazilian cities in `dry` sites, lacking vegetal cover and presenting quantitative and qualitative green areas insufficiency. He supports the thesis that “.. the lack of pleasant areas within a town may not bring about apparent damages in the physical conditions or in the performance capacity of man in his role as a component of the technical and economic organizations of society, but brings in itself an impoverishment of life, a progressive loss of the qualities associated with the human being subtle potential, and finally, a decrease in his physical and mental balance“ (MORERO, 1996). MONTEIRO (1993) concludes that green areas constitute a fundamental element for the psycholological equilibrium, the quiet recovery and the mood restoring.

“It is admitted that the green areas present numerous uses and functions in the urban environment. The architectural and aesthetic use of vegetation in the urban landscape or structures becomes obvious even for casual observers. According to MONTEIRO (1993), the green areas when well distributed throughout the urban grid can grant it coloring and plasticity. MILLER (1988) affirmed that these areas have the capacity to considerably modify the urban microclimates and to affect the human comfort. Moreover, these areas constitute appropriate spaces for the promotion of environmental education. As GOLD (1973) emphasizes, the outdoors promotion of environmental education programs incorporates a new dimension to their protagonists. Some open spaces are strategic as control areas, and it is exactly where the inhabitants can get acquainted with the native flora and fauna of the city they live in. The mere fact that they can reach a place with such characteristics represents already an educational experience“ (MORERO, 1996).

“Mentioning the specific case of Belém, Pará State’s capital, located amidst the Amazon Rain Forest in the north region of Brazil, the streets and avenues arborization perform a fundamental role in the city’s equatorial microclimate softening. In view of its dense downtown area with a high concentration of buildings, the resulting progressive suppression of private backyards and gardens as well as the meaningless contribution of squares and parks, the arborization appears as the sole and ultimate solution for the urban greening incorporation“ (SILVA BRASIL, 1995).

As reinforced in *Guia de planejamento e manejo da arborização urbana* (ELETROPAULO, 1995), “there is no point in depriving the population of the comfort provided by the urban arborization. A single tree can transpire, on average, 400 liters a day, bringing forth a refreshing effect that corresponds to 5 air conditionings with 2,500 kcal capacity each, working 20 hours a day“.

The Belém municipal legal framework by dint of the Land Parcelling and Use Law as well as the Urban Development Law does foster the urban arborization. Nevertheless, both private and public new land parcelling projects have not in practice been up to the legislation. Very seldom, planners reserve in housing schemes significative areas for squares and green sidewalks. Even more uncommonly are those housing schemes in which small groves are preserved. It is according to SILVA BRASIL (1995), a common practice amongst construction companies to clean up the terrain before the beginning of the engineering works, leaving thus the soil totally unprotected, and laying on it mostly an inert and impermeable cover after the works completion.

In such housing schemes, the first inhabitants are also those responsible for the first trees planting, almost always on the sidewalks, since it rarely exists available backyards or gardens able to shelter them. Although not aligned with each other and fortuitously allocated, these trees account for the gradual upgrading of the monotonous landscape resulting from the completely alike houses.

For CULLEN (1983), “amongst the natural elements that integrate the urban landscape, the tree is undoubtedly the most often one, and the relationship between trees and cities own a long and respectable tradition“.

“GREY & DENEKE (1978) comment the utilities of arboreal vegetation in the architectural projects: they provide privacy; guide the eyesight to determined places; soften the dimension of areas and buildings, thus also mitigating the man’s oppression feelings before huge constructions; interrupt or enhance the architectural lines as well as ease the aggressive feature of construction materials. Specifically concerning streets arborization, these authors state that it enables to orient the pedestrians and vehicles traffic, to call people’s attention for a crossing and to furnish shadow to parked vehicles.

The arborization has also an important role as to the consolidation of engineering works. For GEISER (1977), the vegetal cover on surfaces modified by earthworks has as its main goals, amongst others, “the protection against erosion, visual and ecological landscape recovery, and the natural balance restoring, specially regarding the relationships among soil, air, water, flora and fauna, thus increasing the favorable conditions for vegetal and animal’s life“.

Assuredly, the benefit of the arborization and urban greening as a whole most longed by the inhabitants of tropical cities is the softening of climate conditions, whose components such as solar radiation, temperature, humidity and ventilation are those which most affect the urban inhabitant.

DETZEL (1992) emphasizes that the cities’ planned arborization is an “option towards the betterment of the urban environmental quality“ and, furthermore, that “the possibility of guiding the wind through the vegetal barriers can sharply drop the need of air conditionings use in internal environments“, which, in their turn, concur to the temperature increase in the outside environment.

Through the interruption, absorption, transmission and reflexion of the direct or reflected solar radiation, not only the trees, but also shrubs and lawns decrease the temperature and soften the luminosity. The soil, cement and asphalt store more heat than the vegetal cover and transfer to the air the amount of heat received.

The vegetation absorbs 97% of the long wave radiations, that is heat, and dissipate it through their physiologic processes. "The refreshment produced by evaporation is particularly effective when the air temperature is high, the humidity low and the plants are well supplied with water" (LARCHER, 1986). It occurs that in cities, the wind flow normally faces hindrances, what makes it inefficient regarding the humidity removal. That is the reason why, especially in areas with a reasonable concentration of high rise buildings, arborization is very important in order to guide the wind flow downwards, make it aerate the lower areas and let it then go up again, taking along with it the humidity, and consequently, the heat.

Hindering part of the rain water and softening the power with which it reaches the ground, the trees allow that the water penetrate deep in the soil, preventing thus the superficial drift (dragging of the soil upper layer) that, if really took place, would bring about the water bodies silting up. Absorbing the soil water and dispersing heat through transpiration, the vegetation concurs to the hydrologic cycle maintenance, rather modified within the urban boundaries.

Besides all the above-mentioned benefits, the urban greening as a whole is still able to work as noise buffer, to retain dust - until 70% of the suspended particulates, according to Bernatzky -, to purify the air by the bacteria and other microorganisms depuration, to recycle the air through photosynthetic mechanisms, to absorb toxic gases for man, to attract birds and shelter other fauna species, and lastly, to concur for the biodiversity maintenance.

It is worthy remarking that the benefits brought about by the urban greening regarding the improvement of the urban environment microclimatic conditions must not be considered alone. The architectural and urban planning solutions must equally support a rational ambiance in terms of climatic suitability. According to LOMBARDO (1995), the urban heat island "occurs due to the drop in evaporation, increase in rugosity and the thermal characteristics of the buildings and paving materials". In Belém, for instance, it becomes evident the lack of concern with respect to the buildings architectural and location solutions as well as to their construction materials, disregarding the extent of their suitability to the region's climatic conditions.

Just as the man suffers the consequences of a badly planned and accomplished urbanization, the plants are also affected in view of poorly planned arborizations. Nevertheless, the latter ones' adjustment capacity to environmental factors is greater than the man's. LARCHER (1986) identifies as environmental stressing conditions those which surpass the adaptation and self-regulation capacity of the natural communities" (SILVA BRASIL, 1995).

SILVA BRASIL (1995) reports that in Belém the man's proceeding towards the mango trees on the streets is undoubtedly the most stressing factor to them; even the mangoes harvest, for instance, is made by means of stones and sticks which break the trees branches in a period that coincides with the wettest and raining season, making the trees vulnerable to fungus attack. Even the public agencies, responsible for the implementation and management of aerial and underground infrastructure network, also respond for the offences caused to the crown foliages (arguing that they must free the wires from interference) and to the trees roots.

On the other hand, the disturbances caused by branches touching the wires (short circuits, transformers burn) or the underground infrastructure network (sidewalks and walls destruction) in Belém cannot be denied. In such cases, it is usually the tree that is blamed, and being so, it is drastically cut or simply felled. In face of these facts, only a few people realize that it all can be ascribed to a badly planned and inappropriately managed arborization.

Lastly and to conclude, it is worth it and necessary to approach the urban greening economic and social benefits. “In his inquiries about this topic in the city of Sacramento, California, GOLD (1977) concluded that trees can increase the satisfaction of parks users and inhabitants of greened neighborhoods in general, concur to raise the immovables value and provide an encouragement to the human sensibility.

GOLD’s (1977) conclusion as to the increase in the immovables value is confirmed by BARTENSTEIN (1981) who observed also a raise in the rents value associated with the decrease of available empty immovables on a commercial street in Seattle, which had been specially planted with trees during the preparatives for the World Fair in 1962, in opposition to similar streets which had not been awarded trees.

The urban greening policy, problem considered of minor importance until some years ago, has become under the public opinion pressure, a social trend full of lessons to be learned. This social aspect, considered by LAPOIX (1979), shows that the trees increasing importance in urban societies is a result of the human way of life that nowadays search for harmonizing with the surrounding environment. It follows that the society has been more often requiring to the government and political class the adoption of effective actions towards the urban greening as a whole. The administration motto in the southern Paraná State’s capital, “Curitiba, Ecological Capital“, is a good example of such political concern“ (MILANO, 1991).

• ***MEASUREMENT AND EVALUATION OF THE IMPORTANCE OF THE PUBLIC AND PRIVATE BENEFITS***

“Although widely divulged, the use of indicators to evaluate the efficiency of green areas is strongly criticized by the scientific literature. In this way, CAMARGO already in 1986 put in question the estimates of a minimum green area sum (in m²) per inhabitant, which when isolately considered does not make sense, requiring thus to be carefully analyzed. He supports this opinion by providing the example of the Tietê Ecological Park in São Paulo. “To what extent does the park benefit the city inhabitants“? argues the author. He states that this park “raises the green area share per inhabitant, helps in the air recycling of the metropolitan area and is therefore an honorable attempt. But in the daily and weekly leisure practice, it benefits basically the inhabitants located closer to it“ (MORERO, 1996).

According to CAVALHEIRO’s opinion (In *Planejamento ambiental de áreas verdes*, MORERO, 1996), there is so far no existing efficient methodology to evaluate the urban green areas. The authors affirms that the indicators presented in the literature must not be generalized, and either regarded as goals, since it does not exist satisfying methodologies for their calculation. One of the most common critics regards the fact that all kinds of free spaces are included in the reckonings, comprising thus totally unsuitable terrains.

• **RISKS INVOLVED IN OBTAINING THEM**

The streets and avenues arborization itself in Brazil is a relatively recent practice in comparison with the European countries, and has been implemented here for a little over 120 years, as reported in *Guia de planejamento e manejo da arborização urbana* (ELETROPAULO, 1995).

The first attempts occurred on Rio de Janeiro streets during the preparatives for the Emperor Don Pedro I's wedding. At that time, the persons in charge faced great problems in accomplishing the streets arborization. The people believed that the shadow provided by the trees was responsible for the malaria, yellow fever, measles, and even for the slaves' scabies. This negative attitude towards the arborization seems to a certain extent to have survived throughout time however. Some inhabitants of Brazilian cities still complain against trees located close to their residences in view of the disturbances caused by their leaves and flowers falling, besides the filth of birds that they shelter, as well as in face of the fact that the trees present risks to the inhabitants' safety, since they darken the night lighting and, at the same time, ease the invasion of robbers into the dwellings, for they profit from the trees trunk and branches to overcome high walls.

Considering the above-mentioned reasons, a comparatively few species have been since then handled for urban greening, and the relationship between the arborization technicians either with the population or with the public administrations could have been otherwise rather better off. As a result of it, disastrous arborization examples take place, represented by huge trees limited by paving, houses, buildings as well as sewage, water supply, power supply, telephone, gas and stormwater pipelines, etc. Further interferences may still occur, such as the current spreading of cable TV and optic fibers pipelines.

In summary, to render compatible the arborization benefits with the infrastructure network is not at all an easy task. **Plant the right trees in the right places** is undoubtedly the most recommended practice for the coming urban greening achievements (ELETROPAULO, 1995).

6. PLANNING

• **INTRODUCTION**

Within the urban context, the green areas purpose is directly related to the functions they perform, whether ecological, scientific, economic, social or political. Therefore, in the planning of green areas, the first stage is the definition of objectives and strategies to orient the actions to be implemented, clearing thus the functions and purposes of such areas (SOUZA, 1990; CAVALHEIRO, 1995, in *Planejamento ambiental de áreas verdes*, MORERO, 1996).

The improper distribution or the simple absence of free spaces, either recreational or green areas, is to be regarded as a problem of social range, for it does not meet the population leisure and recreational needs and deprives them of the microclimatic betterment as well as of the environmental balance provided by such areas "(GONCALVES, 1994, in *Planejamento ambiental de áreas verdes*, MORERO, 1996).

According to MORERO (1996), “the urban green areas planning must concern the natural resources protection, fit environmental and development policies and strategies designed for the considered region and closely regard the expectations and behaviors of potential users“.

• ***DEFINITION OF OBJECTIVES AND STRATEGIES OF URBAN GREENING PLANS***

Up to the present, the formulation of objectives and strategies for urban greening interventions seem to be associated rather directly with programs and projects than with plans. The actual municipal administration, however, has been committed with the formulation of an environmental strategic planning dossier for São Paulo City, entrusted with the establishment of leading objectives and strategies, which were conceived according to the strategic planning guidelines and are to be followed already by the current city’s government. A brief summary of its main points with respect to urban greening is presented next.

****STRATEGIC PLANNING IN SÃO PAULO: ITS URBAN GREENING CONCERN***

A *Strategic Environmental Planning* was conceived by the Department for Environmental Education and Planning of the Municipal Secretariat for the Green and the Environment in 1994. It comprises as its main goals:

- to perform as basic tool for the planning task, conceiving short-, medium- and long-term actions;
- to serve as an important input for the establishment of annual and pluriannual plans and of the budget allocation program;
- to allow the creation of a network-oriented organization, and thus to enable a rational use of the traditional governmental institutional framework;
- to search for managerial alternatives in the environmental scope, based on pre-established objectives and missions.

The entire Strategic Planning set is subdivided into 5 plans, each one presenting its related programs and respective projects. A summary of the programs and respective projects concerning urban greening, accompanied by an evaluation of their priority degree, is presented below, in *Table 6.2*.

Urban Greening in Latin America and the Caribbean
Urban Greening in Brazil: a Case Study - International Seminar

Table 6.2
Strategic Environmental Planning for São Paulo City - Its Urban Greening Concern

PLANS	PROGRAMS	PROJECTS	PRIORITY DEGREE	
1. ENVIRONMENTAL QUALITY DIAGNOSIS	1.3 QUALIDADE DO SOLO	1.3.2 Assessment and Inventory of Degradated Areas	High	
	1.4 FAUNA AND FLORA	1.4.1 Fauna Inventory 1.4.2 Flora Inventory 1.4.3 Green Areas Assessment 1.4.4 Fauna Reports 1.4.5 Flora Reports	High High Medium Medium Medium	
	1.7 ENVIRONMENTAL DATA BANK	1.7.1 Inventory and Mapping of Environmental Data 1.7.2 Inventory of the Springs Protection Areas Data 1.7.3 Data Systemizing	High Medium Medium	
2. ENVIRONMENTAL PLANNING	2.1 ENVIRONMENTAL RULING	2.1.1 Environmental Rules and Standards 2.1.2 Municipal Environmental Code	High High	
	2.2 ENVIRONMENTAL ZONING	2.2.1 Zoning Criteria 2.2.2 Zoning Proposals	Medium Medium	
	2.3 ENVIRONMENTAL ACTION STRATEGIES	2.3.4 In Special Areas 2.3.6 In Environmental Education 2.3.8 In Flora 2.3.9 Environmental Auditing	High High High Medium	
	2.4 MANAGERIAL INFORMATION SYSTEM	2.4.1 Follow up of the Strategic Environmental Planning 2.4.2 Evaluation and Control	High High	
3. INSTITUTIONAL STRENGTHENING	3.1 HUMAN RESOURCES TECHNICAL CAPACITY	3.1.1 Short-Term Courses, Meetings, Congresses, and Seminars 3.1.2 Specialization and Post-Graduation Courses 3.1.3 Institutional Capability	High High High	
	3.2 TECHNICAL-SCIENTIFIC COOPERATION	3.2.1 Institutional Exchange 3.2.2 Institutional Mechanisms for the Resources Allocation and Capacitying	High High	
	3.3 TECHNICAL-SCIENTIFIC DOCUMENTATION	3.3.1 Environmental Publications 3.3.2 Environmental Documentation File	Medium Medium	
4. ENVIRONMENTAL PROTECTION SYSTEMS	4.1 ENVIRONMENTAL EDUCATION	4.1.1 Environmental Education for the Community 4.1.2 Environmental Education in Springs Protection Areas 4.1.3 Environmental Education in Institutional Projects 4.1.4 Museums and Environmental Treckings 4.1.5 Courses, Shows and Events in Parks	High Medium High High High	
	4.4 RECUPERATION OF DEGRADATED AREAS	4.4.1 Definition of Methods and Criteria 4.4.2 Recuperation of Green Areas 4.4.3 Recuperation of Geologic Risk Areas 4.4.4 Recuperation of Degradated Mining Sites	High High Medium Medium	
	4.5 SOS SPRINGS PROTECTION AREAS	4.5.1 Recuperation of the Springs Protection Areas 4.5.2 Environmental Control and Fiscalization	Medium High	
	4.6 GREEN AREAS MAINTENANCE AND EXPANSION	4.6.1 Green Areas Planning 4.6.2 Projects for Parks, Squares and Other Green Areas 4.6.3 Municipal Parks Management 4.6.4 Trees Cut Control and Fiscalization 4.6.5 Fauna Handling	Medium Medium High High High	
	4.9 SOCIO-INSTITUTIONAL COMMUNICATION	4.9.1 Fostering and Support of Events 4.9.2 Institutional Diffusion	High High	
	5. STRATEGIC ENVIRONMENTAL PROGRAMS	5.1 PROCAM - PROGRAM FOR VALLEYS ENVIRONMENTAL CONTROL	5.1.1 Program Management Unity (UGP) 5.1.2 Institutional Strengthening 5.1.3 Environmental Recuperation 5.1.4 Environmental Education 5.1.5 Environmental Auditing	High High High High High
		5.2 ONE MILLION TREES PROGRAM	5.2.1 Actions Strategy 5.2.2 Saplings Furnishment 5.2.3 Implementation, Evaluation and Control 5.2.4 Environmental Education Strategies	High High High High
5.3 LOCAL AGENDA 21		5.3.1 Eclosion of the Local Agenda 21 (finished in 1996) 5.3.2 Elaboration of the Local Agenda 21 (finished in 1996)	High High	
5.4 INTERNATIONAL CENTER FOR ENVIRONMENTAL INFORMATION - CIA		5.4.1 Green Agenda Elaboration (achieved) 5.4.2 Planning and Implementation (presently on course)	- Low	
5.5 SPECIAL PROGRAMS		5.5.4 Fructify Project 5.5.8 Financing for Parks Recuperation	High High	

Source: SVMA- DEAPLA, Planejamento Estratégico - Planos, programas e projetos, São Paulo: DEAPLA, 1994.

***THE LOCAL AGENDA 21: GOALS, STRATEGIES AND IMPLEMENTATION MEANS
REGARDING THE GREEN AREAS**

As already defined in Part 2 (*PUBLIC INVOLVEMENT*), the Local Agenda 21 is a document representing the commitment of the São Paulo Municipality towards the sustainable development and the inclusion of the environmental concern in all fields and levels of political action, firming in the Global Forum held in Manchester, England, 1994. This document is designed to define public environmental-related policies and subsidize the municipal environmental planning.

According to the Local Agenda 21, the municipal government sectors entrusted with the public green areas management do not incorporate in their daily practice the planning culture or thinking. Their actions are commonly planned in view of their immediate needs and not through the analysis of diagnosis and trends. These different sectors of the municipal administration do not either maintain a regular communication amongst themselves, having in view the working out of solutions to diverse problems, besides the fact that they do not dispose of enough resources for research, management, environmental education and fiscalization. The city inhabitants in their turn do not own an effective tool that allows them positively interfere in the planning and management of the public green areas.

Taking into consideration the above-mentioned managerial shortcomings, the Local Agenda 21 lists up objectives and strategies envisaging an effective green areas system in São Paulo, well managed, protected and conserved, as well as the respective means of implementing such strategies, which are presented as follows.

■ **OBJECTIVES**

1. Formulation of a policy for public and private lands utilization that envisages the enlargement and maintenance of the São Paulo Municipality green areas.
2. Establishment of a public commitment amongst the mayor, the House of Council and the organized civil society towards this proposal implementation, scheduling and defining, according to the determined priorities and together with the population, the revision and enlargement of the Municipality Green Areas System.
3. Conservation of all significant forms of vegetal cover like wood, brush wood, flood plains, fields and riparian vegetation, aiming to warrant a genetic bank with scientific exploitation potential in order to support projects of deteriorated areas rehabilitation and natural green areas enlargement.
4. Raise the actual public green areas/inhabitant rate.
5. Upgrading of the current taxes charging system so as to better assure the maintenance of private real state properties with significant green areas.
6. Fostering of improvements in the actual public green areas and streets arborization management, including the species diversification.
7. Awareness of the population, through environmental education, towards the matters related to the formulation and implementation of a policy of green areas as a means to achieve the sustainable development and good standards of life quality.
8. Warranting of the green areas implementation on plots designed for such purpose, under the risk otherwise of the irreparable loss of soil permeability as well as air, flora and fauna quality.

9. Creation of tools to allow the enlargement of the public lands asset for the implementation of social infrastructure facilities.
10. Increase in the technical, legal and institutional mechanisms that warrant a proper land occupation in environmental, town planning and social terms, consolidating procedures that assure the legislation respect.
11. Support to the entrepreneurs for implementing undertakings that take into account the green areas conservation by means of urban or fiscal incentives.
12. Creation of a specific planning for the green areas implementation, having in view the deteriorated areas rehabilitation.

■ **STRATEGIES**

1. Create an up-to-date data bank about the municipal green areas, as well as elaborate and update regional plans and demands studies in order to give support to a green areas municipal policy, subsidize the design of new green areas, and divulge the existing information.
2. Review the current Green Areas System (SAV - Sistema de Áreas Verdes), since it does not totally meet the actual demands.
3. Elaborate a green areas municipal policy together with the population which assures the environmental conditions diagnosis as well as the development of techniques and the human resources upgrading for these areas management.
4. Create a Council of Park Users for each municipal park.
5. Revise the actual municipal institutional framework responsible for the green areas management (SVMA + SAR) and its performance and articulation system.
6. Investigate, together with the local population and the municipal administration a warranty strategy for the plots designed to shelter green areas, especially for those with remaining natural vegetation or indicating to present significant flora and fauna samples.
7. Create a program for the “green incentive“, with benefits to sponsors of projects in the scope of environmental education as well as research, inventory, conservation, and management of green areas.
8. Elaborate an agricultural policy for the municipality that comprises the access to: technology for the production increase and for the products conservation; trading structure (distribution and supply); maintenance of agricultural areas and activities; appropriate technical assistance.

■ **MEANS FOR IMPLEMENTATION**

1. Review of the existing legislation that directly or indirectly concerns the green areas.
2. Intensifying of all works related to environmental education together with the population as well as with public and private institutions.
3. Enlargement of the public participation in the green areas planning processes.
4. Upgrading of the municipal technical personnel directly involved with the public green areas planning and management.
5. Grant of equipments to all sectors of the municipal administration that work with the public green areas planning and management.

6. Establishment of conventions with the State and federal governments to render technologically and financially feasible the implementation of an agricultural policy.

• *USE OF GIS IN INVENTORIES, MONITORING AND EVALUATION*

Presently, GIS systems are commonly used for the analysis and selection of green areas in the scope of environmental planning. A typical example of the employment of this technological resource in Brazil is the Green Eye Project (“Projeto Olho Verde”), which has been implemented by the State Secretariat for the Environment and aims to assess all the State vegetal cover in terms of category, location, extent and conservation status.

The digitalizing and processing of the information obtained through remote sensing is being carried out by the Secretariat technicians themselves. Other public entities in Brazil use these systems to monitor forest burns, especially in the north and central west regions, occupied by the Amazon Forest. This is the task of the Environmental Monitoring Nucleus (NMA) of EMBRAPA (Brazilian Agency for Agricultural Research) as well as of INPE (Brazilian Institute for Spatial Research).

“ESCADA & KURKDJIAN (1993) and GONÇALVES (1994), for instance, suggest the use of remote sensing in the planning of urban free spaces or green areas. The last author states that is possible to handle through GIS a lot of basic data that can be later processed by means of thematic maps overlay, until the obtainment of the final product. This is for him a useful tool to work with, since it allows to deal with georeferenced data, huge data bank and prognoses formulation. One should always bear in mind that, when working with GIS, it is necessary a considerably large data bank and its later classification. Once the necessary input is taken into account, this tool enables that the selected environmental indicators are reviewed, interpreted, and accessed in a practical, clear and efficient way. The GIS systems are often used for planning procedures which aim to obtain zonings and to have a future support for the environmental management of the study area“ (In *Planejamento ambiental de áreas verdes*, MORERO, 1996).

7. TECHNOLOGICAL ASPECTS

• *SPECIES SELECTION CRITERIA*

“The selection of the species to be planted must take into account the basic needs and requirements of the vegetation as to soil, water, lighting and the local environment. Therefore, the selection process must take into consideration the following criteria:

- 1) **Species Origin** - Give priority to native species which are already adapted to the region, concurring thus to their conservation. Exotic species should be only chosen when it is clear that they are acclimatized to the local conditions.

- 2) **Tree Dimensions and Shape** - The selected tree must have a unique trunk and a well defined crown foliage, with a height and crown foliage size compatible with its location,

so as to avoid risks and damages to the electricity wires or the buildings as well as to avoid the need of drastic prunings, always undesirable.

3) **Radicular System** - The rootage must be of a tap-root type, avoiding as much as possible species with a superficial or tabular radicular system, that damage the building foundations and bring about the raising of pavements and sidewalks, even on sites technically dimensioned.

4) **Growth Rythm** - It is recommended the selection of species whose growth is from medium to fast, in order to escape from a possible depredation, and also to enable a quick recuperation of the plant in case of accidents where the pruning is the only acceptable technical option. The trunk and the branches of the selected species must not be excessively bulky. On the contrary, they must be compact, deprived of aggressive thorns, and enough resistant to bear the foliage weight in case of windstorms, without splintering. In a general way, species presenting a weak wood or easily broken trunk and branches as well as species that regularly demand pruning must be avoided.

5) **Presence of Fruits and Flowers** - The employment of trees with heavy, bulky, or dehiscent fruits must be avoided. The flowers are highly appreciated in the trees. For sidewalks, the so-called ornamental trees must present small flowers, because the big ones may cause accident risks to the pedestrians with their falling. It must be given priority to ornamental trees that produce lively colored flowers, whose permanence span on the trees lasts as long as possible. Trees with flowers that breath out strong smells or that are rather juicy must be avoided.

6) **Leaves** - If the selected tree presents deciduous leaves, their falling should preferably take place during winter, when the light and heat are at the same time more requested. These species are indicated for cooler regions. On the other hand, the species with semi-deciduous foliage or even not strongly deciduous have the advantage of not causing so much dust and disturbance as the other ones. It is also convenient the adoption of species with non leathery leaves.

7) **Resistance to Weeds and Diseases** - Species which are resistant to the attack of insects (wood-borer, fruit-borer, etc.) and phytopathogenic microorganisms must be selected, given the difficulties and even employment constraints in the biocides application. Whenever there is the need of a phytosanitary control, the consultancy with a competent professional like an agronomist is highly recommended.

8) **Toxic Principles and Resistance to Climatologic Conditions** - Species of comproved resistance to frost, drought and winds must be given priority. On the other hand, species that own toxic principles or that bring about allergy to man must be avoided“ (ELETROPAULO, 1995).

• **MAINTENANCE AND PLANT PROTECTION**

* **THE CASE OF SÃO PAULO STATE**

“The practice has demonstrated that the life span of a tree in adverse conditions is limited to about 30 years, age at which a replacement or transference of it is recommended. In São Paulo State, for instance, around 3.6 million trees are in need of this replacement.

In a survey realized from 1989 to 1991 by a work group of the Department of Water and Electric Energy of São Paulo State (DAEE), an assessment of the arborization was accomplished for 295 municipalities. According to it, only 4% of them followed an arborization plan. Even within this extremely reduced share, the implemented plans did not appropriately regard the existing infrastructure network, reason for which the trees interference problems still remain.

This survey confirmed the overwhelming predominance of *Sibipiruna*, a tree of the family of the leguminosae, which although its improper size for the large scale arborization, has still been the most planted species in the latest 20 years. Out of the 20 most employed species, only three are compatible with the constraints imposed by the aerial electricity wires. They refer to the 10th, 14th and 15th positions in *Table 7.1*.

Table 7.1
**Planted Trees for Arborization from 1989 to 1991
in 228 Municipalities of São Paulo State**

ORDER ACCORDING TO THE FREQUENCY OF OCCURRENCE	TREE SPECIES	Nr. OF MUNICIPALITIES WHERE THEY WERE PLANTED
1st	SIBIPIRUNA	109
2nd	POTTERY TREE	69
3rd	UNHA DE VACA	67
4th	PRIVET	62
5th	CAESALPINIA: BIGNONIA	57
6th	BRAZILIAN SPIDERFLOWER	49
7th	OCOTEA PULCHELLA	48
8th	BRAZILIAN SILK COTTON TREE	45
9th	MALABAR ALNOND	39
10th	RESEDA	32
11th	CASSIA	27
12th	YELLOW MAGNOLIA	25
13th	FLAMBOYANT	25
14th	HIBISCUS	23
15th	MYRTLE	20
16th	ROYAL PALM	19
17th	SPATHODEA CAMPANULATA	15
18th	TIPU TREE	11
18th	JACARANDA MIMOSO	9
20th	SWAMP OAK	8
21th	CAMPINAS ROSEMARY	6
22th	GREVILLEA ROBUSTA	5

Source: DAEE, in *Guia de Planejamento e Manejo da Arborização Urbana*, São Paulo: ELETROPAULO, 1995.

The trees under the aerial electricity wires show to be inappropriate in 91.5% of the cases. In view of this fact, the need of pruning shall still remain for a long while. The pruning task, although a typical governmental responsibility, is only in 63.05% of the cases really carried out by the municipal governments, usually once a year (63.36%) and in winter (45.42%), according respectively to *Tables 7.2, 7.3 and 7.4*.

Table 7.2

Pruning Accomplishment in Some São Paulo State Municipalities

PRUNING EXECUTOR	PARTICIPATIO SHARE IN RELATION TO THE TOTAL EXECUTORS (%)
Municipal Government	63.05
Power Supply Agency	6.44
Both the Municipal Government and the Power Supply Agency	21.69
Others	1.00
No references	7.82

Source: DAEE, in *Guia de Planejamento e Manejo da Arborização Urbana*, São Paulo: ELETROPAULO, 1995.

Table 7.3

Pruning Frequency in Some São Paulo State Municipalities

PRUNING FREQUENCY	SHARE IN RELATION TO THE TOTAL (%)
Once a year	63.36
Twice a year	9.16
Every two years	8.82
Others	10.52
No references	8.14

Source: DAEE, in *Guia de Planejamento e Manejo da Arborização Urbana*, São Paulo: ELETROPAULO, 1995.

Table 7.4

Pruning Period in Some São Paulo State Municipalities

PRUNING OCURRENCE PERIOD	SHARE IN RELATION TO THE TOTAL (%)
Winter	45.42
Sommer	8.81
Spring	3.73
Fall	15.26
No references	26.78

Source: DAEE, in *Guia de Planejamento e Manejo da Arborização Urbana*, São Paulo: ELETROPAULO, 1995.

The pruning waste material is deposited on landfills in most of the cases (99% of the surveyed cities). The number of trees that die after the pruning is high, reaching the alarming share of 27.45%. One third of the surveyed municipalities own presently or had already had their trees attacked by insects or diseases, whereas 77% of them could not overcome these problems.

A definite plant nursery (arboretum) for the arborization maintenance is not envisaged amongst the priorities of municipal governments (only 10.17% of the surveyed municipalities present nurseries in satisfactory conditions), hindering the increase in planting as well as the replacement or transference of the improper trees.

The depredation rate of newly planted saplings on streets remains high. Out of every 100 planted trees, around 52 to 80 of them are depredated. That is the reason why in São Paulo City, the “One Million Trees Program“ foresees the adoption of protectors for each and every new sapling planted.

The arborization is usually undertaken without the public involvement in the country side of the State. However, the population keeps close attention to the pruning works in terms of their fiscalization, for they are necessary to prevent risks of power supply breakages. These works, besides implying in high costs (US \$ 40 to 60/ tree/ year), bring about difficulties in the relationship with the community. If all the prejudices deriving from an inappropriate tree, such as the economic losses resulting from the activities interruption due to breakages in power supply, the pedestrians safety, as well as the traffic disturbances, are duly reckoned, they amount to very high sums which are effectively born by the society as a whole.

Considering all this, it becomes necessary the adoption of practical decisions to revert this situation in the benefit of a better life quality to all citizens“ (ELETROPAULO, 1995).

*** THE CASE OF BELÉM, THE NORTHERN PARÁ STATE'S CAPITAL**

“According to technical procedures commonly recommended to be followed in Belém, the arborization handling need is directly related to the tree quality:

- the good trees (20.9%) require cultural handling in terms of routine maintenance;
- the regular trees (24.9%) request handling procedures aiming at stopping the aggravation of problems eventually taking place, like phytosanitary control, cleaning or adjustment pruning;
- the bad trees (46.3%) surely need drastic pruning (recuperation pruning), phytosanitary treatment and trunks reconstitution;
- the irrecoverable trees (7.9%) should be removed before they may cause accidents, and their replacement should include trees either of the same or of further species, but appropriate in relation to the local physical and historic conditions.

The absence of a program that envisages the trees maintenance and recovery implies in an increasing number of senile trees, which may bring about a greater number of accidents if they are not removed. The replacement is indispensable, and the saplings must be produced up to proposed standards regarded as ideal for the urban arborization, besides appropriately planted and maintained“ (SILVA BRASIL, 1995).

*** MAINTENANCE OF PARKS: THE CASE OF SÃO PAULO CITY**

Presently, the Municipal Secretariat for the Green and the Environment in São Paulo (SVMA) has idealized the “Program for the Recuperation and Upgrading of Municipal Parks“, which is technically characterized as a program for the environmental urban revitalizing through the recuperation, readjustment and upgrading of the municipal parks functional performance. This undertaking represents an attempt to substitute the former procedures adopted for the municipal parks maintenance, which were not implemented under the guidance of an integrated planning and deprived of their insertion in the urban environmental context.

This program shall be integrated to further correlating programs, such as the air quality improvement (through the urban vegetation recovery) as well as the implementation of large scale urban leisure programs, and interrelated to current environmental education programs. These are programs belonging to the SVMA Environmental Goals Plan, which represents with regard to the municipal management a public policies program, and searches the cooperation of local communities for its development and implementation.

Within its scope, 30 municipal parks are included, and the specific objectives concern the upgrading of their technical infrastructure as well as sports, leisure and primary health care facilities; the flora and fauna recovery and revitalizing; and, if applicable, the recuperation of their water bodies quality.

• *INVENTORY TECHNIQUES FOR DIFFERENT TYPES OF GREEN AREAS*

* *THE EXAMPLE OF SÃO PAULO CITY*

“From 1989 to 1991, the Municipal Government of São Paulo undertook the measurement and monitoring of the vegetal cover in the city, allowing thus an evaluation both of the green areas effective lack and of their uneven distribution.

Although the city does not dispose of numerical data on the green areas rate evolution within the urban grid, there is an ‘empirical conviction’ that these rates have been continuously dropping.

The referred work did not have in view the accomplishment of a detailed botanic inventory, but rather relies on some important criteria regarding the selected outstanding events. In principle, a great emphasis was granted to the arboreal vegetation, for this vegetal category is the one that most contributes to the spaces organization in the city as well as the environmental conditions maintenance. In urbanized areas, the adopted criteria were the following:

- the vegetal components quality;
- the extent and density of the arborization assemblages;
- the fact of constituting a testimony of the native vegetation;
- the location of the vegetal assemblage in the city and its importance as a landmark and as a ‘pause’ between areas densely occupied;
- the lack of bulky vegetation in the considered neighborhood;
- the area typology where the vegetation is inserted, its use degree (intensity) and its visual enjoyment potential;
- the vegetation contribution to better the environmental conditions.

For isolated arboreal samples, the selection criteria for inventorying were the rarity or the reduced incidence of the species in the municipality; the size magnitude; the condition of being a native sample of non-often planting; and finally, the samples importance in the landscape. The progresses achieved in the realization of this work mainly regard the incorporation of the qualitative dimension in the analysis process.

The employed methodology was based on the crosschecking of aerial photos and city maps (scale 1: 5 000), followed by corrections made by site survey. This work resulted in a publication entitled ‘Significant Vegetation of São Paulo Municipality’, released in December 1988, and served as an important input for the formulation of legal environmental protection tools, enlarging the knowledge possibilities and providing research directions in the botanic and landscape fields“ (in *Situação atual das áreas verdes - estudo de caso: distrito de Moema*, BARBEDO, JARDIM et al, 1993).

*** THE CASE OF BELÉM**

In Belém, a quantitative inventory of the very particular arborization, that is to say, the green areas and gardens belonging to *public and private buildings*, was carried out. The involved analysis criteria, based on spatial units samples more or less coinciding with the different city neighborhoods, were:

- the total public buildings' green areas surface;
- the total private buildings' green areas surface, sub-analysed with regard to:
 - the total surface occupied by gardens;
 - the total surface covered by the trees shadow;
 - the volume resulting from the trees shadow;
- the total sum of public and private buildings' green areas surface.

For each spatial unit sample, the rate of private arborization surfaces in relation to its total surface was reckoned, leading to a conclusion concerning the private arborization proportional distribution within the urban grid as to the neighborhoods shares (SILVA BRASIL, 1995).

*** THE CASE OF MARINGÁ, LOCATED IN THE SOUTHERN STATE OF PARANÁ**

The innovative aspect regarding the arborization inventarying system in this case concerns the execution of separate quantitative and qualitative inventories, which were then crosschecked for a final formulation of a quali-quantitative inventory. For the formulation of such an inventory, it becomes necessary the appropriate knowledge of the arborization spatial distribution and the correct definition both of the sample units shapes and sizes and of the sampling intensity required for the envisaged precision (MILANO, M., SOARES, R., in *III Encontro Nacional sobre Arborização Urbana*, Curitiba, 1990).

8. FINANCING

Generally speaking, the urban greening plans, programs and projects as a whole carried out in Brazil are not followed up by a corresponding financing macro planning. When a specific short-term plan, as well as when a program or a project is conceived, a special correlate financing system is worked up for that particular occasion.

Indeed, no guidelines of permanent character at the municipal level stand for the budget allocation, and in the specific environmental field, there is not either a financing master plan associated with the environmental policies and political actions. No concern as to, for instance, the type of financing partnerships (whether with external sources, the private sector, non-governmental organizations or the population itself) and their respective share in the total envisaged budget to be allocated for the environmental sector seems to be present amongst the municipal governments' issues in most of the Brazilian cities. Rather unusual is when the municipal governments prioritize their strategies taking also into consideration the readiness and availability of the corresponding funding as well as its granting conditions, if any, with regard to application and amortization.

Part of these shortcomings can be ascribed to the public administrative discontinuity, since there is no legal requirement that compels a newly installed administration to proceed the plans, programs, projects and works of the previous one. The remaining responsibility can be

shared by the governments themselves and the political class, who prefer to start new programs, projects and works, which shall be used for self-promotion and political advertisement, instead of continuing the achievements of the preceding administration.

With respect to the specific case of the current municipal government of São Paulo, the very need of a special financing planning in the environmental sector has been acknowledged and taken into account in the formulation of the new *São Paulo Municipal Environmental Code*, already approved by CADES (Municipal Council for the Environment and Sustainable Development) and to be submitted to the House of Council for approval, as previously stated in Part 1 (*LEGAL, INSTITUTIONAL AND OPERATIONAL FRAMEWORK*).

According to this new environmental code, a special Fund for the Environment and Sustainable Development (FEMA), directly subject to the Municipal Secretariat for the Green and the Environment (SVMA), is envisaged. This fund will comprise resources proceeding from:

- budget grants specifically designed for the fund;
- additional supplementary credits designed for the fund;
- the capital deriving from fines imposed by infractions against the environmental legislation;
- donations from persons or national entities;
- donations from international entities;
- accords, contracts, consortiums, conventions;
- the revenue proceeding from the analysis of environmental projects and the access to the information of the environmental data bank and file generated by the SVMA;
- the profits obtained with the application of its own capital;
- the financial compensation for mining exploitation;
- other eventual revenues.

The FEMA resources are designed to mainly support:

- the development of plans, programs and projects:
- that aim the rational and sustainable use of natural resources;
- of maintenance, upgrading and/or recuperation of the environmental quality;
- of environmental research and activities;
- the control, fiscalization and protection of the environment.

The establishment of guidelines, priorities and programs for the fund budget allocation, in accordance with the Municipal Environment Policy and respecting the federal and State guidelines, is a task of the Municipal Council for the Environment and Sustainable Development (CADES).

The FEMA resources are administered by the Municipal Secretariat for the Green and the Environment, with close regard to the guidelines set by the Council for the Special Fund for the Environment and Sustainable Development, whose operation and duties are to be established in its internal statute. Such Council will be composed of the following members:

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- one representative of the Municipal Planning Secretariat - SEMPLA;
- one representative of the Municipal Financing Secretariat - S.F.;
- one representative of CADES;
- one representative of non-governmental environmental organizations, registered at the Municipal Secretariat for the Green and the Environment;
- one representative of the further NGOs registered at the SVMA.

The programs developed at present by SVMA are being implemented with the Municipality's own resources, as well as State and federal resources and also those obtained through international funding agencies, or in partnerships with private enterprises.

As an example, the PROCAM, which is the environmental component of PROCAV II - Program for the Canalization of Streamlets, Insertion of Streets, and Environmental and Social Reclaiming of Valley Regions, is to be mentioned. PROCAM, thoroughly presented in Part 2 (*PUBLIC INVOLVEMENT*), is a program which uses an international funding mechanism for the solution of environmental issues, obtained through the Interamerican Development Bank (IDB).

Another similar case refers to a program proposal still undergoing negotiation, which aims the recuperation and upgrading of parks in São Paulo City, and is envisaged to be partially sponsored by the São Paulo municipal government and partially funded by international sources. A summary of the sums involved in the financing of such a program proposal is presented below, in *Table 8.1*.

Table 8.1

**Proposal of a Program for the Recuperation and Upgrading of Parks in São Paulo City -
 Total Costs and Financing Sources**

<i>FINANCING SOURCES</i>	<i>VALUE (US\$)</i>	<i>PERCENTAGE OF CONTRIBUTION</i>
External Source	104,951,200	48%
Internal Source 2 - São Paulo Municipal Government	114,314,000	52%
TOTAL COST	219,265,200	100%

Source: Programa de Recuperação e Melhoria dos Parques da Cidade de São Paulo, São Paulo: SVMA, 1994.

Finally, a last and interesting example regarding financing systems based on the partnership with the private sector as well as with the civil society is the "One Million Trees Program", already introduced in Part 2 (*PUBLIC INVOLVEMENT*), and which foresees the arborization of the city through the trees planting, including fructiferous species, particularly along the city's streets and avenues.

The tree protectors shall have a space for advertisements and educational messages to be used either by the private sector or by citizens themselves, in order to fund part of the program as well as to protect the saplings. What is worthy remarking is the fact that the public involvement in this case is also by means of financing and not only concerns the organized civil society (NGOs), but rather integrates common individuals, who can bear the saplings maintenance costs by having in return the right to fix an educational message on the protector.

9. CONCLUSION

The sped-up development processes, through which the majority of Brazilian cities have passed in the latest decades, produced new and spontaneous land occupation models in the outskirts of big cities, transforming these latter into chaos. Due to the extremely vulnerable character of these outer areas, they deserve special attention on the part of a conscientious planning, for they naturally tend to an environmental deterioration caused by such an improper land use and occupation.

In a general way, these phenomena brought forth the need for a planning having in view the upgrading and expansion of the urban greening, since the struggle for space *devoured*, particularly in peripheric and low income neighborhoods, the few existing green areas.

The importance of the urban greening-oriented planning and control actions is presently acknowledged by the Brazilian society, whereas many proposals have already been formulated to warrant an effective commitment in the actions implementation. In this way, the Strategic Planning concept, regarded under the same approach found in the managerial culture of modern private enterprises, has been disseminated in the public sector, specially at the local level.

The publishing of the São Paulo Local Agenda 21, for instance, which represents a commitment of the São Paulo Municipality towards the sustainable development and the inclusion of the environmental concern in all fields and levels of political action, constitutes also part of a compromise assumed by Brazil during the UNO International Conference on Development and Environment - ECO 92, held in Rio. In this commitment document, through the provided objectives, actions and implementation means regarding strategic fields of action, the guidelines for tackling the environmental problems in São Paulo City, specially by means of the local power strengthening, become clear.

The current institutional framework responsible for the green areas management as well as its performing and articulating system within the three governmental levels (federal, State and local) is in need of a review, in which not only the governmental institutions, but also private entities and the population could take part. This framework urges to have its technical personnel upgraded and well-equipped, so as to satisfactorily perform in the planning and management of public urban green areas, owning thus a wide domain of the most up-to-date concerned techniques and knowledge, acquired through research, documentation, creation and maintenance of data banks, and training.

The intensifying of actions and works in environmental education, both formal and informal, represents a safe path towards the widening of public involvement in green areas programs, in a way to assure the environmental conditions diagnosis of such areas for further handling, the spread of related information and knowledge, as well as the observance of green areas destination. Hence, greater opportunities for the NGOs intervention are equally created.

The procedures for establishing financial sources to subsidize urban greening programs and projects as well as the green areas control and management need to be enhanced by means of mechanisms that:

- include the adoption of charges and fees associated with the use of these areas;
- render opportunities for the entrepreneurial marketing; and finally,
- foster covenants with other governmental levels and international financing agencies.

Concerning the specific case of São Paulo City, the new *Municipal Environmental Code* envisages already the creation of a special Fund for the Environment and Sustainable Development (FEMA), what constitutes an important measure in order to assure the necessary budget allocation for the urban greening actions implementation as well as for the existing programs and projects operating.

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