GOALS FOR URBAN FORESTRY IN BELGIUM IN THE YEAR 2000[1]

by R. A. Impens and R. Paul

Urban forestry policies are not established on a national level in Belgium. Urban green spaces, parks, and periurban forests are numerous; some of them are very old, created in the medieval period or during the last centuries. As green spaces are built on decades of experience, experimentation, and professional know how, they are a real source of environmental well being.

Each town retains responsibility of its own green areas, with municipal officers, specialists, and workmen being responsible for the management and care of all trees and green spaces. There is no central office coordinating the research and management policies in urban forestry and ornamental arboriculture. A special state department, called "plan vert" (green project), created in the 1950's, was designed to help towns in urban forestry programs and to manage plantations near highways. The engineers and officers of the green project constitute a team of specialists developing and coordinating all urban forestry activities. Their job has been limited by an old and well appreciated, historic and political meaning, the independence of each city, and the distribution of authorities and responsibilities between state, regional, and city administrations.

During the next 20 years, Belgian urban foresters will encounter a lot of problems, i.e., how to preserve historical "green areas" in old and touristic towns, the ways to create new plantations more adapted to urban conditions and pollutions, and the research of new tree species and the techniques for more progressive urban forestry programs.

Green Areas in Old Towns

For a country like Belgium, with high population pressures on a limited area, green space, especially in towns and highly congested urban districts (such as the Meuse Valley, the Antwerp industrial and harbor area), assumes a major importance with respect to environmental benefits, physical, and ecological well being.

Green areas are exposed to many causes of decline. It is not so much the pressure of traffic, air pollution, or climatic changes as the pressure of city expansion and the economic value of building sites. In Belgium, as in nearly all the industrialized and developing countries, towns are expanding taking into use more and more agricultural land. The urban growth has embodied a lot of green spaces such as forests, fields and meadows, military exercise grounds, parks, and historical or private gardens.

An evaluation of the green spaces in larger European towns is difficult due to the varying appraisals of its meaning. This evaluation differs following a study of the historical core of the city, the surrounding districts, or even the suburbs. Other problems lie with the differing conceptions as to the inclusion of cemeteries and playgrounds, or the estimation of the areas that street trees represent. As an example, Brussels, with its 19 districts covering 138 km^2, and more than a million inhabitants, has a green space area of 28 square meters per inhabitant. In the city center of Paris, with its 2.6 million residents, each enjoy 7.5 square meters of green space. When the surrounding districts of Neuilly, Vincennes, Boulogne-Billancourt, with their suburban forests, are taken in account, this increase to 18 square meters per inhabitant.

In historical towns, urban green spaces have a long history too. In the crowded little medieval cities, area was restricted. Only a few rich citizens or institutions maintained gardens and parks for leisure and decoration purposes. Some of these gardens still exist today as inner city green areas, and have to be specially protected.

Brussels' Jardin d'Egmont and Royal Park are represented in very old maps or tapestries (of the XVIth century) where they are described as game animal reserves for the monarch. The structure and landscape of these "historical gardens" must

1. Presented at the annual conference of the International Society of Arboriculture in Quebec City, Canada in August 1984.

be maintained in respect of the aesthetic heritage they represent.

We find lines of old trees with special trimming requirements. The replacement of dying trees will encounter a lot of difficulties, e.g., the occurrence of Dutch elm disease attacking the old elms of the Royal Park has accelerated studies to prevent decay of trees. Trunk injections of fungicides were made with a high percentage of failure. Other species will be used to replace the dying elms. Some majestic avenues with monumental chestnut or lime trees became too old and hazardous with high risks of accidents. They had to be removed. New trees of the same species must be interplanted. It is necessary to favor these historic areas and maintain the aesthetic effects. As an example, the Avenue de Tervueren, a large avenue ornamented by four files of old and majestic chestnut trees must be renovated, as most of the trees were decayed.

Recently, there was an important press campaign followed by a citizen referendum for maintaining the decaying trees. All explanations about the need for replacing old trees by new ones were ignored by the citizens. After a long, controversial discussion, a decision was made and 20-year-old planes were transplanted in their new locations, with a high rate of success. Special attention for the transplanting of big trees was taken; the soil was fertilized and improved with manure and compost, water was regularly added, trunks were properly braced, transpiration was reduced, and special trimming was performed. The cost of such a prestigous operation was particularly high, but the results are aesthetically full of promise.

In other cases, a short-term goal has been to replace the older trees with container trees. Other long-range objectives would be to assure that the avenue has a continuous tree cover. This might be realized by interplanting slow-growing, long-lived trees with faster growing, short-lived ones.

New Plantations and the Peripheral Belt

Urban green areas within the city core have traditionally been handled by citizens (owners of the gardens, parks, and meadows), public institutions (hospitals, churches, universities, etc.), or city-employed horticulturists. On the other hand, the forests in the urban periphery have always been under the management of state foresters. Forest engineers have received the standard Belgian forestry education at the university (faculty for agronomy and forestry), and are following a long-term policy for timber production, which remains a major objective. Recreational and environmental benefits are other goals of these peripheral forests, which are much appreciated by the urban citizens.

Our major towns have retained more or less continuous green belts, relicts of the old peripheral forests. They serve as buffers between the city's core, industrial districts, and outlying suburban areas or neighboring agricultural areas. In Brussels, the Boi de la Cambre, with its lake and great lawns, is well known. The Foret de Soignes (4,369 hectares) is a large and famous beech forest. In the northern districts of Brussels, new forests were designed and planted to form a green belt between residential areas and the industrialized area near the Channel. Air pollution conditions will be encountered in these new plantings.

The urban green belt serves primarily as the recreational playground for city people who seek fresh air, solitude, free movement, relaxation, and contact with nature. Some special areas are prepared such as bicycle or horse trails, ponds, picnic groves, etc.

Mixed forest types are planted in the new green belt, with the addition of exotic specimen trees (Sequoia, Metasequoia, Tsuga, different American maples, oaks, etc.), some uncommon native trees (Carpinus, Sorbus, Malus, Juglans, etc.), or even a few fruit trees (Corylus avellana, Prunus avium, etc.).

The variety of ownership of the urban and peripheral forest, its distribution over wide regions, and being shared by a number of muncipalities, would appear to create political obstacles for the establishment of an urban forest management authority; the organization responsible for urban forestry within the urban area. We hope that the new peripheral forests will be managed by foresters especially devoted to social, leisure, and tourism objectives. Through a coordinated and qualified forest management design, the peripheral forest can satisfy the varied urban needs in an optimal manner, at low cost.

New residential districts are continuously being developed with a special design for green areas, sports areas, and the creation of city gardens.

Garden cities, built in the 1920's, are well known for their "modernism." Every year, in the spring, there is a "cherry tree festival" in Watermal (southeastern district of Brussels), where a collection of different ornamental Prunus species are blooming. In this district, city homes are built with the same format: shrubs in front along the street, lawns and trees on the sides, and a small garden in the backyard. All are the same and enjoy the continuous green area.

In the newly designed garden cities there are no more hedges, and private gardens are replaced by collective space for children's games. Shrubs and groves predominate. Trees are reserved for the street ornament and shade for bicycle trails and walks. Traffic of motor vehicles is well separated from pedestrian and children ways.

Urban expansion in industrial regions has led to the reclamation of idle wasteland, railroads, old factory courtyards, and mine spoils. These poor and disturbed soils are amended with compost, peat or garden soil, and planted with species of Salix, Betula, Populus, or even Alnus.

An example for reclamation of mine spoils is the town of Charleroi, located in a coal mining region. When economic evolution led to the closure of the mines, the municipal horticulturists created new parks and district-urban forests on spoil heaps. The urban landscape is given a new look; the town is surrounded by artificial hills covered by trees and shrubs. Playgrounds for children were designed for these new green areas. In other towns, former garbage mounds are covered with lawns and converted into major recreational attractions and new district parks.

Abandoned railroad rights-of-way have been transformed, after removing the rails, into pedestrian walks, and the wild flora is protected. The only management of these walks is to keep them in repair, and to make them suitable habitats for bird and wildlife development. Portions of the walk may be devoted to a living lesson in ecology, with signs describing the region's flowers, birds and game animals, and characterization of geology, soils, and occurrences along the walk.

Underground parking or railroads are often covered with a layer of soil, and new green areas are created above the concrete. Special attention is required for soil irrigation and the choice of species since superficial rooting is needed. Only a few trees are planted between shrubs, hedges, and woody ornamentals disseminated in a lawn site.

In the city core and near shops and galleries, green pedestrian ways are planted, including trees (grown in containers), shrubs, flowers, and lawn plots. Of special interest is the recreational and aesthetic aspects: benches, terraces of cafes and restaurants, fountains, and ornamental sheets of water, pavement variations, statues, mosaics, etc. Groups of trees may be used to articulate, to contain, and to define more clearly the space and to delimit the traffic of vehicles. Screens of plants are used to hide unsightly idle grounds or wild parkings. Street trees are able to form a canopy along the walks under which pedestrians move. Small areas of park supplemented by extensive urban tree planting serve to clean the air, block dust dispersal, and to a certain extend reduce the traffic noise.

Tree Selection and Research Objectives

Our cities contain a vast variety of tree species. A recent inventory of 90,000 street trees in Brussels enumerated 86 different species. That forms heterogenous populations of trees susceptible to a great number of diseases and pathogens which are specific to each genus. This diversity of species keeps most pathogenic agents to an endemic level, which inhibit some large epidemic effects and contribute to a large variety of landscapes. When species are more frequently encountered in an urban area, their health may be severely affected by some diseases (Table 1).

Platanus acerifolia and *Prunus serrulata* are the two major species in Brussels (about 25% of the street trees). Their large occurrence is correlated with a recent spread of *Gnomonia platani* (anthracnose of plane tree), which is responsible for an important dieback of this species. Observed rarely during the 1960's, the disease occurs more and more frequently and invades new territories every spring. New plantings are affected too. In some locations it will be necessary to remove dying trees or to prune the diseased young trees. No

chemical control measures are applied.

The main reason for uncertainty in deciding which species or cultivar to plant is the difficulties of predicting health and survival under urban conditions. Selection of urban trees must be based on general and specific criteria. New species or cultivars have to be introduced into urban sites and to be surveyed for their performances. Attention must be given to survival after planting, growth rate, risks of disease and insect injuries, nutrients, and water requirements, and maintenance costs (trimming and pruning frequencies). The longevity of trees growing in specific urban sites must be correlated with soil, drought, and air pollution conditions, etc.

There is a lack of such information on cultivated species or cultivars. One of our research projects is to compare some new introduced species, and to collect observations and information on their behavior in Belgian towns (Table 2). These comparison trials of different species in various urban environments will be important to detect the tolerance of trees to urban stress conditions. Improper choices of species can result in serious losses due to premature death and removal of the tree, or a greater susceptibility to pathogens, pollutants, and climatic stresses.

Selection of urban trees must also be based on other significant considerations. Among them, the initial and ultimate size of a species in relationship to the height of surrounding buildings, the narrowness of the street, the importance of the traffic, and the number of pedestrian users. Tolerance to deicing salt injuries, dryness of ground, the compactness of soil, heavy metals contamination, and anaerobic conditions near the roots are some of the problems we have to resolve.

Our experiments on resistance to atmospheric pollutants are performed in fumigation chambers and in field pot trials. We agree with the opinion that comparison of field tests with chamber fumigations indicate that revisions will be made in sensitivity lists.

One of our local problems is poor soil aeration. These conditions are due to a soil surface sealed by flag pavements, asphalt or concrete, soil compaction, natural gas leakage, or exceptionally high biological activity in the soil (landfill gases). Anaerobic soil conditions, whatever their cause, are especially disastrous for street trees. Root growth is stopped, while root respiration and the uptake of water and nutrients are reduced.

In our trials since March 1977, big containers filled with different kinds of urban soils have been artifically gassed with natural gas (40 L/hr). Comparison of these treated soils with the same soils ungassed is made for several criteria: change of pH, evolution of microflora (total microflora, molds, Actinomycetes, and specific methylotrophic bacteria), of ATP in soil samples (an indicator measurement of soil biological activities), water content, and water retention.

Our results show that gassed soils have a better water retention in spite of a superficial dry layer.

Table 1. The 20 major tree species in Belgian towns.

Platanus acerifolia (Ait.) W.
Prunus serrulata Ldl.
Robinia pseudoacacia L.
Acer platanoides L.
Tilia platyphylla Scop.
Aesculus hippocastanum L
Prunus cerasifera Ehrh.
Acer pseudoplatanus L
Populus nigra L.
Crataegus oxycantha L.
Malus atrosanguinea (Sieh) Schn. (x)
Sorbus aurcuparia L.
Tilia europaea L.
Sorbus aria (L.) (Crantz)
Tilia euchlora K. Koch (x)
Populus euramericana Guinier (x)
Betula verrucosa Ehrh.
Acer saccharinum L.
Aesculus carnea Hayne
Crataegus lavallei Herincq (x)

Table 2. Ten new species for urban plantations.

Carpinus betulus L.
Catalpa bignoniodes Walter
Ulmus glabra Huds
Crataegus monogymna Jacq.
Sophora japonica L.
Metasequoia glyptostroboides Hu f. Cheng
Ailanthus altissima (Mill) Swingle
Paulownia tomentosa (Thbg) Steud
Ginkgo biloba L.
Gleditsia triacanthos L.

Aerobic soil conditions are characterized by an alkaline pH (around pH 8.0); gassed soils (after 6 years of treatment) are neutral (pH 7.0). There is biological activity in gassed soils as measured by ATP content. This is confirmed by microbiological tests, and by an increasing content of organic carbon in gassed soils.

The accumulation of organic matter and the extent of the anaerobic zone depend on the exchange of gases between soil and atmosphere. Under pavement this exchange is restricted, so less oxygen is available for microbial oxidation of the gas, and consequently there is an accumulation of organic matter per unit volume of soil.

Our next research goals will be to determine which bacteria are natural gas consumers (methylotrophic bacteria, to characterize the phytotoxicity on roots, grasses and young trees, and to follow the reaeration of anaerobic soils.

Another problem is caused by deicing salt treatments. We are busy with tests for salt tolerance. This offers the only logical approach for accurately determining the degree of plant resistance or susceptibility. In our open field trials, four common tree species (*Acer pseudoplatanus, Sorbus aucuparia, Tilia platyphyllos,* and *Platanus acerifolia)* are submitted to daily treatments with soil-applied $CaCl_2$ (14 times, 30--60 g/m^2). Soil samples are collected at 20 to 40 and 60 cm depths and analyzed for their Ca^{++} and Cl^- content, pH, and moisture.

Soil salinity treatments resulted in marked visual differences among the four species, with appearance of specific symptoms and necrosis. Linden was the first species to show symptoms (47 days after the buds open), followed by maple (64 days), mountain ash (77 days), and plane (87 days). Presence of Cl^- in the leaf tissues were correlated with sensitivity to dryness in the soil.

Air pollution is frequent in our crowded towns. We are testing, with fumigation chambers, the relative sulfur dioxide tolerance of some commonly planted shrubs and shade tree cultivars. In our eastern forests a new disease, known as "fir dieback", has increased alarmingly. Our laboratory was chosen to survey this new forest decline. This injury affects spruce, fir, and beech in virtually all age categories, although with certain differences in symptomatology. Some of our peripheral forests near industrial towns are being surveyed for the early detection of such a dieback.

Another survey and warning system is the creation of a monitoring network of indicator and accumulator plants. Such a network was created by our laboratory in 1978. It is still in effect and 24 experimental plots are disseminated in industrial urban and rural areas.

Conclusions

The defining of green space goals must involve the citizens. Urban forestry is a public program; it must, therefore, serve the public's needs.

We can no longer be satisfied with managing urban forests, green areas, and street trees on a day-to-day basis. We need long-range management planning and research. In the next 20 years, many of the trees planted in our towns will have to be removed and replaced. Our research on species selection must be based on a better knowledge of urban life conditions for trees, more information on present conditions of the trees and their expected longevity, and special attention to maintenance requirements.

We are awaiting a state or regional authority responsible for urban forestry. It might coordinate integrated pest control, municipal tree nurseries, the purchase of plant material and its use, the choice of composting processes, and general policies for tree management and care. It might utilize tree inventory systems and data banks and management with computers. It might initiate research on new cultivars and new maintenance cares.

Our investigations carried out in Brussels and in different Belgian towns show how complex the ecological and technical factors are in urban forestry.

Belgian people are well known as good gardeners. With a greater exchange of information between urban foresters in the USA and our municipal horticulturists, we are sure to win the challenge of preserving the green areas in our crowded towns, and meet the environmental needs of our citizens.

Faculte Sciences Agron de l'Etat
196 av A.J. Slegers
Woluwe St-Lambert, Belgique