MANAGING URBAN FORESTS USING FORESTRY CONCEPTS

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Abstract. In the past twenty years, management planning for the urban forest has become commonplace in this country, but has not yet focused on long-range objectives. Steps used in forest management planning are outlined and applied to urban forest management. Other forestry concepts, such as age structure and rotation, can also be applied to the urban forest and should be given more serious consideration in its management.

Over the past twenty years the concept of urban forestry has been introduced, and to some extent, accepted by urban tree managers. A direct result of this has been that many cities and towns throughout California and the rest of the country are attempting to incorporate the principles or urban forestry into management plans for their street trees and parklands. But most of these efforts should be regarded as only a first step; a step from no management toward short-term management planning. To write management plans which consider the next 5 to 10 years work is not enough. If we are to continue calling urban tree management "urban forestry," we must begin writing management plans which encompass the entire life span of the trees we are working with. We plant trees in our cities whose life spans range from 20 to 200+ years, so our planning must of necessity be long-range. Unfortunately, due to political and economic considerations this is too often not the case.

I would therefore like to challenge each urban forester to begin thinking in terms of what the forests under their care will be like in one hundred years. Many of the trees growing in our cities will no longer exist. A far-sighted urban forester will have begun to think about replacement of these trees, in a manner which will cause minimal environmental and political disturbance. He will also have begun to consider economic factors such as the cost of maintaining those same trees over an extended period of time and the possibility of using wood quality as a factor in species selection. Another example of the kind of long-range management to which I am referring is considering the environmental changes which will take place over the next hundred years and incorporating these potential changes into the planning process. Specifically, air quality will most likely continue to deteriorate in many cities. Urban foresters should be seeking trees to plant that are both tolerant of air pollutants as well as efficient filterers of particulate matter.

Urban Forest Management Planning

If urban foresters are to develop long-range management plans, there must be a system which can be readily used and adapted to particular situations. Following is an outline of the steps that should be systematically used in developing any forest management plan — urban or otherwise.

The first step in management planning is by far the most important, yet it is too often neglected or is itself the cause of our short-sightedness. This step is the defining of the management plan's objectives. These objectives can be a mixture of both short-range and long-range goals, but long-range objectives must not always be given second priority. As an example, let us suppose that a group of older trees along a major boulevard is dying. A short-term goal would be to replace the trees. Long-range objectives would be to guarantee that the boulevard has a continuous tree cover, perhaps by interplanting slow-growing, long-lived trees with faster growing ones and possibly selecting the "nurse trees" not only for their fast growth habit but also for the ultimate usefulness and salability of their wood.

The defining of objectives must, of course, involve the people of the community, since it must not be forgotten that urban foresters are public servants and that they must therefore serve the public's needs. Work crews also must be involved in this process. They have a wealth of practical information and ideas which are too often not drawn upon.

Once the plan's objectives have been enumerated, a thorough inventory of the present urban forest must be undertaken. Any data that will assist in defining future tasks must be gathered at this time. Some examples of the kinds of information that should be gathered are:

1. species composition
2. present condition of the trees and their expected longevity
3. maintenance requirements (preferably by species so that intelligent species selection can be made in the future)

It is not within the scope of this paper to identify all the attributes of a good urban tree inventory system; but the importance of an inventory to intelligent resource decision-making cannot be over emphasized.

Once the current status of the urban forest is known, the writing of the management plan can begin. The plan essentially outlines the steps required to turn the current forest into the forest described by the plan's objectives. A time frame in which to complete these steps must be included as well as an analysis of the costs involved and how these costs are to be met.

Implementation of the plan then begins according to the time frame that has been constructed. Do not forget that we are discussing long-range management, so this time frame may be 20 to 50 years or longer and will encompass changes in the urban forest over the next hundred years or more. A prime example of this type of long-range planning can be found in San Francisco's Golden Gate Park, where the management plan covers the first three 75-year rotations of trees in the park.

Public involvement is also extremely important at this stage. People need to see that the plan is being carried out and that the objectives, which they helped to define, are being met. There are two other reasons for involving the public at this stage. First, their help can and has been proven to reduce costs, by providing labor and by protecting new plantings. A prime example of this can be found in Oakland where the vandalism rate dropped from 95% to less than 2% simply by getting the people to plant their own trees (Cole, 1980). A second, and perhaps more important reason for public involvement is that since obtaining enough money for our programs is of prime importance today, having the political (i.e., public) support for these programs is the best way to obtain financial support for them.

Of course, it must be realized that political and economic realities change over time, so any long-range management plan must be made flexible. Flexibility can be provided for in the last two steps, re-inventory and re-evaluation. The urban forest should be periodically re-inventoried to document that planned changes in the forest structure are indeed taking place and to determine if there are new factors which need to be taken into account in the management of the urban forest, such as disease or insect infestation. Re-evaluation would include careful study of the objectives of the plan and the steps being used to implement it. Re-evaluation must also have further public input to ensure that the public's objectives are being met, and should again include input from crew members to determine if changes can increase their efficiency and effectiveness.

Indeed, public input cannot be emphasized enough, for it has been found that this involvement can be a tremendous asset to urban foresters by providing original ideas, volunteer labor, fund-raising, educational activities and political support for urban tree care programs.

Long-range management planning has been discussed very briefly by outlining the steps used in traditional forest management planning. To summarize, these steps are:

1. Defining the objectives of the management plan in order to give the planners a definite direction to follow.
2. Inventory of the current urban forest to determine its condition and compare it with the forest described by the objectives.
3. Writing the management plan to encompass:
   a) the steps required to change the current forest to the one outlined in the plan's objectives
   b) the time frame in which to accomplish these steps
4. Implementation of the management plan using the time frame outlined in the plan
5. Re-inventory of the urban forest on a periodic or continual basis to document changes tak-

ing place as a result of the plan's implementation
6. Re-evaluation of the management plan to ensure that the public's objectives are being met
7. Public input and direct involvement should be continuous, but must be included in the first, fourth and final steps.

Other Applicable Forestry Concepts

Several articles have recently appeared in scientific journals which emphasize the state and federal grant programs and tree planting projects as good examples of urban forestry. These are indeed good examples of specific components of urban forest management plans, but the term "urban forestry" means more than these articles imply. If urban forestry is to continue being a viable concept, it must bring the application of forestry principles to the community forest and to its inhabitants. Most forestry concepts are indeed applicable to urban forest management, both of street trees and park lands. Five examples of the application of these forestry concepts to urban tree management will be presented here.

Age structure is probably one of the most applicable concepts to which I am referring. There are two types of management in forestry; even-aged and uneven-aged. Most urban forests are managed on an even-aged basis, at least at some scale. An example would be a street in which all the trees along it were planted at the same time. Foresters consider a stand of trees that varies in age by 20 years or less to be even-aged. An uneven-aged forest would be one in which the tree's ages span a longer period of time. An example might be a park in which the trees have been planted over the last hundred years, or even a street tree system where certain trees have been periodically replaced.

Scale must be viewed as a major determinant here. A particular stand of trees in a park may be even-aged, but if stands scattered throughout the park were planted over a long period of time, the entire park might be considered uneven-aged, being managed on what foresters call a group selection system. Foresters usually consider uneven-aged forests to be those in which the individual trees are of varying ages, having no large area covered with trees of the same age. Few urban forests would meet this definition, simply because most of them have been planted within a relatively short time span. Yet the uneven-aged structure is one which should be striven for in urban forests since a definite goal in urban forestry management is to have a continuous forest cover. In order to accomplish this, we must continually be replanting trees, for an uneven-aged forest, by definition, must have a larger number of younger trees than older trees.

Species diversity, we have all heard, leads to greater ecological stability and should therefore be a goal of all urban foresters. I do not believe I need to expound upon this, since the example of the American elm and Dutch elm disease is stronger logic than any I could present here.

Creating a greater species diversity within out cities also can be an indirect method of creating an uneven-aged structure to the urban forest, if we choose species whose lifespans very considerably.

Visual diversity in form, color, and texture add to the aesthetic value of our urban forests and should be striven for. This is, actually, a principle of landscape architecture rather than forestry which is only now being applied to forests, but one that has long been used in our cities and parks.

The concept of rotation, however, is not being used in most urban forests. Some cities are beginning to explore its uses and application, most notably Oakland, California. The major argument against its use is a negative public reaction to the idea of growing trees to a ripe old age and then inadvertently cutting them down simply because the end of the rotation cycle is at hand. This is not, of course, how this concept should be used in our urban forests.

In forest management, the rotation period is defined by economics. In urban forests it should also be defined by economics. The difference lies in the method of determining the value of the tree and in the costs involved. A tree grows at a certain rate throughout any portion of its lifespan. This rate slows down as the tree ages. The tree's total value in board feet increases as the tree grows in

girth and height and this increase in value also slows as the tree's growth does. The rotation period for the forest tree is determined by the age at which its growth in value begins to decline below a certain specified rate.

The main difference between the landscape and the forest tree is that the value of a landscape tree is determined by aesthetics and age, rather than by board foot volume, so that its value continues to increase at a fast rate longer than it would if the tree were in a forest stand. But unlike a forest tree, the cost of maintaining an older landscape tree in a healthy vigorous condition also increases. There must be an age, then, at which the landscape tree is costing more to maintain than it is worth. Economically speaking, this should be the end of the rotation cycle for a landscape tree. In this age of economic hardship, we need to find a method to determine this "rotation period" for each of the species we deal with in our urban forests.

Factors which determine the value of a landscape tree are its size, its condition or vigor, its location, its historical significance, and the value of its wood. Factors that add to the cost of maintaining the tree include its size, how often it requires pruning, its condition in terms of disease or insect control, the extent of any heartrot, the extent to which it is causing sidewalk, foundation or sewer damage, and the costs of removal and replanting.

These factors do not necessarily have to point toward a specific age at which all trees of the same species are removed. But they certainly should be used as guidelines that will help us to reduce future costs. An example would be planting fast-growing trees which are notorious for breaking sidewalks (such as Liquidamber or fruitless mulberry) only to the size at which they begin to cost the city a specified amount in sidewalk repair. If this age is known and planned for by interplanting other trees along the same street, and the trees are replaced when removed, public objections to the trees' removal should also be minimized. The essential point here is that we need to consider not only the tree's value but also its costs, and then balance the two.

Species selection, then should be based on more than a tree's aesthetic value and its ability to withstand and grow in the urban environment. Its ultimate cost to us must also be given serious consideration. Factors that may limit the use of a particular species or its economic lifespan include:

1. pruning requirements — frequency and intensity
2. disease or insect susceptibility
3. tendency to be shallow rooted, thus causing sidewalk damage
4. quantity of litter produced
5. ability to withstand root and heart rot organisms
6. biological lifespan
7. ultimate size
8. quantity of water required for establishment and drought tolerance

A final factor which should be discussed in more detail is the cost of disposal of the trees when they are removed. Most cities today are faced with increasing costs of disposal due to less available space for landfill and longer hauling distances to the sites that still remain. We are therefore faced with disposing of large volumes of wood through new methods. Much of this wood is being used as a ground cover, mulch or compost in our parks. But a tree species' ultimate value for lumber or firewood should be given serious consideration during the planning process. If we can gain some monies in the process of disposing of these trees, then we should by all means do so. I am not saying that this should be one of the first considerations in species selection, but it should certainly be given substantial weight in this decision-making process.

In conclusion, I would like to return to my opening remarks to repeat that, as urban foresters, we can no longer be satisfied with managing street and park trees on a day-to-day basis. Instead, we must constantly be looking ahead, trying to picture what the urban forests under our care will be like in the future; and in the process, strive to reduce costs to future generations through thoughtful, long-range management planning.

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