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MAINTAINING AND PRESERVING WOODED PARKS

by Thomas L. Green

Abstract. A rapid and simple evaluation system has been developed by the Morton Arboretum to enable managers of wooded parks to assess the relative health of park trees and predict their longevity. This system facilitates the preparation of planting plans and budgets. Each park tree is assigned to one of six condition classes. An overall inventory provides figures on both the species composition and the percentage of trees in each condition class. The breakdown into condition class categories enables park managers to recognize declining trees and make decisions as to when to replant, how many to replant, and what species to replant in order to perpetuate and enhance the woodland character of the park. This system is especially helpful in parks where tree decline is present but not obvious. Also, this system may be utilized by city arborists and homeowners to forecast tree longevity.

Key words: *Tree inventory; Forecasting tree longevity; Park management.*

Many cities and towns in the United States have beautiful wooded parks with valuable trees. In many parks great numbers of trees are mature, over-mature, and declining. The rate of tree loss usually is not known. Indeed, it is only over a long period of time that tree loss becomes apparent with the increasing openness of the canopy. Park managers typically respond to this problem with a short-term budget request for replanting. Complete reforestation seldom occurs, and when it does, it usually occurs during a short period of time and requires a major expenditure of funds. Provision for modest outlays annually would be more desirable.

Since park trees, like all other living things, start as embryos, develop, mature, grow old, and die, they are not permanent parts of the landscape, though park visitors may imagine them to be. Many of our parks were developed from pre-existing woodlands, and the trees are now suffer-

ing from advanced age and the impact of heavy use accompanying urbanization. In many of our old city parks the former forests are slowing trending toward open meadows. Most of these parks lose a few old-timers each year. This gradual loss of park trees was observed by Barker (2) in the recreation sites in the forest lands of the western United States.

Information on tree management and projections for tree loss cannot be found in park management and park development literature. Barker (2) reported that he was unaware of any records for systematically projecting tree loss. This paper presents a systematic procedure for projecting tree loss and determining replacement needs. This system is a modification of an inventory procedure developed for projecting tree loss in urban forestry (4). The park inventory and tree evaluation scheme attempts to determine tree health and to estimate a tree's expected longevity by placing it into one of six condition classes. Tree "condition classes" have been used previously in urban tree evaluation, but the classes dealt only with tree health (1). In the *Guide for Establishing Values of Trees and Other Plants* (3), tree "condition" is based on several health factors including life expectancy. Richards (4) recognized four classes in developing a tree "condition" rating system involving health and longevity. His classes are: developing, stable, declining, and deteriorated. In this study, the condition classes reflect tree size as well as health and longevity.

Materials and Methods

Reed-Keppler Park is a forty-acre city park located in West Chicago, Illinois. Approximately

one-third of the park is forested with native hardwoods predominantly mature and over-mature oaks. Concerned about the steady loss of oaks, the West Chicago Park District Director agreed to a cooperative research program with the Morton Arboretum, Lisle, Illinois. During the fall of 1981, all park trees were identified to species, sequentially numbered, plotted on a map, and rated for condition class. Data sheet inventory forms included tree reference number, identification, height, diameter at 4.5 feet, location, condition class, and remarks.

Condition Class. The condition class characterizes the size and relative health of an existing tree:

Class

- 1 Young tree; seedling, sapling, or recently planted; apparently healthy and not yet near final height and shape.
- 2 Developing tree; no major visible defects; well established; indicating ultimate height and shape.
- 3 Mature tree; may show some defects; mature shape and height; life expectancy beyond 20 years.
- 4 Declining tree; exhibiting major defect(s); life expectancy less than 20 years.
- 5 Deteriorating tree; exhibiting such serious defects that immediate removal is warranted.
- 6' Stump; location of a previously inventoried tree now removed.
- 6" Location for future tree. (The Elmhurst [Illinois] Park District adopted this condition class system for park master plans except that class 6 represents future tree plantings.)

All condition classes except Class 4 are rather easy to recognize. Distinguishing between Classes 3 and 4 is the most difficult inventory determination. Some obvious defects or factors contributing to decline must be present to indicate that the tree is not expected to live for another twenty years.

Condition Class 4: Defects and factors contributing to decline:

Roots: Underground girdling roots (apparent from a flattened to concave trunk at the groundline); fill soil added; soil level lowered; com-

pacted soil; poorly drained soil; recent trenching; planting in above-ground pots or where root growth is restricted; toxic chemicals (deicer salts, herbicides, excessive fertilizer).

Trunk base: Wounds (including lawnmower injury); hollow areas; above ground girdling roots; lack of basal flare (an indication of being planted too deep); fungal fruiting bodies (mushrooms, bracket fungi).

Trunk: Wounds; hollow areas and hollow branch stubs; fungal fruiting bodies; attached electrical wires, lights, signs, or fences (that create wounds for decay organisms to enter).

Top: Top broken out; storm damage; dieback at branch tips; chlorosis; small leaves; thinning crown; pre-seasonal fall color; excessive fruit production; pronounced shortening of internode length.

A tree with one or more of these symptoms and signs may or may not be placed in Condition Class 4. Judgment of the overall appearance and assessment of seriousness of debilitating signs must be used to predict whether the tree is expected to live for twenty years or fewer. For example, trees with severe decay are very prone to storm damage and are almost always rated in Class 4. There will always be trees that may be rated in Class 3 by some and in Class 4 by others. Similarly, intermediate trees between Classes 4 and 5 can usually be found.

Map. Each tree was sequentially numbered in the field with an aluminum tag and was plotted on a map. Each mapped tree's number was given a superscript (1-6) corresponding to the tree's condition class. The superscript was color-coded to indicate species (red = bur oak, green = white oak, etc.). A representative canopy, using symbols similar to those used by landscape architects, was drawn on mylar overlays. Condition Classes 1 and 2 were drawn on one sheet, Class 3 on another, and Classes 4, 5 and 6 on a third. The canopy symbol color corresponded to the species. These plastic overlays, as will be shown, give a comprehensive overview of the entire park at a glance.

Results

The results of the Reed-Kepler Park inventory are shown in Table 1.

Table 1. Reed-Kepler park tree species. 1982 Inventory.

| Tree species | Condition class | | | | | | Total | % |
|---|-----------------|----|-----|-----|-----|-----|-------|----|
| | 1 | 2 | 3 | 4 | 5 | 6 | | |
| <i>Quercus alba</i> , white oak | 0 | 0 | 104 | 72 | 6 | 6 | 188 | 30 |
| <i>Q. sp.**</i> , black oak | 0 | 4 | 39 | 109 | 8 | 5 | 165 | 26 |
| <i>Q. macrocarpa</i> , bur oak | 1 | 2 | 82 | 36 | 0 | 0 | 121 | 19 |
| <i>Prunus serotina</i> , black cherry | 1 | 24 | 22 | 3 | 0 | 0 | 50 | 8 |
| <i>Crataegus mollis</i> , downy hawthorn | 0 | 2 | 23 | 2 | 0 | 0 | 27 | 4 |
| <i>C. phaenopyrum</i> , Washington hawthorn | 0 | 0 | 6 | 2 | 0 | 0 | 8 | 1 |
| <i>Pinus resinosa</i> , red pine | 0 | 14 | 0 | 0 | 0 | 0 | 14 | 2 |
| <i>P. sylvestris</i> , Scots pine | 2 | 0 | 0 | 0 | 1 | 0 | 3 | <1 |
| <i>Carya ovata</i> , shagbark hickory | 1 | 0 | 8 | 3 | 1 | 1 | 14 | 2 |
| <i>Tilia americana</i> , linden | 0 | 4 | 3 | 1 | 0 | 0 | 8 | 1 |
| <i>Fraxinus pennsylvanica</i> , green ash | 0 | 2 | 5 | 0 | 0 | 0 | 7 | 1 |
| <i>F. quadrangulata</i> , blue ash | 0 | 0 | 0 | 1 | 0 | 0 | 1 | <1 |
| <i>Ulmus americana</i> , American elm | 1 | 3 | 0 | 0 | 0 | 0 | 4 | <1 |
| <i>U. pumila</i> , Siberian elm | 0 | 2 | 0 | 0 | 0 | 4 | 6 | <1 |
| <i>Celtis occidentalis</i> , hackberry | 2 | 2 | 1 | 0 | 0 | 0 | 5 | 1 |
| <i>Malus sp.</i> , crabapple | 0 | 0 | 4 | 1 | 0 | 0 | 5 | 1 |
| <i>Populus sp.</i> , aspen | 0 | 0 | 0 | 0 | 0 | 0 | 4 | <1 |
| <i>Acer saccharum</i> , sugar maple | 0 | 3 | 0 | 0 | 0 | 0 | 3 | 1 |
| <i>Prunus americana</i> , wild plum | 0 | 0 | 0 | 2 | 0 | 0 | 2 | <1 |
| <i>Juglans nigra</i> , black walnut | 0 | 0 | 1 | 0 | 0 | 0 | 1 | <1 |
| <i>Morus alba</i> , mulberry | 0 | 1 | 0 | 0 | 0 | 0 | 1 | <1 |
| <i>Hamamelis virginiana</i> , witch-hazel | 0 | 0 | 0 | 1 | 0 | 0 | 1 | <1 |
| Total | 8 | 63 | 298 | 233 | 16 | 16 | 634 | |
| % | 1 | 10 | 47 | 37 | 2.5 | 2.5 | | |
| Oaks | 1 | 6 | 225 | 217 | 14 | 11 | 474 | |
| % | 1 | 1 | 47 | 45 | 3 | 2 | | |

* Tree species listed in descending order of frequency by genus.

**Some of the trees in this group appear to be hybrids of black oak (*Quercus velutina*) and Hill's oak (*Q. ellipsoidalis*).

Discussion

This inventory will bring to the attention of park managers trees intermediate between Condition Classes 3 and 4. Recognition of these trees is very important because of the potential for rejuvenation by arborists through special treatments or with appropriate cultural practices (i.e., fertiliza-

tion, aeration, mulching with fallen leaves, incorporation of wood chip mulch. Such treated trees may remain in or return to Condition Class 3. Failure to recognize these transitional trees will doom them to continued decline and make recovery through arboricultural procedures impossible or impractical.

Trees intermediate between Condition Classes 4 and 5 are not yet dead, but probably are beyond hope of saving. These trees can simply be included in the routine removal schedule since there is less urgency for their removal than for the potentially hazardous standing dead trees.

How many to replant. Table 1 shows that 16 trees (2.5%) were removed in 1981 (Condition Class 6). Another 16 are standing but are dead and will require removal in 1982. At this rate of removal the park will lose 320 of its 602 remaining trees (53%) over the next 20 years. The inventory reveals that 233 of the 602 (39%) are expected to die during the same period. These numbers provide both a precise and an emphatic demonstration that a significant loss will occur. If replanting is not done on a regular (annual) basis, the net loss will exceed the net gain. The expected loss of 233 trees over 20 years breaks down to the loss of 11.65 trees per year. Since some replanted trees may not live to maturity because of transplant shock, accidents, site adversities, and vandalism, it has been recommended that a minimum of 15 trees be planted annually in Reed-Keppler Park. In 20 years, 300 trees will have been planted. Some of the fast-growing 15- to 20-year-old trees may reach Condition Class 2 or perhaps even 3 in that time span.

Where to replant. The plastic overlays are very useful in planning locations for replanting. The sheet containing the canopy representation of trees in Condition Classes 4, 5, and 6 will show the areas of greatest loss and where loss is expected. The sheet containing the canopy representation of trees in Condition Classes 1 and 2 shows the areas with existing young trees, the future canopy. It also shows areas devoid of young trees. With such visual aids, a park manager can more effectively plan a program for replanting in those areas devoid of young trees and in those for which the greatest losses are indicated.

What to replant. The completed inventory presents a clear picture of the species composition of Reed-Keppler Park: 30% are white oaks; 26% are black oaks; 19% are bur oaks; and all the other species together comprise 25%. Because of the lesson on vulnerability of monocultures learned from Dutch elm disease, a

replanting program should stress diversity. It is suggested that the composition be no more than 10-15% of any species. Native trees and shrubs are emphasized because they are best adapted to area soil conditions and climate. Since there is only one oak in Condition Class 1 and six in Condition Class 2, some oaks must be replanted if they are desired for future generations. With twenty years of planting diverse species, along with the loss of many old oaks, the percentage of each oak species will greatly decrease and move toward an optimum 10-15%.

Care must be taken in selecting planting sites. Hard maples, beeches, and lindens require moist but well-drained sites. Oaks, black cherry, and spruces require sunny locations. Sycamore, hackberry, green ash, river birch, and silver maple will tolerate the poorly drained and compacted areas.

It is important to note that the tree replacement rationale recommended for Reed-Keppler Park is a tree planted for a tree lost. In parks where general tree decline is more advanced, the rate of replacement should exceed the loss rate. In parks with dense tree stands, the loss rate may exceed the replacement rate without significantly affecting the character of the park. The replacement rate should involve the judgment of the park manager because he must decide the particular stand density required. The Morton Arboretum and the Chicago USDA Forest Experiment Station are currently involved with the determination of replacement rates.

This park evaluation system provided the Reed-Keppler Park manager with the following: (a) a plan to determine the number of trees required for replanting each year; (b) a map showing where to place the new trees; (c) some criteria as to what to plant and what not to plant; and (d) a document to justify the purchase of 15 new trees every year. If replanting is not done, future generations will be bereft of one of the pleasures of their predecessors — mature park trees.

This evaluation system can also be utilized readily by city arborists. Frequently, street tree inventories contain condition class headings for which compiling requires considerable time (5,6). Condition Class 4 encompasses most of these headings with a great saving of time and money.

With map overlays or computers that plot coordinates, city arborists can display their future urban forest (trees in Classes 1 and 2); their stable forest (Class 3); their declining forest (Class 4); trees designated for removal (Class 5); and the stumps scheduled for removal (Class 6). Although the city arborist has more restrictions as to where to replant than does the park manager, the determination of how many trees to replant and what trees to replant can be obtained by following the same procedures and criteria as outlined above.

It may also be possible for homeowners to evaluate their own landscape trees. All too often, homeowners contact arborists and tree pathologists long after the point at which something could be done to save a valuable tree. It is a difficult task to educate laymen to recognize problems with their trees and other vegetation before it is too late. This tree evaluation system is fairly simple and is believed to be potentially useful to homeowners in predicting longevity and assessing the health of their trees.

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Thomas L. Green
Plant Pathologist
The Morton Arboretum
Lisle, Illinois 60532

ABSTRACT

PELLETT, H.M. 1983. **Beauty and hardiness combined in breeding program at arboretum**. Am. Nurseryman 158(4): 69, 71-72.

The University of Minnesota Landscape Arboretum, Chaska, is identifying and developing new landscape plant materials. The breeders here are striving to combine aesthetic qualities with improved adaptation to the climate of Minnesota and other states with similar environments. We approach this objective in two ways. One approach is to acquire various taxa of woody plants for evaluation. This includes various species of plants acquired from research institutions or arboreta throughout the world, the U.S. Department of Agriculture Plant Introduction Station, nurseries, and the wild. The emphasis is on acquiring new clones of species commonly grown in Minnesota to determine if they are as well adapted as the species. Our second general approach is to develop superior clones through breeding and selection. Development of hardy deciduous azaleas is a major thrust of our activities.