PUBLIC PREFERENCE FOR TREE DENSITY IN MUNICIPAL PARKS

by Herbert W. Schroeder and Thomas L. Green

Abstract. Park managers faced with declining tree populations must plan for replacing trees in order to preserve attractive landscapes for the future. For this purpose it is useful to know what tree densities are preferred by the public who uses the parks. In this research study we showed photographs of parks with varying tree densities to public groups, who rated them for scenic quality and for number of trees (too few, too many, or about right). By comparing this information with actual tree inventories in the parks, we estimated what tree density would create the most attractive park landscapes for each group.

Annotation. Optimal tree densities for scenic park landscapes were estimated by having public groups rate photographs of the parks.

Community parks frequently contain even-age stands of trees that have grown to maturity and are now suffering losses due to stress, storm damage, insect attack, and disease. To prevent serious losses in future landscape value, park managers need to evaluate the condition of trees in their parks, and to replace those trees expected to die over the next few years. To prevent significant loss of the park's tree cover, tree replacement should begin several years before the older trees actually die.

Green (1984) developed a simple evaluation system to help park managers assess the health of park trees and predict their longevity. Trees are inventoried and assigned to condition classes based on their age and the presence of defects and factors contributing to decline. The inventory enables managers to identify declining trees and to prepare replanting plans and budgets.

To develop effective tree replacement programs, however, managers need to know not only how many trees are expected to die over a period of years but also how many trees are required in a park to create an esthetically pleasing environment. If tree losses have taken place during several years before replanting programs are implemented, it will be necessary to plant more trees each year than are being lost to restore the original character of the landscape. But if the tree density was originally very high, it may not be necessary to replace every tree that has been lost.

Research on public preferences for outdoor environments such as parks and streets has consistently shown that trees make an important contribution to the esthetic quality of the environment as experienced by users. There is as yet, however, little information on what the right density of trees is for a park landscape. Is there an "optimal" density, so that planting too many trees would actually decrease the scenic quality of the park landscape? To answer this question, we must turn to the users and potential users of the park and learn how the trees found in the park affect their perceptions and preferences.

Research methods for assessing public perceptions of forest landscapes were first developed for backcountry forest areas (Daniel and Boster 1976). The basic method is to take photographs of an area and then show the photographs to groups of people, who rate them on a scale of scenic quality. Through this approach, it has been possible to quantify the effect of various forest features, such as trees and downed wood, on people's preferences for forest landscapes (Schroeder and Daniel 1981). More recently, this area of research has been moved into the city to study the role of vegetation and other features on people's preferences for streets and city parks (Buhyoff et al. 1984; Schroeder and Cannon 1983; Schroeder and Anderson 1984). Our study is a continuation of this research, looking specifically at the question of what tree density looks most attractive in a park.

Methods

This study focused on preferences for tree densities in two community parks in northern Illinois: Reed-Keppler Park in West Chicago and Pottawatomie Park in St. Charles. The first step was to collect a set of photographs depicting scenes of varying tree density within each of the parks.

The photos were taken on sunny days in June and July 1983, between 9:00 a.m. and 3:00 p.m. We used color slide film so that the photographs could be shown easily to groups of observers. We photographed only those parts of each park devoted to "passive" recreation, such as walking, sitting, and relaxing.

Thirty slides of Reed-Keppler Park and 10 slides of Pottawatomie Park, depicting a range of tree densities, were shown to public groups. The slides were arranged in a tray so that every fourth slide was of Pottawatomie Park. Aside from this, the slide locations were determined randomly.

Slides were shown to seven groups of observers:

Group	*Size*
Morton Arboretum Staff	28
West Chicago Lions Club	20
College of DuPage Horticulture Class	17
College of DuPage Design Class	13
Kishwaukee College Horticulture Class	23
St. Charles Kiwanis Club	26
Park District Employees	21

The observers were first shown a preview consisting of 10 slides from the middle of the slide set. Then they were shown all 40 slides for approximately 10 seconds each, and were asked to mark a rating scale on their response sheet to indicate their evaluation of the attractiveness of the scene shown in the slide. The scale had six positions, with the endpoints labeled "unattractive" and "attractive".

The slides were then shown to the observers a second time, and they were asked to rate the number of trees near where the photo was taken on a six-point scale with the endpoints labeled "too many" and "too few". The words "about right" appeared above the center two spaces on the scale.

For each of the 40 slides, we made a field inventory of thé trees visible in the slide. Every tree within 150 ft (46 m) of the photopoint was counted, its diameter was estimated, and its distance from the photopoint was recorded, using a hand-held range finder. For each photo, we noted whether the background was closed (i.e., a solid backdrop of vegetation) or open (i.e., a field with few or no trees).

Analysis and Discussion

We coded the rating responses, using a 1 to indicate the lowest category and a 6 to indicate the highest category for both the number-of-trees and the scenic beauty scales. We next calculated mean ratings for each slide within each group by averaging individual's ratings on both the scenic beauty and number-of-trees scales. Then we compared the groups' ratings on both scales, using correlation coefficients.

For the number-of-trees scale, the correlations between groups are all very high (mean correlation = .949). This means that the ranking of slides according to number of trees is very similar across the groups. Slides that received high ratings from one group also received high ratings from the other groups, and similarly for slides rated low.

The correlations between groups on the scenic beauty scale are consistently lower than for the number-of-trees scale (mean correlation = .820). This means that the groups differed somewhat with respect to how they ordered scenes on the scenic beauty scale. That is, the slides rated highest by one group were not necessarily rated highest by the other groups.

The next step was to relate the number-of-trees and scenic beauty scales to the actual number of trees inventoried near each photopoint. It seemed likely that ratings could also be influenced by trees in the middle-ground and background of the scene. We therefore looked at how the tree and scenic scales are related to the number of foreground trees (within 150′ of the camera point), the number of middle-ground trees (farther than 150′ from the camera) and the character of the background (open or closed). In examining several statistical models, we found that foreground trees and background were the strongest predictors of both scenic beauty and number-of-tree ratings. The effect of foreground trees on scenic beauty could be described by an inverted "U" curve, with low or high tree densities producing lowered ratings of scenic beauty (Figure 1). On the other hand, the effect of foreground tree density on number-of-tree ratings was described as a straight line (Figure 2).

On average the statistical models accounted for 69 percent of the variation in number-of-tree ratings and for 56 percent of the variation in scenic beauty ratings. The latter figure indicates that a

large part of the variation in scenic beauty among these park scenes can in fact be accounted for in terms of tree densities. Some examples of the actual scenes viewed and rated by public groups are given in Figures 3-5, showing how they were rated by the groups.

Finally, we estimated the optimal number of trees per acre for each group, using the statistical models for number-of-tree ratings. We did this by seeing what number of foreground trees in the photograph would be rated "about right" (the center of the scale) on the number-of-trees rating scale. Two values were estimated for each group, one assuming an open background and one assuming a closed background. These values, converted to trees per acre, are shown in the first two columns of Table 1. As a check on the validity of these estimates, we also looked at what number of foreground trees corresponds to the maximum scenic beauty rating for each group. These estimates are given in column 3 of Table 1, and are generally consistent with the estimates in columns 1 and 2.

There appear to be some differences in the optimal number of trees for different groups of viewers. The groups from the Morton Arboretum and Kishwaukee College prefer more trees than the other groups. This seems reasonable for the Arboretum group, but it is not so obvious why the Kishwaukee group would prefer parks with more trees. The design class and the Park District employees tended to prefer fewer trees than the other groups. The two most extreme groups were the professional ones (the Arboretum and Park District employees). This could have implications for park management: perhaps park professionals should be cautious of applying their own preferences to the design and management of public parks.

Qualifications. Several limitations must be remembered when interpreting the information presented here. First, the research used only one set of photos, taken in only two parks. The estimates of optimal tree density cannot strictly be generalized to parks that differ from these two parks in terms of tree species, tree sizes, size and species diversity, and terrain. The two parks we studied, however, are fairly typical of community parks in this region, so the estimates should be applicable in other parks similar to the ones we studied.

Another limitation concerns the context in which the judgments of the park photos were made. Raters were instructed that the areas they were viewing were to be used for passive activities. Obvi-

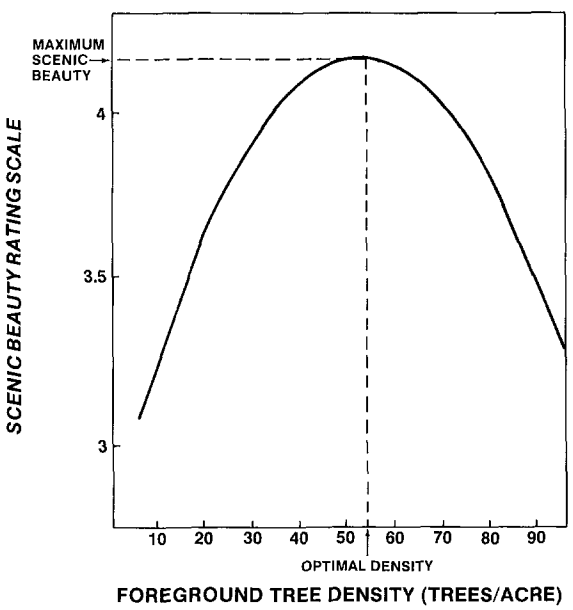

Figure 1. The effect of tree density on scenic beauty is described by an inverted "U" shaped curve.

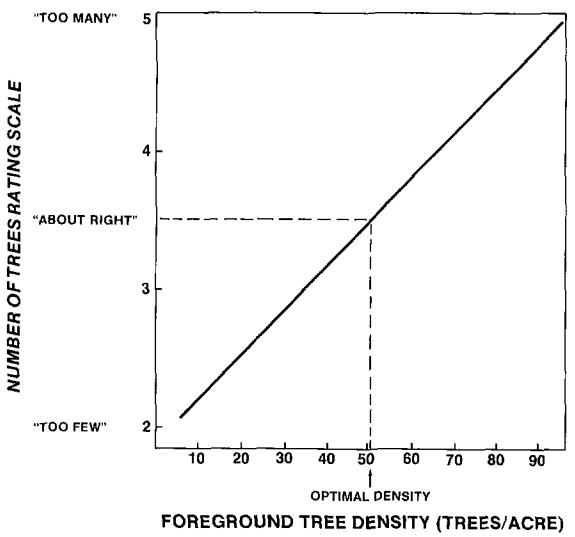

Figure 2. The effect of tree density on number-of-tree ratings is described by a straight line.

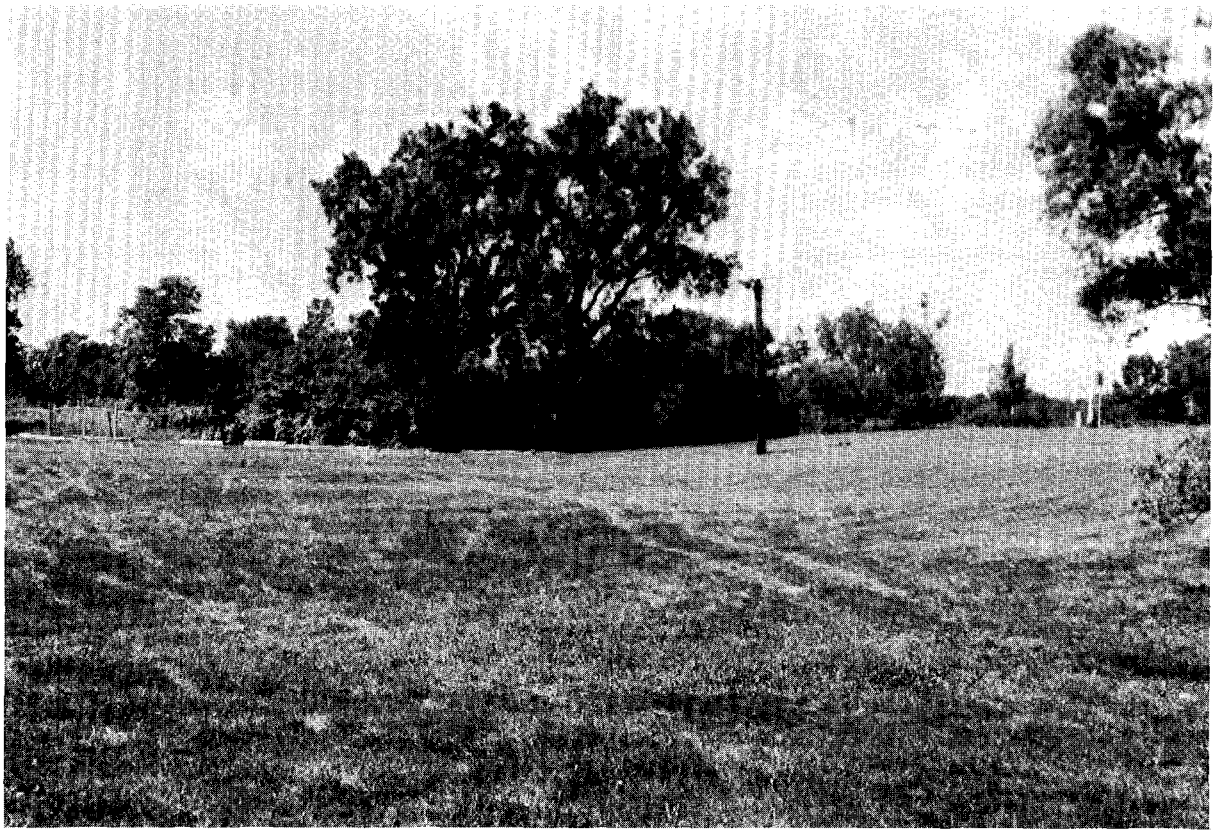

Figure 3. Most groups rated this scene as having too few trees. (Scenic beauty rating = 2.16; number-of-trees rating = 1.26; foreground tree density = 0 trees/acre).

ously, if the areas were intended for other uses, the ratings could have been quite different. Also, the set of photos itself created a context within which the ratings were made, i.e., the context of a maintained municipal park. If the slides had instead depicted natural, unmanaged sites such as forest preserves, the context of judgment and the optimal tree densities could have been quite different.

Table 1. Estimates of Optimal Tree Density (trees/acre)

Group	*Open background*	*Closed background*	*Maximum scenic beauty rating*
1	77	61	75
2	62	44	53
3	65	49	59
4	59	40	56
5	72	57	72
6	65	50	62
7	57	44	50

Application of findings. The estimates of optimal tree density presented here may be used as a guideline for park tree replacement in Reed-Keppler Park, Pottawatomie Park, and similar parks in other communities. If we assume that the Lions Club, Kiwanis Club, and the College of DuPage classes are the most typical of people who actually use these parks, then it seems that the ideal number of mature trees is about 60 to 65 per acre (150-160 per ha) when there is an open background, and about 40 to 50 per acre (100-125 per ha) when there is a dense background.

These estimates should be regarded as general guidelines, rather than as precise prescriptions. The exact placement of trees with respect to each other and to other features of the park may have important influences on scenic beauty, and deviations from the optimal density ranges may enhance the appearance of the park by producing variety and special effects. The park designer or

Figure 4. Most groups rated this scene as having about the right number of trees (Scenic beauty rating = 4.79; number-of-trees rating = 3.80; foreground tree density = 42 trees/acre or 104 trees/ha).

Figure 5. Most groups rated this scene as having too many trees. (Scenic beauty rating = 3.72; number-of-trees rating = 4.78; foreground tree density = 97 trees/acre or 240 trees/ha).

manager must still use professional judgment in developing a specific strategy for park tree replacement. We are reasonably confident, however, that these tree density guidelines are appropriate as a general target for a tree replacement program.

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Literature Cited

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ABSTRACT

BING, A. 1984. **Effective control of grasses now possible with herbicides.** Am. Nurseryman 159(2): 63-65.

Frequently weed control programs are inadequate because treatments were not put on in time or conditions for treatment were not favorable. If grasses are the weed problem, there now are some very good control measures. The choice is between (1) a directed spray of Paraquat or Roundup (glyphosate) or (2) an overall, non-directed spray of one of the new selective grass killers. Other new herbicides are now available that kill a wide range of grasses and harm very few other plants. These were first labeled for use on soybeans, where there is no injury to the crop and good control is obtained of many seedlings and perennial grasses. These chemicals have been tested on ornamentals for several years, and Poast (sethoxydim) and Fusilade (fluazifop-butyl) are now labeled for use on ornamental crops.