THE ESTHETIC CONTRIBUTION OF TREES TO RESIDENTIAL STREETS IN OHIO TOWNS

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Abstract. Street trees are an important factor in the attractiveness of residential streets. However, large, older trees that are the most attractive to the public are not necessarily the most desirable from a silvicultural point of view. Shade tree commissions, apparently formed in response to losses in esthetically valued trees, can create tree distributions that are less prone to catastrophic losses of attractive trees. Factors other than street trees also contribute to street esthetics and should be considered in shade tree management.

Keywords: Esthetics, Silviculture, Management, Street Trees, Shade Tree Commissions

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Trees are an important element in the residential landscapes of communities in the United States. They provide color and shade, screen out unpleasant sights and sounds, provide habitat for wildlife, and greatly enhance the esthetic quality of urban and suburban neighborhoods. Individual homeowners benefit from having trees on their property, as is reflected by increased values for lots with trees (Payne and Strom 1975). The overall visual effect of tree-lined streets creates a strikingly attractive atmosphere in many older residential areas. Research on the esthetics of urban landscapes has consistently shown that vegetation is an important feature enhancing the visual quality of urban environments.

This important esthetic resource is subject to several hazards: wind, ice, salt spray, pollutants, insects, and disease. Perhaps the best known example is Dutch Elm Disease, which has killed thousands of American elms. In communities that suffered heavy tree losses, many streets are now almost completely devoid of trees. Many years will pass before these streets regain their former beauty.

Recognizing the high esthetic value of street trees, many commntiies have established management policies to cope with the threats of insects, disease, and storms. These policies dictate what species can be planted, as well as what measures will be taken to protect trees from damage and to remove diseased and dead trees. Shade tree commissions have been formed in many communities to implement sound tree management policies and to protect attractive streets from catastrophic losses such as those associated with Dutch Elm Disease. Successful street tree policies will increase the health and stability of street tree populations. They will also influence the visual quality of the street by changing the combinations of species and sizes present.

Our study had two main objectives: first, to investigate features (especially street trees) that contribute to the esthetic quality of residential streets in Ohio towns; and second, to compare the esthetic quality of streets in towns having shade tree commissions with towns having no commissions.

A street tree managment program must consider both the existing scenic quality of the street and the probability of future losses. Streets with mostly large, old trees of a single species may appear attractive, but they are susceptible to sudden loss of scenic values due to insects, disease, and other damage. Shade tree commissions therefore try to create tree distributions that contain a variety of species and age classes so that disease or severe weather will not destroy large number of trees at one time. This may be accomplished through rotation planting (Shetlar 1981) and by deliberately planting a variety of species (Flemer 1981).

Too often, however, commissions are not organized until after major tree losses are already evident. The new commission is then faced with the difficult task of restoring attractive street tree populations. The effectiveness of a shade tree commission in improving the esthetic quality of a community should therefore not be judged until

the commission has been in place long enough for new planting and maintenance policies to show their effects.

Methods

This study builds on an earlier on by Hager et al. (1980) in which 16 Ohio towns with varying shade tree policies were inventoried to determine the effectiveness of their policies. For the current study we selected 10 towns in northern and central Ohio, ranging in population from 13,000 to 55,000 residents. Three of the towns had active shade tree commissions that had been in place for more than 15 years; three of the towns had commissions that had been in place for less than 10 years; and four of the towns had no active commissions or other legally constituted bodies for managing shade trees.

In each town, we inventoried street trees on 16 randomly selected streets, recording the species, size, and condition of each tree. The inventory included trees between the sidewalk and the street, or trees within 10 feet of the street if no sidewalk was present.

During the field inventory, we photographed the view from several locations looking along the street. We took a total of 480 photographs, from which we selected a subset of 340 slides with good photographic quality showing only residential streets. We showed the slides to four college classes in Chicago and Urbana-Champaign, Illinois. Each class saw 80 of the slides plus a 20-slide set that was common to all the classes. The observers rated each slide on a 10-point scale of attractiveness. From the ratings, we calculated a standardized Scenic Beauty Estimator for each scene, using the procedures of Daniel and Boster (1976).

We also showed a set of 40 slides to several local groups in one of the Ohio towns we inventoried. These groups included the League of Women Voters, a shade tree commission, a horticulture class at a local vocational school, and

Figure 1 — Example of a street rated high in esthetic quality. There are many large trees and no cars. The houses are mostly hidden by the trees.

three high school biology classes. Comparing the ratings of the Ohio public groups with the Illinois University students, we found a very high correlation (.91) meaning that the Illinois and Ohio groups were very similar in their ratings of street esthetics.

We also recorded the visual prominence of a variety of vegetative and manmade features directly visible in the photographs. Visual prominence was measured either as the area of the photo showing the feature (e.g., street tree vegetation) or as the number of occurrences of the feature visible (e.g., vehicles parked along a street).

Results

Inventory data. We found that the towns in our study differ most notably with respect to the numbers of small (1-3" dbh) trees and large (16" dbh) trees (Table 1). In general, the towns with older shade tree commissions (Towns A, B, and C) have a higher proportion of small trees and a lower proportion of large trees. Towns with new (D, E, and F) or no (G, H, I, and J) commissions tend to have fewer small trees and more large trees. One of the towns with a new commission (E) had few trees of any size on the streets we inventoried.

The towns also differ in the dominant species on the streets we inventoried (Table 2). The three towns with established commissions have fewer streets on which silver maple is the dominant species and more streets with crabapple as the dominant species. In the other towns, the most commonly occurring species is silver maple. Thus, it appears that the established shade tree commissions have been successful in influencing the size and species distributions of trees in their towns away from an undesirable preponderance of older, damage-prone silver maples.

Feature rating models. To determine which visual features contribute to the esthetic quality of a street, we used regression analysis. This statistical technique calculates the relative impor-

Figure 2 —Example of a street rated low in esthetic quality. The newly planted trees are very small. Buildings, utility poles, and wires are in plain view.

tance of various features for creating high esthetic quality. We did a stepwise analysis, which examined the features one at a time and on each step selected the one that contributed the most to predicting esthetic quality. The final result was a small set of features that explains a substantial portion of the variation in scenic quality among the street scenes.

We did two analyses (Table 3). One of them represents street trees by the area of street vegetation visible on the slide, while the other uses the number of street trees visible on the slide in four (estimated) size classes. The analysis based on area of vegetation has an R^2 of .61, meaning that 61 percent of the variation in esthetic quality among scenes can be accounted for by the features listed in the table. The regression coefficients indicate that on-street and off-street vegetation are the two strongest positive influences on esthetic quality. Cars and buildings both have significant negative effects.

The R^2 for the analysis based on numbers of trees is lower, but the model shows the role that trees of different sizes play in street esthetics. Coefficients for the 4-10-inch and the 16+-inch classes are not statistically significant, but the regression coefficients (B's) increase consistently with the size of the trees. Small trees (1-3" dbh) do not even enter the model. Trees 4-10" dbh in size make a small contribution to the esthetic quality, while larger trees (11" and up) are the most attractive. It appears that newly planted trees need to grow for a while before they have a significant impact on esthetic quality. Cars and buildings in the second analysis have the same negative effect as in the first analysis. Two additional features, overhead wires and exposed soil, also have negative effects on esthetic quality. The coefficient for lighting indicates that scenes photographed in bright sunlight are more attractive than scenes photographed on overcast days.

Esthetic comparisons. A main purpose of this study was to compare the esthetic quality of streets in towns having shade tree commissions with towns having no commissions. For several reasons, however, it is hard to directly compare the esthetic ratings for streets in different towns. The main reason is that factors unrelated to street trees influence esthetic quality. For example, our survey showed that the distribution of neighborhood age within the 16 randomly selected street segments varies considerably across towns. Neighborhoods of different ages probably differ in housing types, the layout of streets, sidewalks, power lines, and other visual features. Also, lighting conditions at the times photographs were taken varied among the streets. As shows in the feature rating models (Table 3), lighting may effect esthetic ratings; photos taken under bright sun received higher ratings. Therefore, esthetic dif-

Table 1. Size distributions of trees in Ohio towns

	Town									
	A	*B*	*C*	*D*	*E*	*F*	*G*	*H*	*I*	*J*
Shade tree commission established	1964	1924	1953	1973	1976	1977	None	None	None	None
Trees/mile:										
Total	64.8	86.6	54.0	63.5	14.4	33.8	73.3	66.9	79.9	31.3
1-3" dbh	28.5	44.9	18.9	5.9	1.3	5.3	16.8	11.0	10.9	2.8
4-10" dbh	16.7	11.1	11.6	6.1	3.5	9.1	12.6	9.5	7.5	2.7
11-15" dbh	7.7	17.5	10.0	10.7	6.2	6.5	16.0	21.0	16.1	5.5
16" + dbh	12.0	13.1	13.6	40.8	3.5	13.0	27.9	25.4	45.3	20.4

ferences between streets photographed at different times may be due to factors unrelated to the trees themselves.

The regression analysis based on feature ratings of slides do provide a way of comparing street tree esthetics between towns. The coefficients (B's) for trees in different size classes represent the contribution that each size class makes, adjusting for other influences such as buildings, cars, and lighting. Multiplying these coefficients by the actual inventory counts, we derived a street tree esthetics index for each segment in each town. Because the segments were randomly selected, we can use this index to compare the contribution that street trees make to the esthetics of the town. A one-way analysis of variance showed that there are significant differences among the towns on the esthetic index. In Table 4 the towns are rank-ordered according to the average scores of their streets on the index. The three towns with established shade tree commissions fall in the middle of the ranking, showing that they are neither very high nor very low in the esthetic contribution made by their street trees. Of the four towns at the top of the list, three have no official shade tree commission. The two lowest towns in the ranking both have newly established commissions. It appears that in these towns shade tree commissions may have been formed only after losses in esthetic values occurred.

Discussion

From these results, we can make five main observations regarding street tree management in the Ohio towns we sampled.

1) Street trees are an extremely important factor in the attractiveness of residential streets. In the regression analysis, the visual prominence of street trees was the strongest positive predictor of street attractiveness. Street tree management decisions therefore will have a large impact on the visual quality of residential environments.

2) The trees that are the most attractive to the public are not necessarily the most desirable from a silvicultural point of view. The large, old trees that appeal to the public are also more susceptible to damage, pests, and breakage; and may be more costly to maintain.

3) Active shade tree commissions apparently can help create tree distributions that are silviculturally more desirable (i.e., more new plant-

Table 2. Dominant species distribution of streets in Ohio towns; table entries are the number of sampled streets on which the indicated species was the most frequently occurring species.

	Town									
SPECIES	*A*	*B*	*C*	*D*	*E*	*F*	*G*	*H*	*I*	*J*
Ash	1				1		1		0	1
Beech			1		1					
Catalpa						1				
Cottonwood					1					
Crabapple	6	2	3				2			
Dogwood		1	1							
Elm				2						
Hickory								1		
Honey locust		2		1						1
Black locust								1		
Red maple		3	3	1		1		1		1
Silver maple	4	1		7	4	11	11	6	8	5
Sugar maple	2	5	5	2	3	3		2	6	2
Pin oak		1	1							
Norway spruce					1					
White spruce					1					
Linden	2		1							
Pine							1			
Other	1	1	4	3	4		1	5	2	6

Table 3. Regression models from features visible in slides

Model 1

Feature	*B*[1]	*Beta*[2]	*F*[3]
Street trees (area of photo image)	2.19	1.02	77.39 **
Off-street trees (area of photo image)	1.43	.391	10.96 **
Cars (number in scene)	−3.20	−.187	6.88 *
Buildings (area of photo image)	−2.07	−.150	4.28 *
Curb (present or absent)	13.55	.177	2.79
Lighting (sunny or cloudy)	9.14	.099	1.99
(CONSTANT)	−21.93		

$R^2 = .608$

Model 2

Feature	*B*[1]	*Beta*[2]	*F*[3]
Street trees DBH 11-16 (number in scene)	4.42	.367	14.31 **
Cars (number in scene)	−3.24	−.189	5.14 *
Wires (number visible)	−4.11	−.223	6.80 *
Lighting (sunny or cloudy)	22.08	.238	9.43 **
Buildings (area of photo image)	−3.03	−.219	6.27 *
Dirt (area of photo image)	−.573	−.162	4.35 *
Street trees DBH 16+ (number in scene)	4.55	.221	5.43 **
Street trees DBH 4-10 (number in scene)	2.46	.136	2.90
(CONSTANT)	61.75		

$R^2 = .476$

* $p < .05$; ** $p < .01$

[1]B is the regression coefficient, which indicates the change in esthetic quality corresponding to a one-unit change in a feature.

[2]Beta is the standardized regression coefficient showing the overall importance of each feature for explaining differences in esthetic quality among the streets sampled.

[3]F is a statistic showing the significance of each effect.

Table 4. Ranking of Ohio towns on a street tree esthetics index

Town	*Esthetic Index*	*Shade Tree Commission*
I	124	None
D	76	New
H	60	None
G	57	None
B	− 7	Old
C	− 37	Old
A	− 42	Old
J	− 48	None
F	− 61	New
E	−120	New

ings and fewer streets dominated by large, old trees). Although these distributions may be less esthetically attractive in the short run, they have less risk of serious losses to pests and physical damage.

4) The small number of towns sampled in this study makes our conclusions tentative, but the ranking of towns on the street tree esthetics index might be explained in the following way. Towns with streets dominated by large, old tree are attractive to the public, and as long as no problems are visible there is no public pressure to organize shade tree commissions. However, when problems develop and trees are lost to insects, disease, or storm damage, esthetic quality decreases drastically, and public pressure develops for more active street tree management. Hence, new commissions are found among towns at the bottom of the esthetic ranking. When the shade tree commissions have been in place long enough, they may succeed in restoring the esthetic quality of the streets through improved maintenance and new plantings, thus putting towns with old commissions higher in the esthetic ranking than towns with new commissions.

5) Factors other than street trees also contribute to street esthetics, and should be considered in shade tree management. Trees on lawns away from the street are particularly important and can significantly increase the attractiveness of the street even when no street trees are present. Perhaps priority should be given to planting street trees in neighborhoods where there are few trees on private lawns because this is where street trees are likely to have the greatest positive influence on esthetics.

Conclusions

Street trees make an important contribution to the attractiveness of residential streets. Shade tree commissions in Ohio towns have influenced the distribution of tree sizes and species planted along residential streets. Unfortunately, the most esthetically attractive distributions of trees at present seem to be those that present the greatest management problems. An important role of the shade tree commission is to find alternative distributions of trees that will possess greater

stability and continuity, while providing attractive tree cover for streets and neighborhoods.

Literature Cited

Daniel, T.C. and R.S. Boster. 1976. Measuring landscape esthetics: The scenic beauty estimation method. USDA Forest Service Research paper RM-167, Rocky Mt. Forest and Range Exp. Sta., Ft. Collins, Colorado.

Flemer, W. 1981. *Mixing species of shade trees for beauty and safety.* J. Arboric. 7(3):57-63.

Hager, B.C., W.N. Cannon, Jr., and D.P. Worley. 1980. *Street tree policies in Ohio towns.* J. Arboric. 6(7):185-191.

Payne, B.R. and S. Strom. 1975. *The contribution of trees to the appraised value of unimproved residential lots.* Valuation 22(2):36-45.

Shetlar, D.J. 1981. *Crop rotation, sanitation and resistance for urban pest control.* J. Arboric. 7(3):70-72.

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ABSTRACT

HENSLEY, D.L., S.C. WIEST, and F.D. GIBBONS. 1982. **What to consider when planting trees in urban areas.** Am. Nurseryman 156(7): 81-86.

The native environment of most ornamental plants is the forest. In their natural state, most plants have relatively close interactions with their neighbors, many of which are quite advantageous to the plants. Man changes all this by taking plants adapted to those environments and isolating them. This destroys beneficial neighbor interactions. To ensure survival of these plants two things are necessary. They must be placed in environments that are not too different from their native habitats and any adaptation potential inherent in the species must be expressed. Ignoring a plant's natural habitat can also result in weather injury. Plants adapted to a warm climate are commonly used in a colder zone. Moisture stress can result from transplanting or planting in poorly drained sites. Sunscald is a common result of taking plants that normally grow in the shade of a forest understory and placing them in full sun. Man has also exposed plants to unnatural chemicals, including air pollutants, various pesticides, and deicing salt.