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COMMON STREET TREES AND THEIR PEST PROBLEMS IN THE NORTH CENTRAL UNITED STATES[1]

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During the fall of 1981, members of NCR-98, a committee of entomologists in the North Central U.S.A. who study insect pests of trees and shrubs, planned a survey to determine urban forest pest management needs in the region. This information is essential if research and technology transfer programs are to be current and responsive to the needs of tree care specialists. We believed that by documenting urban forest management needs we could help justify increased funding for urban forestry programs. Documentation of problems and needs is required by those who seek funding for research, technology transfer, and implementation programs.

Simmons et al. (1982) conducted a survey to provide information for a problem analysis of urban forest pest management in the North Central U.S. A follow-up conference was held to consider problems indentified in the survey (Parks et al. 1982). Others have documented tree species comprising the urban forest in selected regions (Giedraitis and Kielbaso 1982), urban forest values (Morales 1980, Dwyer et al. 1983), and municipal tree management programs (Kielbaso et al. 1982). From our survey, we report information on the most common, best adapted, favorite, and least desirable street trees, as well as economically important insects and diseases, and environmental stress factors that impact street trees, as perceived by municipal arborists and foresters in the North Central region.

Methods

The committee representative from each of 10 North Central states contacted the municipal arborist or forester responsible for tree planting and maintenance in at least 1 community in each of 4 population size classes: A) less than 10,000, B) 10,000-49,999, C) 50,000-249,999, and D) 250,000 or greater. Each respondent was asked to evaluate the species of street trees in their community and the problems associated with those trees. Street trees were defined as publicly owned trees growing along municipal streets and throughfares. Respondents were asked to rank in order (1 to 5):

- The 5 most common species and the condition of each species (good, fair, poor, or dead)
- The 5 best adapted species
- The 5 least desirable species
- Their 5 favorite species.
- The 5 most chronic and damaging arthropod problems
- The 5 most chronic and damaging disease problems
- The 5 most chronic and damaging environmental problems

Respondents were also asked to indicate pest management approaches employed, including an-

1/ The complete data set, "Street trees and associated problems in the North Central United States," is available from Dr. J. P. Mahlstede, 104 Curtiss Hall, Iowa State University, Ames 50011.

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nual pesticide usage, and strategies for dealing with environmental problems, such as annual fertilizer usage. The respondents were instructed to consider only street trees in formulating their answers. Responses were summarized for the entire North Central region and for 4 subregions representing climatic zones within the region. The subregions were defined as follows (letters following cities designate population class):

I -	North Dakota:	Hebron (A), Oakes (A), Bismark (B), Grand Forks (B), Jamestown (B), Fargo (C)
	South Dakota:	Redfield (A), Aberdeen (B)
II-	Iowa:	Cherokee (A)
	Kansas:	Clay Center (A), Marysville (A), Atchison (B), Manhattan (B), Wichita (D)
	Missouri:	Kansas City (D)
	Nebraska:	Auburn (A), Humbolt (A), Hastings (B), Lincoln (C), Omaha (D)
	South Dakota:	Sioux Falls (C)
III	Illinois:	Urbana (B), Evanston (C), Chicago (D)
	Indiana:	Hammond (C)
	Iowa:	Cedar Falls (B), Cedar Rapids (C), Des Moines (C)
	Ohio:	Burton (A), Dover (B), Findlay (B), Akron (C)
IV	Kentucky:	Bowling Green (B), Lexington (C), Louisville (D)
	Missouri:	Ellisville (A), Mexico (B), Florissant (C), Columbia (C)
	Ohio:	Grandview Heights (A), Fairfield (B), Springfield (C), Cincinnati (D), Columbus (D)

Forty-four communities were included in the survey results; 8 in subregion I, 13 in II, 11 in III, and 12 in IV. All responses for each survey item were weighted to determine their relative ranking. A response listed as number 1 was valued at 5 points, number 2 at 4 points, etc. For example, if ash had been listed as the favorite tree by 2 communities and as the number 3 tree by 2 other communities, it would receive 16 (5 + 5 + 3 + 3) points for the question on favorite tree species. The total points accumulated for each tree species or tree problem was divided by the number of communities in the survey (n = 44) to obtain its relative ranking for that question. Responses for each subregion were evaluated similarly, but divided by the number of communities in that subregion. Relative rankings were compared within the entire region and within each subregion to determine summary rank orders.

Results and Discussion

Tree species. Sugar maple (*Acer saccharum*), Norway maple (*Acer platanoides*), and pin oak (*Quercus palustris*) were among the 10 most common street trees in all subregions except in the Dakotas where they do not grow well (Table 1). American elm (*Ulmus americana*) was common except in the warmest subregion (IV) where elms

Table 1. Most common street trees in the North Central region of the U.S. according to a survey conducted in 1982.

		Ranking according to subregion[1/]			
Rank	*Summary Rank Order*	*I(8)*[2/]	*II(13)*	*III(11)*	*IV(12)*
1.	Silver maple (34)[3/]	American elm	Siberian elm	Sugar maple	Silver maple
2.	Ash (29)	Siberian elm	American elm	Silver maple	Sugar maple
3.	Sugar maple (27)	Ash	Silver maple	Ash	Pin oak
4.	American elm (21)	Box elder	Hackberry	American elm	Ash
5.	Siberian elm (21)	Hackberry	Ash	Norway maple	Norway maple
6.	Hackberry (12)	Cottonwood	Sugar maple	Honeylocust	Sweetgum
7.	Pin oak (12)	Silver maple	Pin oak	Crabapple	Siberian elm
8.	Norway maple (7)	Crabapple	Planetree	Linden	Crabapple
9.	Crabapple (6)	Poplar	Honeylocust	Red maple	Red maple
10.	Honeyloucst (7)	Juniper	Norway maple	Pin oak	Planetree

1/ See explanation in introduction.
2/ Number of cities in subregion reporting.
3/ Number of cities including this tree in their top 5 most common street trees.

were first devastated by Dutch elm disease. Siberian elm (*Ulmus pumila*) was common in subregion IV, reflecting its position as an early substitute for American elm, and in subregions I and II where it can withstand severe winter temperatures and summer drought. Hackberry (*Celtis occidentalis*) was common in the 2 cooler subregions but was seldom mentioned in areas with more moderate winter temperatures. Crabapple (*Malus* spp. hybrids) has been widely planted except in subregion II where cultivars resistant to apple scab could undoubtedly be used more frequently. Honeylocust (*Gleditsia triacanthos*) was common in the middle subregions but seldom used in the northern and southern extremes of the North Central region.

Ash, probably a mixture of green ash (*Fraxinus pennsylvanica*) and white ash (F. americana), was the second most common, best adapted (Table 2), and fifth favorite (Table 3) street tree. This is somewhat surprising because ash are commonly attacked by several damaging insects, including oystershell scale (*Lepidosaphes ulmi*), lilac borer (*Podosesia syringae*), and banded ash clearwing (*Podosesia aureocincta*). Their popularity probably relates to ease of transplanting and establishment, rapid growth rate, ability to withstand environmental extremes, and general availability.

Hackberry was considered the favorite and second best adapted street tree, based primarily on responses from the 2 subregions with harsher winters where the tree thrives in spite of the hackberry nipplegall maker (*Pachypsylla celtidismamma*) and the hackberry blistergall maker (*P. celtidisvesicula*). Hackberry is seldom used and rather uncommon in subregions III and IV, probably due to numerous cosmetic problems and relatively short service life.

Linden, probably a mixture of American linden

Table 2. Best adapted street trees for the North Central region of the U.S., according to respondents in a survey conducted in 1982.

		Subregion[1/]			
Rank	*Summary Rank Order*	*I*	*II*	*III*	*IV*
1.	Ash	Ash	Hackberry	Ash	Ash
2.	Hackberry	Hackberry	Ash	Sugar maple	Linden
3.	Linden	American elm	Siberian elm	Honeylocust	London Planetree
4.	Sugar maple	Linden	Honeylocust	Linden	Sugar maple
5.	Honeylocust	Bur oak	Red oak	Norway maple	Crabapple

1/ See explanation in introduction.

Table 3. Favorite street trees of municipal arborists and foresters in the North Central region of the U.S., according to respondents in a survey conducted in 1982.

		Subregion[1/]			
Rank	*Summary Rank Order*	*I*	*II*	*III*	*IV*
1.	Hackberry	Linden	Sugar maple	Sugar maple	Red maple
2.	Callery pear	Green ash	Hackberry	Callery pear	Crabapple
3.	Linden	Hackberry	Norway maple	Linden	Callery pear
4.	Sugar maple	Honeylocust	Callery pear	Honeylocust	Red oak
5.	Green ash	Silver maple	Red oak + Little-leaf linden	Red maple	Goldenraintree

1/ See explanation in introduction.

(*Tilia americana*) and little-leaf linden (*T. cordata*), was the third most popular and third best adapted street tree. However, it was among the 10 most common street trees only in subregion III. Although little-leaf linden initially appeared to be an excellent street tree east of the Mississippi River, many have failed recently from a syndrome sometimes called crown rot (T. D. Sydnor, personal communication).

Sugar maple was ranked fourth as both favorite and best adapted street tree for the region. It was thought to be among the best adapted trees in subregions III and IV and was the favorite tree in subregions II and III. Favorite trees are not necessarily the most commonly planted, and best adpated trees are not necessarily chosen over others.

Thornless honeylocust is thought to be among the best adapted trees in subregions II and III and is a favorite in subregions I and III; however, it is commonly attacked by numerous insect and mite species. Early defoliation usually results in a new flush of leaves that may either enhance the beauty of the yellow-leafed cultivar 'Sunburst' or provide a fresh green canopy that gives homeowners and landscape managers a false sense of security about the tree's vitality. Recent evidence indicates that early defoliation, followed by production of new leaves, reduced the stored energy in the tree, perhaps increasing its suspectibility to borers (Herms 1984).

Honeylocust was among the 10 most common street trees, the 5 best adapted trees, and in subregions I and III a favorite tree. Although it was preceived as undesirable in these subregions, it was also considered the third best adapted tree in subregion III. These contradictory responses may indicate that well-known, readily available trees are sometimes selected for planting without knowledge of or regard for their maintenance problems. Nectria and thyronectria cankers have become common on honeylocust in areas of high drought stress and low winter temperatures.

Callery pear (*Pyrus calleryana*) cultivars were not considered among the best adapted and were not among the most common street trees, but they were the second favorite tree, being listed by al subregions except the Dakotas. Clearly, the medium-size ornamental pears will become more common as street trees, because they presently have few pests, produce early and showy flowers, and have striking fall color. The only flaw recently reported for some of the more popular cultivars is crotch weakness with advancing age (Haserodt and Sydnor 1983). This problem can be minimized by proper pruning during nursery production and soon after transplanting.

Silver maple was the most common (Table 1) and least desirable (Table 4) street tree, was not included in the top 5 best adapted trees (Table 2) by anyone, but was the fifth favorite tree (Table 3) in subregion I where it was not considered an undesirable tree. These discrepancies reflect the disagreement among even the most noted landscape horticulturists, some of whom champion silver maple as a street and landscape tree if properly pruned, while others condemn it. There can be no disagreement that this species has stood the test of time as a street tree while neighboring American elms and chestnuts have perished. Vital, properly maintained silver maples thrive in the urban environment, have few insect and disease problems and outlive many of their tree neighbors in the landscape. Silver maples can

Table 4. Least desirable street trees in the North Central region of the U.S., according to respondents in a survey conducted in 1982.

		Subregion[1/]			
Rank	*Summary Rank Order*	*I*	*II*	*III*	*IV*
1.	*Silver maple*	*Siberian elm*	*Siberian elm*	*Silver maple*	*Silver maple*
2.	*Siberian elm*	*Box elder*	*Silver maple*	*Cottonwood*	*Box elder*
3.	*Cottonwood*	*Cottonwood*	*Tree of heaven*	*Siberian elm*	*Siberian elm*
4.	*Box elder*	*Honeylocust*	*Popular*	*Box elder*	*Cottonwood*
5.	*Tree of heaven*	*Poplar*	*Cottonwood*	*Honeylocust*	*Mimosa*

1/ See explanation in introduction.

continue to be assets in the urban landscape if properly managed.

So-called brittle, lowland, and often short-lived trees, including box elder (*Acer negundo*), cottonwood (*Populus deltoides*) and other poplars (*Populus spp.*) were commonly listed as undesirable street trees. Except in harsh climates where these are some of the only trees that will grow, they should not be used as street trees or as specimen landscape trees. Siberian elm, a common replacement following removal of dead American elms, is now recognized as an undesirable tree and should not be used. The Chinese elm (*Ulmus parvifolia*) is a much better choice that is adapted well for the North Central region.

London Planetree (*Plantanus acerifolia*) and sycamore (*Platanus occidentalis*) were among the 10 most common street trees in subregions II and IV. The former was the third best adapted tree in subregion IV. Neither was viewed as undesirable by any respondent; both could be used more extensively where large trees are specified, especially in subregions III and IV. Although anthracnose is a problem in some areas, especially during wet, cool springs, trees survive even without direct control measures.

Oaks (*Quercus spp.*) were not perceived as undesirable, but only pin oak was listed as common. Bur oak (*Quercus macrocarpa*) (subregion I) and red oak (*Quercus rubra*) (subregion II) were considered among the best adapted trees; red oak was a favorite in subregions II and IV. Although some oaks, especially those in the white oak group, may be somewhat difficult to transplant, they are sturdy, long-lived trees that commonly do well throughout subregions II, III, and IV.

Tree condition. Respondents were asked to rate the condition of all trees inventoried for their 5 most common street trees. Averaging all estimates from 35 cities throughout the region, 48% of the trees were considered to be in good condition, 31% fair, 19% poor, and only 2% dead or dying. As expected, condition varied significantly between tree species. Sugar and Norway maples and honeylocust were in similar and better condition than silver maples; there was more variability in condition classes with the latter (Table 5). Most green ash and hackberry were in good or fair condition. Fewer American elms were in good condition and a higher percentage were dead or dying. Many Siberian elms were in poor condition. Nearly 75% of the pin oaks and 96% of crabapples were in good condition; few were in poor condition or dying.

Based on this information, it appears that Siberian elm has not been a good tree and has been a poor substitute for American elm. Sugar and Norway maples and pin oak are perceived to be the best large street trees; honeylocust the best medium-size tree, and crabapples the best small trees in the North Central region. Information on tree condition may be at least partially reflective of urban tree pest management needs.

Insects and diseases. Respondents indicated that only a few species of insects and pathogens cause most of the pest problems on street trees (Table 6). Lepidopterous defoliators, pests that are easily controlled with conventional insecticides or the bacterium *Bacillus thuringiensis*, were the most common insect pests. Although information about pests was not analyzed according to subregion, bagworm (*Thyridopteryx ephemeraeformis*) is a problem in subregions III and IV, cankerworms (fall cankerworm, *Alsophila pometaria*, and spring cankerworm, *Paleacrita vernata*) are common in subregions I and II, and eastern tent caterpillar (*Malacosoma americanum*)

Table 5. Perceived condition of 10 most common street trees in the North Central region of the U.S., as reported by respondents from 44 cities in 1982.

	Condition (% ± S.D.)			
Tree	*Good*	*Fair*	*Poor*	*Dead/Dying*
Silver maple	35 ± 26	38 ± 19	26 ± 23	1 ± 2
Ash	49 ± 29	32 ± 19	17 ± 22	1 ± 2
Sugar maple	61 ± 28	27 ± 22	10 ± 8	2 ± 3
American elm	38 ± 29	34 ± 22	21 ± 26	7 ± 15
Siberian elm	18 ± 19	37 ± 19	43 ± 28	2 ± 3
Hackberry	48 ± 16	42 ± 17	7 ± 6	0.1 ± 0.3
Pin oak	74 ± 23	18 ± 15	6 ± 7	2 ± 3
Norway maple	68 ± 37	20 ± 20	11 ± 14	1 ± 3
Crabapple	96 ± 9	3 ± 7	1 ± 2	0
Honeylocust	63 ± 23	28 ± 16	7 ± 6	2 ± 5

is common throughout the region. Borers, probably including round-headed (Cerambycidae), flat-headed (Buprestidae) and clearwing moth (Sesiidae) species, were next most common, followed by leaf beetles (primarily elm leaf beetle (*Pyrrhalta luteola*), scales, aphids, and bark beetles. Most of the bark beetle problem is associated with Dutch elm disease; scales are insidious pests that commonly cause damage before they are detected. Borer attack often indicates that the tree is in low vitality as the result of other biotic or abiotic factors or a combination of environmental stresses. Influence of tree vitality on insect and pathogen attack and damage is a current area of research that may someday change the way urban pests are perceived and managed.

Dutch elm disease is still a serious problem, especially in more nothern parts of the North Central region where landscape managers continue the fight to protect and preserve existing American elms. Anthracnose, wilt diseases, and fire blight are chronic problems for which there are limited direct control options (Table 6).

Enviromental stresses. When given the opportunity to assess the occurrence of perceived environmental stresses on street trees, respondents indicated rather divergent but related categories (Table 7). For example, drought was reported as the most common environmental stress problem; winter dieback was also listed but may be drought-related. Soil compaction was listed a distant sixth to drought, but the former may exacerbate or cause drought symptoms even during periods of normal rainfall. In any case, factors that reduce the ability of roots to thrive in soil are recognized as key environmental stress problems for street trees. Research is needed to determine if preplanting practices can alleviate these problems and if soil amelioration around existing trees can improve tree vitality and increase longevity.

Lawn mower damage and vandalism were reported as important environmental stresses that impact street tree vitality. These problems will always occur but can be minimized in many localities through educational progams, use of mower guards and mulch, and planting trees with at least 5 cm (2 inch) caliper to initiate street tree plantings, whenever possible.

Pest Management. A primary goal of our survey was to determine urban forest pest management needs. Although we did accumulate information on the most important pests and environmental stress factors, as perceived by municipal arborists and foresters, respondents were commonly unfamiliar with appropriate control tactics and management strategies for controlling insects and

Table 6. Most common arthropod and disease problems encountered on street trees in the North Central region of the U.S., according to respondents in a survey conducted in 1982.

Anthropods	*Weighted value*
Lepidopterous defoliators	14.7[1/]
Borers	11.7
Leaf beetles	8.6[2/]
Scales	7.0
Aphids	4.8
Bark beetles	2.8[3/]
Hackberry galls	1.8
Spider mites	1.5
Diseases	
Dutch elm disease	11.4
Anthracnose (Sycamore and others)	8.8
Verticillium wilt	5.9
Fire blight	4.0
Oak wilt	1.9

1/ Bagworm = 5.5; cankerworms = 4.5; eastern tent Caterpillar = 2.4; mimosa webworm = 1.5; others = 0.8.
2/ Elm leaf beetle = 7.0; others = 1.6
3/ Elm bark beetle = 2.6; others = 0.2.

Table 7. Most common environmental stresses that impact street tree vitality in the North Central region of the U.S., as perceived by respondents in a survey conducted in 1982.

Environmental stress	*Weighted value*
Drought	10.1
Salt	6.0
Lawn mower	5.4
Chlorosis	4.1
Vandalism	3.9
Winter dieback	2.8
Soil compaction	2.8

diseases. This was somewhat surprising since Giedraitis and Kielbaso (1982) reported that, nationally, 41% of municipalities monitor pest levels on their street trees. It would seem that personnel who are trained well enough to monitor trees for pest presence and abundance would also be familiar with pest control options.

Apparently, much insect and disease control work is done by contract arborists. Of those reponsing to the question, "are you familiar with appropriate management techniques for your most common street tree insect problems?," 36% indicated yes, 39% were familiar with adequate control tactics for some important insect pests, while 17% had no knowledge of insect control tactics for street trees. The most frequently used control tactics included: pesticides (56%), sanitation (31%), cultural practices to improve tree vitality (9%), and use of tolerant or resistant trees (4%). Of those responding to the question, "are you familiar with appropriate management techniques for disease problems?," 23% said yes, 51% were familiar with control tactics for some of their most important tree disease problems, while 20% had no knowledge of disease control tactics for street trees. The most frequently used control tactics for diseases included: sanitation (53%), pesticides (37%), use of tolerant or resistant trees (10%), and cultural practices to improve tree vitality (4%).

When asked if they were familiar with appropriate management techniques to minimize effects of environmental stress, 14% responded yes, 47% said yes for some stresses, and 31% were unfamiliar with management techniques for any environmental stress. The most common techniques used to manage environmental stresses were: use of tolerant or resistant trees (22%), improving tree vitality (20%), watering (17%), sanitation (12%), fertilization (12%), proper planting technique (10%), and wrapping and pruning (7%).

Cities with less than 10,000 inhabitants rarely used pesticides or fertilizer on street trees. Those with populations of 10,000 to 49,999 used an average of 8 pounds of insecticides, 3 pounds of fungicides, 5 pounds of herbicides, and 8900 pounds of fertilizer annually. Cities with populations of 50,000 to 249,999 used 243 pounds of insecticides, 687 pounds of fungicides, 16 pounds of herbicides, and 3200 pounds of fertilizer. Cities larger than 250,000 population used 287 pounds of insecticides, 167 pounds of fungicides, 94 pounds of herbicides, and 767 pounds of fertilizer annually.

Conclusions

There were 2 clear messages resulting from our survey. The first: urban forestry programs vary dramatically between states and between municipalities within a state, regardless of population. Some states have initiated aggressive programs and are actively inventorying street and park trees and making efforts to inform municipal foresters and shade tree commissions about tree management. Other states, and especially many small towns, invest little in street tree planning or management. This heterogeneity complicates efforts to quantify parameters of the urban forest, including species composition, tree condition, and management approaches. Future surveys to evaluate urban forest pest management programs and needs should focus on cities with inventory programs that keep adequate records regarding tree success and management activities and costs.

The second message is that urban forest managers need a conceptual framework for addressing urban forest pest management and technology transfer programs to help them make better decisions about tree health care, including insect and disease control. There are data gaps regarding insect and pathogen/street tree relationships, but there is a tremendous amount of information on street tree insect and disease control that has not been packaged for efficient delivery to state and municipal foresters. The need for these packages has been suggested by others (De Voto 1982, Kielbaso and Kennedy 1983). Package components have been specified (Nielsen 1982), but a coordinated effort to provide this information has not been organized.

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ABSTRACT

POWELL, C.C. 1984. **Success in coordinating disease control depends on finding common elements.** Am. Nurseryman 159(2): 75-77.

To coordinate programs for turf and ornamental disease control, we must first find the common denominators of the diseases that affect these two plant types. Few, if any, turf diseases, however, also affect trees and shrubs. Thus what are some common denominators? There are three parts of plant health management. First, there are cultivar, or plant selection, decisions that lead to good health. Next are considerations of stresses in the environment and how to best manage them as the plant grows. Finally, there are decisions regarding the kind of pesticides to use and how and when to apply them. With ornamentals, the plant material may be more diverse than turf, but the variations in the timing patterns are fewer. There are four patterns or scenarios concerning the application of fungicides to ornamentals: the bud break sprays or the very early spring sprays; the post-bloom sprays or the later spring, early summer group; the wet-weather sprays; and the sprays during cool weather, especially cool nights followed by warmer days. Nurserymen should try to fit information on ornamental diseases into a scheme to clarify their thinking and programming abilities.