STATUS OF STREET TREE INVENTORIES IN THE U.S. [1]

by John R. Bassett and William C. Lawrence

The Problem

One of the problems faced by most city foresters is a lack of information about the trees that constitute their urban forest. Where and how many trees are there on city streets? How many specimens of each species are present? How old are they? Are they vigorous or do they need help? How tall are the tallest? What percentage needs pruning or other maintenance? Answers to such questions facilitate planning the maintenance, removal and planting of street trees. As part of a project to design and implement a tree-inventory system for cities, we investigated the status of urban tree-inventory systems in the United States.

Methods

During the summer and fall of 1973 we mailed 510 questionnaires to cities throughout the United States to learn whether they now conduct or plan soon to conduct a periodic or continuous inventory of street trees. Approximately two-thirds of the questionnaires were addressed to individuals on the 1972 mailing lists of the Society of Municipal Arborists and ISTC Yearbook whose titles indicated that they are city or village foresters or arborists, tree wardens, superintendents of a parks and recreation department or a bureau of forestry, or commissioners of forestry. The remaining one-third of the questionnaires were addressed simply to "City Forester" of cities whose population exceeds 50,000 inhabitants. This paper is based on the 172 replies received (we did not mail a follow-up questionnaire to non-respondents). We do not know the total number of cities in this country that have a formal department assigned to tree care but, assuming that the head of such a department is a member of SMA or ISTC, we feel that we have an adequate sample to make valid statements.

The Sample

The 172 replies came from 166 cities in 35 states and 6 cities from three Canadian provinces. We divided the sampling area into five regions (Figure 1); responses received within each region from cities that do or do not inventory were:

Region	Do	Do not
1	9	27
2	5	28
3	19	25
4	8	17
5	12	22

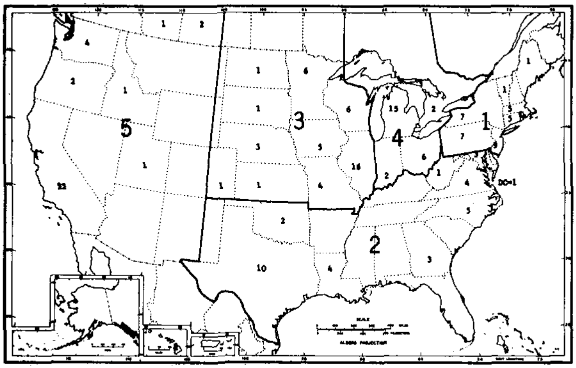

Figure 1. Number of cities sampled in United States and Canada, by region, state and province.

Unless otherwise noted, we detected no appreciable differences in mean responses between regions or between cities that do or do not inventory. Individual states heavily represented in our sample are California with 22 replies, Illinois with 16 and Michigan with 15.

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Of those cities that furnished population information, approximately one-half (84 of 165) contain fewer than 75,000 inhabitants; relatively few large cities now conduct an inventory:

Population (thousands)	Do inventory	Do not inventory
0-24	7	8
25-49	17	20
50-74	7	25
75-99	5	10
100-149	9	14
150-249	1	11
250-499	3	9
500-999	2	9
1,000 +	0	8
Not stated	2	5

Of those cities that have counted their trees, approximately one-half (68 to 138) contain fewer than 20,000 street trees; cities that do inventory tend to have fewer trees than cities which do not:

Street Trees (hundreds)	Do inventory	Do not inventory
0	0	8
1-49	4	11
50-99	9	9
100-149	10	6
150-199	2	9
200-249	8	6
250-499	8	11
500-999	4	12
1,000+	2	19
Not stated	6	28

Results

Seventy percent of the respondents said that they do not now conduct a periodic or continuous inventory of street trees. The most frequently cited reasons (68%) reflect a lack of funding; approximately one of every six (18%) city foresters and their superiors feel that such a project is not worth the investment:

Reason given for not conducting an inventory	% of 114 replies
My dept. lacks manpower	32
My budget will not allow it	25
My dept. lacks facilities	11
I feel it is not worth cost	11
I am uncertain how to do it	7
City admin. feels too costly	5
Supervisor feels too costly	2
Miscellaneous reasons	7

Two-thirds of these respondents (more than one-half of whom are in Regions 2 and 5) said that their predecessors had never conducted such a survey. Asked whether they plan to begin an inventory by July 1976, one-third do, one-third do not and one-third are uncertain. Asked if they have access to a computer, 39% do, 31% do not and 30% are uncertain.

On the average, cities that do conduct a periodic or continuous inventory have been doing so for nine years:

Region (replies)	Years (average)
1 (9)	9
2 (5)	2
3 (19)	10
4 (8)	10
5 (12)	12

Fifty-five percent of the cities that do inventory collect data continually throughout the year, 31% gather information periodically throughout the year, and the remainder collect data sporadically. The majority of cities gather information from May through August but many also inventory during fall and winter. Of 53 respondents who conduct inventories, 89% retrieve information by hand and 9% use computers.

All cities were asked how they use their survey data or how they would use it if they were to begin an inventory. Planning maintenance was the most frequently cited use, followed closely by planning tree planting, planning tree removal and evaluating the performance of new trees.

Interval (years)	Percentage of total replies Do (17)	Do not (105)
1-2	24	18
3-4	35	31
5-6	29	40
7-8	0	2
9-10	12	7
11-12	0	2

Cities in Region 2 have had considerably less inventory experience than cities in other regions.

We asked all cities how frequently they do inventory or how frequently they would inventory if they were to begin a street-tree census program. Among cities that do inventory, 35% (of 17 replies) do so once every 3-4 years; among those that do not, 40% (of 105 replies) would inventory once every 5-6 years:

We asked cities that do inventory how many workers they use in their survey crews and how many crew members hold college degrees in forestry or related fields. In the 48 cities that furnished this information, the average survey crew consists of 2.2 members, and one of every four members holds a college degree:

Region (replies)	Mean no. per city	% with degree
1 (9)	1.7	53
2 (3)	1.0	100
3 (18)	2.6	16
4 (7)	2.3	25
5 (11)	2.5	14

Regions 1 and 2 employ a greater percentage of professionals on surveys than do other regions. We asked all cities if they plan to add a professional assistant to their city-forestry staff (not necessarily as part of an inventory program) by July 1976; of the 150 who answered this question, 19% do, 48% do not and 33% are uncertain.

Twenty-seven cities stated how many trees they survey per month per crew member:

Region (replies)	Trees per man-month
1 (5)	320
2 (2)	2,150
3 (10)	1,200
4 (4)	1,750
5 (6)	580

We asked all cities either to state the cost of their current survey or to estimate the cost of a survey were they to begin one (81 cities furnished this information but for each region we excluded the maximum and minimum cost reported because a few respondents furnished questionable data). Actual cost per 1,000 street trees ranges from $96 to $311 (averaging $127) among 23 cities that do inventory whereas estimated costs range from $80 to $331 (averaging $156) among 48 cities that do not inventory:

Region	Dollar cost per 1,000 trees	
	Do (23)	Do not (48)
1	111	102
2	311	89
3	106	134
4	149	80
5	96	331

In Regions 2, 4 and 5 wide differences exist between the average cost of surveys in cities that do inventory and the average estimate of what an inventory would cost in cities that do not inventory, but the differences are not consistent.

On the basis of population, the annual cost for 28 cities that do inventory ranges from $18 to $57 (averaging $26) per 1,000 inhabitants whereas the estimated annual cost ranges from $26 to $51 (averaging $35) for 53 cities that do not inventory:

Region	Dollar Cost per 1,000 people	
	Do (28)	Do not (53)
1	57	26
2	44	34
3	18	51
4	16	35
5	20	37

Again, the differences between the actual and estimated costs are not consistent.

We asked for an estimate of the total number of street trees in each city, by species; 93 cities furnished usable information (Table 1). In Region 4, for example, the 13 cities that responded contain a total of 746,000 street trees, 39% of which are *Acer* and 15% of which are *A. Platanoides* (Table 1). The genus *Acer* also constitutes nearly one-quarter of all street trees in Regions 1 and 3. In Region 2, 36% of all street trees are *Quercus*, one-half of which are *Q. virginiana*. *Ulmus americana* represents 52% and 20% of all the street trees in Regions 3 and 4. Region 5 exhibits the most diversity of species used for street trees. Of the 75 genera and

150 species cited, the 10 genera and 10 species listed in Table 1 play an important role in American cities.

Recipients of our questionnaire were asked to list the three most pressing street-tree problems they faced in 1973. To develop a quantitative ranking of the problems, we assigned three points to those cited as most pressing, two points to those ranked second and one point to those ranked third. Diseases, insects and maintenance represented 76% of all the ranking points assigned:

Problem category	% Ranking points
Diseases	37
Insects	23
Maintenance	16
Construction	7
Replanting	6
People	4
Traffic	3
Climate	2
Management	2

Diseases were assigned 37% of the ranking points by the 156 cities that responded, and they are particularly troublesome in Regions 1 3 and 4 (Table 2). Vascular diseases are the most serious problem, representing 52% of the ranking points from the 38 cities in Region 3 and 28% of the total ranking points from 156 cities. Dutch elm disease was most frequently rated as the most pressing problem, particularly in Region 3 where it represented 39% of all ranking points.

Insects are the second most pressing problem currently faced by city foresters throughout the country. They are especially troublesome in Region 2, where defoliators alone represent 21% of the ranking points (Table 2). Maintenance is an important problem in all regions except Region 1. Construction and replanting appear to be important problems only in Regions 4 and 5.

Asked what single street-tree problem they thought would be most pressing in 1978, 36% of 149 respondents cited maintenance.

1978 Problem	% Total replies
Maintenance	36
Diseases	17
Replanting	16
Insects	9
Construction	9
People	4
Traffic	2
Climate	2
Management	1
No problem	1
Do not know	3

Three specific kinds of maintenance problems *that are expected to be most pressing in 1978* are pruning-fertilizing-bracing-cabling, removal and replacement of trees and a lack of qualified manpower (Table 3). Diseases are expected to be less of a problem than maintenance in 1978, but Dutch elm disease is expected to remain a serious problem in Region 3. Replanting problems are expected to be more troublesome in 1978 than in 1973 but the reverse is true with respect to insects.

Discussion

Although 30% of the respondents do inventroy street trees, we suspect that some of these inventories are of limited value because of one or more reasons: observations are made when tree crowns are leafless, few data are collected per tree and most data are retrieved by hand rather than by computer. Moreover, only one-third of these respondents stated the frequency between their surveys and only one-half cited how many trees they inventory per month. This suggests that their inventories are not being conducted on a regular or comprehensive basis.

Lack of funding was the fundamental reason cited by two-thirds of the respondents who do not inventory, yet their estimates of what they thought a survey would cost per 1,000 trees exceeded costs of ongoing surveys by an average of 23%.

Many cities that do not inventory are interested in beginning a survey, as evidenced by the fact that one-third of them plan to start one by July 1976. In our judgment these newcomers will be or should be looking for guidance. For example, 61% of the respondents who do not survey stated that they either have no access to a computer or are uncertain as to access. If they are willing to look for guidance, surely they can find computer access and programming help in their own cities or at nearby towns, universities, business establishments or state and federal offices.

Maintenance is expected to be the primary street-tree problem by 1978. We believe that a periodic or continuous comprehensive survey of urban trees will be an invaluable tool to pinpoint maintenance problems and to hlep plan and schedule daily work, particularly in the larger cities, where inventories are not common. Relatively few cities in the United States are now committed to a comprehensive inventory of street trees. In our opinion a familiarity with what computers can do and a realization that computerized surveys are less expensive than expected will convince city foresters that a street-tree inventory is a good investment.

Table 1. Percentage of Total Street Trees, by Major Species[1]

Genus/Species	Region 1 (21) 1,527	2 (15) 3,144	3 (27) 1,726	4 (13) 746	5 (17) 594
	(replies)/thousands of street trees[2]				
			%		
Acer spp.	24	5	23	39	7
platanoides	11		7	15	
saccharinum			8	8	
saccharum			4		
Carya illinoensis		6			
Fraxinus spp.					9
Gleditsia spp.				6	
Lagerstroemia indica		5			
Pinus taeda		17			
Platanus spp.	21	4		6	
acerifolia	18				
occidentalis				5	
Quercus spp.	8	36	5		7
virginiana		17			
Tilia spp.	5				
Ulmus spp.	10	8	54	21	7
americana	10	5	52	20	

[1]Listed are only those genera and species that represent at least 4% of all street trees in the cities reporting from each region.

[2]Read headings as follows: Region 1 had 21 cities reporting a total of 1,527,000 trees, etc.

Table 2. Street-tree Problems Important in 1973, by Region

Problem	Region (number of cities responding) 1 (35)	2 (29)	3 (38)	4 (22)	5 (32)	Weighted Average
				%1		
Diseases	46	17	58	40	16	37
Vascular	35	10	52	32		28
Dutch elm disease	22	10	39	17		19
Wilts			11			
Insects	22	43	14	21	17	23
Borers		12				
Defoliators		21				
Sucking		10		16		
Maintenance		11	11	23	23	16
Prune-Fert.-Brace-Cable				10		
Construction				14		
Sidewalks				10		
Replanting				11		

[1]Each of 156 cities ranked its three most pressing current problems, which were assigned 3, 2, or 1 points, depending upon rank. Data are the percentages of total ranking points represented by each problem; listed are only those problems that represent at least 10% of the total ranking points in each region.

Table 3. Street-tree Problems Expected To Be Important in 1978, by Region

Problem	Region (number of cities responding) 1 (32)	2 (28)	3 (40)	4 (19)	5 (30)	% of Times Cited
			times cited			%
Maintenance	12	2	11	7	12	36
Prune-Fert.-Brace-Cable		6			4	
Removal and replacement	4					
Lack of qualified manpower			2	2		
Diseases	4	0	17	3	1	17
Dutch elm disease			15			
Replanting	5	5	7	1	6	16
Lack of suitable species		2			3	
Insects	4	5	0	4	1	9
Gypsy Moth	2		3			
Construction	3	3	0	0	7	9
Sidewalks					4	

ABSTRACT

Leonard , O. A., D. E. Bayer, and R. K. Glenn. 1974. **Control of tree roots.** Weed Science 22: 520-522.

Roots in sewers and drains cause problems that are of considerable economic significance. Several authors have reported on the chemical control of such roots by soaking them in a herbicide solution for varying periods of time or by spraying the roots directly. In addition, they reported the results of studies with a variety of herbicides using these techniques for killing tree roots. They concluded that the most promising chemicals for this purpose were metham and dichlobenil.

This report will present results using foam to apply metham and dichlobenil for the control of roots in sewer lines. In addition, the results of treatment on the distribution of labeled assimilates within the plant will be presented. Although large woody plants are difficult to work with for conducting such studies, the results do indicate physiological effects of these treatments.

Metham applied alone or in combination with dichlobenil in foam, was effective in killing roots of eucalyptus or willow. An air-aqueous (19 to 1) foam of these herbicides was at least 20 times as effective as the aqueous mixture alone. Killing of the root with metham was rapid and extended above the lower treated portion, with the extent of necrosis resulting from translocation of the herbicide varying with concentration of metham that was used. The amount of the root killed with dichlobenil was limited to the treated area regardless of concentration. Four weeks were required to control the larger roots. Root killing with metham proceeded via both the aqueous and vapor phases. Results from labeling trees with Carbon 14 indicated that neither translocation nor accumulation were greatly affected by metham or dichlobenil except in the tissues actually killed. However, transport and accumulation into untreated roots were reduced for a few weeks by dichlobenil. Similar results were obtained with cotton treated with dichlobenil.

Soaking, spraying, and foam methods all have their own favorable and unfavorable aspects. Soaking requires the most herbicide and labor, but treatment can be accurately controlled; the solution can move through cracks or openings in the tile, killing all roots contacted. Spraying requires the most expensive equipment. Roots in the tile openings or cracks are not killed unless they are directly connected to roots that are sprayed. Although a very high concentration of herbicide is required for effective control by spraying (perhaps 80,000 ppmw metham and 800 ppmw dichlobenil), the actual quantity of herbicide used is much less than with soaking. Foam is a new method of application under extensive field trial. Both the quantity of chemical and amount of labor required are less with foam and the percentage of roots killed promises to be as good as or better than for either the soaking or spraying method. The main disadvantage to the foam appears to be the difficulty of controlling the distribution of foam in the sewer lines. Several pounds of pressure are required to force foam into the lines, and foam may be forced up service lines further than desired. However, a system of easily reachable clean-outs that can be temporarily plugged would solve this problem.

In conducting lathhouse research aimed at the control of roots in drains, the experimental procedure should relate realistically to the field problem. Some of the problems that should be considered are as follows: 1) Roots in the sewer lines grow in air, not in water; therefore, the roots to be treated should be grown in moist air. 2) Since roots in lines are of various sizes (often greater than 5 mm diam), some roots of more than 5 mm diam should be present. 3) Since the purpose of treatment is to kill roots in cracks and joints in the tile as well as in the lines, roots should be killed for a limited distance beyond that actually treated. 4) Since killing a root by a chemical can be slow (as with dichlobenil) quick tests for detecting viability of tissue may be of limited value. 5) The chemical must be nonexplosive and must not produce hazardous toxic vapors because some homes are not vented.