COSTS OF DUTCH ELM DISEASE MANAGEMENT IN WISCONSIN COMMUNITIES

by Charles J. Kostichka and William N. Cannon, Jr.

Abstract. In 1980, communities participating in the Wisconsin Dutch Elm Disease Demonstration Program spent about $2.62 per capita for Dutch elm disease management. The percentage of the total program expenditure for each control practice was: tree removal and disposal, 79%; systemic fungicide injections, 11%; sanitation and symptom surveys, 7%; and root-graft barriers, 3%.

At one time, elms accounted for 50 to 75 percent of the total urban forest in many Wisconsin communities, and as much as 95 to 99 percent in some communities (Hafstad and others, 1965). Dutch elm disease (DED) destroys many of these trees each year. But the effects of DED are not limited to the drastic changes in appearance of a community from the loss of so much of the urban forest. Equally distressing are the financial consequences. These must be faced even if a community chooses to do nothing to limit DED. Doing nothing, however, incurs greater immediate annual costs than if a well-thought-out disease-management plan were followed. During a DED epidemic, a good management program can cost less than tree removal without control (Cannon and Worley, 1980).

The best way now available to reduce the impact of DED is not a single control practice but a systems approach which includes the use of several appropriate practices (Phillipsen and Gkinis, 1981; Sherald, 1982).

The cost study. In 1980, the cost of community-wide integrated DED management programs was studied in certain Wisconsin communities (Kostichka, 1982). These communities were participants in the Wisconsin DED Control Demonstration Program and possess a wide assortment of physical characteristics and DED situations. Figure 1 illustrates their varied geographic locations.

In each community, detailed records of the costs of individual control practices were kept by the program supervisors. These practices included sanitation survey, symptom survey, root-graft control, systemic fungicide injection, tree removal, and tree disposal. Dormant spray application to suppress elm bark beetles was not used. Only labor and material expenditures were analyzed. Capital equipment, overhead and transportation costs were excluded because of differences in type or brand of equipment purchased and in cost accounting methods. The median and range of costs for each control practice are shown in Table 1. A frequency distribution of costs for each practice is shown in Figure 2. Since none of these distributions is normal, the median is more representative than the mean cost.

Sanitation survey. Sanitation now is the most effective individual treatment for reducing the incidence of DED. Sanitation aims at lowering elm bark beetle populations and amounts of the disease fungus by eliminating all elm wood suitable for beetle breeding and fungus growth (Campana and Stipes, 1981, p. 18). For effective sanitation, all dead elm wood with intact bark (including dead branches in living trees, firewood piles, felled trees, standing dead trees, stumps and brush) must be removed and disposed of before April 1 of each year.

The sanitation survey consisted of a lot by lot examination of the community for actual or potential elm bark beetle breeding sites and pathogen reservoirs. The survey was conducted in the spring by control technicians. In most cases they went on foot because of the many backyard firewood piles to be inspected. Vehicles were used only in relatively open areas and to transport

technicians to and from survey areas. The hourly labor cost for seasonal employees was $4.50 in each community.

Combined totals of the 10 demonstration municipalities reporting were: elm inventory, 74,145 trees; management area, 63.1 square miles; sanitation survey cost, $3,213. Sanitation survey cost per square mile of control area was $51. Cost per elm in the total inventory was $0.04, ranging from $0.01 to $0.25. The median cost, $0.04, more nearly reflects the typical cost since the value of the mean is increased by data from two communities that reported much higher costs than those of the other eight communities (Fig. 2).

Cost estimates per elm become outdated as the elm population declines. Cost based on area is more useful for planning purposes because the entire management zone must be canvassed for broodwood each year despite decreased numbers of elms. On an area basis, an average of 14.3 hours per square mile was required for a sanitation survey. At $4.50/hour, the cost was $64.35/square mile.

Symptom survey. Surveys of the elm population to detect DED symptoms are very important. Early detection followed by prompt removal of diseased elms can greatly lower the incidence of DED (Barger, 1977).

Each elm in a community was examined by technicians on foot for foliage symptoms of DED once a month in June, July, August, and September. The labor cost was $4.50 per hour. Data from 15 communities showed that the cost of surveying 87,475 elms was $27,529 ($0.32/elm). Community costs per elm ranged from $0.10 to $1.59 (median of $0.43) (Table 1). The average cost per elm per survey was $0.11.

Systemic fungicide injection. The systemic fungicide Arbotect 20-S[1] was used for DED therapy in 13 communities. The various types of injection equipment (Sinclair and Campana, 1978, p. 34) consisted basically of a container (to hold the fungicide solution) and a series of injection heads connected by tubing. Injector heads were 1/8 to 3/8 inches in diameter. The chemical was either forced into the tree under pressure or allowed to flow passively by gravity. Kostichka and others (1979) described the equipment set-up. Costs were $4.50 per hour for labor and $1.30 per ounce ($170 per gallon) for chemical.

The cost of treating 988 elms was $22,757 ($23/elm). Community costs ranged from $8 to $61 per tree for an average of $27.50 (Table 1). At the therapeutic rate of 4 ounces of Arbotect

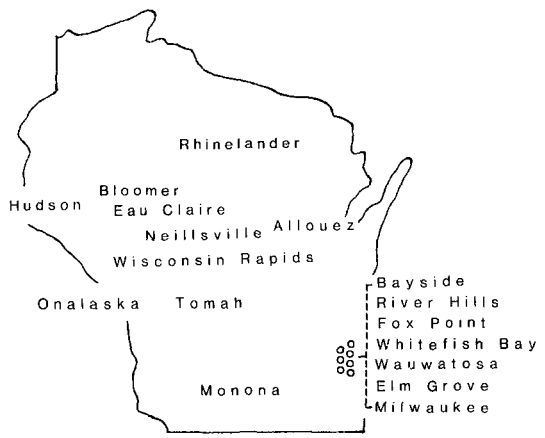

Figure 1. Communities cooperating in the Wisconsin Dutch Elm Disease Control Demonstration Program, 1980.

Table 1. The median and range of costs of Dutch elm disease control measures applied in Wisconsin communities, 1980.

Item	Number of Communities	*Median*	*Range*
Sanitation survey			
($/elm)	10	0.04	0.01-0.25
($/sq. mi)	10	44.00	14.00-171.00
Symptom survey			
($/elm)	15	0.43	0.10-1.59
Therapeutic injection			
($/elm)	14	27.50	8.00-61.00
Root-graft barrier			
($/ft)	15	0.60	0.29-1.55
Tree removal			
($/public elm)	12	111.00	44.00-210.00
($/private elm)	10	150.00	85.00-300.00
Tree disposal ($/ton)	5	7.00	5.55-12.00
Cost/elm in population ($)	6	6.40	2.82-8.88
Cost per capita ($)	6	2.62	1.78-4.50

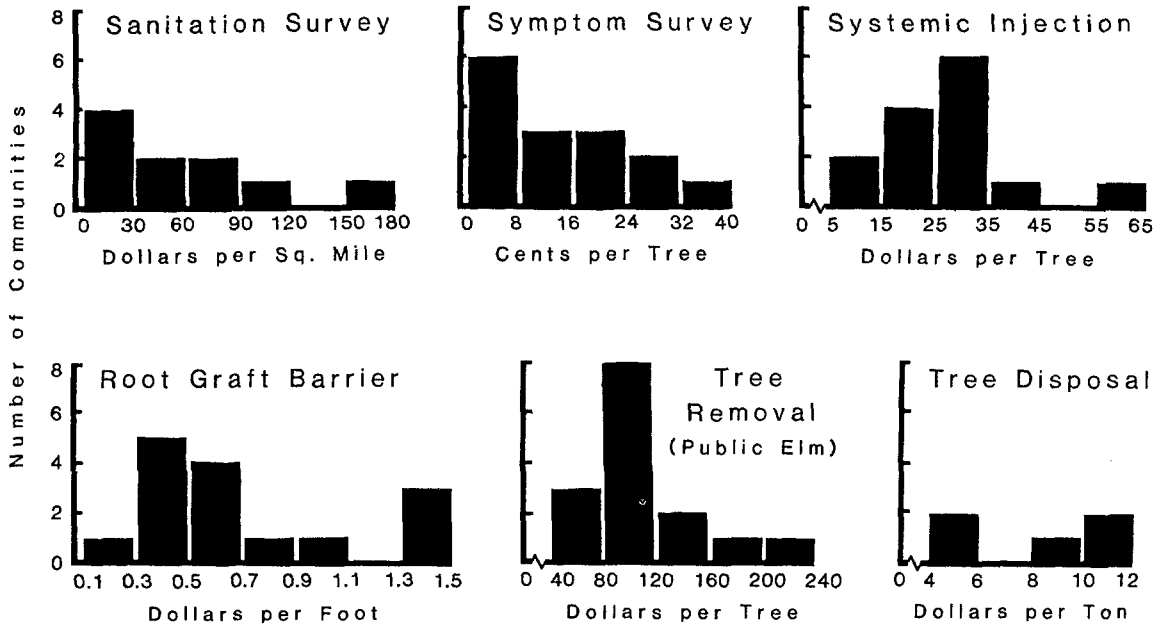

Figure 2. Distribution of costs for DED control practices applied by demonstration communities in Wisconsin, 1980.

per 5 inches dbh, the average cost was $1.46/diameter inch.

Costs for preventative treatments were not reported, but should be about the same as for therapy since the recommended chemical rate was the same for both in 1980 in Wisconsin.

Root graft barriers. Essential to DED management is preventing the DED fungus from reaching healthy elms through grafted roots. Where sanitation is not practiced, transmission through root grafts is of little concern (Sinclair and Campana 1978, p. 27). However, where sanitation is practiced and elms are closely spaced, up to half of the new infections can be attributed to root transmission (Cuthbert and others, 1975). Control of root transmission depends on early detection of new infections and prompt disruption of root grafts (Phillipsen and Gkinis, 1981).

Root grafts are commonly broken by fumigating the soil with Vapam[1] or by mechanical cutting with a trenching machine or vibratory plow. Girdling of elms also has been attempted to keep the fungus out of the root system (Barger and others, 1982).

Soil fumigation was used in 14 communities, deep girdling of trunks in 1 and mechanical severence in none. The labor cost for both fumigation and deep girdling was $4.50/hour. The cost of Vapam (undiluted) was $7.50 per gallon.

The 15 communities installed 908 root-graft barriers — 2 to 4 barriers per diseased elm. The median length of the barriers was 20 feet. The median cost per foot was $0.60 (Table 1). The single community that used girdling spent an average of $1.05/tree.

Elm removal and disposal. Diseased trees on public property were removed by municipal crews or contractors. Removal of elms on private property was the responsibility of the property owner. All private work was done by contractors.

The cost of removing public-elms ranged from $44 to $210 per tree; the overall median cost was $111, $106 for municipal crews and $115

[1] Mention of a commercial or proprietary product does not constitute endorsement by the U.S. Department of Agriculture, the Forest Service, or University of Wisconsin Extension.

for contractors. The cost of removing private elms ranged from $85 to $300; the median cost was $150 (Table 1). Tree disposal costs at landfills, reported by 5 communities, ranged from $5.50 to $12.00 per ton; the median cost was $7.00 (Table 1).

Discussion

Tree removal is the most expensive item in community DED control. The wide range of removal costs is due to differences in tree size, crew efficiency, wage levels, and bids. There was no cost advantage associated with tree removal by municipal crews versus contractors.

Disposal cost often is overlooked when considering the total cost of DED management. Only 5 communities paid directly for tree disposal. Those with their own landfill did not; however, a substantial amount of wood over the years will shorten landfill site life. Utilization of wood could prevent this as well as recover part of DED management costs.

Sanitation survey costs were calculated on a per-tree and a per-unit area basis (Table 1). Area figures probably represent annual costs better than per-tree figures because they take into account the need to survey the entire management zone for broodwood each year, regardless of the number of elms.

Symptom survey, basic to good DED management, must be thorough and timely to detect DED at early stages of symptom expression. Thoroughness need not be expensive, however. Survey costs for our communities were a small part of their expenditures for DED management. The median cost, $0.11, is lower than the average cost ($0.35/elm) of 39 midwestern communities reported by Cannon and Worley (1980).

Root-graft control by girdling costs less than control by fumigation especially since 2 to 4 barriers are required to isolate a single elm. Girdling a diseased tree once could prevent the fungus from being transmitted to adjacent healthy elms if it is done before the fungus moves into the lower trunk.

The cost of systemic fungicide injected was low compared with that reported by Kondo and Huntley (1973), probably because of differences in tree size, equipment type, and crew efficiency. Systemic fungicide injection is expensive in relation to other control practices and should be limited to trees of unusually high value. Injection should be considered only after sanitation and root-graft control.

Total program costs. All of the control practices discussed were used by 6 communities. Their data yielded total program costs (Table 1). The median cost, $6.40/elm, seems in line with average 1980 tree care costs of $11.23 for cities with a population of 10,000 to 25,000, and $8.07 for larger cities (Giedraitis and Kielbaso, 1982). If we subtract the 15% included for tree planting, these costs would be $9.54 and $6.79, respectively.

The average per capita cost of $2.92 for DED management is $0.40 above that reported by Giedraitis and Kielbaso (1982) for all tree care in cities with a population of 10,000 to 25,000; but for cities in the North-central United States, the average tree-care cost was $3.06.

Costs of individual practices as a proportion of total DED management program are shown in Figure 3. The cost of elm removal and disposal was almost four times more than the combined costs of the other practices. The basic program of

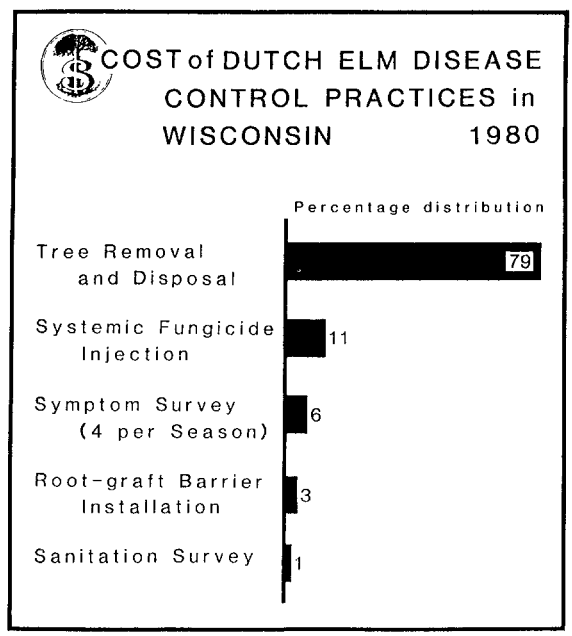

Figure 3. Average percentage distribution for costs of DED control practices.

survey, tree removal and disposal accounted for 86% of the total cost.

Clearly, the best way to lower the cost of DED management is to diminish the cost of elm tree removal and disposal. One way is to spend more on early detection of DED and prompt removal. Fewer elm removals mean much lower costs. The balance between added cost of additional surveys and the cost of tree removal depends on the number of elms that could be saved (Cannon and others, 1977).

The cost of replanting and temporarily decreased property values are part of the loss to DED. We did not determine these costs.

Management of DED requires timely, careful use of appropriate control practices for a long time. DED programs are not cheap, but the cost is similar to costs for care of other urban trees.

Integrated DED control program costs can be kept low by including only essential components: (a) survey, (b) sanitation, and (c) root graft control. The wide range of costs for each practice used by Wisconsin communities shows that money can be saved by improved operating efficiency.

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