

Science and Management Work Together In Controlling Dutch Elm Disease in NCR

By James L. Sherald and Richard S. Hammerschlag

More than 3000 elms have long played a significant role in lending grace and continuity to the federal core of our Nation's Capital. The American elm *Ulmus americana*, the predominant species, was selected undoubtedly because of its unique arching habit, its rapid growth, and its tolerance of urban stress. Unfortunately, in addition to its many good qualities, the elm is susceptible to Dutch elm disease (DED), a vascular wilt disorder caused by the fungus *Ceratocystis ulmi*.

The first case of DED in Washington, D.C. was recorded on the grounds of the Lincoln Memorial in 1947 by Horace V. Wester of the National Capital Region (NCR). Although many elms have succumbed to the disease since then, yearly losses have been kept below 3 percent which indicates a good management program. In communities where little or no DED control has been exercised, elm populations were decimated shortly after the onset of the disease.

Successful DED management in NCR is credited to an evolving integrated management program coordinated by NCR's Ecological Services Laboratory (ESL). The ESL provides a link between technology and management through literature review, contact and cooperation with researchers and other professionals, resource monitoring, training, and applied research. All of these avenues are being used by the ESL in directing DED management in NCR.

In Washington, D.C., DED is spread almost exclusively by the European elm bark beetle, *Scolytus multistriatus*. The beetle is attracted to stressed and dying elms where it lays its eggs beneath the bark. Since dying elms are often infected with DED, beetles emerging from these trees are covered with fungal spores. In the process of feeding in twig crotches of healthy elms, beetles introduce these spores into the tree's water conducting tissues initiating new infec-

tions. Disease control relies primarily on reducing the beetle population through sanitation, which involves scouting, detection, and rapid destruction of brood trees.

Monitoring trees for DED symptoms and beetle broods is a joint responsibility of tree maintenance workers and the ESL pathologist. Tree workers, who are trained by ESL staff in disease detection and management, scout the elm population throughout the summer for symptoms. Twig samples are collected from suspected trees and brought to the ESL for culture of the pathogen to confirm infection. Laboratory confirmation is particularly important for trees exhibiting questionable symptoms and for documenting the disease incidence.

Most infected trees are removed immediately; however, some trees with early, localized infections may be treated. A three-year cooperative research project between the USDA Forest Service and the ESL demonstrated that the combination of radical pruning coupled with fungicide injections into the trunk and infected limb will save about 50 percent of the trees treated. Such therapy is extremely important when elms of historic or significant landscape importance are infected.

Although sanitation has been practiced rigorously in cultivated elm populations, naturalized elms along Rock Creek as well as the Potomac and Anacostia estuaries have generally gone unmanaged. These natural stands are adjacent to cultivated plantings, and serve as beetle reservoirs. Since natural elms cannot be removed without considerable disruption of surrounding vegetation, other measures must be explored.

A pilot project is being conducted to evaluate the arboricide (tree killing) cacodylic acid as a treatment for trees infected with DED. These trees, upon being injected with the chemical, dry out rapidly, killing the tree and all beetles developing beneath the bark. The technique is effective, inexpensive, and can be applied in areas where tree removal is not possible or in cultivated plantings where constraints prohibit tree removal before beetle emergency. Cacodylic acid injections may soon become part of the DED management program. The pilot project is being conducted by Dr. Jerry Lanier of the College of Forestry and Environmental Sciences at the State University of New York - Syracuse, in cooperation with the ESL and maintenance staff in several NCR parks.

Another tactic used in DED management is the spraying of elms with the insecticide methoxychlor to protect twig crotches from beetle feeding. The ESL has cooperated with the USDA Forest Service in collecting twigs from sprayed trees for beetle feeding studies.

Tree workers were interested to learn from the study that only the lower limbs were being adequately protected and that coverage would have to be improved. Previously, two applications of methoxychlor were made, one in the early spring and the other in late June. Beetle feeding studies showed that the spring application remained effective throughout the period when the beetles were active. Because of the long residual effectiveness of methoxychlor the summer spray has been eliminated. As sanitation improves in the natural areas and the surrounding urban commu-



American elm tree branches are lopped off near the Jefferson Memorial in Washington, D.C. as the first step in destroying the tree, infected with Dutch elm disease. USDA Photo

nity, beetle populations will decline and methoxychlor may no longer be necessary. Consideration is currently being given to limiting methoxychlor treatment to the most highly valued historic elms.

A biological approach to beetle population reduction that has been explored is the use of sticky traps baited with the elm bark beetle pheromone "multilure" – an aggregating pheromone that attracts both male and female beetles. Multilure is composed of three chemicals – one produced by the host (the tree) and two produced by the virgin female beetle. Although research has not shown trapping to be effective in reducing the incidence of DED, the ESL has used "multilure" baited traps in monitoring the timing and number of beetle emergence periods.

Biological control of the fungal pathogen is also being investigated. Isolates of the bacterium *Pseudomonas syringae* are known to kill the DED fungus in laboratory cultures. Injections of these isolates into the water conducting tissues of elms may establish the bacterial antagonists as permanent residents in the tree's vascular tissue and provide "immunity" to DED infections. Unfortunately, initial studies at the ESL nursery have not shown the treatment to be effective. This approach is new and more research is required for full evaluation of its efficacy.

The most promising approach to long term management of DED is through the use of DED resistant elm species and cultivars. American, Asiatic, and European elms from many sources have been screened and evaluated for resistance in NCR parks and at the ESL nursery. Some of the best selections are being propagated and grown for NCR by the ESL and several commercial nurseries. The elm is still the predominant landscape tree within NCR urban parks and in some areas, such as the Mall where most of the original planting remains, the elm population will be perpetuated. In other areas where the elm does not play as significant a role it will be replaced with other tree species. The ESL is working with the Regional Tree Advisory Committee to determine those areas where elms should continue to be the dominant tree and those areas where other species can be introduced.

By reducing the size and increasing the resistance of the elm population, DED will become less of a threat to the NCR urban forest.

For the first few years following the outbreak of DED



Elm limb prepared for a therapeutic fungicide injection.

in Washington, D.C., a cooperative sanitation program existed throughout the city. In recent years controls have slackened in surrounding areas and the disease incidence is beginning to rise. Since the NCR elm resource depends on effective DED management in the surrounding community, the ESL has initiated a Save the Elms Task Force to coordinate and encourage a community approach to DED management. The Task Force is under the auspices of the National Capital Planning Commission. A comprehensive DED management strategy stressing sanitation practices for all elms within the District of Columbia is being developed. Soon the Task Force will seek a commitment from city jurisdictions to adhere to the program. The ESL will continue to participate in the Task Force by monitoring the effectiveness of the program and by providing recommendations as new weapons and techniques are developed for dealing with the disease and its carriers.

Like so many other resource management problems, Dutch Elm disease requires continual technical direction from a scientific staff closely allied with the resource and with those who manage it.

Hammerschag is chief of the MCR Ecological Services Lab. Sherald is the lab's plant pathologist.

Editor's Note: On pages 56-66 of the August 1981 issue of Scientific American, "Dutch Elm Disease" by Gary A. Strobel and Gerald N. Lanier describes in scientific detail the techniques discussed here. The article is illustrated with maps, drawings, and scanning electron micrography, showing the beetle (two species), the characteristic patterns that the disease etches on elm sapwood, and the molecular structure of the toxic substance from cultures of the Dutch elm disease fungus.



Injection of a nursery elm with a suspension of an isolate of *Pseudomonas syringae*, which is antagonistic to the Dutch elm disease fungus.