WOUNDS: NUMBER ONE PROBLEM OF CITY TREES

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New information about the decay process in trees, and a new tool for detecting decay, have come from research during the last decade. These advances give us new opportunities to combat the number-one problem of city trees: wounds. Wounds start the processes that can lead to decay. And decay can lead to hazardous and unsightly trees. There are few city trees that reach maturity without receiving many wounds.

City trees are especially vulnerable to many types of wounds. They seem to always be in collision courses with moving people, pets, and vehicles of all types. City trees are wounded by lawn mowers, snow plows, by nails for posters, and by construction equipment during street repairs.

Yet the most common and most serious wounds on city trees usually go unrecognized most of the time--branch stubs. The stub or opening into the tree that remains after a branch dies, or is broken, or is pruned improperly, is indeed a serious wound. All trees have branches, and all trees lose some branches during their life.

If a tree is vigorous, and if the branch is pruned properly, the wound will heal rapidly. But if the tree is not vigorous, and if the branch is not pruned properly, the wound heals slowly. Then the wood-inhabiting microorganisms have an easy access into the tree.

Trouble starts for the tree. It is the branch stub that makes wounds such an important problem on all species of trees all over the world. Trees in the city are at a greater disadvantage than forest trees in this respect, because the city trees have all the problems that go with branch stubs plus the greater number of mechanical wounds due to people, pets, vehicles, and construction equipment. This disadvantage is even greater when you consider the other stresses that city trees suffer, such as pollution and salt injury.

Indeed, city trees can be killed by pollution, Dutch elm disease, and other destructive forces. But wounds are problems on all species of city trees throughout the United States. People realize that wounds on humans are major problems, but they do not realize that wounds are major problems for trees too. The accumulation of wounds on a tree over a long period can weaken the tree. When a weak tree dies, some obvious secondary agent is often considered as the killer.

As more people move back to the inner city, more trees are being planted. Many young trees are wounded during planting. Basal wounds are covered with soil and are out of sight.

The wound problem on city trees is serious now, and it will get worse unless something is done. One thing we can do is to develop tree-maintenance programs, using new information and new tools that have come from recent research on wounds and decay.

COMPARTMENTALIZATION OF INJURED TISSUES

We know that trees respond to wounds in a unique way (Shigo and Larson 1969, Shigo and Hillis 1973). Many tree defense systems are activated immediately after wounding. Chemical barriers are formed in the wood behind the wound to prevent infection by microorganisms. These barriers stop most wood-inhabiting microorganisms most of the time. The wound then heals.

But in other cases, some aggressive wood-inhabiting microorganisms surmount the protective chemical barriers set up by the tree. Then infection begins. When this happens, the tree has another line of defense: the wood infected by the mirroorganisms is walled off--compartmentalized. Then the microorganisms grow only in the wood in the compartment. The wood that forms after the tree is wounded is seldom infected unless other wounds are inflicted at a later time. Then other compartments form.

An understanding of compartmentalization is the key to understanding the development of decay in living trees. We know that wounds on young trees do not spell doom in all cases. When the young wounded tree is kept vigorous and additional wounds are prevented, the tree will compartmentalize its injury and continue to grow. But as additional wounds are inflicted over a time, the decay that develops in the compartments can weaken the tree.

DETECTION OF DECAY

Here is where a new tool can be used (Shigo and Shigo 1974) to detect decay in living trees. The meter measures the electrical resistance of wood to a pulsed current. It works this way: First a minute hole is drilled into the tree with a battery-powered drill. A long thin twisted-wire probe, attached to the meter by a thin cable, is inserted into the hole. A pulsed current, passed through one wire on the probe, passes through the wood from the probe tip and returns to the meter through the other wire on the probe. The resistance is measured in K (thousand) ohms on the meter. As the tip of the probe passes through sound tissues, the electrical resistance remains approximately the same. But as the probe tip passes from sound wood to unsound wood, the electrical resistance displayed on the meter drops abruptly.

Some wounds appear to be much worse than they are. Other wounds may not appear serious, but a great amount of decay is associated with them. How can you tell what condition you have in a tree? The new tool will tell you what the internal condition actually is.

On the basis of this information, an action plan can be started: remove the hazard tree or do everything possible to increase its vigor, knowing that the tree will compartmentalize its injured tissues.

SUCCESSIONS OF MICROORGANISMS

We know that many species of microorganisms are involved in the decay process: bacteria, non-decay fungi, and decay fungi (Shigo 1967). They infect wounds in a wave action. One group of microorganisms follows another, and each group exerts its infection force against the defense forces of the tree.

It takes time for microorganisms to get established in a tree. This gives us time to help the tree after wounding. We know also that, if we can disrupt the normal successional patterns of microorganisms by purposely infecting the wound with another fungus, we can get even more time to help the tree.

WOUND DRESSINGS DO NOT STOP DECAY

But what do we do for the tree after we know we have some time to help it? One thing we should not do is cover the fresh wound with some wound dressing and forget it, thinking we have done all that is possible to help the injured tree!

After a tree is wounded, the injured bark and wood should be removed with a sharp knife. The wound should be shaped to form an ellipse when possible. This often means that the wound must be enlarged. The important point is that all the injured bark must be removed so that vigorous bark is in contact with sound wood at the margins of the wound.

Then do everything possible to increase the vigor of the tree. Properly prune dead and dying branches; fertilize and water the tree; and thin out less valuable competing trees when possible. After all of these steps are taken, some wound dressing may be applied--only to indicate that someone has treated the tree.

Wound dressings alone do not stop decay (Shigo and Wilson 1971). To apply wound dressings without doing all the other things for the wounded tree is foolish.

GREATER AWARENESS OF WOUNDS NEEDED

Too often people think that trees are so big and strong that they can withstand anything. This is not so. We must make people more aware of wounds and what they can lead to. Awareness of a problem is the first step towards solution. Know that wounds start the processes that can lead to decay. Know that there are ways to help wounded trees. Then we can continue to get the benefits that only healthy trees can provide.

LITERATURE CITED

Shigo, A. L. 1967. Successions of organisms in discoloration and decay of wood. Int. Rev. Forest Res. 2: 237-299. Academic Press.

Shigo, A. L., and W. E. Hillis 1973. Heartwood, discolored wood, and microorganisms in living trees. Ann. Rev. Phytopath. 11: 197-222.

Shigo, A. L., and E. vH. Larson 1969. A photo guide to the patterns of discoloration and decay in living northern hardwood trees. USDA Forest Serv. Res. Pap. NE-127, 100 p.

Shigo, A. L., and A. Shigo 1974. Detection of discoloration and decay in living trees and utility poles. USDA Forest Serv. Res. Pap. NE-294. 11 p.

Shigo, A. L., and C. L. Wilson 1971. Are wound dressings beneficial? Arborist's News 36: 85-88.

THE DUTCH ELM DISEASE: CHALLENGES AND SOLUTIONS IN URBANIA

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American elm is the most abundant tree species in many cities and towns of this country. For many years it has been widely planted along city streets, in parks, and on private property. But Dutch elm disease is now eliminating elms as a major species in the urban landscape.

Killing trees is an obvious, highly visible impact of this disease. Less obvious, but of major importance, is the often overwhelming financial burden on municipalities and homeowners for removing dead trees, the substantial reduction in real estate values, and the erosion of aesthetic quality of the urban environment.

Millions of elms have been killed, and the millions that remain are threatened with seemingly inevitable destruction. We don't have an accurate count of the number of trees that die each year because of Dutch elm disease, nor can their value be precisely measured. But the disease is widespread in 38 states, and an annual loss of 400,000 elms worth 100 million dollars has been generally accepted as a conservative estimate. For all of these reasons, public concern for current and future losses due to Dutch elm disease may be greater than for any other urban tree problem.

Dutch elm disease is caused by a fungus infection that almost always results in death of the tree. The fungus is spread from diseased trees to healthy trees by elm bark beetles. These beetles are attracted to recently dead, weak, and diseased elms, where they tunnel into the inner bark, breed, and lay eggs. The eggs hatch, producing larvae that develop into pupae that develop into the next generation of adults. These activities account for the scarab-like scars apparent after the bark sloughs from dead elms. The new generation of adult beetles emerge and search for a new breeding site, but enroute they may feed in twig crotches in healthy elms. Those that emerge from diseased trees may have spores of the fungus adhering to their bodies; and these spores, rubbed off into feeding wounds, can produce new infections.

Another avenue of spread for the Dutch elm disease fungus is through natural grafts between the root systems of diseased elms and nearby healthy elms. Such connections frequently exist, and this mode of spread contributes significantly to disease incidence and greatly complicates suppression measures.

The proven methods for controlling Dutch elm disease have not changed in recent years. They are: (1) sanitation--prompt removal and disposal of dead and dying elms that provide beetle breeding sites and, in the case of diseased trees, a source of fungus inoculum; (2) spraying healthy elms with insecticide for protection from beetle feeding; and (3) in some situations, chemical or mechanical severence of roots to prevent spread of the fungus through root grafts.

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