SOME NEW IDEAS IN TREE CARE[1]

by Alex L. Shigo

Decay is a major cause of damage to all species of trees all over the world. New information about the decay process has come from many researchers during the last few decades. This new information gives us new opportunities to control decay more effectively.

From the new information has come an expanded concept of decay. This concept gives us a more complete understanding of decay.

A complex process

The decay process in living trees is extremely complex. It involves interactions of microorganisms among themselves and with the tree in an ever-changing environment. A model has been developed that helps to combine these events in such a way that patterns of changes that occur most of the time after wounding can be understood. It is the pattern of events that are important (see decay model below).

Wounds start the processes that could lead to decay. Immediately after a tree is wounded, it reacts! A complex chemical system for defense is activated. Most of the time this system functions effectively, and microorganisms do not infect. Stage 1 in the model involves those defense processes of the wounded tree.

Some microorganisms that colonize the surface of the fresh wound may begin to grow into the tree. To do this, these microorganisms must first surmount the chemical defense barriers formed by the tree after wounding (Stage 2). When some pioneer microorganisms infect, others may follow. The internal defense system of the tree could still stop or stall the development of these microorganisms in Stage 2, and the wound would heal. But, once wood cells around the wound are invaded and killed, other microorganisms begin to digest the dead cells (Stage 3).

When microorganisms are successful in invading the tree, they do not grow at will in the tree. The tree has a very strong second line of defense. The tree begins to wall off the invaded wood.

The Decay Model

	Stage 1	Stage 2	Stage 3	
Wound →	Host response to wounding	Infection & invasion	Decay of wood	→ **Total Decomposition of Wood**
	Tree only	Tree and microorganisms interactions	Microorganism interaction with other microorganisms	

A tree is a highly compartmented plant. In a sense, a tree is a multiple plant made up of

1. Presented at the International Shade Tree Conference in Detroit, Michigan in August, 1975.

many trees, trees within trees within trees. Each growth ring is a tree. Each growth ring is divided into compartments.

Trees do not replace or repair wood injured by wounds. The injured wood and the invading microorganisms are compartmentalized. Details on an expanded concept of decay and compartmentalization have been published by the author (See References).

Here are some recommendations for tree care that have come as a result of research on the expanded decay concept.

Recommendations and comments

1. *Prevent wounds*

Make people aware that wounds start the processes that can lead to decay.

Point out that wounds inflicted during construction operations are especially damaging.

Man and his activities are major causes of wounds.

2. *Treat wounds and wounded trees properly*

Cut away injured bark to an interface of healthy bark and healthy wood. Shape the wound to form an ellipse when possible.

Increase tree vigor. Help the tree to help itself.

Properly prune dead and dying branches (caution: poorly pruned branches are major causes of decay).

Fertilize and water properly.

Remove dead wood from around the tree-sanitation.

Establish a tree-maintenance program.

Remove less valuable woody plants that may be crowding the valuable wounded tree.

If the situation is such that some sign, such as paint, is needed to show that the job has been completed, then add a thin coat of some wound dressing; but otherwise, *do not paint the wound*. The commonly used wound dressings do little to stop decay.

Know that a vigorous tree has a strong defense system that is effective most of the time. Most wounds will heal. Some trees of the same species have stronger wound-defense systems than others. Even if the perfect wound dressing were known, its value would still depend first on the proper care of the wound and the care of the tree. If the perfect dressing were applied without treating the wound and the tree properly first, the perfect dressing would be of no value. This means that almost all of what can be done to help a tree after it is wounded is now known. But, the simple steps necessary to help the wounded tree *must be done properly*.

3. *Examine wounded trees carefully*

Before considering the steps for wound treatment, consider first the healing history of the tree by observing old mechanical wounds and old branch stubs and pruning cuts. A tree that has healed old branch wounds rapidly will usually heal new wounds rapidly. The opposite is also true.

Figure 1.—Dissection of a poorly healed large branch stub on a paper birch. Poorly healed stubs are major external indicators of decay.

Many poorly healed wounds may indicate the beginning of a hazard situation, especially when the tree is over mature.

When thinning young trees, use branch-stub healing as an indicator of healing potential. Select for removal those young trees that have poorly healed stubs.

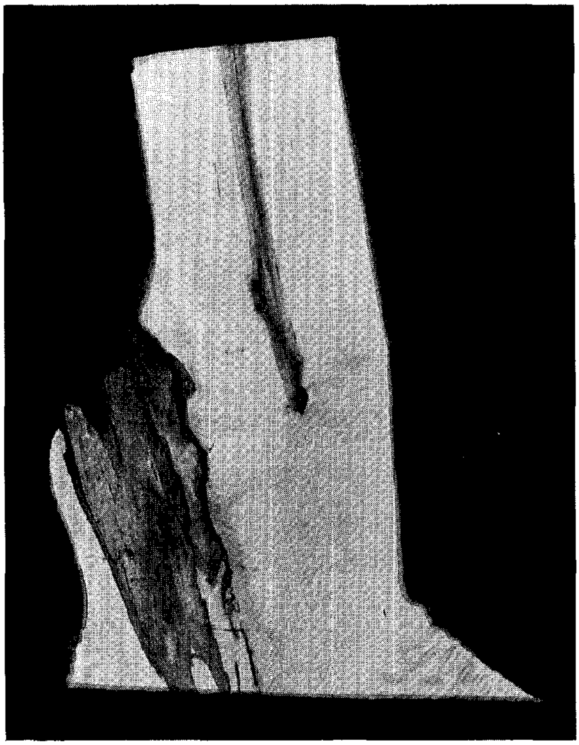

Figure 2.—Dissection of a maple with a dead basal sprout. The decay in the sprout stub was compartmentalized, and it did not spread into the main trunk.

4. *Learn about compartmentalization*

Know that decayed wood is compartmentalized in wood present at the time of wounding and that the new wood that continues to form after a tree is wounded is not infected by microorganisms from the old wound. New columns of decay will form only when new wounds are inflicted. A wounded tree still has a chance to live for many years with its decay compartmentalized, especially if it is kept vigorous and new wounds are not inflicted.

5. *Fill cavities properly*

When removing decay in preparation for filling cavities, take great care not to break the inner compartment wall that separates the decay in the cavity from the surrounding healthy wood. If this compartment wall is broken, decay will spread into the healthy wood that surrounds the decay.

6. *Do not bore holes in a tree to let out water from a cavity*

The holes will start new columns of decay. It is only because the hollow is separated from the healthy wood by the tough compartment wall that water remains trapped!

7. *Cut suppressed sprouts from clumps as soon as possible*

Choose for remaining sprouts those that have well-healed branch stubs. When sprouts are still around the old stump, choose for remaining sprouts those that are low on the old stump. Because of compartmentalization, the worst that can happen when a sprout is cut is that the diameter of the remaining sprouts at the time the others are cut will be the diameter of the column of decay.

8. *Determine the internal condition of the tree*

Use the Shigometer to determine the internal condition of trees, especially those that do not have external indicators of internal decay. The meter will indicate whether the tree is

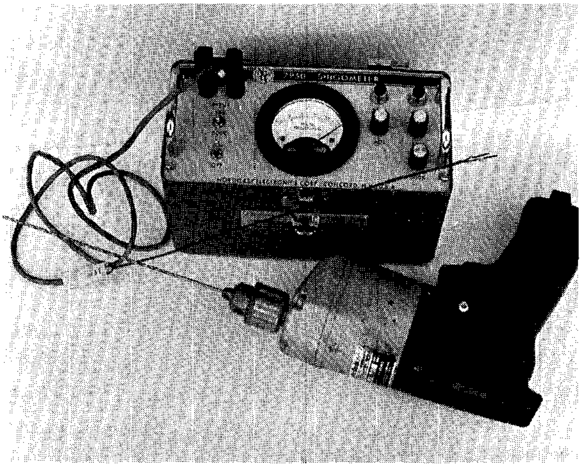

Figure 3.—The Shigometer and accessories for detecting decay in trees. A 3/32-inch hole is drilled into the tree with a battery-powered drill. A special probe is inserted into the hole, and the electrical resistance of the wood at the probe tip is recorded on the meter. When the probe tip moves from sound to decayed wood, there is an abrupt decrease in resistance.

sound, decayed, or starting to decay. If the tree is sound, a maintainance program should be developed to keep it sound. If the tree is starting to decay, every effort should be made to increase the vigor of the tree by proper pruning, thinning, and fertilizing. If the tree is decayed, its possible hazard potential should be evaluated. If it is a hazard, it should be removed.

Using the meter, determine the condition of the wood behind wounds. A wound that looks serious may not be, while one that does not look serious may be associated with advanced decay. Use the meter to detect the depth of the compartment wall that surrounds a decay column. When filling the cavity, make certain not to break the compartment wall from the inside.

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ABSTRACT

Cathey, H. M., and L. E. Campbell. 1975. **Effectiveness of five vision-lighting sources on photo-regulation of 22 species of ornamental plants.** J. Amer. Soc. Hort. Sci. 100(1): 65-71.

One of the changes that is occurring in outdoor environment is increased installation of lighting for outdoor activities and security. High-intensity-discharge (HID) sources of light make possible acceptable visibility with less use of electricity than incandescent (INC) filament lamps. Illumination levels in outdoor lighting now are from about ¼ foot-candle (ft-c) to 5 ft-c along roadways, walkways in parks, and building surroundings. Both the amount of light per unit area (ft-c) and the total area lighted have increased. The HID lamps provide up to 6 times as much visible light as incandescent lamps (NC) for equal use of electricity. They also differ in color, providing a range from blue to yellow.

Three types of HID lamps are in use: mercury (Hg), metal-halide (MH), and high-pressure sodium (HPS). Mercury (Hg) was the main source of outdoor lighting through the "sixties." The original "clear" Hg lamps emit radiation that appears blue. Other Hg lamps with "improved color" emit radiation that appears bluish to greenish white. Metal-halide lamps emit radiation that appears white or slightly green. They are more efficient than Hg and have better color rendition. High-pressure sodium lamps emit radiation that appears intense yellow. They are more efficient than the other HID lamps and have a broad spectrum, peaking near 589 nm (yellow), with some radiation near red. Metalhalide lamps emit little red radiation, with peaks from 400 to 600 nm. Mercury lamps have higher peaks, near 400 to 500 nm, and essentially no red radiation.

We determined the effects of outdoor night light sources on 22 species of plants that are used in landscapes or grown in greenhouses. Preliminary tests were conducted at 1 ft-c, a level common in present lighting. Subsequent experiments were conducted at intensities up to 32 ft-c to determine if any of the lights could be used to control photoperiodic response as do incandescent-filament lamps. The interaction with night temperature was also investigated.