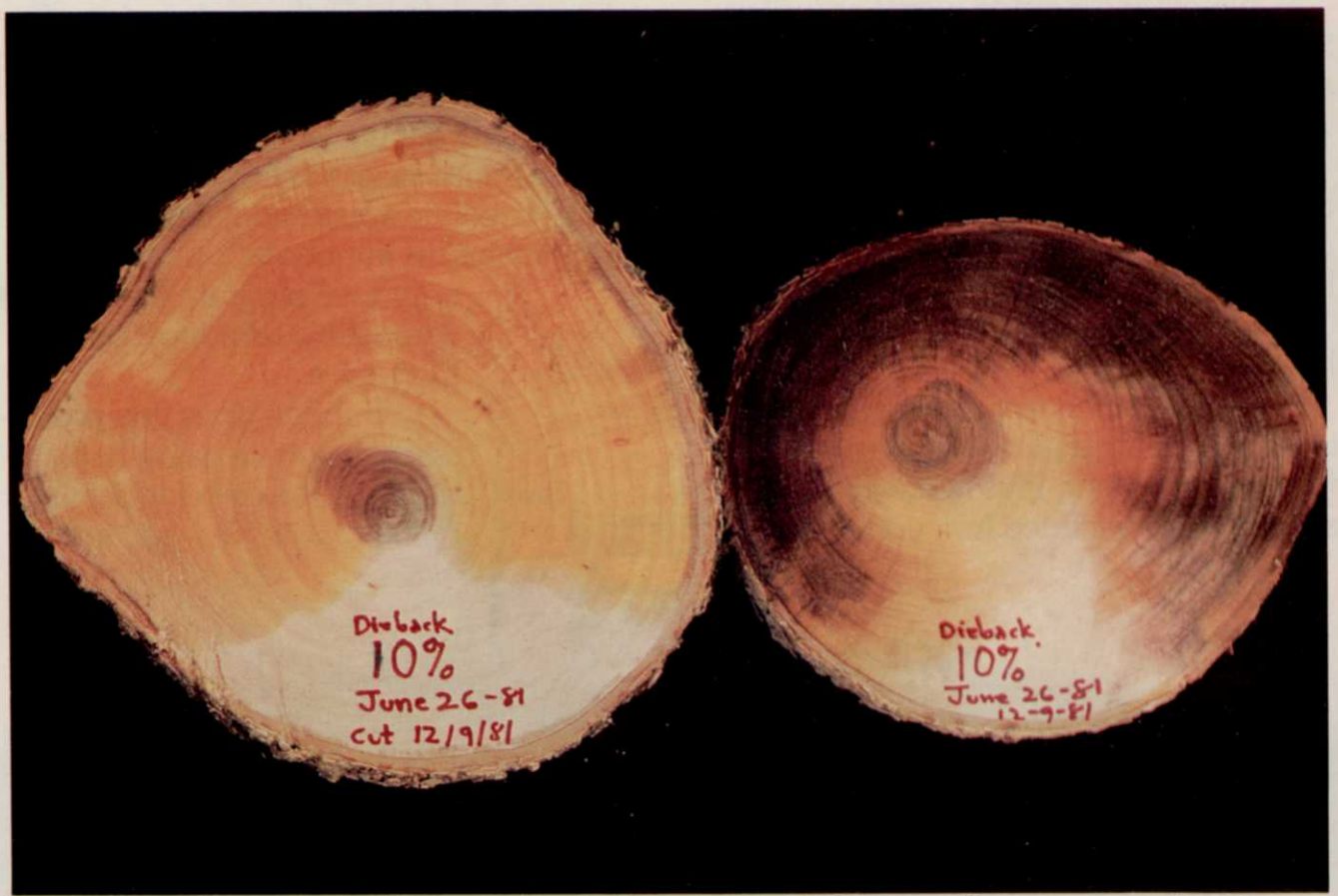
SHIGO AND HIS SAW SHED NEW LIGHT ON TREE HEALTH

By BRUCE F. SHANK



Darkened wood tissue *indicates starch reserves of sample. Slice on left shows virtually no reserves—a hopeless case. Whereas, the slice on right came from a healthy tree with good reserves.*

Alex Shigo, chief scientist at the USDA Northeastern Forestry Experiment Station in New Hampshire, is well-known to the tree care community. In 1950, he began to dissect hundreds of trees with a chain saw to pin down the actual response of trees to injury and maintenance practices. He is largely responsible for finishing work begun by Hepting in the 30's on compartmentalization. Shigo developed a model called CODIT to show exactly how a tree walls off injured and diseased wood to protect the rest of the tree.

His string of discoveries has not stopped. In fact, he is very close to a major discovery within the next two years. If he is correct, a number of standard maintenance practices could be reevaluated or replaced with more effective methods.

I visited Dr. Shigo and his team of scientists in New Hampshire in March to see first hand how he works and what is on his mind for the coming years. Take my word, his lab is a busy one with thousands of wood samples stacked for testing and his staff going in and out for more.

The following article is based on 12 hours of interviewing. Hopefully it describes the unique train of thought of this leading tree researcher. Consider these statements by Shigo, "We should be more concerned with selecting and planting decay-resistant trees than with trying to treat trees like humans. We must have strongly compartmentalizing trees in the city. A tree can survive after many severe wounds as long as it has the energy and time to wall off the injured and infected tissues. Trees may contain a large amount of decayed wood without having obvious external indicators. Tree care practices are based upon a concept of tree decay developed more than a century ago."

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Once an idea is firmly established, it takes years of hard work and education to amend it. Shigo has spent more than 30 years reevaluating old notions about three disease and care.

There are many people causing unnecessary damage to trees during pruning by cutting into the collar of the branch. Many still use tree wound paint even though it serves no purpose to the tree. During cavity repair, excessive cleaning may reinjure the tree rather than help it. Injecting materials into the tree may do more harm than good, especially if holes are drilled along the same line year after year. These are just a few of the conclusions made by Shigo while working for the Forest Service.

The biggest breakthrough, however, may be just around the corner. Shigo is focusing on the energy needed for a tree to protect itself and the level of stored energy in healthy versus unhealthy trees. If the energy problem can be solved, then perhaps the tree will depend more on itself for maintenance.

"It really was the chain saw that made it possible to find out so much about trees so rapidly," Shigo says. He estimates he has sliced and cored more than 15,000 trees in his research. It is the chain saw that makes Shigo different from his fellow researchers. He takes the lab work of others and goes to his lab, the forest, for application. "A scientist doesn't create totally new ideas," says Shigo, "He adapts the ideas of previous scientists to a new perspective."

Most of Shigo's concepts are recent. Even though his work extends to the late 40's, his CODIT system, pruning recommendations, and wound dressing findings were published only in the last five years. For science, that is very recent and those who apply his work today are current.

His work on energy reserves in trees really developed out of Dutch Elm Disease research he is doing. When potassium iodide was applied to cores or slices of various trees, healthy trees showed good starch reserves while dying trees showed little if any reserves. The thought follows if starch reserves can be restored, the tree's defensive reactions will improve and it will survive. Shigo is also working on Chestnut blight.

One of his first successes was the detection of weak utility poles by an electrical probe, now known as the Shigometer. The electrical resistance of the pole to a pulsed current can show whether a pole is sound or not. The same technique can be used for trees to detect interior decay. The device was actually constructed for New England Bell and is now produced by an electronics firm. Shigo did not name the device nor does he receive any money from its sale.

Compartmentalization in Trees

The original concept of tree decay was wounds expose heartwood and decay organisms attack the "dead" heartwood. Arborists saw many trees with decayed interiors and this concept made sense. In the 1930's, G.H. Hepting of Mississippi studied tree decay following forest fires. He noticed that decay in trees tended to be localized.

Shigo knew of Hepting's work and used a one-man chain saw, first developed in the late 40's, to dissect trees across and up and down. From his findings, and those of his colleagues, Shigo hypothesized that the tree responded to injury by creating vertical and horizontal barriers to contain the spread of decay. He developed an explanation involving four walls, three stopping inward or vertical spread and a fourth separating the wound from new growth. If you look at a slice of an older tree, you

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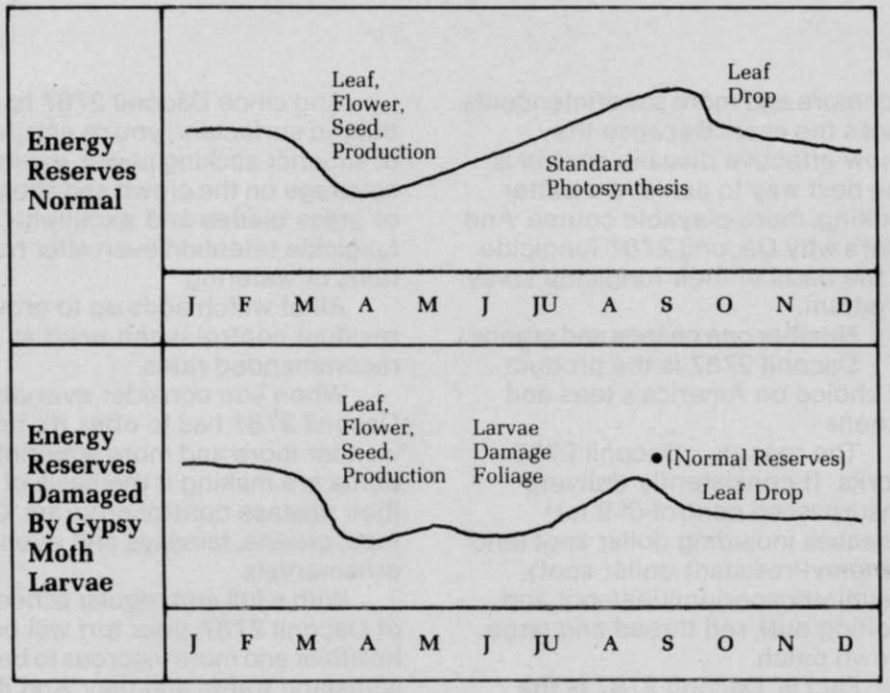
Myths About Trees

1. Trees heal wounds.
2. All wood cells are dead, unresponsive.
3. Decay develops unrestricted through heartwood.
4. Decay starts when wounds expose heartwood.
5. Trees get their food from the soil.
6. When pruning, cut flush with the stem.
7. Frost initiates frost cracks.
8. Callus forms on from the sides of the wound.
9. Point ends when tracing wounds, use pointed or diamond-shaped washers.
10. Core holes to drain water from cavities.
11. Cavities should be cleaned to sound wood.
12. Wound dressings stop decay.
13. Water causes rot.
14. Decay is a problem of old trees only.

Shigo's laboratory *is the forest where he makes unusual cuts with his chain saw to expose new facts on tree response to injury and decay.*

SHIGO *from page 30*



can see areas where injuries by man or insect caused decay and the tree walled the wound off.

Recently, Shigo has theorized the walling off process takes energy, just as growth, foliage production, and seed production do. If a tree is weak from performing any normal task or from previous wounds, it walls off poorly and decay will spread.

In pruning, cutting flush to the trunk injures the collar of the branch. This, in turn, causes damage within the trunk. If the collar is not damaged, a wall will form and no damage is done to the trunk. This outer wall, according to Shigo, is highly protective but weak structurally. When other strains, such as wind or temperature, are put on the trunk, the tissues along the exterior wall may split to form a circumferential crack called a ring snake.

The so-called heartwood of a tree may not be active in nutrient transport and storage like the sapwood, but it does provide support and will wall off decayed tissue like sapwood. The heartwood, Shigo found, is not defenseless.

Cabling and bracing does cause injury to the tree, but this damage can be minimized. Holes should be made only in sound wood and large, round washers should be used. The tree will surround and grow over the bolt, washer, and nut if properly done. Square or diamond-shaped washers should not be used since the tree has difficulty walling these off.

Lag screws should also be placed into sound wood only to assure healthy walling off of the screw inside the branch or trunk.

Prior to filling cavities in trees, do not cut the wound to be pointed at the top and bottom. The wound will close better if the shape of the opening is oval or round. Filling the cavity is a preferred substitute to drilling a drain tube. Drain tubes only cause more injury. Wet wood does not necessarily mean decayed wood, Shigo says. Filling and draining cavities may not be helpful.

Other Ideas

One major problem with Dutch Elm Disease, according to Shigo, is the tree produces seed before it leafs out. Therefore the tree is not replacing energy by photosynthesis during seeding. The borer attacks the tree in a weakened condition, and the elm lacks the energy to properly wall off the injury. If the elm were healthy and had the needed energy to wall of the insect's damage, it would stand a better chance of survival.

You can make an energy curve for a tree by charting when it uses energy and when it produces energy. It can only produce energy via photosynthesis or draw from it's reserves. Leaves carry on the process of photosynthesis, so deciduous trees produce energy only from spring to fall. Leaf, flower, and seed production use energy. Growth and defensive actions require energy as well. Any energy consuming process that occurs while the tree lacks leaves is a potential drain on its reserves and health.

As Shigo says, the city tree has many more problems than its forest relatives. Competition for survival from the seed stage is greater in the forest, however. Nursery practices may produce trees which wouldn't survive in the forest.

Trees with favorable energy curves, storage capacity, or natural resistance should be selected in the future for urban use.

Finally, some maintenance tools have not kept pace with research findings, Shigo says. Few saws or pruning tools work without damaging the collar or branch ridge during pruning. Too often the cut is sloppily made and bark is stripped during pruning. The size of the saw may actually prevent proper placement outside of the branch collar.

Shigo says there is a point when you let the patient die. Core samples showing little or no starch indicate the tree is a hopeless case. His hope is that trees with declining reserves can restore them in some way.

The case of the Gypsy Moth is a perfect example of dwindling energy production caused by foliage damage. Weakened trees are more susceptible to other injury. If energy reserves could be restored, defoliated oaks could stand a better chance for survival. Elms and chestnut trees which still have hope could be saved in the same way.

The theory appears sound. Shigo and other researchers in the U.S. are working cooperatively to prove it's sound. Some results will be available this fall. I'm going back to New Hampshire this summer to see Shigo and his team for an update. As soon as there is proof, *Weeds Trees & Turf* will let you know. **WTT**