TREES AND TREATMENTS

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Some adjustments in tree care practices have been made. Many more adjustments are needed. There are still many points about some of the adjustments I have been discussing that need further clarification. This paper is a collection of brief notes and comments on recurring questions. Additional details can be obtained from the author.

Tree basics. Trees have no wound healing process in wood. If you use the word heal, then you must know the difference between animal-type and tree-type healing. Heal does mean to restore to a previous healthy state. The restoration is by repair or replacement of cells in the same spatial position.

Callus forms after wounding. Callus does close wounds. Callus formation is closely associated with the growth rate of the tree. Callus formation also appears to be under moderate to strong genetic control.

Wood is a highly ordered arrangement of cells, with walls of cellulose and lignin mostly, that are in all gradations of aging. Every wood cell was cambium first. Some wood cells live a very short time while some others may live for over a hundred years.

Trees are generating systems. They are constantly producing new cells in new spatial positions. Even the vascular cambium changes positions every growing season.

Trees set firm boundaries between woody parts and nonwoody parts, after the nonwoody parts have aged to a genetically controlled point. Then the boundaried part either falls away or it is digested away.

Compartmentalization. Compartmentalization is a boundary-setting process that resists the spread of infection. At the time of wounding, the next season's wood is not present, and the infection cannot spread into wood that had not formed yet. The tree responds to the injury and infection by setting firmer chemical boundaries about the infected cells. The tree resists the spread, and the microorganisms grow to increase the spread. There is a tree-microorganism interaction. If the tree is very fast and effective with its boundary-setting defense system the infection will not spread. If the tree is not so fast and effective, and the microorganisms are, then rapid spread will occur. If the cambium is killed during the spread, then that part of the tree dies -- cambial dieback. When the spread is so far and fast, the entire tree may die.

While an interaction between tree and microorganism is proceeding in the wood present at the time of wounding, a barrier zone is being formed as the cambium continues or resumes its growth. The barrier zone does set a firm boundary between infected wood and healthy wood that will continue to form after the barrier zone is completed.

Energy reserves. Compartmentalization can be very beneficial in small amounts, especially when the tree has time to produce enough new cells in new positions after an injury and infection. But, when repeated injuries or infections start too much compartmentalization, the results may be harmful for the tree. Every time the tree walls off wood that would normally be used to store energy, the tree is reducing the size of its "fuel tanks". This means that there is less volume in which to store energy. And, when energy reserves are so reduced that normal tree functions cannot continue, then the tree and its remaining energy reserves are easy prey to the microorganisms.

Shigometer method. The Shigometer is a meter that sends a pulsed electric current and shows the resistance to this current in thousands of ohms on its ohmeter. The resistance is dependent on the type of electrodes used and the three major factors that affect resistance: moisture, temperature, and concentration of cations, or positively charged ions. In living trees, moisture content will be above the fiber-saturation point, or 28%. Temperature above 40°F have little affect on resistance. It is primarily the concentration of cations that affects resistance in trees.

The meter can be used for two basic type of measurements: detection of decay and determination of relative vitality. Sudden decrease may signal defects in wood. Low resistance in inner bark means high vitality.

Wound dressings. Results of several studies with many materials over a 13-year period show that no materials stopped decay. The tree was more important than the treatments. Some individual trees of a species closed and compartmentalized wounds very rapidly, regardless of treatments. Other individuals of the same species did not close or compartmentalize wounds effectively, regardless of treatment.

Many materials reduce discoloration, but discoloration is not decay. Some discolored wood is essential for the tree's defense system. It may be that early disruption of the discoloration process may actually speed decay. Many materials will stimulate callus formation, but callus formation is not associated with the decay process. Large wounds seldom close completely; even when they appear closed, they have very fine hairline cracks. Such a situation favors the growth of decay-causing fungi.

When insects infest wounds, they usually bore into the dying tissue around the wound, so dressings would be of no benefit.

Many investigators have considered putting fungicides in dressings, but the decay-causing fungi are seldom the first to infect wood behind wounds.

Cavity filling. Great care should be taken when cleaning a cavity before filling, so as not to break the boundary that separates the decayed wood from the sound wood. A cavity can be filled for cosmetic reasons with any type of materials that will not rub against the living tissues. I know of no data that show added strength due to filling; although hardware inserted during filling may add strength.

Inections and implants. Injections properly done may be beneficial. Injections improperly done will be harmful to the tree.

Holes should be shallow and small, at the treebase, not into the roots. No holes should be directly above or below other holes or wounds, and if possible, holes should not be drilled every year. Great care must be taken not to get the injected chemicals on the cambium.

Discolored wood is dead wood. The living cells in the wood are killed. Long streaks of discolored wood are not so harmful. But when the discolored columns begin to develop laterally, then they can be very harmful. The tree has room for many long discolored streaks, but the tree has only so much circumference. Any treatment that reduces the living circumference of a tree will be harmful. Always check your injection sites for lateral cambial dieback. If you see that the injection wounds are not closing within one growing season, be on the alert for cambial dieback, especially when material begins to flow from the injection holes. Injection sites should be checked the next season after application. If the holes are open and if materials are flowing from the holes, it would be very unwise to continue to inject. Never plug injection holes. The same precautions given for injections are applicable for implants.

You can do almost anything to a tree once or twice, or even four or five times, but as such treatments are repeated, the chance for internal injuries increases.

Cabling and bracing. Proper use of hardware can be of great value for trees. Proper cabling and bracing does take a great amount of skill, and it is hard work.

Screw lags can be used safely in sound wood. Even in sound wood, it will be the wood that forms after the lag is put in that provides the long-term holding power.

Hardware in trees can start some problems, but they must be weighed against the potential losses if no hardware is put in.

It is best to use washers on both sides of a bolt or rod. Sharp-pointed washers should be avoided. There is no need to throw away all your diamond shaped washers -- grind the tips off to round the ends; this will help to reduce bark and wood cracking that is often associated with sharp-pointed washers.

Seat washers on the wood, not in the wood or on the bark. This can be very difficult with thick-barked trees. It is a good idea to carry a large curved wood chisel to make the rounded margins, especially on the vertical ends.

The weakest part of most trees is the trunk section from approximately 4 to 12 feet above the ground. On many short-trunked trees, the trunk section below the forking of large branches is a weak spot.

Scribing or tracing. If possible, try to avoid scribing or tracing wounds in such a way that the vertical ends are sharply pointed. It is best to round them off. There is no need to scribe in the form of a vertical ellipse. Try to follow the natural contour of the wounds and cut away as little healthy cambium as possible. When in doubt about the margins of a wound, and when time is not limiting, allow the tree to show you the limits by the formation of callus during the current or next growth season. Then remove, carefully, the dead bark up to the living callus. On lightning wounds this may be the best procedure, because it is often very difficult to determine the margins of the wound.

Be very careful tracing wounds on large, thick-barked trees, Car-wounded street trees are good examples: Many times only the outer thick bark is removed by the car, and the tree is not wounded until someone with a chainsaw begins to scribe the bark injury.

Cracks. Three events must occur in sequence to fire a gun: First, it must be loaded, then cocked, and finally the trigger must be pulled. In the same way, three events must happen in sequence before a large vertical crack develops in a tree. A wound, or a dying branch or root, opens the tree to infection. The charge on the "gun" depends on the microorganisms. If microorganisms spread deep into the tree very quickly, the charge is high. The tree responds to the injury and the infection by setting boundaries. The boundary-setting "cocks the gun". Any number of events may pull the trigger: natural growth stresses, sudden heat, sudden cold, abrupt movement by wind, sudden weight loading by snow, ice, or fruit, and when the tree is cut, the impact of felling. Even after the log is cut and drying, pressures and weight loading will set off "the gun".

There are three basic types of cracks in living trees. Shallow bark cracks usually start from the outside and spread inward. They usually stop at the wood but some may spread slightly to the wood. This type of crack is common on young trees, and on older trees of some species, such as Norway maple. The second type of crack is the one along the barrier zone. The common term given to the separation is ring shake. This circumferential separation, or shake, is the start of many tree problems. The third type of crack is the radial crack, or radial shake, or ray shake. What all of this means is that the position for a crack in the radial direction is set, but not necessarily opened yet. Before a radial separation starts, a circumferential separation comes first.

A common starting point for basal vertical cracks in recently planted young trees is dying roots. Roots are either wounded or killed during planting, or roots are injured and they die in a few months to a few years. Then the cracks form upward on the turn. Even worse is the death of two roots that join together at the base of the trunk. The crack begins to grow between the two dying roots and spreads upward on the trunk. Wounds at the base of young trees are also common starting points of cracks. The wounds are commonly inflicted during planting.

Shallow cracks or bark cracks may often form near some branch stub or shallow bark wound. With dead or dying branches, the trunk crack seldom will be in direct vertical alignment with the branch. The crack will usually be to the side of the branch because of the way a branch is set in the tree trunk. Because the crack is off to the side, it does not seem to be associated with the dying or dead branch.

Pruning. Pruning properly done is still one of the best things you can do to help trees stay healthy; pruning improperly done is still the worst thing you can do to a tree. Proper pruning means removing dead, dying, or living branches in such a way that the branch collar is not injured or removed. The branch bark ridge is the key to proper pruning. No cuts should start behind the branch bark ridge.

The slightly swollen branch collar that will be present on some branches is not a stub. A stub is a projection of the branch; a proper cut does not leave any projection of the branch.

The first target is the outer side of the branch bark ridge where the branch meets the main stem. The second target is where the lower part of the branch meets the branch collar. These target points are obvious on most branches. They are even more obvious on dying and dead branches, because as a branch begins to die, the branch collar usually begins to swell, to form a "doughnut" around the base of the branch.

With dead branches, do not injure or remove the living ring of callus that surrounds the base of the branch. A major problem we have with pruning is that most tools are made for flush cuts. It is easy to place the bar of a small chain saw behind the branch bark ridge. It is almost impossible to make a proper cut with pole pruners or with small hand cutters. We need some new pruning tools.

Topping. No matter how you top a tree, it is going to cause the tree moderate to serious injury. The aim of topping is to cause the tree as little injury as possible. Flat-top cuts must be avoided. A proper cut of a vertical stem of leader starts with finding the branch bark ridge again. This time the first target point is on the inside of the branch bark ridge where the lateral branch meets the vertical stem. The cut line should be at an angle downward that is approximately the same as the angle of the branch bark ridge. As with branch pruning, it is always best to stub the stem first.

Hazard trees. Many factors must be considered when trying to determine the potential hazard condition of a tree. Tree hazards center about three major breaking points: 1) a tree falls over because its support roots are decayed, 2) branches fall as they die and decay, and 3) trunks break, usually at the 4 to 12 foot level above ground.

Branch breakage is the most common type of tree hazard. Even small branches can cause serious injury when they fall on a person. Proper pruning is the best answer to the problem.

Be on the alert for vertical cracks. Be on the alert for cracks that are on opposite sides of the tree. This is one of the most critical indicators of a hazard tree. Such a crack pattern starts with a wound or the death of a large support root. The first internal crack is still a circumferential ring shake, and then radial cracks begin to form. When two radial cracks form at 180° to each other, the tree is a high hazard risk. A moderate wind may cause the tree to move as two separate trees, and breakage will result as a shearing failure. The tree will break, not at the base where the root is most advanced, but above, where the spreading cracks meet sound wood.

The proper use of the Shigometer can help greatly in hazard tree assessment. Check suspect roots. Check for fruiting bodies, and vertical cracks. Use the Shigometer to check the width of sound wood 1 foot above obvious injuries, and on the opposite side of the trunk for the injury. When in doubt about the tree, put your recommendations in writing.

The real working world of trees. In the end we must do the best we can with the information and tools that we have, and under the constantly changing regulations and the pressures of uninformed people with strong emotions. The real working world of trees is both a wonderful place and very difficult place.

Everybody wants a red light -- don't do it -- and a green light -- do it. But natural systems always have an orange light in between the two. Everybody wants a generalization, and the best you can ever do with a generalization about natural systems is to be correct about 80% of the time. There will always be exceptions.

I believe that the professional understands the "orange light" or the constantly changing exceptions. I never lose sight of the difficulties of the real working world.

Figure 1. (page 88). Dissection of a young red maple tree one year after the branch was cut 15 inches out from the trunk. Note where the tree set boundaries to wall off the dead branch. This is the natural line for proper pruning. Note also the discolored wood within the branch collar. This type of discolored wood is very beneficial because it is a strong boundary to inward spread of decay-causing fungi. Pruning cuts behind the branch bark ridge will remove this boundary, and decay will spread rapidly above and below the cut.

Figure 2. (page 89). Proper pruning cut of a living branch on a red maple.

The angle of the cut line is opposite the angle of the branch bark ridge as shown on the inside. The same angle of the branch bark ridge will be in the bark, and easily visible from the outside. Note the well-compartmentalized small dead stub at lower right.

Figure 3. (page 90). Proper cut of a living branch on a paper birch. The branch bark ridge is very obvious. The angle of the cut is opposite the angle of the branch bark ridge. Do not make cuts behind the branch bark ridge. Do not leave stubs.