AN URBAN FORESTRY
HOME WORKBOOK
FEATURE

THE RIGHT TREATMENTS FOR TROUBLED TREES

by Alex L. Shigo

This is the fifth in a series of workbook articles that offer guidance for urban forestry projects. The practical, hands-on information is useful for backyard projects and larger-scale community forestry activities. Each article is designed so that it can be clipped out and assembled in a notebook for easy future reference.

Look out your window. Drive down the street. Fly to another country. Almost everywhere you go in the world you will see many beautiful trees, but you will also see some trees that are not so beautiful, and some that are in trouble.

Many myths and misconceptions about trees and tree treatments have developed over the centuries—such as the belief that the best way to remove a branch is to flush-cut it as close as possible to the joining stem or trunk, or that wound paints will stop rot.

If you really want to help trees, learn how trees really work. Too many decisions about trees are made on the basis of human emotion rather than tree biology. If you don't know why something is dying, you will never be able to keep it alive. We have many new and wonderful medicines, but the wrong treatment will not help a sick tree. In order to understand sick trees, we must focus on what keeps trees healthy.

A tree should be thought of as a multiple plant rather than as a single one, because the cambium (the layer of tissue one cell thick between the wood and the bark) produces a completely new layer of wood and bark tissue every growing season. In a sense, a new tree envelops the old one every year.

Trees live longer and grow taller and larger than other plants mainly because they have very effective ways of resisting death and decay. A major cause of defect, decay, and death in all species of trees throughout the world is infection caused by microorganisms in wounded branches and roots. Over millions of years, trees have developed effective built-in systems of protection against injury and infection by microorganisms.

The life span of microorganisms is measured in days, and their size in thousandths of an inch. But without them no organic matter would decompose, there would be no re-use of once-living materials, and thus no continuation of life. Some are beneficial; some are destructive.

Microorganisms that cause decay sometimes surmount the protective barrier set up by a tree after injury. When the tree's vigor is low and the injuries are severe, the advantage tips toward the invading microorganisms. When the tree's vigor is high and the injuries are minor, the advantage tips toward the tree. But the cumulative effects of many minor stress factors over time may also tip the balance in favor of the microorganisms.

TREE STRUCTURE

Trees are highly compartmented plants, and when they break down because of disease, they do so compartment by compartment.

Trees survive injury and infection by walling off the injured and infected wood. Some individual trees do this

The author has pioneered the dissecting of trees with a chainsaw in order to study the internal effects of wounds

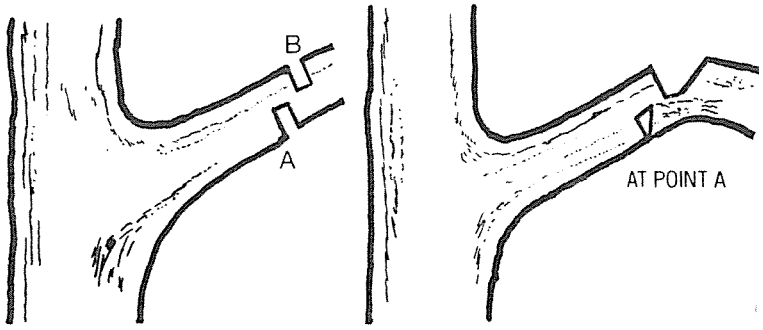
Alex Shigo, a nationally recognized expert on tree wounds and diseases, is chief scientist for the U.S. Forest Service's Northeastern Forest Experiment Station.

HOW TO PRUNE A BRANCH

STEP 1

In pruning any sizable tree member, first remove most of the branch's weight with two cuts:

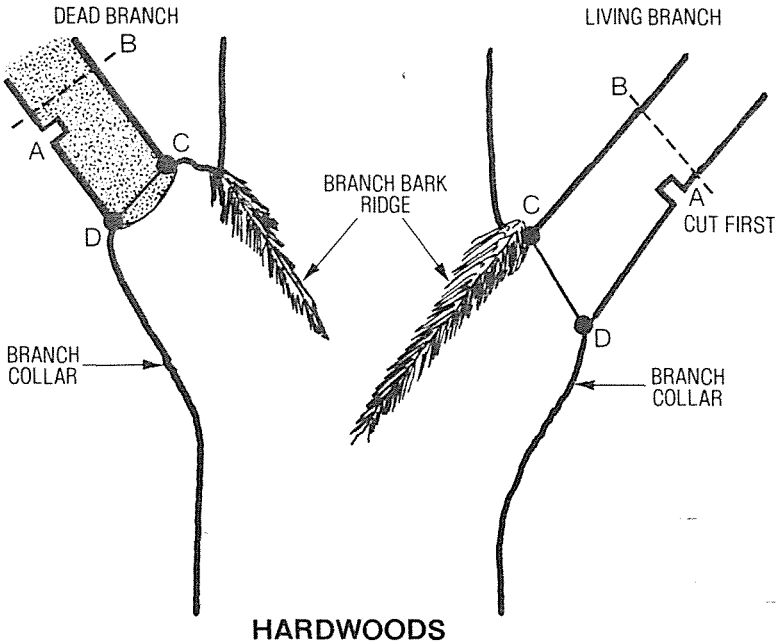
1. Undercut branch at Point A about one foot from main stem.
2. Make second cut at Point B one to two inches beyond cut A. Point B is *always* farther from the main stem than Point A.



STEP 2

Note the Branch Bark Ridge and Branch Collar in the illustration. These areas vary substantially in appearance on different species; the difference is especially notable on hardwood vs. softwood trees.

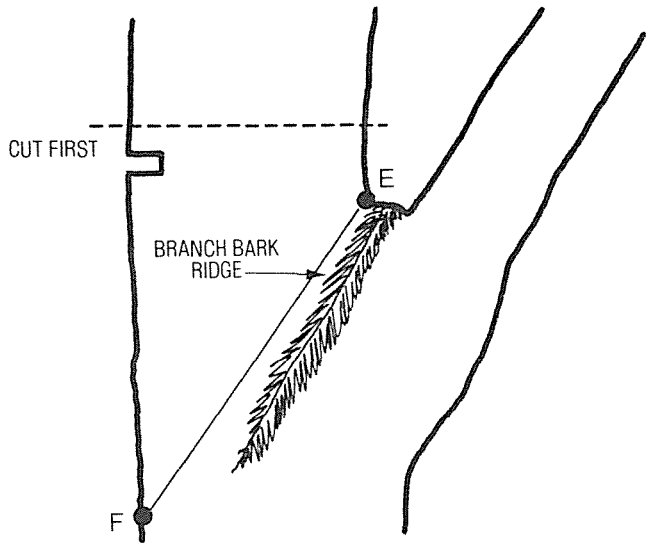
The final pruning cut is made between Points C and D.



HARDWOODS

PRUNING TO REDUCE SIZE

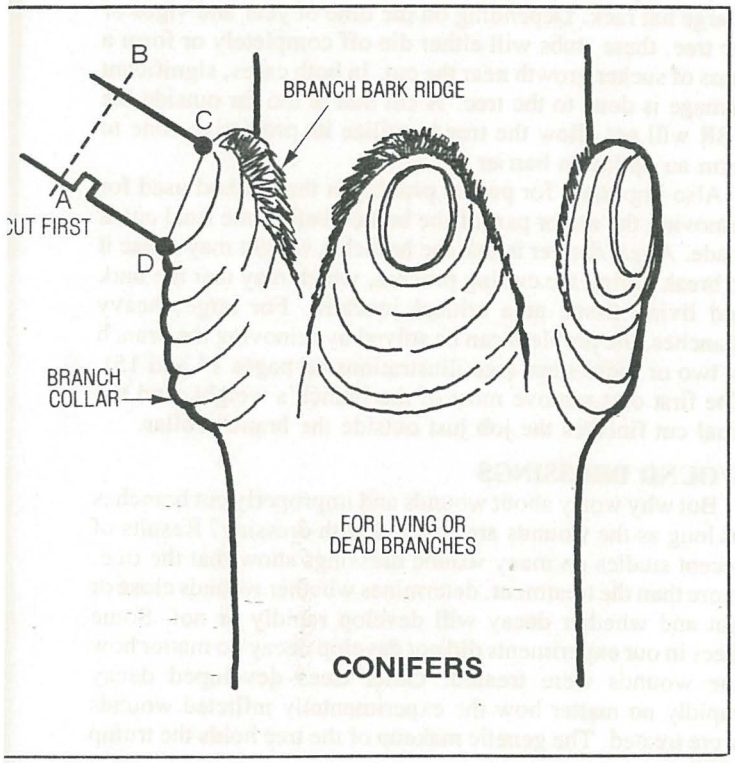
This process involves removal of larger branches back to a point (E-F) where a smaller branch joins the stem. Locate the Branch Bark Ridge, and make the cut—without disturbing the Ridge—from Point E to Point F at approximately the same angle as the Branch Bark Ridge.



REDUCING TREE SIZE

rapidly and effectively. They can live in a healthy state while having hundreds of infections walled off in pockets throughout their structure. Other individual trees of the same species do not wall off rapidly and effectively, and the force of the infecting microorganisms quickly leads to very large volumes of injured wood. Therefore, walling off or compartmentalization does not assure that the tree will win.

Wood is a highly ordered arrangement of living, dying, and dead cells with walls composed mostly of cellulose and lignin. The three major functions of wood are to transport and store nutrients and minerals, and support the structure. Sapwood performs all of these functions. Heartwood has a minimal to nonexistent mineral-transport and nutrient-storage function, but has a very high protective system and also performs a support function.



TREE WOUNDS

Wounds are breaks in the bark that expose a tree to many wood-inhabiting organisms. Trees in cities, parks, and near our homes are wounded by vehicles, lawnmowers, vandals, fires, and animals. But the most serious wound is inflicted when branches are improperly cut. When branches are removed, long stubs should not be left, nor should the branch be cut flush with the trunk or the joining branch.

PRUNING

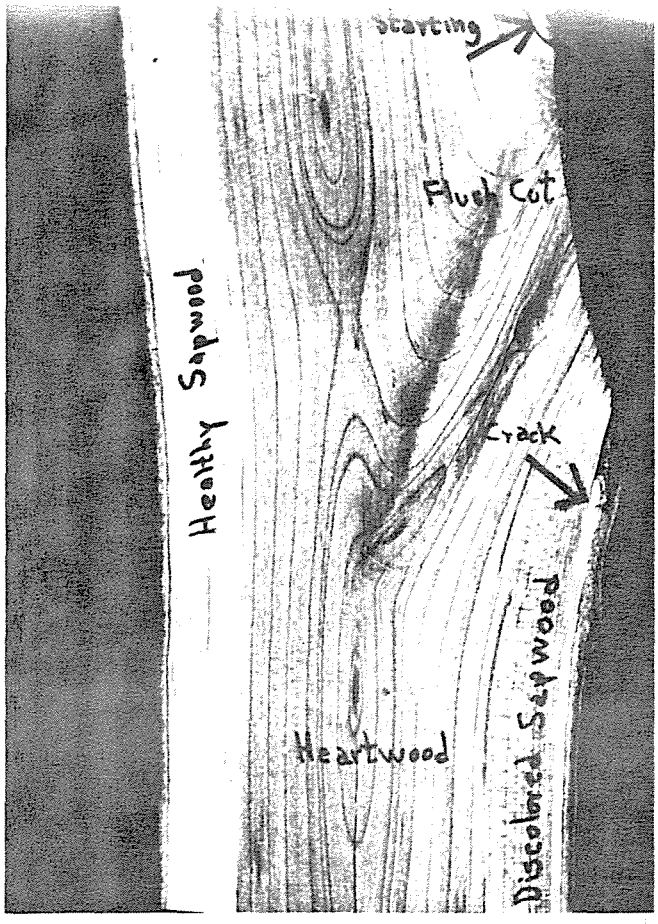
Improper pruning is the major cause of wounds humans inflict on trees. Pruning properly done is one of the best

The dark encircling line in this sweetgum represents the new tissue formed as a barrier zone. Note that decay is restricted to the inner side of the barrier zone, and even insects that infested the decayed wood stayed on the inner side

PRUNING PRINCIPLES

1. Do not leave stubs.
2. Do not cut into the Branch Collar.
3. Painting the cuts with wound dressing serves cosmetic purposes only; it does not help the tree to heal.
4. Best time to prune is late in the dormant season or in early spring before leaves form.

Boundaries of protective chemicals are formed by the tree at the base of dying branches. Tissues that separate branch from trunk tissues are shown by the vertical row of arrows. Arrows at the bottom of the sample show a walled-off stub. The decayed wood will remain within this walled-off pocket. Lines marked "yes" and "no" show correct and incorrect pruning points



Flush-cuts start many tree problems, including cracks, cankers, and rapid decay. This cherry tree was flush-cut a year previously. The thin band of clear wood above and below the cut will crack easily when temperatures change suddenly, producing frost cracks or sunscald. Insects have easy entrance through the thin band of healthy wood, which contrasts to the thick band of healthy sapwood on the opposite side of this cross section

things you can do *for* trees. Pruning improperly is the worst thing you can do *to* a tree.

For over 400 years man has been trying to find the best way to prune trees. There are hundreds of publications that discuss pruning. In his 1936 book on the history of pruning in Europe, Dr. Hans von Meyer-Weglin cites 269 papers. The final recommendation is to cut branches as close as possible to the joining branch or stem (a flush cut) and then paint. That recommendation is still with us today. It is in the textbooks, it is taught worldwide, and it is common practice.

However, we now know that flush-cuts cause severe injury to trees. They start at least eight serious problems: internal cracks, discolored wood, decayed wood, cavities, cankers, sunscald, frost cracks, and insect borer injury.

Back a few years ago, when hand saws were used rather than chainsaws, cutting branches too close to the main stem of the tree was rarely a problem, simply because it was easier to make the cut a few inches from the main stem. When the lightweight chainsaws hit the market, however, trimmers found it easy to make the cut flush with the stem.

The key to proper location of the pruning cut is recognizing the branch bark ridge (BBR) and branch collar. The BBR is a raised bark line that separates the branch from the main stem. This ridge is present where any two branches join. The branch collar—a raised ring of protective tissue circling the branch—should not be injured or cut off. The collar contains the highly active protective zone that resists the spread of infection into the tree after a branch dies. A cut behind the BBR will remove the tree's protective zone, the natural "wound dressing" that trees have perfected over millions of years.

Just as damaging to the tree is the practice of leaving a stub after the trimming operation. A stub results when the branch being removed is cut many inches or feet from the main stem. When this process is repeated extensively, the tree resembles a large hat rack. Depending on the time of year and vigor of the tree, these stubs will either die off completely or form a mass of sucker growth near the cut. In both cases, significant damage is done to the tree. A cut that is too far outside the BBR will not allow the tree to utilize its protective zone to form an optimum barrier.

Also important for proper pruning is the method used for removing the major part of the branch before the final cut is made. A real danger is that the branch's weight may cause it to break during the cutting process, which may tear the bark and living tissue at a critical juncture. For large, heavy branches, the problem can be solved by removing the branch in two or more steps (see illustrations on pages 14 and 15). The first cuts remove most of the branch's weight, and the final cut finishes the job just outside the branch collar.

WOUND DRESSINGS

But why worry about wounds and improperly cut branches as long as the wounds are covered with dressing? Results of recent studies on many wound dressings show that the tree, more than the treatment, determines whether wounds close or not and whether decay will develop rapidly or not. Some trees in our experiments did not develop decay no matter how the wounds were treated. Other trees developed decay rapidly no matter how the experimentally inflicted wounds were treated. The genetic makeup of the tree holds the trump card.

Trees cannot restore injured wood and bark to their previous healthy condition. The tree walls off the injury, and then a callus forms so that new cells are formed in new spatial positions. Large wounds seldom close completely. They may appear to be closed, but fine hairline openings keep just enough air circulating to support the growth of microorganisms.

Dressings, like paint, serve only cosmetic purposes. If a proper pruning cut is made, there is no need for a dressing, as far as the health of the tree is concerned.

A PRESCRIPTION FOR HEALTHY TREES

We know that a tree's ability to respond rapidly and effectively after wounding is moderately to strongly determined by its genetic makeup. We suspect that this is also true for many tree species. What we should be doing is selecting "tough" trees for our cities and forests. Trees with the right genes. It can be done. We need trees that are superior not only in growth rate but also in defense systems. Such trees, even when wounded, will respond rapidly to set firm boundaries to resist the spread of infection. These are the trees we should be planting. And we should be pruning these genetically superior trees (and others, of course) in a way that allows the tree a fighting chance to heal itself. ■