

# Root Pruning: *Severing Subterranean Stranglers*

By Guy Meilleur

*“Root pruning is hard, dirty work, and the results are not always obvious, so it is usually discussed more than it is practiced.”*

After reading these discouraging-but-true words in *Arboriculture: Integrated Management of Landscape Tree, Shrubs and Vines* by Harris, Clark and Methany, it is no surprise that many arborists would rather not deal with root collar examinations (RCXs) to manage stem-girdling roots (SGRs). This article will discuss the reasons that root pruning is a service that every arborist, especially those who want to identify and correct the cause of many urban tree problems, can and should be practicing. It will also describe ways to make this task less hard and dirty, or at least easier and cleaner in terms of understanding the why, what, who, where, when and how of pruning defective roots.

## Why prune roots

Let's talk about safety first.

After Hurricane Fran hit Raleigh, N.C., in 1996, the Director of the North Carolina State University Arboretum, J.C. Raulston, and I inspected 87 trees that were toppled. Almost 75 percent of these trees (63) had moderate to severe root defects. Most had



*Finding the flare is not enough. Under the visible trunk flare, the root collar of this sugar maple is strangled by stem-girdling roots. Courtesy of Dave Leonard*

stayed too long in a container, so their roots circled around the stem instead of radiating away from it.

Ten years later, I used an Air-Spade excavation tool to expose the roots of more than 400 trees planted at a private school after one of them failed near a classroom. More than 75 percent of these trees, many of them high-dollar specimens, had moderate to severe stem-girdling root defects.

In Minnesota, 73 percent of linden species that failed completely in storms broke at the point where stem-girdling roots strangled the stems.

In storm damage research conducted since 1997, 30 percent of trees that failed completely and were not located in storm centers but at the edge broke at stem-girdling-root compression points. This is why Dr. Ed Gilman of the University of Florida reminds us to “Examine the root collar (the place below ground where main roots meet trunk) carefully as part of a regular tree maintenance program near buildings, parks, streets and other places where people live, play and work.”

Let's talk about tree health next.

Roots that are circling the trunk instead of growing away from the trunk injure the tree by reducing or eliminating circulation where the root presses against the trunk. The injury increases with time, often leading to tree decline. When a root collar examination is done, the number of stem-girdling roots associated with tree decline and/or sudden failure is amazing. In Kentucky, consulting arborist Dave



*The trunk flare on this *Acer saccharum*, sugar maple, is visible, but the root collar is not. Courtesy of Dave Leonard*



*Cutting notches in girdling roots makes it easier to wiggle and pry them loose without wounding them. Photo by Chip Hildreth*

Leonard uncovered stem-girdling roots as the cause of death of a sugar maple. After the owner witnessed what the tree looked like underground, he wanted his other 39 sugar maples assessed. Leonard found only two with normal root systems.

On his first root collar examination job, Leonard worked on 10,000 trees at a large horse farm, and again found only two with normal root systems.

In another Minnesota study, more than 80 percent of declining sugar maples had stem-girdling roots, so it's not hard to see that decline of those trees was caused at least in part to strangulation. It's not just happening with sugar maples – no species is immune to this human-caused condition. Look at any underground landscape across America – municipal, residential, you name it.

### What to do

Most stem-girdling roots were once small circling roots, innocent in appearance to most observers. If these roots are not straightened or cut in the nursery when trees are transplanted into larger containers, the result can be a “multiple corkscrew” effect.

European nursery standards specify root pruning at every step, 4 to 8 inches further out each time, to avoid these defects. The American nursery standard (ANSI Z60) does not address this problem. The best way to expose and treat this condition is to wash off the nursery soil and correct the roots as you plant trees in the bareroot style. This process, called root washing, is growing in popularity with planters who are concerned with long-term tree health and stability. But even when roots are growing away from the stem, the tree is not yet out of the woods.

Rootballs, the volume of soil packed inside a young tree's packaging, have been getting rounder and rounder every year. Whether trees are grown in containers or dug from the field then balled and burlapped, soil is commonly heaped around the trunk where it does not belong. The trunk flare, where the trunk naturally turns into roots and the tree joins the earth, is all too often buried early in the growing process – and buried deeper yet at planting time. Some specifications still ignore the requirement in ANSI A300 (Part 6)-2005,

63.6.2.3, “The bottom of the trunk flare SHALL be at or above finished grade.” Instead, they instruct the landscape contractors to plant the root ball at ground level, so the landscapers obediently follow this instruction, with disastrous consequences.

Arborists should have the ANSI standard in hand when they talk to growers and landscape architects and landscapers about deep planting. When these professionals see with their own eyes that the American Nursery and Landscape Association and the American Society of Landscape Architects are represented in ANSI, they will realize that they don't have a stem to stand on when they bury trees. The entire green industry agrees that we should always be able to find the trunk flare.

Technically, the rootball does not even include the soil above the trunk flare. It is “measured from the bottom of the trunk flare to the bottom of the ball.” (ANSI A300 (Part 6)-2005, 63.6.1.2) If the flare is found and set to grade, in a hole “a minimum of 1.5 times the diameter of the root ball” (63.6.1.4), with mulch “applied near, but not touching the trunk” (63.6.2.9), the tree roots will not need to grow up in search of oxygen. But even if these standards are followed at planting time, the tree may not grow well.

For some reason, there is nothing in the



*The stem-girdling root on this Acer saccharum, sugar maple, in the town square of Hillborough, N.C., is celebrated by its citizens, and considered by many too large to remove. Photo by Chip Hildreth*



*Root tissue is known to graft with root tissue, but rarely with stem tissue. The upper fork of this root girdled the stem, and came off cleanly. The lower fork stuck to the bark of the buttress root, causing a small wound when it was removed from this Quercus phellos, willow oak. Photo by Chip Hildreth*

standard about the making sure the roots, at least the major roots, are growing away from the stem. Why not? You'll have to ask your organization's representative to the ANSI committee, and get your comments in before the standard is revised again in 2010. The ANSI pruning standard does not currently cover root pruning; perhaps with the right kind of input, that standard can change to provide needed guidance on this simple act of arboriculture.

### Who is responsible

Many arborists who are paid to assess tree condition do not get to the bottom of tree problems. *A Practitioner's Guide to Stem-Girdling Roots of Trees* by Johnson and Hauer reports that less than half of the arborists who responded to a 1997 survey performed a root collar examination when they were called to look at trees. In that same survey, stem-girdling roots were found 52 percent of the time a competent inspection took place. Most practitioners assumed that these examinations took too much valuable time, so their clients would not be willing to pay for them. However, if the consultant is working alone, the client may want to do some preliminary earth moving to save time and money.

If a crew is present, most of the work can be done by entry-level employees, making the service more easily affordable. With a little training and the proper equipment, all but the most delicate surgery can be done by crew members. Many workers express appreciation of working with a different





*A root collar examination with an air tool can be fast and thorough. Courtesy of Dave Leonard*

little training and the proper equipment, all but the most delicate surgery can be done by crew members. Many workers express appreciation of working with a different part of the tree for a change, and also of being trusted with increasingly technical procedures. Dave Leonard's two-person root crew alternates between the Air Knife

excavation tool and hand tools, which makes sense for ergonomic, morale and other good reasons.

Close supervision is required during training, however, to ensure the job is done carefully. I confess to leaving a trainee with hammer in chisel in hand, returning to find that a swatch of bark had been cleanly

trimmed off the stem. This experience was instructive in two ways. First, it's important to keep one eye on the job until the worker is proven to handle it. Second, the speed at which young trees seal injuries can provide a great sense of relief.

As with untangling vines from branches, the most important part of the job is to think before giving a firm quote, and go on the clock whenever possible. After all, the object of the job is out of sight, and it takes time to avoid injuring the trunk or removing too many roots at one time. It's a service that sells itself, because most customers can just look and understand that strangulation is fatal. For the biologically challenged, just show them page 50 of Shigo's *A New Tree Biology Dictionary*, which says: "As young girdling roots are noted later in the life of the tree, they should be cut."

#### **Where to look**

On some very young trees, the trunk flare is not yet formed, so the topmost roots can be located by poking into the soil with a finger or a screwdriver. If roots are found in the top two inches of soil, that is considered acceptable, though future inspections will be needed to ensure that the roots are developing normally. One source cautions against removing soil away from the primary roots of larger trees and recommends using the poking method on all of them, but most authorities agree that the primary roots should be visible to ensure good root structure when planting, and to maintain tree health and safety.

On severely girdled trees, the "scratch test" can save time and trouble. Scrape away the outer bark above the stem-girdling root until you reach moist and bright-colored tissue, indicating living cells. If the inner bark is brown and dry it is dead. Resonance testing with a rubber mallet can yield a hollow sound, indicating the need for a closer inspection. If the dead area extends for a considerable extent of the circumference, removing the tree should be considered. This degree of injury is rare.

Aside from nursery- and landscaping-caused defects, stem-girdling roots can form from several locations on the tree. When roots are cut by harvesting in the nursery or damaged by construction activity, lateral buds can be released and grow at

right angles. A root tip can do a 180 if it hits an obstruction such as a wire basket, or the hard wall of a poorly prepared planting pit, or a rock.

### When to prune

The season during which stem-girdling roots are removed might influence the success of the treatment. We typically avoid pruning branches in spring and fall, when leaves are forming or falling, because these are times of increased sap flow and hormonal activity. Midsummer is a good time to prune deciduous trees, in part because the wound response may be more active than in winter. For all these reasons, midsummer may be the best time to prune roots. Scientists at the Bartlett Tree Research Laboratories found that summer removal of stem-girdling roots resulted in better diameter growth over two years than did fall removal or a combination of summer and fall removal for red maples under an irrigation system.

Drought can complicate recovery from



*With proper tools, pruning stem-girdling roots can restore energy flow within the stem without injuring it. Shown here is a Japanese Flowering Apricot. Photo by Chip Hildreth*

root pruning, so mulch and extra water in lieu of rain are strongly recommended. Even without extra care, a study by Robert Tate at Rutgers University in New Jersey in the late 1970s on Norway maples showed that “The amount of foliage dieback after two years was less on girdled trees with roots cut compared to girdled trees with

uncut roots ... Girdled trees with roots cut grew slightly more than non-girdled normal trees.” Current experience bears out this observation.

Many sources echo Dr. Alex Shigo’s concern as expressed in *A New Tree Biology*: “On older trees ... it is best to leave the girdling roots alone. More harm than good can be done in attempts to remove large girdling roots.”

While strictly speaking this is true, it does not seem to consider the widespread problem that stem-girdling roots have become, or the technical expertise of today’s arborist. Even some very large stem-girdling roots can be removed without collateral damage. Pruning roots relieves one kind of stress, but causes another. The stress from root removal should not last for very long, and will lessen as the tree recovers. You must judge whether eliminating stress by removing the defect outweighs the temporary adjustment brought on by root removal. Pruning large branches is, unfor-

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tunately, a routine activity, so pruning large roots should not be taboo. In the great majority of cases, pruning the stem-girdling roots is best for the tree.

#### How to proceed

The usual first step is to clear away the misplaced mulch and soil above the trunk flare so the sides of the primary roots are exposed. The surplus soil should be set

aside for future use. Smaller roots growing upward and inward must be snipped out of the way to find the flare.

If young roots are found growing out of the stem before the flare is found, the arborist is faced with a difficult decision. These adventitious roots were formed from stem tissue in response to darkness and moisture. If they are large or numerous, they may be forming a secondary support system for the tree. Adventitious roots should be removed only with caution. One source suggests that if they are greater than 1/2 inch in diameter, they may be better left alone. But adventitious roots are fairly rare in the landscape.

When stem-girdling roots are found, clear the earth away from them as much as is practical. The idea is to make a clean cut at the origin, so their regrowth does not regirdle the trunk or buttress root. Tools ranging from a well-balanced chain saw to small chisels should be available so the work can be done efficiently but without damaging stem tissue. If the root is large and only girdles a small portion of the stem, it may be best to leave it alone. The 25 percent guideline for branch pruning may also apply to root pruning. On roots that are overgrown by stem tissue, several cuts and gentle wiggling can pull the root loose. If it does not move, sever both ends and chisel off as much of it as possible so it will be pushed off as the trunk and buttress roots expand.

#### Aftercare

After the exposed roots are covered with a thin layer of soil and mulch, it's time to use the aged mulch, rich soil and pruned roots that were set aside earlier. Its organic matter and mycorrhizae make it the ideal vertical mulching material, so make some holes near the dripline and stuff it in. Standard arboricultural steps such as irrigation, mulching and pest control are, as always, recommended. Cleaning the crown of dead and dying branches will make it easier to see if root pruning has negative effects. Wounds should be kept clear of soil and mulch and should be monitored for rates of closure and decay.

An ounce of prevention in the nursery, or four ounces of inspection at buying time, or eight ounces of correction at planting time can prevent a ton of work. In the end,



*Incompatible tissues do not graft. Despite the size and pressure, this elm root came cleanly off the stem, piece by careful piece. Courtesy of Chip Hildreth*

however, it's up to the arborist to find the flare and fix the roots. It may be hard, dirty work, but the results are obvious over time and make for happy clients. Good roots grow good trees, and good tree care grows

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