



# SCA Today

The Official Newsletter of the Society of Commercial Arboriculture

December 2014 • Volume 19 No. 4

## Structural Pruning: Tree Training

By Ed Gilman, Brian Kempf, Nelda Matheny, Jim Clark

*Editor's Note: In their book Structural Pruning: A Guide for the Green Industry, authors Gilman, Kempf, Matheny and Clark describe important concepts for all tree care professionals: the structural approach to pruning, components of strong tree structure, a structural pruning guide, structural defects caused by pruning, and other pruning methods. In this four-part series, the authors will explain and guide you to proper pruning technique. Each article in this series will include a "Cue Card", a convenient guide to the information found in the article.*

*In this final installment to the series, the authors summarize structural pruning methods, and discuss essential components to competent pruning. This book can be purchased from the ISA bookstore at <http://www.isa-arbor.com/store/shop.aspx>.*



*Most branches on young trees are temporary in the sense that they will be removed as the trees grows. This is a young 20' tree with many temporary branches. All branches below the dashed line will eventually be removed.*

Structural pruning is appropriate for trees of all ages; however, its application varies by the tree's current age. In young and middle-aged trees, pruning for structure is known as training when the tree is rapidly increasing in size and the major framework of the tree is being established. Training is accomplished by pruning to create a stable architecture by developing a strong trunk and branch structure. For most trees that are medium to large at maturity, the focus is on maintaining a single dominant trunk with smaller primary branches. As the tree matures, pruning for structure aims to preserve trees by managing or correcting defects or conditions that may lead to failure. When correcting problems would require excessively large or disfiguring pruning cuts, structural pruning focuses on reducing the weight that is supported, thereby reducing the load and the likelihood for failure. Cabling, bracing, and propping techniques can also be used to stabilize mature trees where routine inspection of systems is practical.

### ESSENTIAL COMPONENTS

The essential components of structural pruning are:

- to develop and maintain a dominant central leader;
- to identify the lowest branch in what will become the permanent crown;
- to prevent branches below the permanent crown (temporary branches) from growing larger than half the trunk diameter;
- to space main branches along the central leader by removing or shortening others over time; and
- to reduce vigorous upright branches and stems back to lateral branches or remove them.

### DEVELOPING AND MAINTAINING A DOMINANT LEADER

There are three basic procedural steps to developing and maintaining a dominant leader:

1. Identify the upright stem that will make the best leader and trunk. It should be among the largest in diameter and in the center of the crown, and under ideal conditions it should be free of cracks, openings, mechanical damage, large pruning wounds, inclusions, cankers, or other defects that could compromise its strength. The largest diameter stem should be chosen as the leader where practical, but it does not have to be straight.
2. Identify the branches that are competing with this stem (i.e., those with a large aspect ratio).
3. Remove competing or interfering branches back to the trunk or subordinate them with a reduction cut, or use a combination of both. Remove or reduce branches that are clustered together and growing from the same point on the trunk. Heading cuts can be used in cases where stems are less than about 2 years old where no laterals exist to reduce back to.

*Continued on Page 4*

# Structural Pruning

*Continued from page 1*

Typically, only the largest-diameter branches (or those that are clustered together at one point on the leader) need to be pruned, because they make up a large part of the crown or they are shading or choking out the leader. Branches that are well spaced with a small aspect ratio do not need pruning because they will not compete with the leader. When pruning is completed, the terminal of the dominant leader should be the tallest growth on the tree, and its diameter should be the largest. However, a smaller stem may be chosen as the leader if it has a more central position in the crown, or if there is a defect in the larger stem. Subordination in these cases may have to be more dramatic in order to direct more growth into the smaller leader. The tips of all branches and stems should be below the top of the dominant leader after pruning is completed.

## PRUNING DOSE: HOW MUCH IS TOO MUCH

The answer is that it depends on the pruning objectives and the severity of defects.

The pruning dose is the estimated percentage of foliage or buds removed during pruning compared with the total amount on the tree prior to pruning. The ANSI A300 Part 1, Pruning Standard, 6.1.4 states that “Not more than 25 percent of the foliage should be removed within an annual growing season. The percentage and distribution of foliage to be removed shall be adjusted according to the plant’s species, age, health and site.”

There are cases when a larger pruning dose may be warranted. Young, healthy trees tolerate greater amounts of live branch removal than do mature or unhealthy trees. Sometimes it is necessary to remove more than 25% of the foliage to correct a significant structural defect such as multiple branch attachments, or to slow growth of temporary branches.

Much larger doses can be applied to certain branches or sections of the crown to improve structure or manage growth. For example, about 60% of the foliage and buds on a medium-aged tree may be removed from a large codominant stem to subordinate it relative to parts of the tree that are not or only lightly pruned.

Pruning a branch slows growth on that branch in proportion to the pruning dose and can direct future growth by invigorating parts of the tree that were not pruned.

## TEMPORARY VERSUS PERMANENT SCAFFOLD BRANCHES

Branches that are below the lowest permanent branch (e.g., below 15 feet over a street) are temporary; those above that height become the permanent branches in the crown. Temporary branches are needed to shade the trunk and to provide carbohydrates that contribute to strong, tapered trunks while the tree grows taller and develops more branches to replace them. When young trees have not yet reached the desired height for the lowest branch, treat all the branches as temporary.

Temporary branches should be selected and pruned differently than permanent branches. At planting and each time the tree is pruned,

1. Determine the height of the lowest permanent branch based on clearance requirements for site use.
2. Select branches on the trunk of weak to moderate vigor to remain as temporary branches.
3. Remove vigorous, larger-diameter, low-growing laterals if less-vigorous, smaller-diameter ones can be selected. Short, horizontal, and small-diameter temporary branches can be left unpruned.
4. If there are not enough low-vigor branches to shade the trunk, more-vigorous branches can be selected and pruned to remove 50% or more of the branch. This subordination treatment will slow growth of the branch, which will minimize the pruning cut size when the temporary branch is eventually removed.
5. As the tree grows taller, remove temporary branches over a period of a few to several years, starting with those that are largest in diameter.

When large-diameter temporary branches remain for too long on trees with a spreading habit (decurent), two things can happen. First, branches grow laterally and become large enough to obstruct passage or block views; their eventual removal results in a large pruning wound on the trunk. Second, branches can grow upright, may overtake the leader, and can shade out what should become permanent spreading branches higher on the leader, preventing their development. This happens when arborists are reluctant to remove or reduce the largest branches on the tree for fear of over-pruning, damaging the tree, or creating a large wound. Arborists may also think that changing the current form of the tree is inappropriate or they may not have budgeted enough to leave the ground during pruning operations. In most cases, trees benefit from the change in form brought about by structural pruning.

## SUMMARY

Tree longevity and stability are enhanced when trees are trained and managed with structural pruning. Long-lived trees appropriately placed in the landscape provide appreciable benefits to urban and suburban landscapes. Training





*A reduction cut slows growth on the reduced branch, which encourages development of a collar. This cut was made through the heartwood, as indicated by the dark area in the center. Although not ideal, this is sometimes necessary.*

young and medium-aged trees to a dominant leader with smaller-diameter branches is the most reliable method of developing tree structure. Maintaining the basic structure throughout the life of the tree minimizes failure and fosters development of large, structurally sound trees. Although objectives other than improving structure can be appropriate on trees, none help train and guide them into a strong structure designed to support normal loads to which they are exposed.

The objective of structural pruning on young and medium-aged trees is to develop and maintain a dominant leader from which smaller primary branches arise that are radially and vertically spaced along the trunk. In mature trees, the structure has already been developed and cannot be corrected without making large pruning cuts. Structural pruning that reduces weight to create less mechanical stress on weak areas is the primary strategy for reducing failure in mature trees.

Young trees should be pruned to guide growth so their crowns clear traffic, signs, and buildings while ensuring that they develop strong structure. Established trees in urban landscapes should be pruned primarily to reduce risk, preserve a tree structure that boosts amenity values, provide clearance, and improve the aesthetic value of the property. Achieving these customer expectations requires different pruning strategies for trees of different species, life stages, and size at maturity.

Structural pruning should be performed at planting and every few years thereafter on young and medium-aged trees in the landscape to gradually encourage more growth in the selected leader and less on competing branches. Invigoration of the leader

occurs from a combination of slower growth on the pruned competing branches and exposing branches higher on the leader to more sunlight. The pruned branches grow slower because there are fewer leaves to conduct photosynthesis; removal of the upright portions of lower branches allows more sunlight to reach the leader. Some species require more frequent pruning than others, especially when young. Early structural pruning can reduce pruning costs in the future by creating a strong architecture early in the life of the tree so less material is removed later.

When done correctly and routinely, more branches are ultimately retained in the crown than with other strategies, minimizing costs associated with debris removal. However, the first pruning on trees with poor structure may remove a large amount of foliage, buds, and wood. Although the size of pruning cuts and the amount of removed material may be large at the initial structural pruning, in subsequent years there will be smaller cuts and less material removed unless too much time passes before the tree is pruned again.

Open-grown trees naturally develop into various shapes and sizes and grow at different rates due primarily to variation in genetics and soil attributes. Pruning strategies should consider these differences. Excurrent trees like London plane (*Platanus × hispanica*) usually maintain a strong central leader with small lateral branches. These trees usually require minimal pruning to maintain a dominant leader and provide clearance. Removal of one or two competing upright stems may be all that is needed. Decurrent trees like Chinese elm (*Ulmus parvifolia*), however, typically require regular pruning to establish and maintain a leader. Without it, the form reverts back to a rounded crown growing on large scaffold branches borne low on the trunk.

## STRUCTURAL PRUNING ANSI A300 (PART I, 2008)

The ANSI Standard defines structural pruning as an objective:

**6.2 Structural:** structural pruning shall consist of selective pruning to improve tree and branch architecture primarily on young- and medium-aged trees.

**6.2.1** Size and location of leaders or branches to be subordinated or removed should be specified.

**6.2.2** Dominant leader(s) should be selected for development as appropriate.

**6.2.3** Strong, properly spaced scaffold branch structure should be selected and maintained by reducing or removing others.

**6.2.4** Temporary branches should be retained or reduced as appropriate.

**6.2.5** Interfering, overextended, defective, weak, and poorly attached branches should be removed or reduced.