



Corrective Pruning for Deciduous Trees

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When we choose and plant a tree, we hope it will remain on the site for a long time, maturing into a beautiful, functional part of the landscape. However, the length of time a tree survives depends on many factors, including environmental stress, location, pests, and many other issues. One important consideration that is often overlooked is tree structure.

Tree structure refers to how branches and stems are arranged on the tree. There are many variations and variables, depending on species, genetics, and environment. The natural shape of the tree's crown can help predict the potential for failure. It can also be important for determining the amount of pruning required to create a more stable structure. Tree species with a decurrent, or rounded, open crown—such as most maple and elm trees—produce clustered branching that can

be weaker than those trees with an excurrent form, or an upright, pyramid shape—such as sweet gum, pin oak, and most conifers.

To keep trees more stable and longer lasting, the tree owner or manager must recognize poor branch structure and know how to correct it.

Branch Structure

A strong central leader system is important for tree stability and for creating a resilient, sustainable tree (see *Figure 1*). Research indicates this is one of the most important factors to help prevent structural failure in storms and wind.

Codominant is a bad word when it comes to trees in our landscapes. It refers to a poor stem structure. The term *codominant stems* describes two or more main stems or leaders that are the



Figure 1. Tree with good central leader

same or nearly the same diameter and emerge from the same location on the main trunk (see Figure 2). As the tree matures, the stems remain similar in size, without a single, dominant leader. This results in a structure that is proven to fail under stress conditions such as high winds and storms.

A codominant leader is a particularly common developmental fault that can occur in many deciduous trees. Trees with codominant stems fail much more readily due to the weak attachment at the trunk. However, proper tree selection and early pruning in the tree's life can remedy this situation before it becomes an issue.

Many times, trees with codominant leaders are an inherited issue for the owner when a tree is already established in the landscape. In other cases, an individual may purchase and plant a tree without knowing exactly how to select trees with good branch habit. Often, just as the tree develops into a significant



Figure 2. Tree with codominant stems

element in the landscape that provides important services such as shade, along come the strong winds, and the tree splits (see Figure 3). This is frustrating and costly. We nurture and value our trees for many years, so this kind of loss leaves the tree owner perplexed and frustrated.

How do you know if you have an issue with poor branch structure that could result in a poor leader system? It's easy to identify. If the trunk produces two main stems that look like a slingshot—with a V union in the canopy—there is a codominance (see Figure 4). Usually, the branches are growing very close together just above the trunk as well.

In more severe cases, there will also be included bark in the center of the branch union, which will appear as bark pushing out on both sides of the stem union (see Figure 5). This demonstrates an advanced stage of codominant structure that is more at risk to fail. If this codominant union has decay present or, perhaps, is oozing a slimy, liquid material and shows cracking, there may be an imminent risk of failure or splitting.



Figure 3. Split in red maple tree

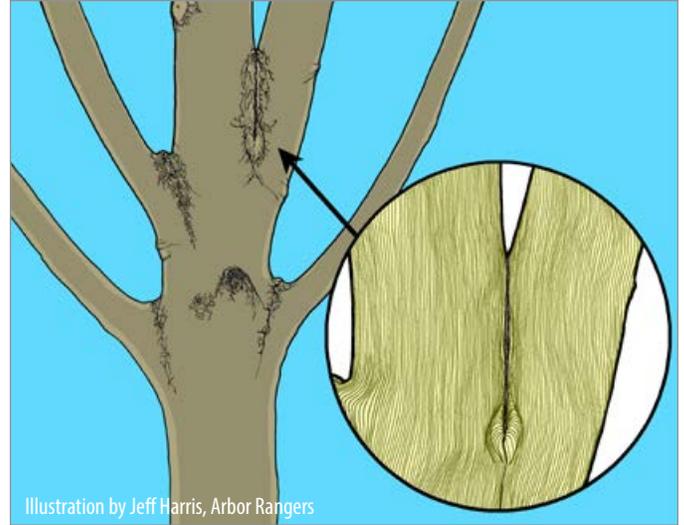


Illustration by Jeff Harris, Arbor Rangers



Figure 5. Codominant stems with included bark



Figure 4. Codominant branch union

The Importance of Pruning

Pruning to improve health and structure is critical for long-lived trees. If a pruning plan isn't in place, poor branch structure is left to develop and will need attention to improve the condition of the tree and help prevent failure. Also, the longer pruning is delayed, the more expensive it will be to remedy issues.

Pruning is appropriate for any young tree, especially those that haven't reached maturity, while older, mature trees require special pruning considerations for a more palliative approach. Structural pruning should begin at planting and continue through the first years of establishment and even longer, if needed. To maintain tree health, remove non-beneficial plant parts, such as broken limbs, crossing branches, and vertical branching. You will also need to address other common tree problems that are just as important in the pruning process (see Figure 6).

Remember that tree selection plays a part in pruning needs as well, so be mindful of branch structure when purchasing a tree. Avoid selecting and planting one with a codominant crown. See the publication titled *Tree Selection for the "Un-natural" Environment* (FNR-531-W) for more information on choosing the right tree for your situation.

How do you create a stronger, more stable tree? The response will be determined by the severity of the situation and the age or size of the tree. There

are three basic steps to removing a codominant branch structure and restoring a strong central leader branching system:

1. Identify the best stem to become the dominant leader.
2. Determine which stem or stems are competing with the leader.
3. Remove or subordinate the competing stems to improve the structure.

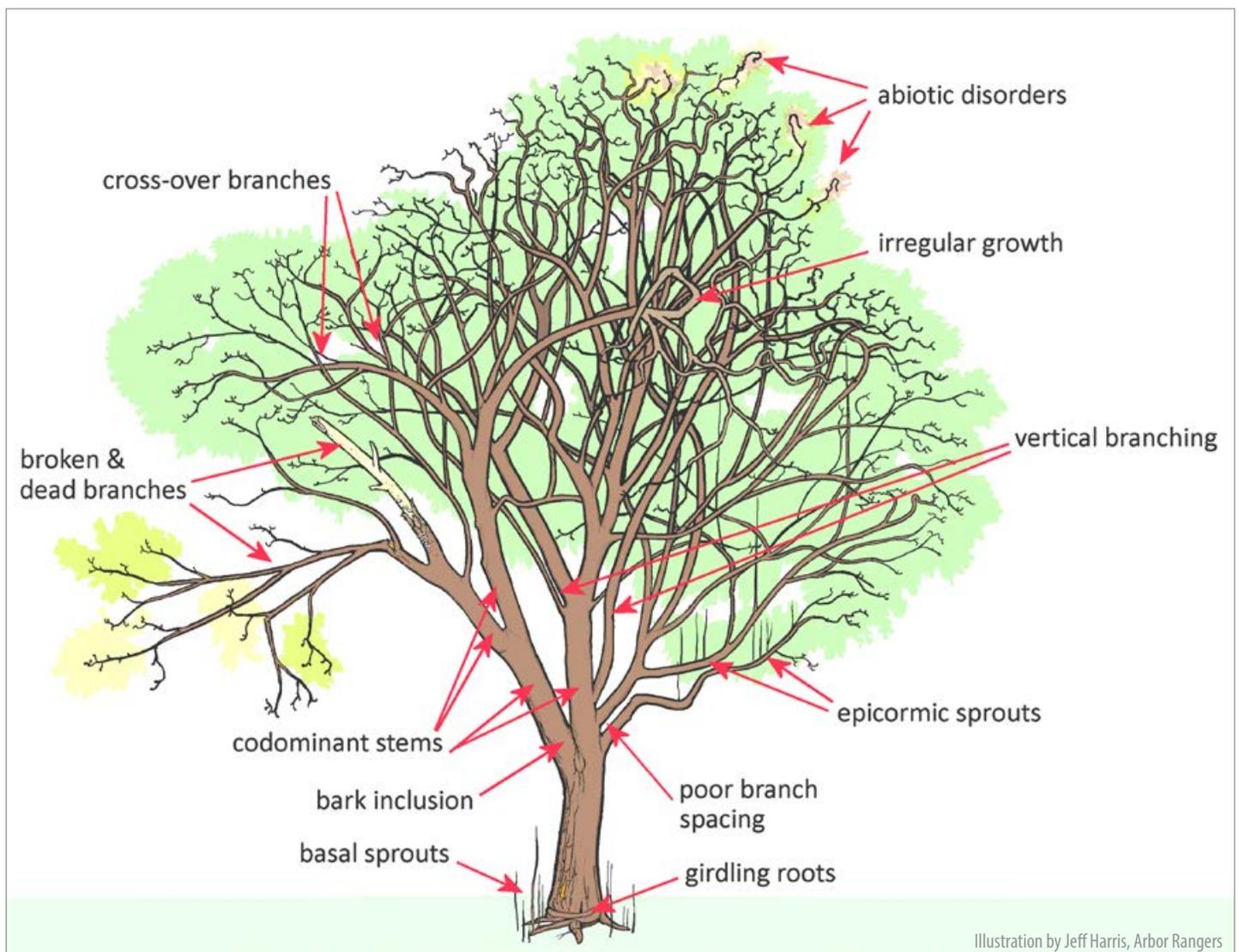


Illustration by Jeff Harris, Arbor Rangers

Figure 6. Common tree problems

Pruning Newly Planted Trees

Let's look at pruning at planting time to eliminate poor branch habit. Even if the stems are small, structural pruning is an important part of tree planting. If the tree is young and newly established, pruning to select the dominant leader is relatively simple (see Figure 7). Select a branch that is in the center-most of the crown, free of any wounds, and relatively vertical. Then remove the competing stem.

There may be a slight void in the crown after pruning due to the removal cut. But the tree will fill in the crown over a period of a few years as it develops, and growth is now directed toward the new leader. Additional pruning may be required to establish form and structure with branch spacing and permanent branches. Formative pruning of young, newly planted trees is also very economical in comparison to pruning larger trees.



Figure 7. Pruning approach for young tree with codominant stems

Pruning Medium-aged Trees

The process of restoring or developing a central leader becomes a little more challenging for established, medium-aged trees (see Figure 8). For practical purposes, medium-aged trees include those that are 15–50 years old. Most trees of this age and in good health are young and strong enough to provide the resources for sealing the pruning wound and reallocating food resources to growing the central leader. This is a critical time to prune to protect the tree from splitting, which can easily occur in the crown branches during strong winds or from the additional weight of ice (see Figure 9). Be sure to review the trunk for codominant stems as well as for branches with narrow angles and poor branch aspect ratio.

The age and vigor of the tree as well as the size of the stems will determine the best approach and amount of pruning required to improve branch structure. In correcting the codominant issue, the leader doesn't need to be perfectly straight. It should be dominant or considerably larger in diameter than all of the other branches. One of the rules for structural pruning is that the leader or parent stem should be twice the diameter of its attached branches.



Figure 8. Medium-aged tree with codominant stems



Figure 9. Split in crown branches

Branch selection

When selecting and pruning branches and stems, pruning cut size is another factor to consider. What can the tree withstand as far as removing live, green tissue without further health consequences? After all, pruning is removing the tree's capacity to create food and energy, which is needed to help with recovery from pruning. Attention to the tree's ability to compartmentalize wounds (heal) and the pruning dose (amount of green tissue removed) is critical. More information can be found in the *Tree Pruning Essentials* publication (FNR-506-W) and video (FNR-541-WV).

When deciding how much of the tree's canopy can be removed or reduced through pruning, consider the size of the branch and stem. If the branch being removed is less than half the diameter of the central trunk, then trunk or main stem problems such as decay aren't expected on most species and proper sealing of the pruning wound would be expected. Larger pruning wounds, such as those exceeding 4 inches, can be difficult to close, and decay may develop in the wounded area, leading to further tree health and safety concerns.

Reducing a larger stem in increments—rather than complete removal of the stem in one session—may be more desirable to prevent stress in the tree and improve recovery. In this case, a progressive pruning plan may be used to reduce the negative impact of a higher pruning dose on larger stems (see Figure 10). If appearance is a primary concern, this approach allows for corrective pruning without disfiguring the crown dramatically. However, it may take several pruning sessions over a few years to complete the task and meet pruning goals.

Plan to subordinate or reduce the stem—especially if that branch is larger in diameter and length—over multiple growing seasons until the branch is removed or the leader is twice the diameter of the codominant stem. The act of reducing the length through pruning sessions still benefits the tree by reducing the weight on the weak, codominant stem and improves stability until the branch is no longer at risk of splitting.

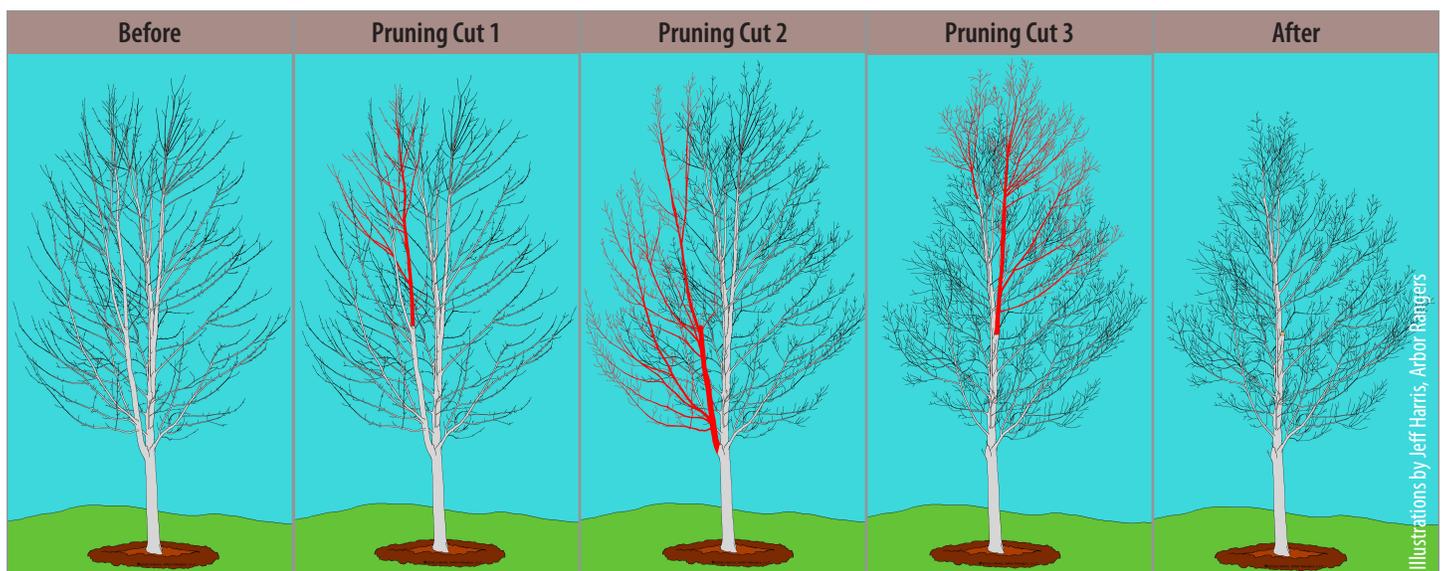


Figure 10. Pruning to improve poor branch structure may be completed over multiple sessions. Pruning goals may be reached in two growing seasons or it may take several years since the pruning dose will be determined by the species, age, and health of the tree.

Response and recovery

What should you expect after pruning? Trees respond to pruning in various ways, again, dependent largely upon developmental age, health, and vigor. After all, pruning is wounding the tree, but if done correctly, it can improve its health and appearance without negative impacts.

Pruning causes a tremendous change in the tree physiologically, including changes in chemistry and structure. Chemical compounds are initiated in the pruned area to help facilitate healing and recovery. Find more information about these changes in the publication *Tree Pruning: What Do Trees Think?* (FNR-534-W).

Proper pruning can be used to encourage growth in the portion of the tree that you want to become dominant. The placement of the pruning cut can affect the direction and amount of growth. Pruning to subordinate or remove a competing stem allows the tree to reallocate food and water resources toward the remaining branches and stems, and promotes better development. If completed correctly, this major stem removal will allow more light energy to the favorable leader and will stimulate growth and elongation, eventually balancing out the crown.

If pruning goals require removing large amounts of green tissue on codominant stems, it can leave large voids in the crown (see Figure 11). This isn't necessarily harmful, but it may create an unbalanced appearance for a time. However, patience should remedy the situation as the canopy develops.

Before deciding the pruning dose, first determine if the tree is healthy enough to withstand large amounts of green tissue removal. A younger tree that is growing fast may allow greater pruning doses, or removal of live, green tissue. However, trees with a slower growth habit, mature trees, or those under stress—such as from drought—should be pruned less aggressively.

Determining the growth rate is also important for assessing the health and vigor of a tree. If leaves are on the tree, note the color, size, and thickness of the foliage. In addition, note the twig growth, checking for the extension growth of twigs between growing points or buds (see Figure 12). A longer distance between the buds indicates the tree is growing more actively.



Figure 11. Maple tree with void in crown

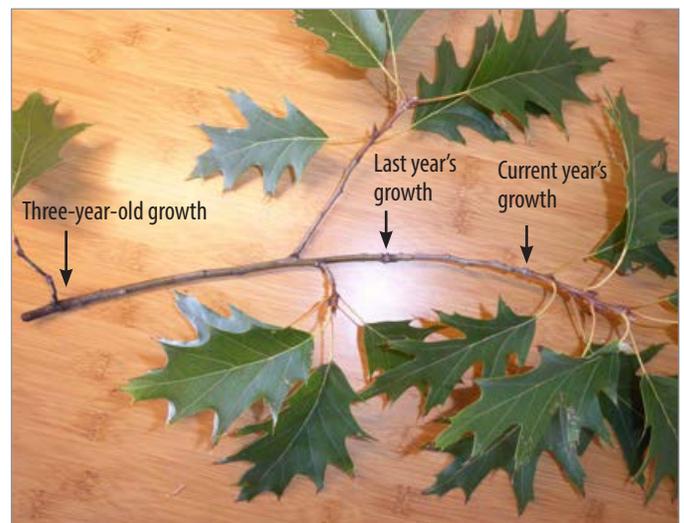


Figure 12. Growth increments on branch

Pruning Mature Trees

Finally, in older trees (75 years or older) or those that have reached their developmental maturity, pruning is still recommended to maintain or develop a strong central leader system. This can be done by using pruning strategies to redirect growth from the lower and middle crown to the center and top part of the crown. This is done by careful subordination of branches and low pruning doses. Due to the potential issues involved with large tree pruning, consult and hire a qualified arborist to complete the work.



More Information

- Tree pruning is an art and a science. Altering branch structure can be complicated, and any changes will remain with the tree for its lifetime.
- Remember, medium-aged and larger trees will require specialized equipment and accessibility to accomplish structural pruning goals for a longer-lived, stable tree.
- Consult an International Society of Arboriculture certified arborist for questions regarding tree pruning. Find an arborist at www.treesaregood.org.

Related Materials

Visit the Education Store, edustore.purdue.edu, to obtain these items:

- *Tree Pruning Essentials*, FNR-506-W and FNR-541-WV
- *Tree Pruning: What Do Trees Think?*, FNR-534-W
- *Tree Selection for the "Un-natural" Environment*, FNR-531-W

Resource

Edward F. Gilman, *An Illustrated Guide to Pruning, Third Edition* (Clifton Park, NY: Delmar Cengage Learning, 2011)