



Author

Lindsey Purcell,
Forestry and Natural Resources

Tree Pruning Essentials

Trees continue to survive in spite of the many challenges they face in the urban environment. However, to grow from seedling to a mature tree in the urban forest, they need our help. They are the largest, oldest living organism on the planet and can live long, healthy lives with some assistance. We often place trees in less-than-favorable growing locations that don't allow natural development and maturity and often require pruning to develop a durable structure, improve clearance, and maintain aesthetics.

Pruning has been called "one of the best, worst maintenance practices" performed on trees. The process creates wounds, which have a major impact on plant processes. Improper cutting on a tree causes severe damage or even death. To prune properly, it is important to understand both the proper techniques and how the tree responds to pruning.

Regardless of who is pruning, doing it right and doing it safely are important. This dangerous work requires expertise and training to prevent injury or unnecessary damage. Never let the situation exceed your skills! If you are uncertain about how to prune larger trees, contact a qualified tree expert to assist you.

Reasons for Pruning

Let's begin with why we want to prune a tree in the first place. The most common reasons typically include aesthetics, structure, and reducing risk. Typically, people prune to improve the appearance of the tree by reducing the length of fast-growing stems or unwanted growth. However, too many times trees are pruned only to maintain a desired shape or size to fit a location in the landscape. This can be the result of poor placement or because the wrong tree was selected for the intended space.



Sometimes pruning is necessary to remove dead or dying branches or those affected by insect damage or disease. This helps defend against the spread of the pest and prevent further damage. Also, pruning can increase the vitality of the plant to improve flowering and fruit production.

The most important reason to prune is to reduce the risk of tree failure, especially in the crown. This includes removing defective branches on a declining tree or branches damaged by a storm. Risk reduction and the improvement of tree stability are important pruning objectives. Begin this type of pruning when the tree is young and newly established. A larger, mature tree often requires professional arborists to remedy structural concerns and other issues affecting clearance, risk, and safety.

Start Before You Plant

Good pruning actually starts with planning—and choosing the right tree. The goal is to minimize inputs and maximize the benefits trees provide, and this starts with proper tree selection and placement. Planning for the right tree in the right place reduces the need for continual pruning. Know the mature size of the tree for its location; determine if it will fit the intended space as it matures and grows before planting.

Reduced-maintenance plantings also include smart selection of good quality plant material. Choosing trees is much like purchasing any product: you get what you pay for, and the tree you select can determine long-term maintenance. Start out right by purchasing from a reputable source, such as a dedicated nursery or garden center. Then, recognize how to choose trees that are healthy and vital with good branch structure and spacing. Do not buy and plant trees with many narrow branch angles, excessive branching, or other structural issues.

Also, spacing trees properly will reduce complications later as they grow into maturity. Overcrowding trees and plants can cause maintenance headaches and unnecessary costs with excessive pruning and even removal of plants to accommodate growth. Pay attention to the projected mature height and width of the tree during the selection process. Right tree, right place can have a major impact on pruning and other maintenance requirements. More information on selection and planting can be found in the publication *Tree Installation: Process and Practice*, <https://www.extension.purdue.edu/extmedia/fnr/fnr-433-w.pdf>



Poor branching habit should be avoided. Structural pruning will be needed to establish a central leader.

Basic Pruning Principles

Any arboricultural practice—including pruning—should not damage or impair the health of the tree. Proper technique and timing are critical to long-term tree health. The most important principle to remember is that each cut has the potential to change the tree considerably. Pruning trees should not be a common practice used to force them into aesthetic constraints or spaces. However, in distinctive circumstances such as espalier, topiaries or pollarding, specialized pruning practices would be necessary.

There are times when trees and other features in the landscape conflict with each other as part of the maturation process. Occasional pruning may be required during the life of the tree to remove branches interfering with buildings or with pedestrian or vehicular traffic. So, plan for a location that allows the tree to expand into its natural shape with limited conflicts, reducing the need for continual pruning.



This tree has a good central leader with a strong, stable structure.



Trees with codominant leaders are prone to damage.

Another key principle is the pruning dose—or amount of green tissue mass removed during any one pruning episode. Pruning amounts will depend upon previous pruning cycles and pruning objectives. How long has it been since the last pruning episode? What do you want to accomplish with this pruning activity? These questions will determine amount of pruning necessary. If extensive pruning is needed, consider phasing in the pruning process over a period of several months or years.

Removing dead, damaged, or dying tree parts doesn't figure into the mass when calculating pruning dose. However, severe pruning, especially during times of stress such as drought conditions, can have severe consequences on tree health.

Development Stage of Tree	Pruning Dose (maximum % of total foliage removed at one pruning)
Young, newly established	50%
Medium-aged	25%
Mature	10%

Some things you should never do. *Topping* is a form of poor pruning that can ruin the tree's shape and health with excessive canopy removal and poor cuts. Topping is the indiscriminate removal of branches between internodes and not where branches meet, leaving stubs and wounds which cannot heal properly. This provides the opportunity for disease and decay, creating serious problems for the tree. The tree responds to topping by producing many



Trees recently topped will be prone to many problems.

sprouts that are poorly attached and prone to damage from wind, ice, and snow. The dormant buds on the stems, which have flushed, are only connected to the xylem and do not overlap or commingle with the main supporting stem. This is a poor attachment that grows quickly and will become a safety concern. Because of this weak attachment, the branches are likely to fail more easily and pose a higher risk of injury or damage around the tree.

The topping process typically involves large branches that are removed, leaving massive wounds that cannot compartmentalize and lead to decay as a result. Pruned branches should be removed back to a point of origin. If a branch must be removed or reduced, it should be cut back to a lateral that is large enough to assume the terminal role. The best practice for this is to cut back to a lateral that is at least 1/3 the diameter of the limb being removed. However, if large cuts are involved, the tree may not be able to seal over and compartmentalize the wounds. When severe pruning is required and excessive, sometimes the best solution is to remove the tree and replace it with a species that is more appropriate for the site. Topped trees present a serious risk to the tree owner and those around the tree. Never use any tree care company that advertises topping.

The Tree's Response

So, how does a tree respond to pruning? Trees are complex organisms that respond to pruning in development, root growth, and quantity of leaf tissue produced. In simplest terms, pruning creates potentially serious wounds in the tree. However, pruned properly, a healthy tree can completely recover from the wounds caused by pruning cuts.

Trees wounded in any way have a natural defense mechanism, which allows them to recover. This process is called CODIT (Compartmentalization of Decay in Trees), which is walling-off or sealing affected areas to prevent decay from spreading from the point of the wound into the tree. CODIT allows the tree to survive from wounds such

as pruning. However, it is important to minimize wounding to facilitate faster recovery. The ability to seal off wounds is largely dependent on the age, health, and species of tree. The healthier the tree, the better it recovers from injuries. Younger trees and those not suffering from stress, pests, or other problems. Some species of trees are just more resourceful in their recovery process and recover more effectively.

It is important to make proper cuts that allow callus growth to begin to close the wounded area. Each pruning cut requires valuable resources from the tree for healing. The larger the cut, the more time and resources are required to recover. Small cuts always are better than larger pruning cuts. The smaller cuts minimize the amount of tissue exposed to pathogens and expedite the healing time more efficiently.

Research suggests that in trees that seal poorly (such as maples, birches, poplars, and crabapples) pruning cuts should be no larger than 2 inches in diameter. On trees that are better compartmentalizers or better at sealing off wounded areas (most oaks, elms, lindens, and hornbeams), 4 inches in diameter should be the maximum-size branch removed. Limiting the size of the wound better enables the tree to seal the wound. If larger branches need to be removed, consider a progressive pruning cycle. This makes



Properly pruned branch heal well. Note the callus tissue surrounding wound.



This poorly structured, medium-aged tree will require progressive pruning cycles over several years to correct these problems.

a great case for structural pruning of trees while they are still young and relatively smaller (more on this later). Wound size and efficiency of the tree's ability to seal the wound are critical for long-term health.

Pruning can strengthen a stem by encouraging growth or stimulating additional branching, but the affects depend upon both the amount of cutting and timing of the practice. Overall, the practice of pruning not only affects the canopy, but can also affect the roots. Fewer green leaves to produce food can also mean fewer roots and less food-storage capability.

Before the equipment comes out, remember these basic concepts:

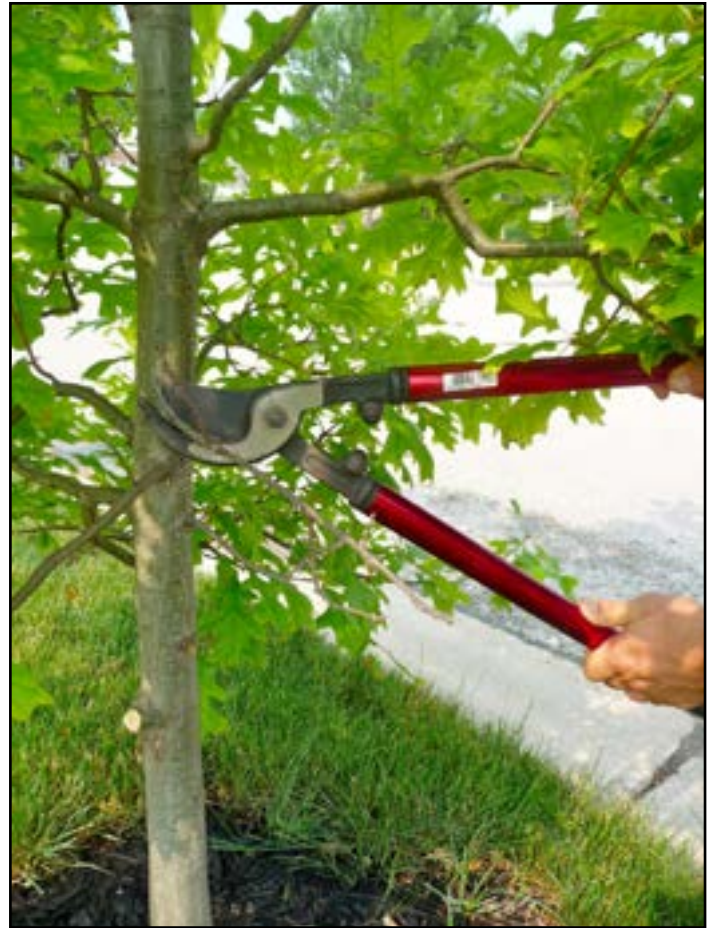
- Each cut has the potential to change the tree forever.
- Removal of branches and limbs affects the tree's ability to gather sunlight for food production.
- Large limb removal can impact form and geometry, affecting stability.
- Inconsiderate removal of branches can leave the tree susceptible to decline.

Excessive removal of large branches and removal of large masses of leaves reduces the tree's ability to create food and energy. Also, this excessive pruning creates serious root issues and can limit root growth dramatically. Food, water, hormones, and other phytochemicals are constantly moving in the pathways between the roots and shoots of the tree. Excessive pruning will cause roots to recede and decline, leaving the tree less able to take up needed water and transport important nutrients.

Pruning Objectives

There should be a purpose with every cut, a purpose based on one or more of three distinct needs or objectives determined by the tree owner and the arborist.

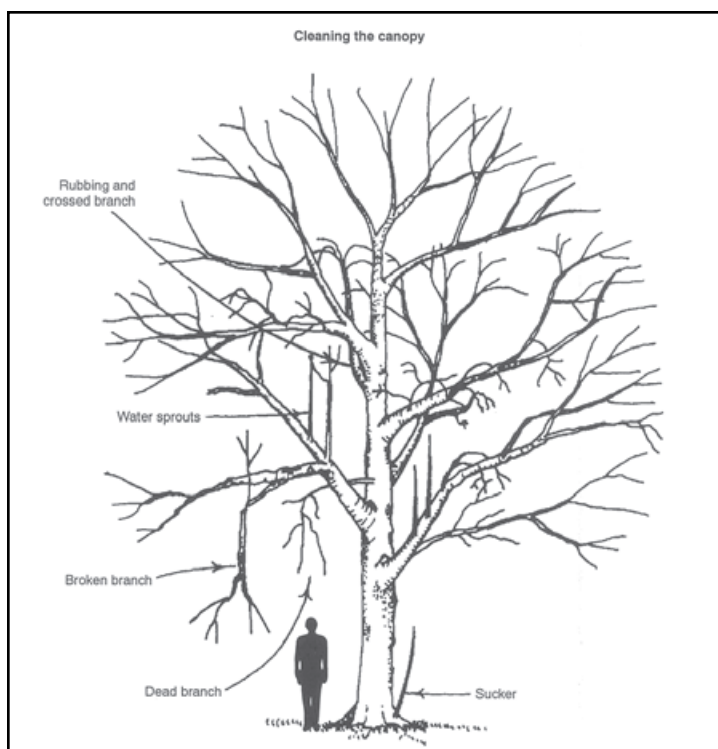
Structural pruning of a young tree is a holistic approach to tree care early in the life cycle. It is the best pruning practice for tree longevity as well as an economical approach to maintenance. It is far easier and cheaper to prune a younger, smaller tree than a tree that is mature, more sizable, and complex. Strong, stable trees should



Choose the correct branches to prune on a newly planted tree.

be the goal of any sustainable planting—and this begins with properly trained trees, pruned to improve branch structure and crown development. Structural correction when the tree is young is the best way to reduce risk. This is accomplished by shortening branches with the largest aspect ratios using reduction cuts. Proper structural pruning lowers the crown density, which reduces the mass and motion of limbs due to the wind.

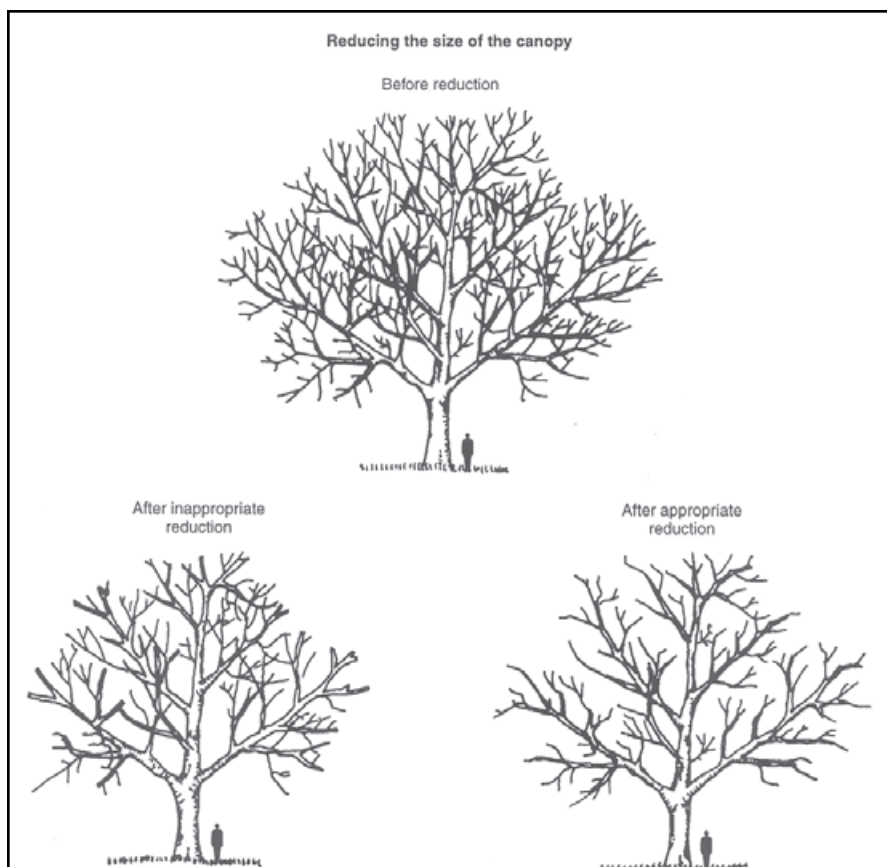
This proactive approach to correcting structural faults helps reduce risk and potential failure later as the tree matures, rather than waiting until the tree presents a problem. Typically, this pruning occurs in the first 5 years after planting. It may take longer, depending on the current structure, species, and growth rate. Additional, planned pruning may be required in subsequent years to achieve desired pruning goals. Trees benefit from structural pruning until the basics of a good, strong structure are established.



Focus on removing non-beneficial plant parts.

Crown cleaning focuses on reducing tree risk and improving appearance. The process involves pruning to remove dead, dying, diseased, broken or poorly attached branches; crossing or rubbing branches; and, perhaps, adventitious shoots, if too numerous. The primary objective is removing non-beneficial plant parts, but minimal live tissue. This is a common pruning practice that not only improves appearance, but also may improve health. Another important objective is to reduce potential risk of failing branches. Crown cleaning is used extensively by arborists after storms have damaged trees and includes selective pruning using proper cuts to repair the damage. This is the most common pruning strategy and is often a regular maintenance procedure in public spaces.

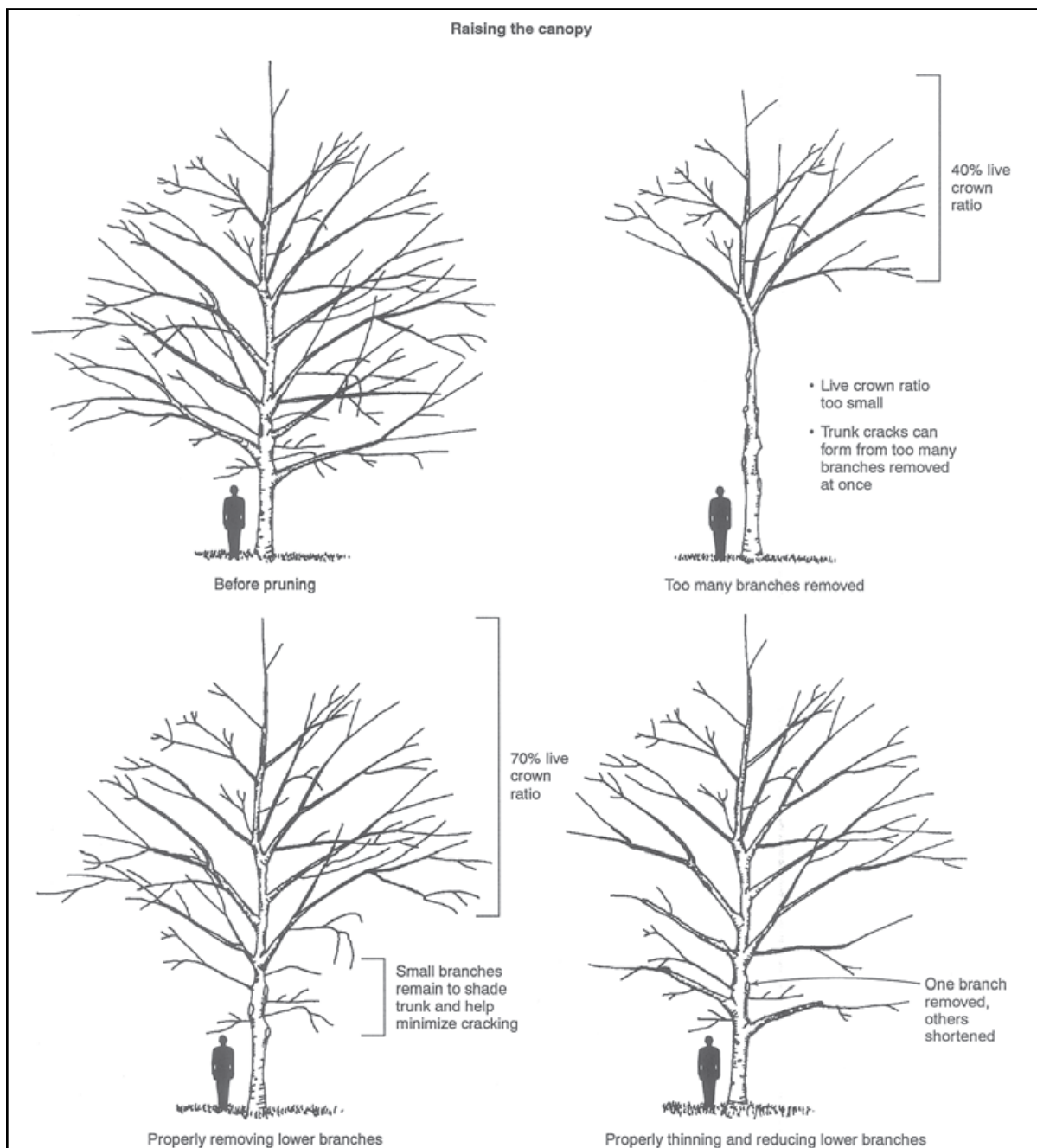
Crown reduction decreases the overall size of the tree and is usually an attempt at making a too-large tree fit into its location. Often, this is the result of a poorly placed tree in a location that cannot allow natural, mature growth. Crown reduction is another advanced pruning strategy that typically requires a skilled arborist. If done improperly, affected trees can develop mechanical and physiological stress. This includes poor crown geometry that can lead to instability and failure as well as decay within the tree, which will eventually lead to decline and death.



Proper canopy reduction makes the tree smaller, using proper pruning techniques.

In this process, heading cuts, made back to a node or bud, or reduction cuts, cutting the branches back to lateral stems, lower the size of the tree's height and spread. When using reduction cuts, the branch remaining should be at least $\frac{1}{3}$ the diameter of the branch removed (small aspect ratio) to be sustainable, otherwise dieback can be expected from the lack of photosynthetic area in the leaves to support it. If done properly, the tree can survive for years in the landscape. Prune branches to avoid large wounds and remove no more than 30% of the foliage during any one pruning occurrence on larger, mature trees.

Before spending time and resources on this type of pruning, consider your objectives. The overall tree size should be reduced by no more than one-quarter. Typically, it will require a commitment to this type of pruning over many years. Does this meet your goal? If not, consider removing and replacing the tree with one more compatible with the location. Talk to a professional arborist to discuss the best options in this situation.



Raising the canopy reduces conflicts with pedestrians and structures.

Crown raising elevates the crown of the tree to accommodate pedestrian or vehicular access, structural conflicts, line of sight, safety, or appearance. Removing the lower tree branches is an important pruning process requiring some knowledge of tree growth. The lowest branches remaining will be the lowest branches on the tree as it matures; proper selection is critical. If the tree is too small to raise to the desired height, a gradual elevation will be required over a period of several years.

An important concern in the process is *live crown ratio* (LCR). The resulting LCR should be greater than 60%. This means that the canopy-to-trunk ratio should be about two-thirds canopy to one-third trunk, or the canopy should be at least 60% of the overall height of the tree. Lower than 60% or excessive elevation of branches should be avoided so that trunk taper is not affected adversely. Also, a low LCR can result in greater susceptibility to failure during high winds.



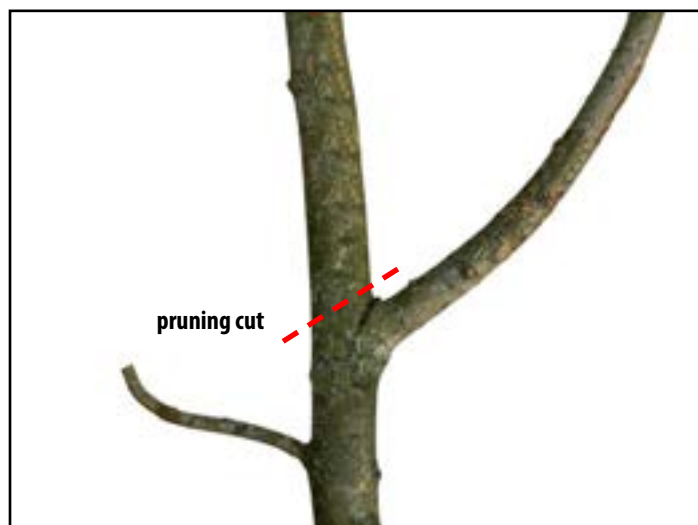
This tree has an improperly raised crown with about a 20% LCR after pruning.

Begin the canopy or crown-raising process while the tree is younger and actively growing and to prevent cutting larger branches. Large pruning wounds compromise healing, promote decay, leave defects, and increase the likelihood for failure in the tree. On larger trees, careful consideration of branches is important to prevent excessive removal of live tissue and large pruning wounds. It may be necessary to raise the canopy over the course of multiple pruning cycles.

Types of Cuts

The tree's response to pruning can be anticipated based on the type of pruning cut you use. Most plants respond in much the same way to pruning. So, if you understand the responses, you can choose the best cut for the situation. There are three types of pruning cuts: reduction, removal, and heading.

Reduction cuts shorten a limb by removing the terminal portion back to a lateral branch of equal or smaller diameter. The cut should be made just beyond the lateral branch and the remaining branch should be one-third to one-half the size of the branch removed. This remaining branch will then assume the very important terminal role for support and survival. Reduction pruning is often used for improving branching structure, directing growth, removing branch defects, or decreasing plant size. Focus on cuts that leave the smallest cut diameter to facilitate faster wound recovery. This is a preferred method of reducing risk by shortening branches with large aspect ratios. The density and weight on branches is reduced. Also, reducing branch length using reduction cuts diminishes mass and motion on limbs, helping reduce potential storm damage as well.



This shows how to make a reduction cut to a proper sized lateral branch.

Removal cuts eliminate a branch back to the trunk or a primary stem just outside the branch collar or branch bark ridge, if the branch collar cannot be identified. For this pruning cut, the part of the plant that remains must have a larger diameter than the part that was removed. Anything less will not support the branch and will result in decline and dieback. These are much different than reduction cuts. The part of the plant that remains following a removal cut has a larger diameter than the part removed (for example, removing a limb from a trunk to a lateral branch from a larger stem).



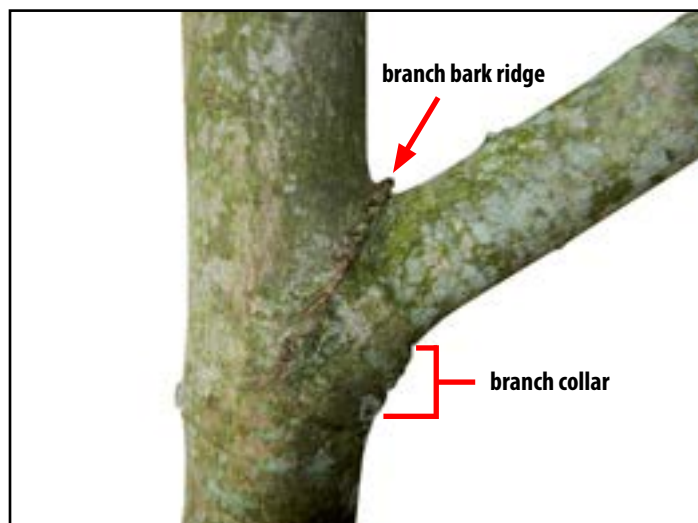
This shows a removal cut to a parent stem.

Heading cuts sever shoots or branches from the current year's growth or branches less than one year old. The cut reduces the length of a stem or branch back to a point without regard to the nearby lateral branches and takes the branch back to a bud or a node. This also describes cutting an older branch or stem back to any size lateral branch. Often, these cuts are used when restoring trees following storms or when reducing trees where there are no suitable laterals to cut back to. This is considered a better alternative than cutting back to the trunk and leaving a larger wound. Heading cuts should not be used frequently in tree trimming. These are the primary cuts when "topping" trees with indiscriminate internodal cuts, which is an unacceptable pruning style. Heading or topping produces weakly attached sprouts and promotes dieback and decay in branches.

Pruning Technique

Proper technique is essential for recovery, health, and aesthetics when pruning trees.

The first step is to identify the key components of the branch. This requires careful examination of the branch attachment to identify two very important components: the branch bark ridge and branch collar.

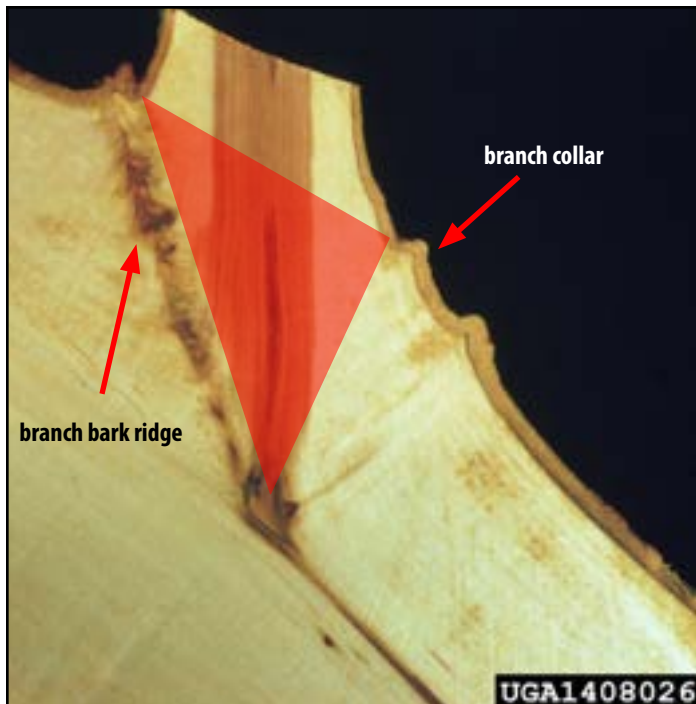


Identification of branch components is critical for proper pruning cuts.

The *branch bark ridge* is a raised strip of bark at the top of the branch union where the growth and expansion of the trunk or parent stem and adjoining branch push the bark into a ridge structure. This is typically present on every branch union and is an important identifying feature for determining tool placement.

The *branch collar* is the area where a branch joins another branch or trunk that is created by the intermingling of vascular tissues from both the branch and the stem or trunk. It is typically a slightly swollen area just outside the branch bark ridge and wraps around the stem at the base of the branch. Collars only develop when the branch is much smaller than the parent branch. However, these branch collars are not always present, especially on codominant branches and stems. Many branch bases lack visible collars.

The combination of the branch collar, branch bark ridge, and the overlap between the branch and stem are the physiological components that form what is sometimes called the branch protection zone. This zone contains specialized chemical compounds that help resist the spread of disease in the tree and facilitate wound-sealing. If the branch collar is damaged or removed as in the case of a



The branch protection zone contains special properties to allow wound recovery.

flush cut, the branch loses the ability to defend against invading diseases. As a result, disease organisms are more likely to invade the wounded area and cause decay.

The vital concepts of pruning are to

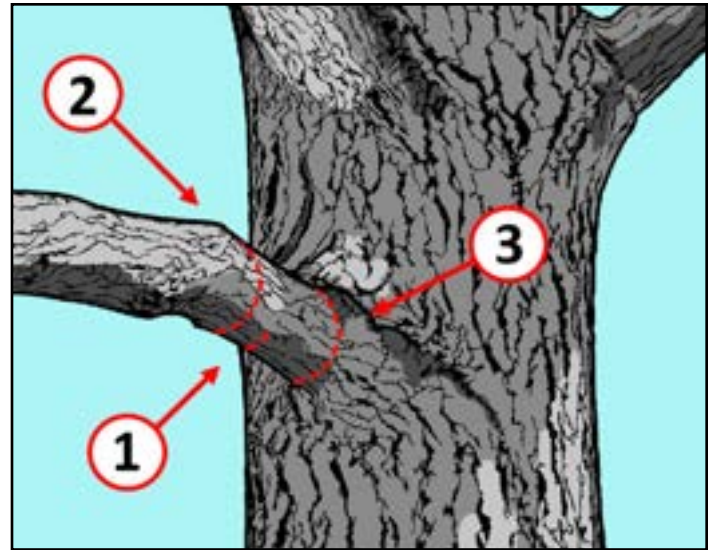
- minimize the impact of the wounds and
- reduce stress on the plant.

Always avoid damaging the area within the branch collar and branch bark ridge, and never remove more than one-quarter of the green tissue during any one pruning dose.

How to Make a Pruning Cut

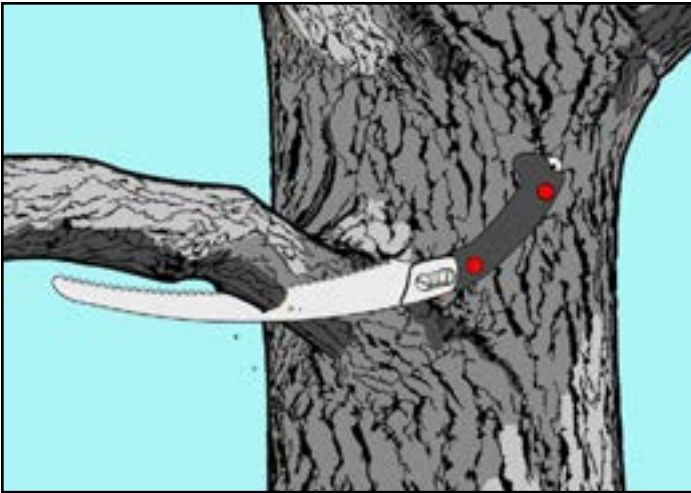
The practices used for pruning depend on size of the branch to be cut; whether or not the branch is safely and easily supported by one hand while cutting; and if a simple, single cut can be made with hand pruners, loppers, or a hand saw. If the branch is too large to support with one hand, you'll need to use a specialized cutting technique and, most likely, a hand saw. Before making any cut, remember to identify the branch components to insure proper alignment of the pruners, loppers, or saw during the cut. When removing any branch or limb, **always** make the cut just outside the branch bark ridge and the collar when it is present.

Branches that are too large to be supported by hand should be removed using the *ternary method* to avoid tearing or splitting the bark and damaging the branch protection zone. (It was formerly called the “double-cut,” which is a misnomer, because it actually takes three cuts to finish the process, rather than two as the name implies.) Arborists now refer to this pruning cut as the “three-cut method” or ternary method.

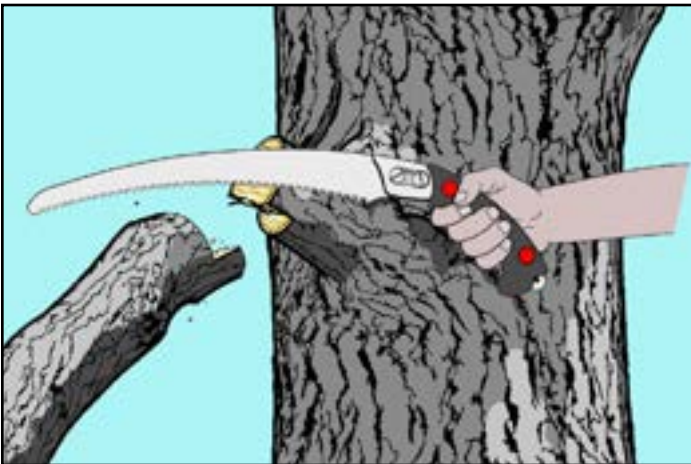


The ternary pruning method requires three cuts.

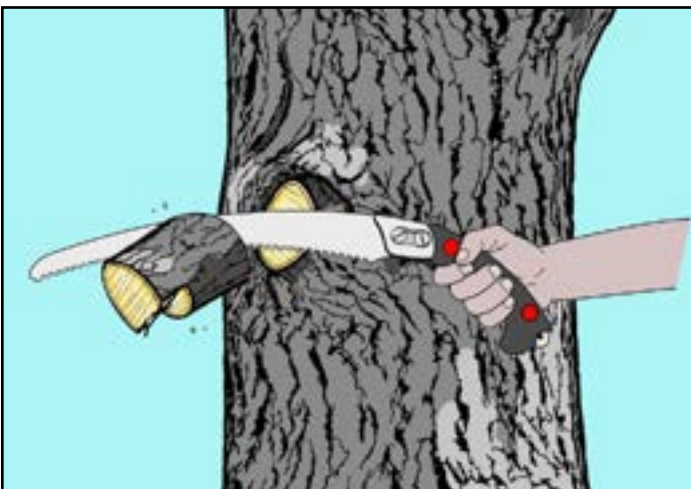
In the ternary method, the first cut, called the *undercut*, begins on the bottom of the branch anywhere from 6 to 12 inches away from the branch union. The second cut, called the *topcut*, is made above or just outside of the undercut; proceed with the saw from the top of the branch moving downward. This is the pruning cut that allows the branch to be cut away completely. As the saw moves through the wood the branch will naturally fall as gravity takes over. This “topcut” will soon meet the plane of the previous undercut, stopping it and preventing the bark from ripping. After both cuts have been made, the branch should easily fall and be removed. However, the job is not finished! Make the third and final cut just outside the branch bark ridge and the outer portion of the branch collar on the bottom side of the attachment. Now that a proper cut has been made, let the sealing begin!



Step 1 - undercut

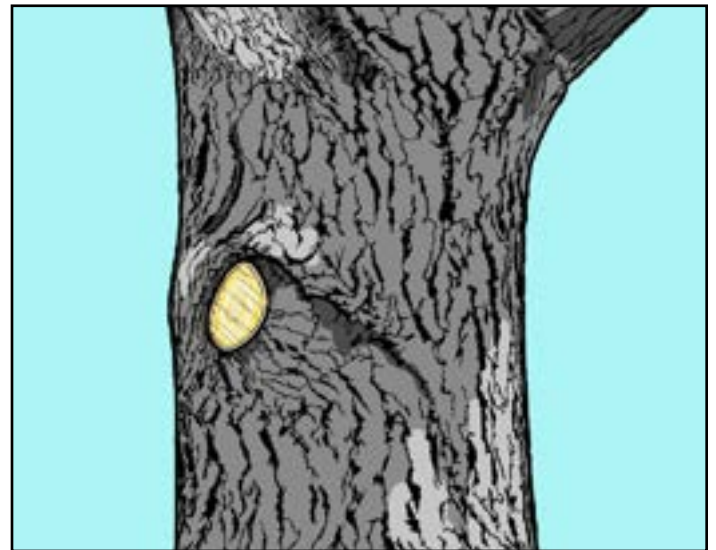


Step 2 - topcut

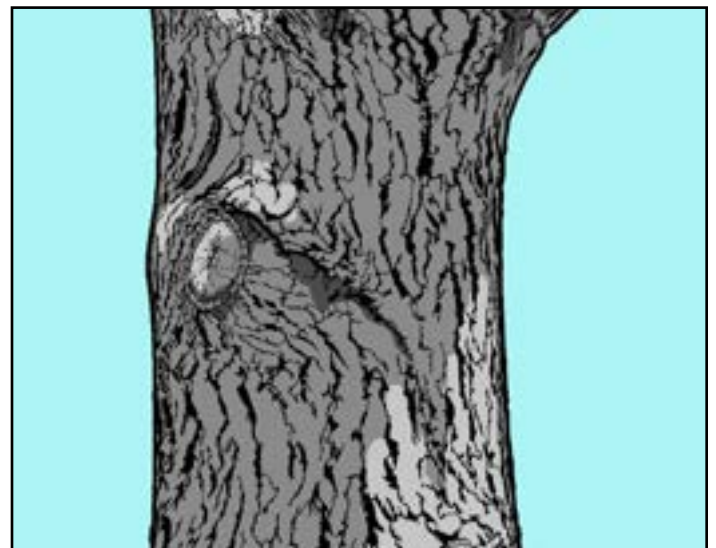


Step 3 - stub cut

Determining the two points on the branch to align the cut can be challenging at times, especially when the branch collar may not be readily visible. In this situation, identify the branch bark ridge, which is always present, and cut at an angle, typically at a right angle with the top of the branch to be removed, which minimizes the wound size, revealing the least amount of exposed tissue. The smaller the wound, the faster and more efficiently the tree seals the cut. If removing a dead branch, sever the branch just outside the area where the wound wood has formed. Take care not to damage any of the newly formed callus tissue. This will eventually seal off the exposed tissue from the cut.



This shows a proper pruning cut to the branch components. Smaller wounds recover more quickly.



A properly sealed wound results from a proper pruning cut.

Poor pruning cuts, leaving rips, stubs, or flush cuts, create many issues detrimental to recovery. Pruning without damaging the branch collar and branch bark ridge encourages the formation of a callus that seals the wound and protects the tree. Never “flush-cut” a branch, because that removes the tree’s ability to recover quickly and effectively. Also, never leave the stub behind outside the branch collar



This *rip cut* is caused by sawing from the top of the branch.



A *stub cut* leaves a small portion of the branch, which promotes decay.



A *flush cut* damages the branch protection zone.

area. This leaves a woody material with no support from leaf tissue; it will soon decay and provide a conduit for disease to spread into the remaining branch or stem.

It continues to be accepted that tree wound dressings are not needed on pruning cuts and provide no benefit to the tree. In fact, many dressings inhibit closure of the wound and slow the sealing process. Many of these are petroleum-based products, which can kill the cells responsible for callus development and wound closure.

What to Prune

Pruning trees to develop a strong, stable structure is the most important objective for any landscape tree. The most important goals to keep in mind are to focus on the development of a central leader, maintain clearance between the tree and any nearby objects, and develop the desired appearance.

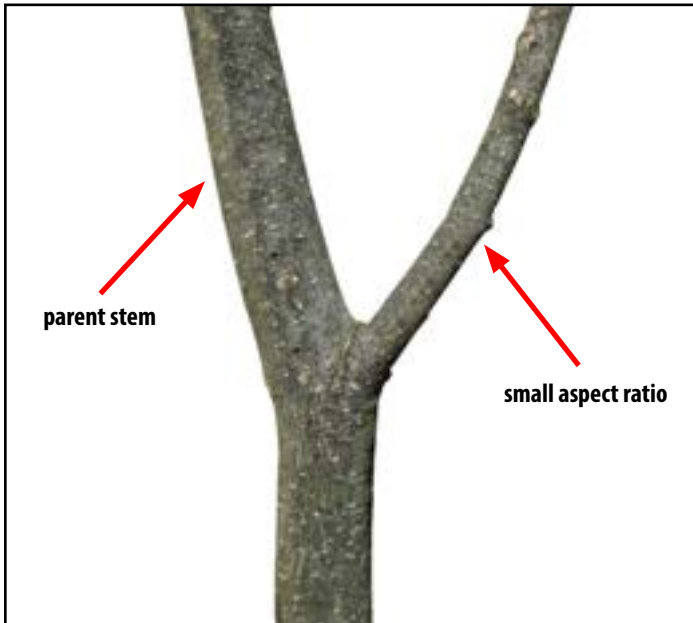
Structural pruning is the most important activity, especially when future pruning is not anticipated for several years.

Choosing a central leader can be a challenge, but is very important in developing a strong, sustainable tree. This can be done with three steps:

1. Be sure to select the dominant stem in the center of the tree that is healthy and free of any defects.
2. Identify any stems that may be competing with that central dominant stem, preventing a true central leader.
3. Remove those competing stems and branches back to the trunk, or subordinate them with a reduction cut.

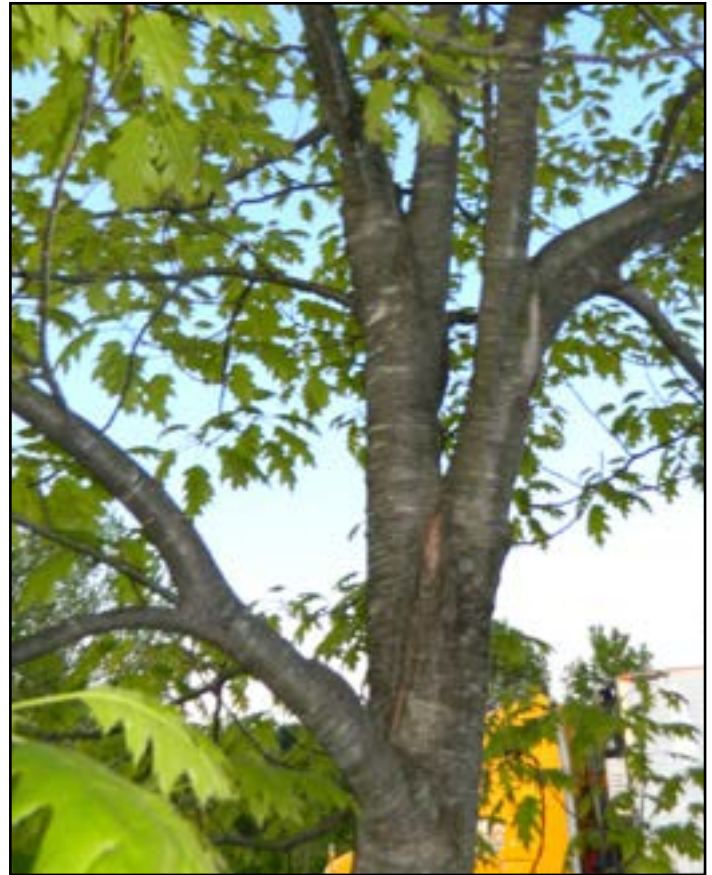
This practice should be the guideline for any structural pruning, especially on young-to-medium age trees and large, maturing trees. Be sure to maintain proper pruning doses during the pruning episode. However, focus on the branches as opposed to the entire tree. In other words, look for the largest limbs in the canopy that serve as the main scaffold branches, typical four to five major limbs. Then, select the branches that need to be removed from those main limbs to obtain your pruning goal, maintaining the appropriate amount of live foliage removed. To determine which branches need to be removed from any limb, maintain a larger aspect ratio for strong branch unions.

Strong branch unions are those considered to have the proper branch aspect ratio. Aspect ratio is the diameter of the branch relative to the diameter of the trunk, both measured immediately above the union. Branches with a small aspect ratio are very well attached to the trunk; those with a large aspect ratio separate more easily from the trunk.



Small aspect ratios are important for strong branch unions. This is an example of a good attachment of at least 2:1 ratio.

The branch aspect ratio can be made smaller by slowing the growth rate of the branch relative to the trunk. The best way to do this is to remove foliage from the branch by pruning. During this structural pruning approach, focus on creating a branch structure that is sustainable and reduces risk of failure. It is important to maintain proper branch sizes and branch angles to create strong branch unions. The goal should be aspect ratios of 50% or less on permanent branch selections. Branches with a small aspect ratio of less than 50% are better attached to the trunk and better able to resist failure. In other words, maintain a low aspect ratio between trunk or stem and branch size of less than 2 to 1, meaning the size of remaining branches should be half that of the supporting stem or less. Try to establish branch attachments that do not have narrow angles and do not include bark in the branch unions. Codominant stems and weak branch unions with included bark formation can be removed with careful pruning strategies to improve physical strength. Included bark in stems and branches are prone to splitting and decay, creating dangerous situations.



Trees with codominant leaders are more likely to split during storms.



Trees with codominant leaders are more likely to split during storms. Note the decay present in branch union.

Young Trees

Pruning procedures vary greatly between a younger, newly established tree and a mature tree, but the principles are the same. Goals and directives change as the tree grows and develops into its mature size and form. For younger, smaller trees, minimize pruning until the tree is established; however, pruning at planting is an acceptable practice and encouraged for proper development. The goals for newly planted trees are to prune to create one dominant trunk and to establish the permanent, lower branches.

One of the first steps is to select a leader in the top of tree. Often there is a codominant stem contending with the top leader stem. Select the strongest, straightest stem and remove any competitors. Allowing a codominant stem to grow will result in a weak arrangement more susceptible to splitting with high winds, especially after it grows in size. After choosing the appropriate leader, the central stem of the tree will form a strong, stable configuration.

Then, prune as needed on the young tree, continuing to establish strong branch unions with large aspect ratios and maintaining a dominant central leader. The primary advantage of early pruning is making smaller



Avoid planting a tree with poor stem configuration. This tree may never achieve a stable form.



It is critical to choose a leader between codominant stems if you want a sustainable tree.

wounds (due to smaller branches) and healing much faster. Structural pruning on young trees prevents many problems that require extensive repair work in mature trees by establishing a good structure while trees are young. Selective removal and reduction of stems and branches early in a tree's life creates a safer, stronger, more aesthetic structure as well. Of course, it is important to know the growth habit of the tree before proceeding. This procedure may not apply to clump-form trees or to creation of specialized habits such as pollarding or topiary.

Next, select the permanent lower branches. The branches on the lower portion of the crown will remain as the lowest branches on the tree throughout its lifetime. Remember to consider sight lines, clearance, and structures around the tree. Select strong lateral branches with good radial placement around the trunk. These permanent branches should be about one-half the size of the main stem or smaller.

Try to maintain adequate spacing between branches to prevent interfering with other branches. If the tree is too young or small to select a permanent lower branch at the desired height, postpone pruning until the tree grows taller. Do not over-prune the smaller trees to establish lower branch size too early. This could create a misshapen tree that is “top-heavy” and more prone to failure. Try to maintain a proportion of two-thirds canopy to one-third trunk for a good live crown ratio.



Proper spacing will allow strong development of permanent lower branches.

This structural pruning should be done while the tree is young, during establishment. According to research, pruning at planting time to improve structure provided no disadvantage. However, take time to analyze the tree carefully, selectively cutting to avoid excessive live-branch removal and disfigurement of the tree. Understand the form and growth habit of the tree species to get the desired results.



This shows a lower permanent branch with a good angle and proper aspect ratio.

Mature Trees

As trees become larger and mature into properly selected locations, some pruning may be required to manage developing conflicts or to repair damage caused by storms, natural aging, and pests. On established trees, focus pruning on reducing risk and enhancing appearance. The primary objective in pruning mature trees is the largest branches, which are often the ones most likely to fail. Focus on reducing these where necessary to improve stability and clearance.

This strategy for pruning mature trees is simple: understand that the objectives for pruning include a focus on aesthetics, clearance, and risk. First, examine the tree to determine what could affect appearance. This includes dead or dying twigs and branches, unnecessary sprouts, or branches in decline. Review the crown for crossing or rubbing branches, those branches with a large aspect ratio, and codominant branches.

Also, remove unwanted epicormic and basal sprouts or water sprouts. *Epicormic sprouts* are branches that sprout from dormant buds on shoots that elongated in a previous period of growth. This type of growth is weakly attached, making it more prone to damage and more susceptible to pests. *Basal sprouts* are shoots that may arise from roots or adventitious buds around the root collar and are not useful or helpful to the tree. On larger, mature trees, sprout-generated branches can grow from old, broken limbs and become an integral part of the canopy. Also, sprouting may be necessary on storm-damaged trees to replace lost limbs. Management strategies can be adapted to accommodate these normal characteristics of older or damaged trees.



Basal sprouts should be removed.

After you complete the initial pruning, step back and check the tree for any unwanted growth from the crown that may influence appearance or other clearance issues. This phase of the process should be minimal, since a majority of the pruning has been completed. If possible, maintain the pruning dose to remove no more than 10% of foliage during the year.

Before deciding to remove any branch, be certain each cut meets the objectives, is really necessary, and doesn't compromise health or stability. Seriously consider the consequences before removing larger, structural branches that are 4 to 6 inches in diameter or greater. Branches of this size have a profound affect on long-term health and stability. If large limbs must be removed, consider progressive reduction to better facilitate recovery and reduce stress on the tree.

When to Prune

There is much discussion and research on the best time to prune trees. Most of the time, pruning doesn't occur until there is a problem. However, timing depends on tree health, environmental conditions, season, desired effects, and purpose. Regardless of the need, always take into consideration the outcomes of the pruning action and what is best, long-term, for the tree. Prune trees when young to enhance growth and structure. Prune mature trees on an as-needed basis to insure safety and to improve structure and necessary clearance.

You can prune to remove dead wood almost any time of the year. This will not have an impact on resources of the tree or pruning dose. The optimal time to prune green wood or living branches is in the late spring and early summer. For the quickest, effective recovery of pruning wounds, this is when the cells are most active during the growing season. Defense systems (CODIT) which produces boundary layers, callus tissue, and wound wood develop and seal fastest on cuts made shortly before or early in the season of active growth.



Use loppers to remove small lower branches for clearance and to establish lower permanent limbs.

Look for and prune out the following problems:

- Dead or dying twigs and branches
- Over extended and weak large branches
- Basal sprouts growing near the base of the trunk
- Water sprouts growing vertically from the branches
- Weakly attached branches in decline
- Crossing and rubbing branches
- Narrow branch angles and codominant branches

However, trees may be pruned at any time of the year, except when the wood is frozen. Pruning in late winter or early spring, just before the new growth emerges, is good timing for many trees. This leaves wound tissue exposed for a shorter period of time before sealing begins. Also, with no leaves on the trees, branching structure is more visible, helping with the decision-making process on pruning cuts. Minimize any pruning in late summer or early fall, because that can promote a late flush of new growth more susceptible to cold damage or can delay dormancy on species such as elms and maples. Also, reconsider any pruning activity if the tree is stressed from drought.

Always consider that any arboricultural practice should not spread pathogens in the process. Proper timing of pruning can reduce spread of certain diseases. Dormant pruning, while trees are not actively growing, may be a good maintenance option on trees where pathogens such as oak wilt may be spread. Avoid pruning until late fall or dormancy, if disease is a problem. Spring or summer pruning increases chances for spread and infection of bacterial diseases such as fireblight. Prune crabapples, ornamental pears, and hawthorns in late February through March if these diseases are an issue.

Certain species (maples, birches and their relatives, ironwood, and beech trees) are sometimes labeled as “bleeders” and can discharge a great deal of sap through pruning wounds in the spring. This is the result of converting large amounts of starch to sugars and the flow of water from the soil into the tree creating positive pressure. The bleeding is not a reason for alarm from a health perspective. However, it can be unsightly and messy. Pruning these species later in the spring can reduce the oozing.

Plan ahead to avoid removing flower buds from trees and facing a year without blooming. Trees that bloom before the end of June should be pruned immediately after flowering, since the current year’s bloom developed last year and overwintered in the bud. If pruned before blooming, the flower buds will be removed, eliminating flowering. Trees in this category include serviceberry, cherry, redbud, hawthorn, crabapple, and lilac. Trees that flower after the end of June should be pruned during dormancy before new growth starts. These plants develop flower buds during the spring of the flowering season. Examples include summer-flowering trees such as lindens, goldenrain tree, and sourwood.

Trees are dynamic, living organisms that respond to outside stimulus, including pruning. Always consider the season and growth cycle before pruning and consider the physiological demands of the tree. Also, take into consideration the health of the tree. Never prune a tree when it is stressed, because that will only result in further decline. You can prune almost any time, but there is always an ideal time.

Conclusion

Trees are important assets and provide functional and aesthetic benefits. Often we plant trees in less-than-favorable environments, such as urban areas, so they require help to survive these often hostile conditions. The goal in any maintenance program should be to maximize the benefits of the tree while minimizing inputs required for it to survive. This is better for the tree owner, the tree, and our environment.



Pruning is often a necessary activity, yet it can be devastating if done incorrectly. The best advice for any tree maintenance, including pruning, is to never let the situation exceed your skills. If you don't know what you are doing when it comes to tree maintenance activities, leave it alone. There are many resources available to the tree owner to assist with plant health care decisions. Be sure assistance comes from tree care professionals with recognized credentials and references. Examples of tree care organizations include the International Society of Arboriculture, Tree Care Industry Association, and the American Society of Consulting Arborists.



Pruning tips for better trees:

- Start training trees with pruning while they are young and newly established.
- Minimize the number of live branches removed at any one time.
- Use proper cuts. Watch the branch collar and/or branch bark ridge.
- Pruning dose should be determined by overall tree health.
- Reduce live-tissue pruning during times of drought.
- Remove smaller branches rather than larger branches.
- Do not top trees for any reason (heading cuts).
- Prune when trees are biologically active to expedite wound sealing.
- Do not use tree wound dressings.

Reference

Purcell, L. 2013. *Trees and Storms*, FNR-FAQ-12-W. Purdue University Cooperative Extension, West Lafayette, Ind., USA.

McKenzie, R. 2008. *What's Wrong with Topping Trees?*, FNR-FAQ-14-W. Purdue University Cooperative Extension, West Lafayette, Ind., USA.

Purcell, L. 2011. *Tree Installation: Process and Practices*, FNR-433-W. Purdue University Cooperative Extension, West Lafayette, Ind., USA.

Special Thanks

Edward Gilman, Professor, Urban Trees & Landscape Plants, Environmental Horticulture Department, University of Florida, for his dedication and research as well as his support on this publication. Jeff Harris, graphic designer and arborist, for his contribution with illustrations on pruning.



July 2015

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