

GardenNotes #616

Pruning Mature Shade Trees

- Outline:
- When to hire a professional certified arborist, page 1
 - Pruning objectives for mature trees, page 1
 - Limitation on how much can be removed, page 2
 - General pruning guidelines, page 2
 - Dealing with structural defects, page 3
 - Pruning to *clean*, page 4
 - Pruning to *thin*, page 5
 - Pruning to *raise*, page 6
 - Pruning to *reduce*, page 8
 - Restoration*, page 10
 - Pollarding*, page 10
 - Frequently asked questions about pruning mature shade trees, page 10
 - o What about topping a tree? page 10
 - o What about utility right-of-way pruning? page 10
 - o I'm concerned about my tree in strong winds, but really don't want to lose the shade. Do I really need to have the tree pruned or removed? page 11
 - o How should storm damaged trees be pruned? page 11
 - o How should trees with root damage be pruned? page 12
 - o How should declining trees be pruned? page 12
-

When to hire a professional certified arborist

Pruning large trees is a safety issue beyond the training and experience of home gardeners. Hiring a bonded professional is the best approach for most tree pruning jobs. Look for arborists with certification from the *International Society of Arboriculture, ISA*. Many are listed in the phone book yellow pages and a list of ISA Certified Arborists working in the area can be found on the ISA web site at www.isa-arbor.com. Also, ask about liability insurance coverage.

This fact sheet is written to help the home gardener understand issues around pruning of mature trees and help them to communicate with their certified arborist.

Pruning objectives for mature trees

As trees mature, pruning should be based on pruning objectives. Do not indiscriminately remove branches. Pruning objectives determines methods to be used, which in turn determines the type of pruning cuts made. Table 1 lists common objectives, methods and types of pruning cuts.

Table 1. Objectives for Pruning Maturing Trees

Objectives	Methods	Pruning Cuts
Reduce risk of failure (wind & snow)	Structural	Removal cut
(Structural pruning)	Cleaning	Reduction cut
Maintain health	Thinning	Heading cut
Improve aesthetics	Raising	
Provide clearance	Reducing	
Improve view	Restoring	
Reduce shade	Pollarding	
Influence flowering and fruiting		

Limitation on how much can be removed

Do not indiscriminately remove branches with live foliage as this can add stress to the tree. The amount of live wood and foliage that can be removed per season depends on the growth rate of the tree. As a rule-of-thumb for healthy trees, 10-15% of the live foliage may be removed per season. For actively growing medium age trees without growth limitation factors (such as a dry site or restricted rooting spread), up to 20% of the foliage may be removed per season. For young actively growing trees (growth phase of life cycle) without growth limiting factors up to 25% of foliage may be removed per season.

More severe pruning slows root growth by shifting the root to shoot growth ratio. This adds significant stress to the tree. Heavy pruning also reduces carbohydrate reserves, making the tree less tolerant of insects, diseases, and drought stress. Do not remove live wood and foliage from trees showing stress.

General pruning guidelines

- To minimize the potential for decay, make *removal cuts* on branches with a branch collar when ever possible. For details, refer to CMG Garden Notes #613, *Pruning Cuts*.
- Ideally, pruning cuts are made on branches two inches and less in diameter. These small wounds minimize the potential for internal decay. Unless there is a strong justification, (taking into account the potential for a decay column) avoid removing branches larger than four inches in diameter. Large wounds predispose some trees to internal decay.
- To maintain overall tree vigor, at least one-half of the foliage should be in the lower two-thirds of the tree. The lowest limb should originate in the bottom one-third of the tree's height.
- Pruning should maintain the tree's natural shape.

- Avoid “lion-tailing” where the small twiggy inner foliage is removed on the lower scaffold branches and secondary trunks. This shifts weight to the ends of branches increasing the potential for wind damage. It also reduces the carbohydrate reserves in the lower branching structure decreasing resilience to stress factors.
- Avoid topping a tree. Topping opens the tree to internal decay. Regrowth of watersprouts (adventitious shoots) is structurally unsound.
- Written specification for any pruning job should include the following:
 - Clearly state which tree(s) will be pruned.
 - Clearly indicate the objectives for pruning (such as reduce risk of failure due to wind damage or snow loading, reduce shade, manage health, improve aesthetics, provide clearance, improve view, influence flowering and fruiting).
 - Specify pruning methods to meet the objectives (that is structural pruning, cleaning, thinning, raising, reducing, restoration pruning).
 - State the size specification for the minimum and/or maximum branch size to be removed. For example, “Cuts shall be made on branches two inches and less in diameter” and “In a reduction cut, the side branch pruned back to shall be at least one-third the diameter of the branch removed.”
 - Specify the maximum amount (percentage) of live tissue that can be removed. For example, “Pruning shall not remove more than 15% of the live crown”.
 - Include the statements “All work shall be performed in accordance with ANZI A300 Pruning Standards and ANZI Z133.3 Safety Standards”. “All work shall be performed under the supervision of a licensed, ISA Certified arborist.”

Dealing with structural defects

In Colorado, most storm damage in trees is due to co-dominant trunks (trunks of similar size). Structural problems of this type should have been corrected while the tree was in the early growth stage. Arborists have a limited potential to correct structural defects on middle-age and mature trees without predisposing the tree to internal decay and creating an unsightly shaped tree. [Figure 1]



Figure 1. Co-dominant trunks (adjacent trunks of similar size) account for the majority of storm damage in Colorado landscapes.

Structural training centers around developing a dominant trunk with subordinate side branches and secondary limbs. It requires annual pruning over a period of years, rather than an occasional one-time pruning. For additional details on structural training, refer to CMG GardenNotes #614, *Structural Training of Young Shade Trees*.

Pruning to clean

Cleaning is the removal of dead, diseased, detached, cracked, and broken branches. This type of pruning is done to reduce the risk of branch failure, improve tree appearance, and to reduce the spread of insects and diseases. Most pruning of middle-age and mature trees falls into this type. Trees under stress or declining trees may need cleaning every few months to years. All dead wood may be removed at one time. In cleaning, do not remove healthy branches and live foliage. Do not clean out healthy growth in the tree's interior. [Figure 2]



Figure 2.
Old cottonwood needing cleaning to remove dead branches and reduce the risks associated with branch failure.

Removing dead branches – To minimize risk if the branch were to fail, it is advisable to remove any dead branch larger than a two-inch diameter and higher than 30 feet. Dead branches may also become a source of insect and disease pressure in the tree.

Remove the dead branches using the three-step pruning technique. For details refer to CMG GardenNotes #613, *Pruning Cuts*. Do not cut into the branch collar opening a high potential for decay to spread into the trunk. If live wood has begun to grow out along the dead limb, cut just beyond the live wood being cautious not to nick the live tissue. Never “flush cut” the dead branch. [Figure 3]

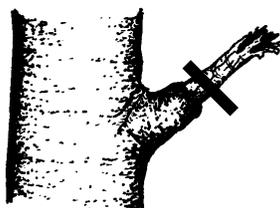


Figure 3. When removing dead branches, do not cut into the living tissues.

Written specifications for cleaning should specify the minimum size of dead branches to be removed. For example, “Clean branches one inch diameter and larger” or “Clean branches two inches in diameter and larger that are 30 feet and higher above the ground.” The location of the branch to be removed should be specific if the entire crown is not going to be cleaned.

Pruning to thin

Thinning is the selective removal of smaller branches (½ inch to 2.5 inches in diameter) to reduce crown density. Since the majority of small branches are in the outer canopy, thinning focuses in this area. Thinning should retain crown shape and size, and provide an even distribution of foliage throughout the crown. Removal cuts are primarily used. [Figure 4]

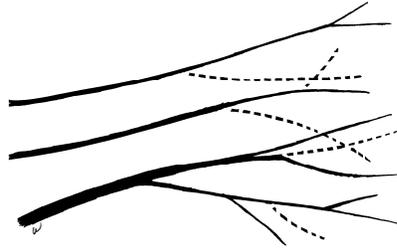


Figure 4. Thinning is the selective removal of small branches, growing parallel to each other, in the leafy upper/outer tree canopy.

Since thinning is in the upper/outer canopy, it requires a trained arborist with a high level of skill. Thinning is expensive, often running \$500 to over \$1,000 per large tree when done correctly.

Thinning can include removal of suckers from the base of the tree and some waterspouts on the interior. Excessive removal of waterspouts at one time often promotes growth of additional waterspouts, and should be avoided.

Benefits of thinning

- Thinning is the best way to minimize potential damage caused by snow loading, a primary situation leading to tree failures in Colorado. Thinning can reduce limb weight in order to compensate for structural defects.
- Thinning increases light penetration into the tree interior. This can invigorate the tree and help retain the tree's natural shape. Thinning may adequately reduce shade for shade tolerant under story plants below the tree. However, thinning middle-age and mature trees will not adequately promote growth of sun loving plants like Kentucky bluegrass.
- Thinning is a technique to partially open a view without removing or structurally impacting a tree. This is often referred to as "vista pruning".
- On tall tree, thinning may not be an effective technique to reduce wind sail and potential for breakage in strong winds. Reducing is the most effective way to deal with wind loading issues.

As a point of clarification, *thinning* is done on relatively small branches in the leafy upper/outer canopy. *Thinning* is not removing large lower branches which could create gaps in the crown and encourage waterspouts. Thinning is not removal of the small twiggy branches in the inner canopy. Thinning will not significantly lower a tree's height. [Figure 5]

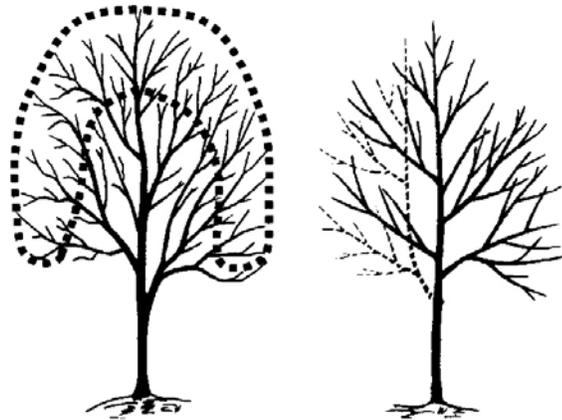


Figure 5.
Left – Thinning focuses on small branches in the upper/outer tree canopy. Right – Thinning does NOT remove large branches, creating a gap in the tree canopy.

Avoid “lion-tailing” which is the removal of the live small leafy twigs down in the tree’s interior. These small interior branches are critical to the trunk’s structural integrity and vigor. They also serve to dampen tree sway in wind. Lion-tailing shifts the wind loading to the outer canopy increasing the tree’s potential for wind damage. [Figure 6]

Figure 6. Do not “Lion Tail” trees as in the photo. Removal of the smaller twiggy wood in the inner tree canopy decreases vigor on the major branches and trunk and shifts the weight to the top increasing the potential for wind damage.



Written specifications for a thinning job should specify the following:

- Clarify what percent of the tree’s canopy may be removed. For example, “Pruning should not exceed 15% of the total live canopy”.
- Clarify where in the tree the pruning will occur. For example, “Pruning shall occur in the outer 1/3 of the crown”.
- Clarify size of branches to be removed. For example, “Pruning shall remove branches from 1/2 inch up to two inches in diameter”.

Pruning to raise

Raising is the removal of lower branches to provide clearance for people, traffic, buildings, or a view. When removing lower branches, maintain at least one-half of the foliage in the lower two-thirds of the tree. The lowest branch should originate in the bottom one-third of the tree’s height (live crown ratio). [Figure 7]

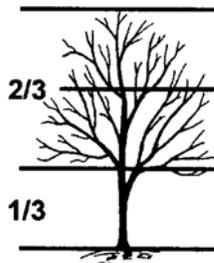


Figure 7. When removing lower branches, maintain at least 1/2 of the foliage in the bottom 2/3s of the tree. The lowest branch should originate in the lower one-third of the tree.

Raising should be part of the tree’s structural training while young. Ideally raising would be done before branches to be removed exceed a two-inch diameter. The potential for decay is high when the branch removed is larger than four inches or when a two inch and larger branch is greater than half the diameter of the adjacent trunk (no branch collar to suppress decay).

On many trees, lower branches make-up a significant portion of the tree’s entire canopy and cannot be removed without significantly impacting tree health and appearance. When the branch to be removed is larger than two inches, consider other alternatives. Can the clearance required be achieved with removal and reduction cuts out along the branch rather than removing the entire branch? Leaving some small diameter branches on the lower trunk for a year helps close pruning wounds and lessens the potential for trunk cracking. [Figure 8]

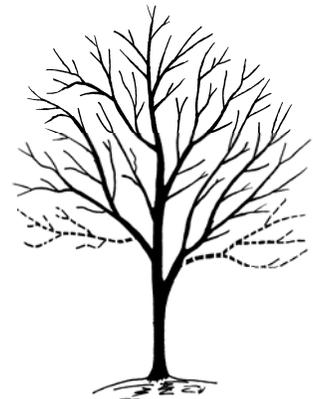


Figure 8. In raising branches on maturing trees, consider if required clearance can be achieved with removal and reduction cuts out along the branch rather than removing large branches entirely.

Excessive removal of lower branches increases the potential for tree failure by decreasing trunk taper, causing trunk cracks and decay, and transferring weight to the top.

Written specification for raising should include the following:

- Clarify the clearance required. For example, “The tree’s crown will be raised to seven feet.”
- Clarify what branch(s) will be pruned and the type of pruning cuts (removal or reduction cut) to be used. For example, “The lowest branch on the south side shall be removed back to the trunk with a removal cut. The lowest branch on the north side will be reduced with a reduction cut at the branch five feet out from the trunk and removal cut to the lowest side-branch.”
- Clarify what size of branches will be pruned. For examples, “All cuts shall be two inches in diameter and smaller.”

Pruning to reduce

Reducing is the selective removal of branches to decrease the height and/or spread of a tree. It requires the use of *reduction cuts* which removes larger branches back to smaller side branches. [Figure 9]

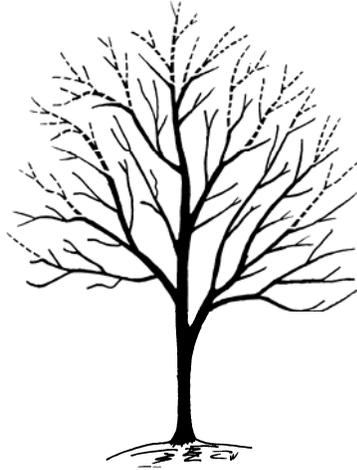


Figure 9. Reducing is the selective removal of branches to decrease a tree's height and/or spread. Just being tall does not indicate that a tree is structurally weak and prone to storm damage.

Reducing is the most effective method to reduce potential wind damage on large trees with structural problems. Reducing and thinning both decrease potential failure from snow loading; however, the removal cut used in thinning may better address issues without predisposing the tree to internal decay.

Not all trees can be reduced without predisposing the tree to decline and death. Crown reducing requires the extensive use of *reduction cuts* which can predispose the branch/trunk to internal decay. On older trees showing stress or decline, reduction cuts can accelerate decline and death.

[Figure 10]



Figure 10. Not every tree should be reduced. Notice the dieback associated with the previous reduction on this old cottonwood. On old trees and trees showing stress or decline, reduction cuts and heading cuts may accelerate the decline cycle.

In a proper *reduction cut*, the side branch pruned back to will be at least 1/3 the diameter of the trunk/parent branch removed. Under ANZI pruning standards, if the side branch is less than 1/3, it is considered a *heading cut*, which is generally unacceptable in pruning standards. For additional details on proper reduction cuts, refer to CMG GardenNotes #613, *Pruning Cuts*.

It is very difficult to use crown reducing to permanently maintain a tree at a small size without causing tree decline. Ideally, trees were selected with adequate space for their mature size. Where size control is necessary, it is best to begin reduction pruning as the tree reaches acceptable size, rather than when the tree becomes overgrown.

In crown reducing, first visualize the new outer edge of the smaller canopy. Then prune the tree back to appropriate branch unions for a proper reduction cut or removal cut. Some branches will be left taller than the visualized outer edge while others will be cut back below the visualized canopy edge. Don't make heading cuts and avoid rounding off the tree canopy.

[Figure 11]

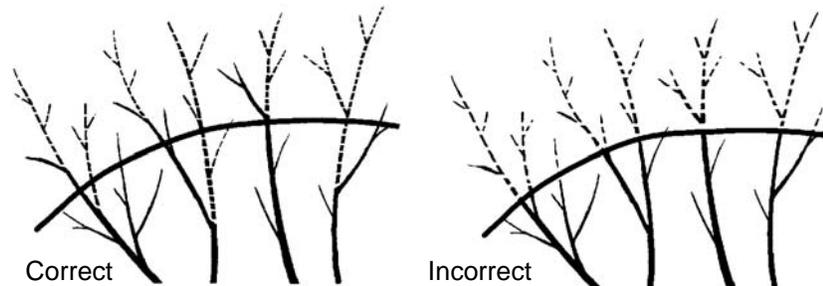


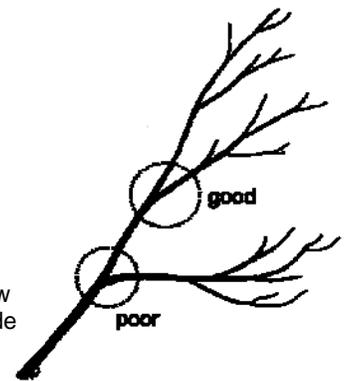
Figure 11.

Left – In reduction, visualize the new outer edge of the smaller canopy. Prune back to branch unions that make proper reduction and thinning cuts. Some branches will be taller than the new outer edge, some shorter.

Right – This tree is incorrectly rounded off with heading cuts.

In shortening primary upward growing trunks/primary branches to a lateral branch, a side branch that is somewhat upward growing with a narrow branch union angle may be stronger than a branch union with a wide angle. [Figure 12]

Figure 12. In shortening a main upward growing branch, pruning back to a narrow branch union may be stronger than a wide branch union.



Just because a tree is tall does not indicate that it is structurally unsound. Potential risk of failure should be evaluated by an experienced arborist based on branching structure, branch union integrity, signs of internal decay, and previous damage.

Written specification for reduction pruning should include the following:

- Clarify what is the desired reduction in height/spread.
- Specify criteria for reduction cuts. For example, “All cuts should be made on branches less than two inches in diameter. Diameter of the side branches pruned back to shall be at least 1/3 the diameter of the branch removed.”
- Percentage of foliage to be removed. For example, “Pruning shall not exceed 10% of the total foliage”.

Pruning to restore

Restoration is the selective removal of branches, sprouts, and stubs from trees that have been damaged by improper pruning, vandalism, and storms. The objective is to restore the trees structure, form and appearance to the extent possible. Restoration generally requires annual pruning over a period of years.

Actual pruning procedures vary with the situation. When dealing with situations of excessive watersprouts, a rule to thumb is to remove one-third and reduce one-third with each annual pruning. Removing all of the watersprouts at one time often stimulates the growth of more watersprouts.

Pollarding

Pollarding is a training system that involves heading the first year followed by annual spout removal to maintain the tree at a predetermined size or shape. Pollarding started as a method to produce shoots for fuel, shelter and produced made from the young shoots. Today, it is used as an art form. Pollarding is not topping and should not be considered a routine method to keep large trees small. Due to annual labor involved, it is uncommon in the United States.

Frequently asked questions about pruning mature shade trees

What about topping a tree?

Shade trees should **never** be topped. The regrowth of a topped tree is structurally unsound. Topping required by utility right-of-way pruning is starkly obvious and sets an unfortunate community standard followed by others. Instead of topping, use *cleaning*, *thinning*, and/or proper *crown reduction cuts*. [Figure 13]

Figure 13. Never top a tree, the regrowth is structurally unsound, making it very prone to wind and storm damage.



What about utility right-of-way pruning?

Pruning for utility line clearance does not always follow desirable pruning techniques in regards to appearance and health of the tree. In this situation, the needs of the utility right-of-way take priority over the tree.

When a tree under a power line requires frequent crown reduction, consider having the tree removed. Utility companies are generally eager to accommodate. In planting trees, selection criteria (i.e., size and placement) should be followed so that a tree's health and appearance will never be compromised by the need for utility pruning.

I'm concerned about my tree breaking in storms, but I really don't want to lose the shade. Do I really need to have the tree pruned or removed?

This is a two-part question. First, does the tree show signs of being highly susceptible to storm damage, i.e., previous storm damage, dieback or dead branches, structural problems such as co-dominant trunks, weak branch unions or internal decay? This should be evaluated by an experienced ISA Certified Arborist.

Second, if yes, what would the tree or branch hit should it fail? If it would cause significant property damage or threaten life, the tree should be pruned or removed as a preventive measure.

Cleaning and *thinning* may reduce the potential storm hazard without compromising the shade. In some situations the risk of failure cannot be reduced without removal. Remember that healthy structurally sound trees are generally windfast even when mature.

Storm damage is usually, but not always, related to structural problems that could have been addressed with proper structural training when the tree was young. Co-dominant trunks account for the majority of tree failures in Colorado. The hazard of wind damage is higher on the regrowth of trees that have been "topped". Consult an ISA Certified Arborist for additional details.

How should storm-damaged trees be pruned?

First, focus on *cleaning* (removing broken and damaged limbs) keeping in mind the structural integrity of the tree. Realize that you may have to accept less than ideal pruning techniques by "Mother Nature".

Second, focus on *thinning* and/or *reducing* to restore the tree's structural integrity and shape to the extent possible. This may take place over a period of years.

The maximum amount of tree canopy that can be removed without putting the tree and its root system under stress includes the live wood/foilage removed by the storm. When Mother Nature removes too much live wood/foilage, limit pruning to cleaning.

On storm damaged trees where excessive live wood and foliage was removed by storm damage, wait until the roots and crown stabilize (as measured in canopy growth) before doing thinning, reducing, or other structural pruning. This may be a multi-year period.

Keep the tree if it can be pruned back to structurally sound wood and will be esthetically pleasing. Often when one side of the tree is gone, the best option is to remove the entire tree.

How should trees with root damage be pruned?

Focus on *cleaning*. Avoid removing live wood and foliage as this could speed the decline. Removing live wood lowers the *auxin* content which is the hormone that promotes root growth. Removing foliage reduces photosynthesis and levels of stored carbohydrates that the tree is living on during the recovery period. Trees in a construction site with damaged roots may require cleaning every 3-12 months for five plus years.

How should declining trees be pruned?

Focus on *cleaning*. Avoid removing live wood and foliage as this could speed the decline. Removing live wood lowers the *auxin* content which is the hormone that promotes root growth. Removing foliage reduces photosynthesis and levels of stored carbohydrates that the tree is living on. Old declining cottonwoods and poplars may warrant cleaning every 1-5 years.

Additional Information

CMG GardenNotes on pruning

- #611 Tree Growth and Decay
- #612 Developing Strong Branch Unions
- #613 Pruning Cuts
- #614 Structural Training of Young Shade Trees
- #615 Structural Training of Young Shade Trees—Pruning Flow Chart
- #616 Pruning Mature Shade Trees
- #617 Dealing with Structural Issues on Shade Trees
- #618 Pruning Evergreens
- #619 Pruning Flowering Shrubs
- #620 Structural Pruning Summary – 2 pages

Books – Edward F Gilman. *An Illustrated Guide to Pruning, Second Edition*. Delmar. 2002

Web – <http://hort.ifas.ufl.edu/woody/pruning/>

Authors: David Whiting, Robert Cox, and Carol O'Meara; Colorado State University Extension.

- o Colorado Master Gardener *GardenNotes* are available on-line at www.cmg.colostate.edu.
- o Colorado Master Gardener training is made possible, in part, by a grant from the **Colorado Garden Show, Inc.**
- o Colorado State University, U.S. Department of Agriculture and Colorado counties cooperating.
- o Extension programs are available to all without discrimination.
- o No endorsement of products mentioned is intended nor is criticism implied of products not mentioned.
- o Copyright 2006. Colorado State University Extension. All Rights Reserved. This fact sheet may be reproduced, without change or additions, for non-profit educational use.

Revised September 2008

