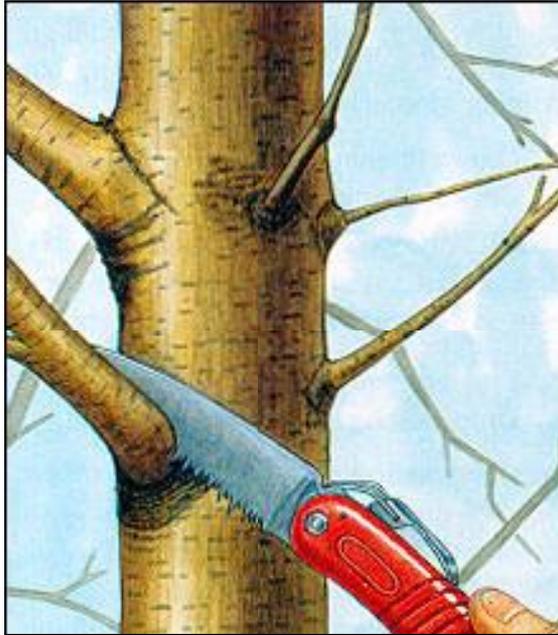


# Structural Pruning of Young Trees



Jacob McCarthy

Wyoming State Forestry Division

in conjunction with

Lake Desmet Conservation District



# Introduction

The objective of pruning is to produce strong, healthy, attractive plants.



By understanding how, when and why to prune, and by following a few simple principles; this objective can be achieved.

# Why Prune

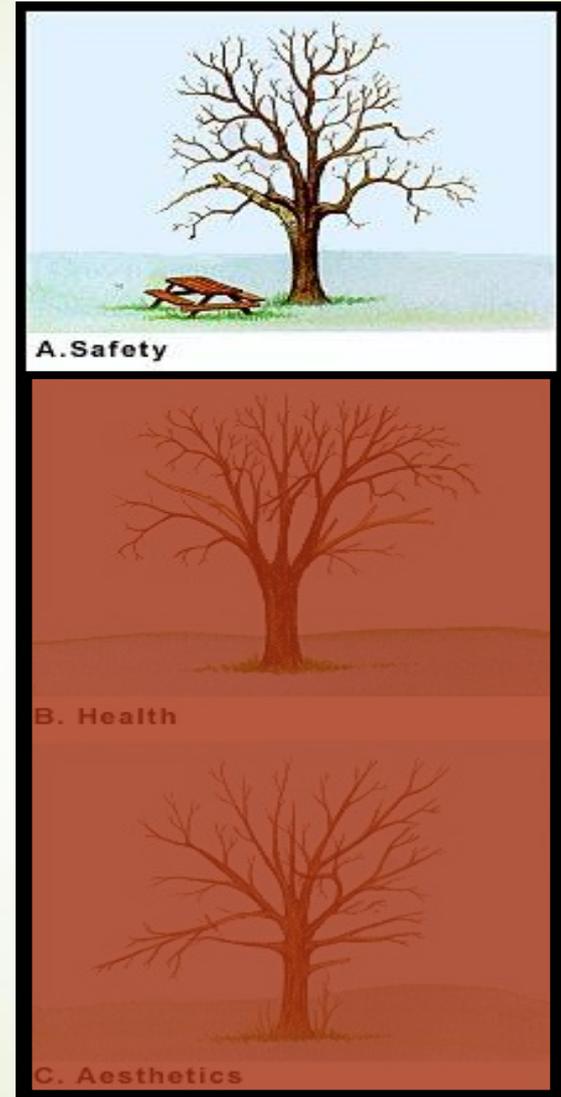
- The main reasons for pruning ornamental and shade trees include safety, tree health, and aesthetics.
- In addition, pruning can be used to stimulate fruit production and increase the value of timber.



*Image source: <http://hort.ifas.ufl.edu/woody/pruning/>*

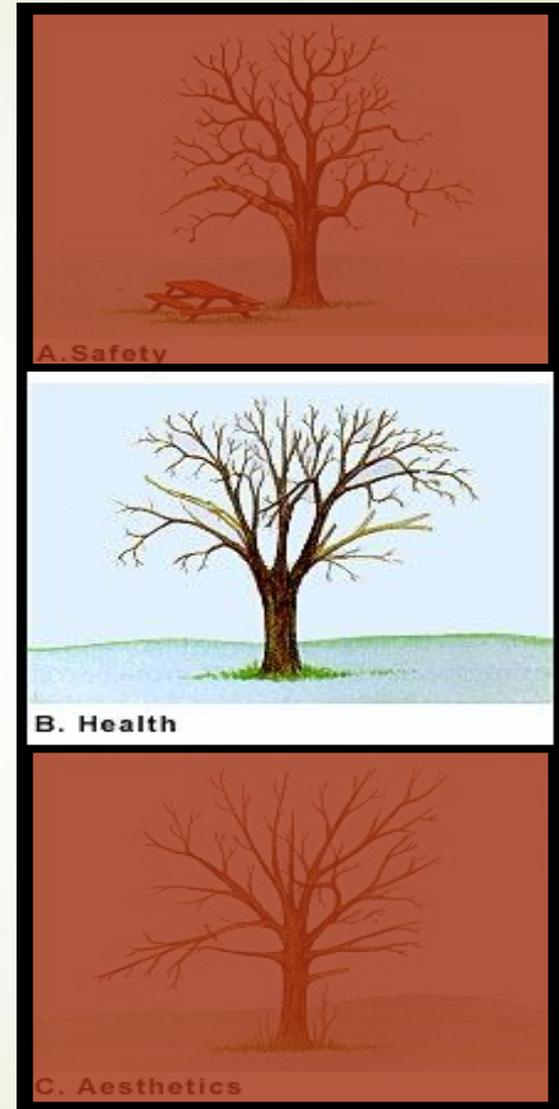
# Pruning for Safety

- Remove branches that could fall and cause injury or property damage to a “target”
- Trim branches that interfere with lines of sight on streets or driveways
- Remove branches that grow into utility lines
- **You can avoid most safety pruning practices by choosing species that will not grow beyond the space available to them, and have strength and form characteristics that are suited to the site.**



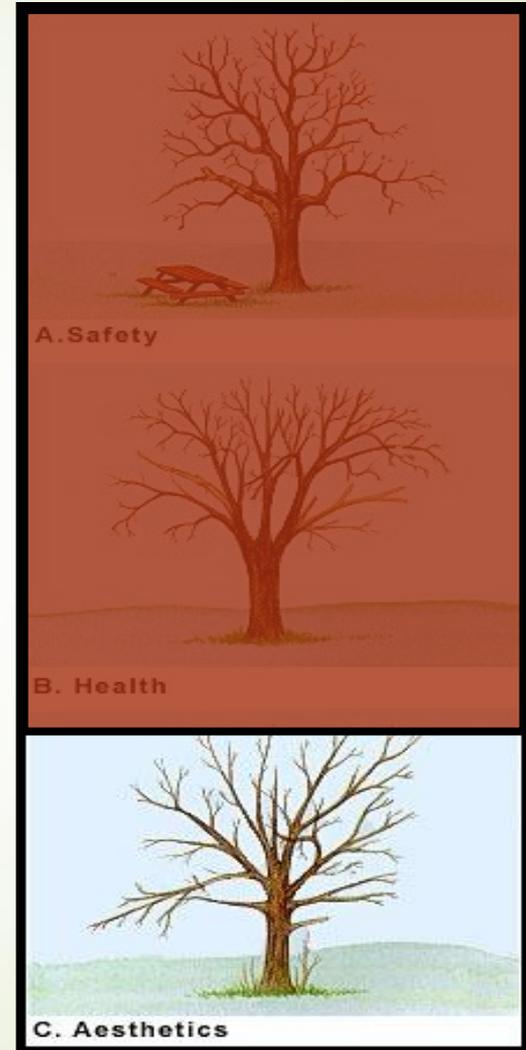
# Pruning for Health

- Remove diseased or insect-infested wood
- Thin the crown to increase airflow and reduce some pest problems
- Remove crossing and rubbing branches
- Pruning can best be used to encourage trees to develop a strong structure and reduce the likelihood of damage during severe weather.
- Remove broken or damaged limbs to encourage wound closure.



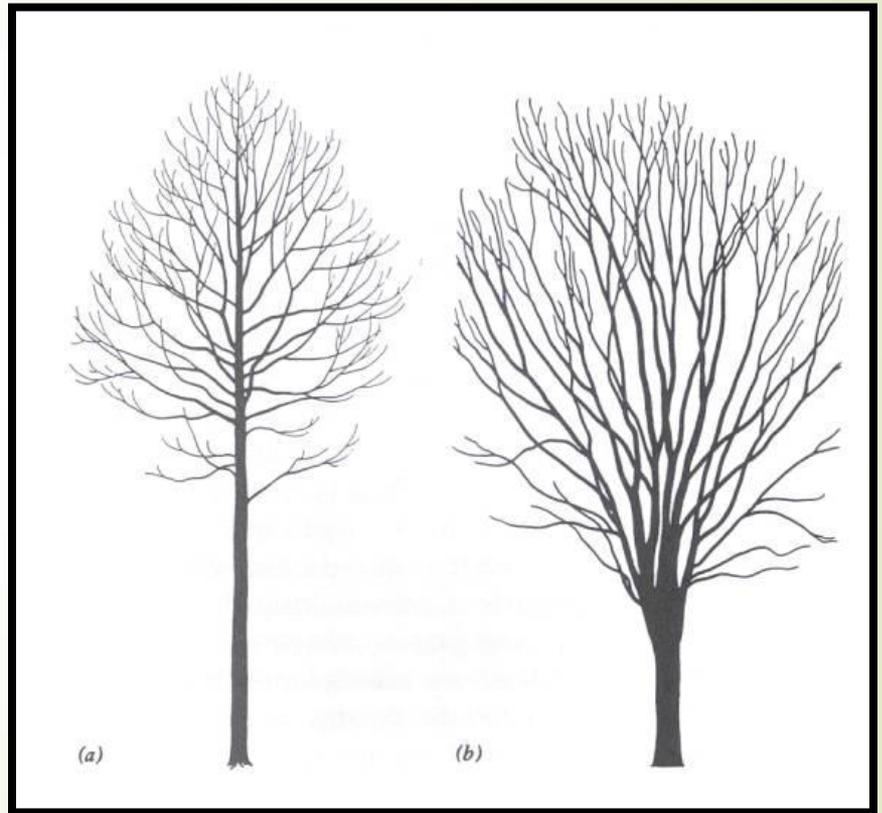
# Pruning for Aesthetics

- Remove branches to enhance the natural form and character of trees or stimulate flower or fruit production.



# Tree Forms

- Most common tree forms are pyramidal (excurrent) or spherical (decurent). Reduce the need for pruning by considering the trees natural form.



Excurrent

Decurrent

*Image Source:*

<http://courses.nres.uiuc.edu/nres230/Lecture%206.htm>

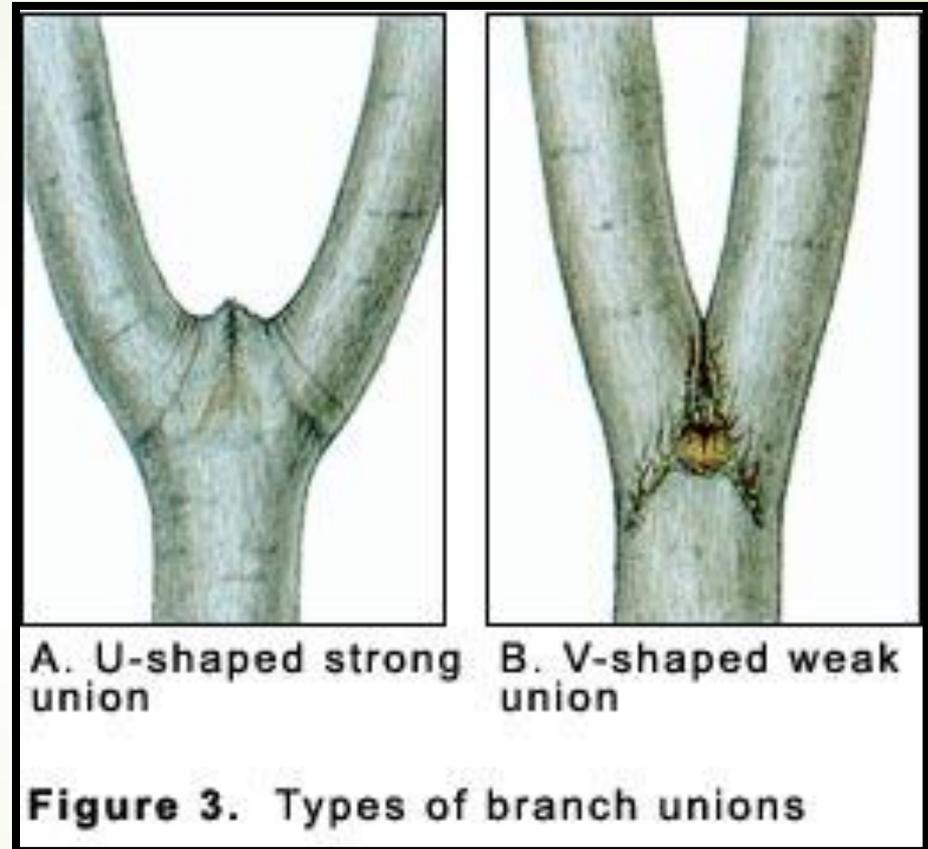
# Conifers

- Conifers rarely need crown thinning. Occasionally, the leader of a tree may be damaged and multiple branches may become co-dominant.
- Select the strongest leader and remove competing branches to prevent the development of co-dominant stems.



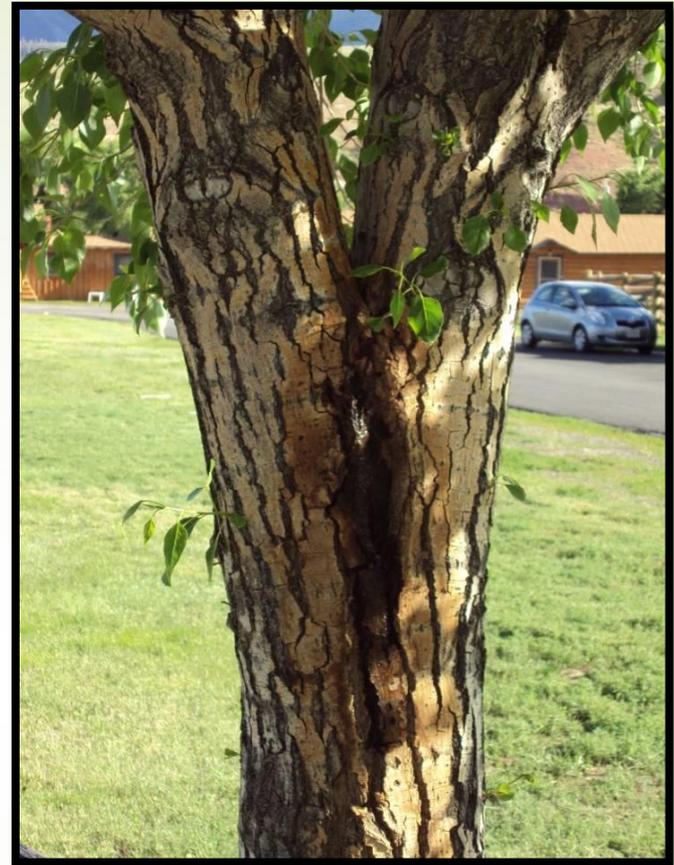
# Branch Unions

- Branches with U-shaped angles of attachment are strong and should be retained. Those with V-shaped angles of attachment often form included bark and should be removed. (See Figure 3.)
- Co-dominant stems that are approximately the same size and arise from the same position often form included bark.
- Removing some of the lateral branches from a co-dominant stem can reduce its growth enough to allow the other stem to become dominant.



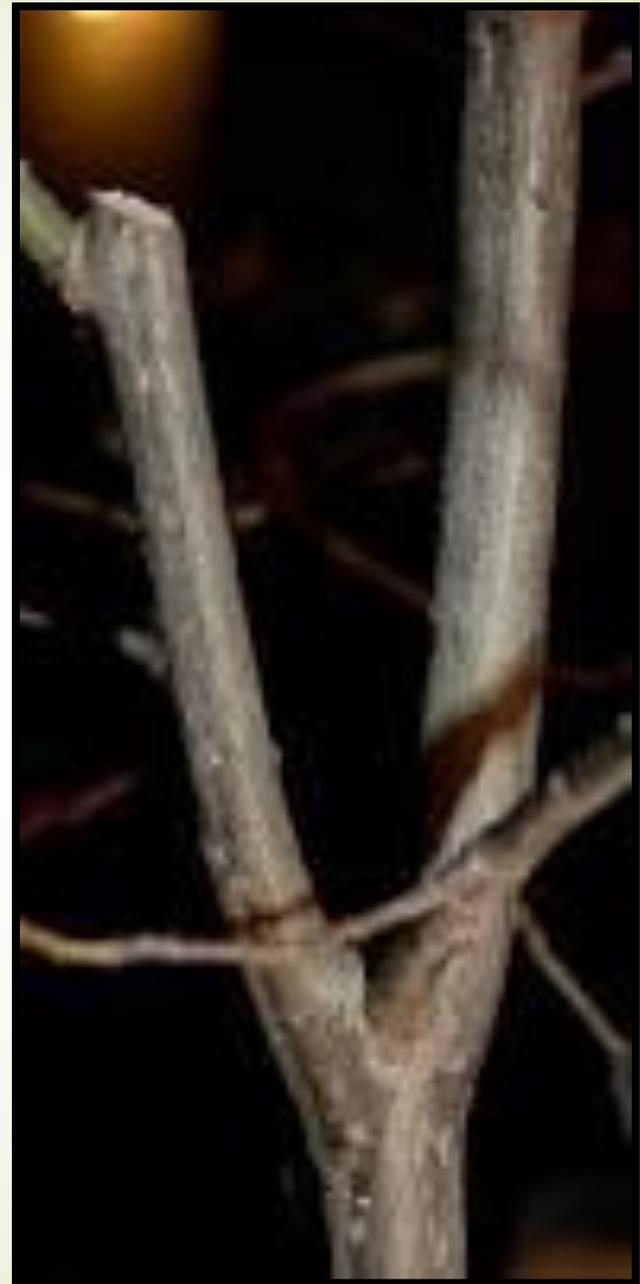
# Branch Unions

- Included Bark – Bark that becomes embedded in a crotch/union between branch and trunk or between co-dominant stems, causing weak structure.



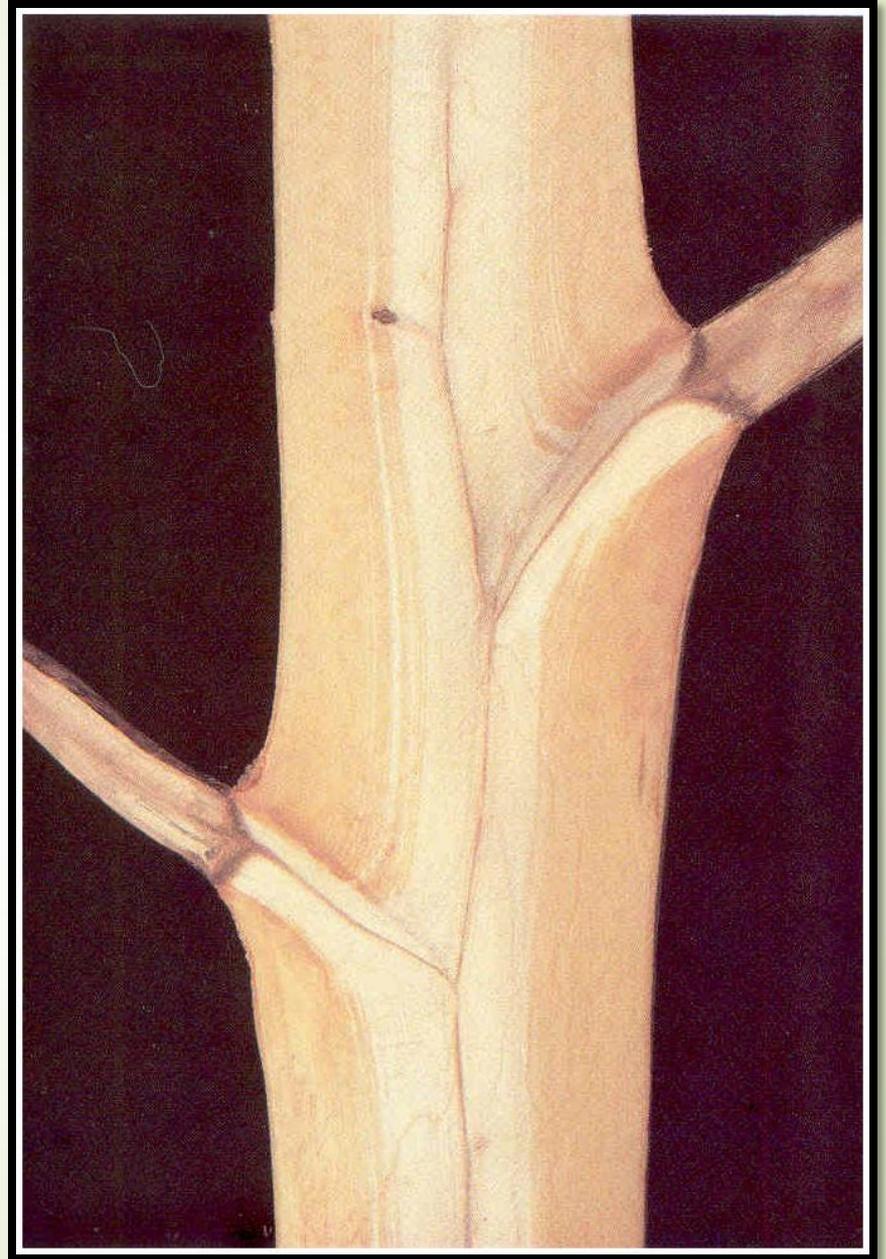
# Branch Unions

- Branch unions' strength is also a factor of aspect ratio.
- Unions with smaller aspect ratio (size of branch in relation to size of main trunk or parent branch) are stronger.
- Look for ratios of approximately 1:2.
- Allows for overlapping of trunk and branch wood (Branch Protection Zone).



# Branch Unions

- Branch Protection Zone – Chemically and physically modified tissue within the trunk or the parent branch at the base of a smaller, subordinate branch that retards the spread of discoloration and decay from the subordinate stem into the trunk or parent branch.



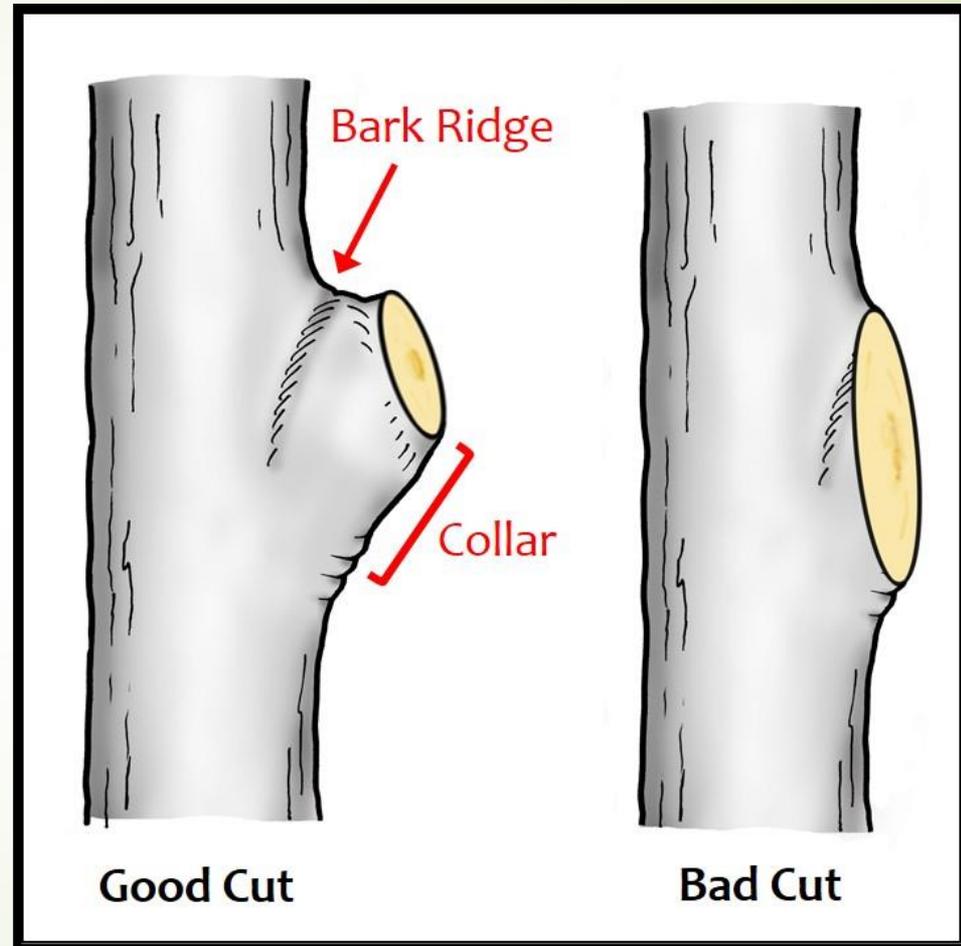
# Branch Unions

- Branch Collar – Area where a branch joins another branch or trunk that is created by the overlapping vascular tissues from both the branch and the trunk. Typically enlarged at the base of the branch.



# Branch Unions

- Branch Bark Ridge – Raised strip of bark at the top of a branch union, where the growth and expansion of the trunk or parent stem and adjoining branch push the bark into a ridge.



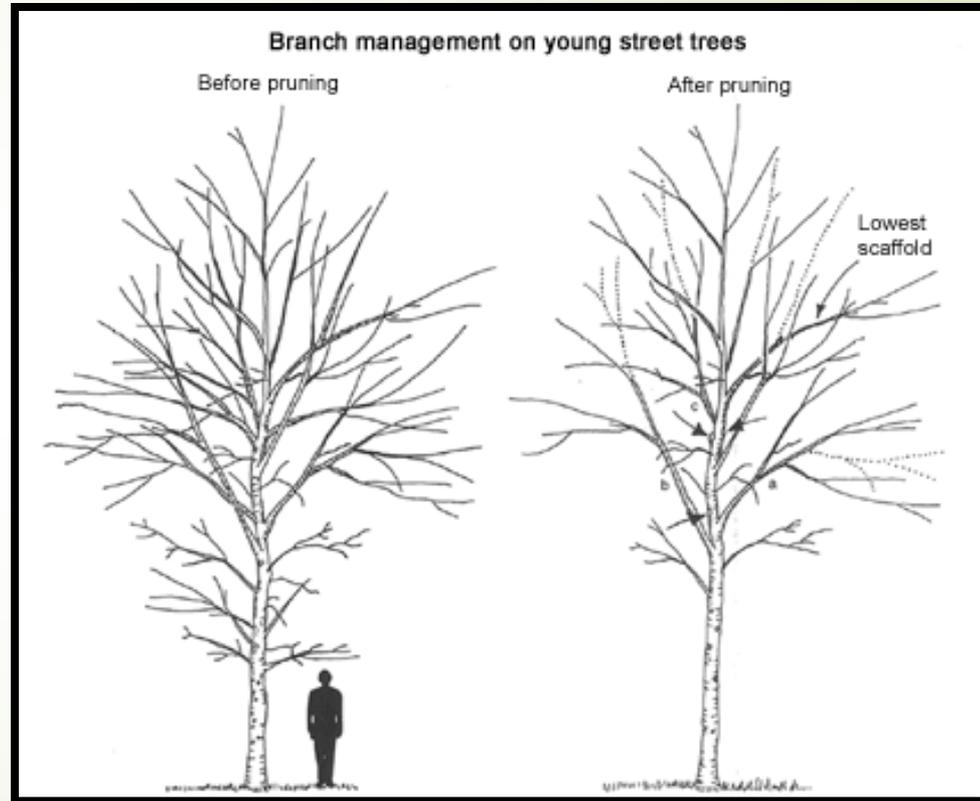
# Pruning Methods

- Five steps to structural pruning:
  - Remove broken, dead, dying, or damaged branches
  - Select and establish a desired structure, most often a dominant leader.
  - Select and establish lowest permanent branch
  - Select and establish scaffold branches
  - Select and subordinate temporary branches below lowest permanent branch and among scaffold branches.
- Remember this process may occur over many years. **NEVER PRUNE MORE THAN 25% OF THE CANOPY.**



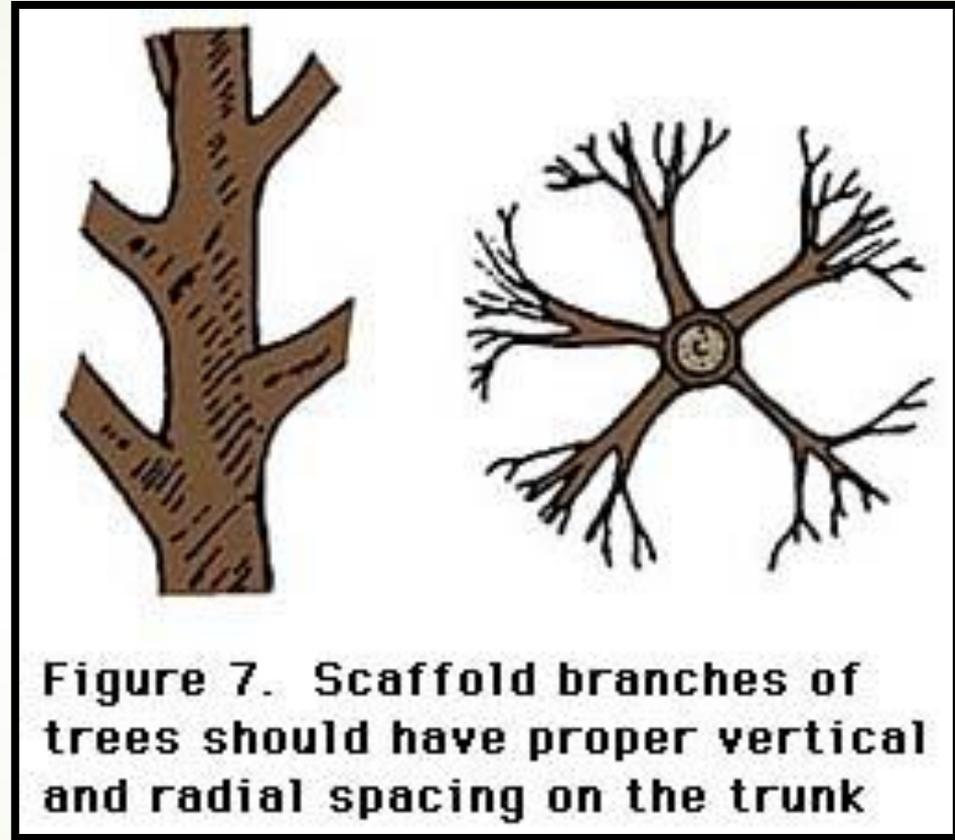
# Permanent Branches

- Trees location on the landscape and its purpose will determine the lowest permanent branch.
- Street trees will have a higher lowest permanent branch for clearance for pedestrian and street traffic.
- Trees used for screening will have lower permanent branches.



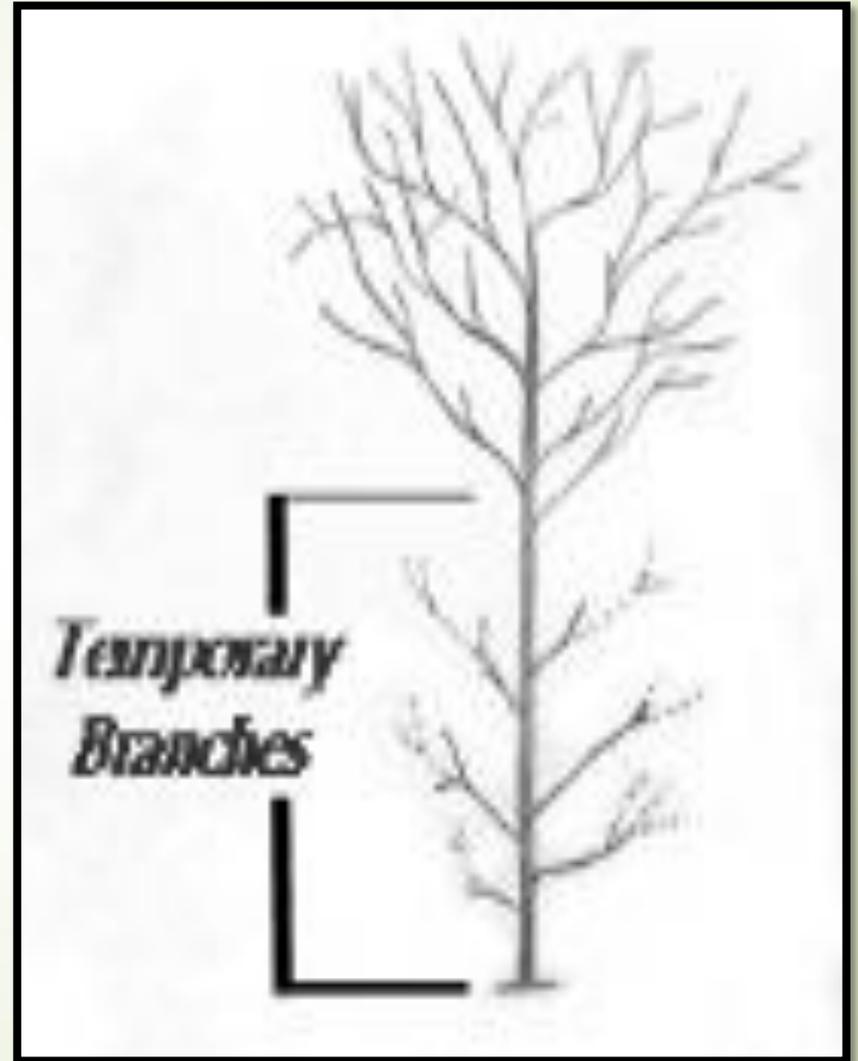
# Scaffold Branches

- Branches selected for good attachments, appropriate size, and desirable spacing.
- These branches shall be retained over the majority of the life of the tree
- Vertical spacing of at least 18 inches for large growing trees and 12 inches for medium and small sized mature trees.



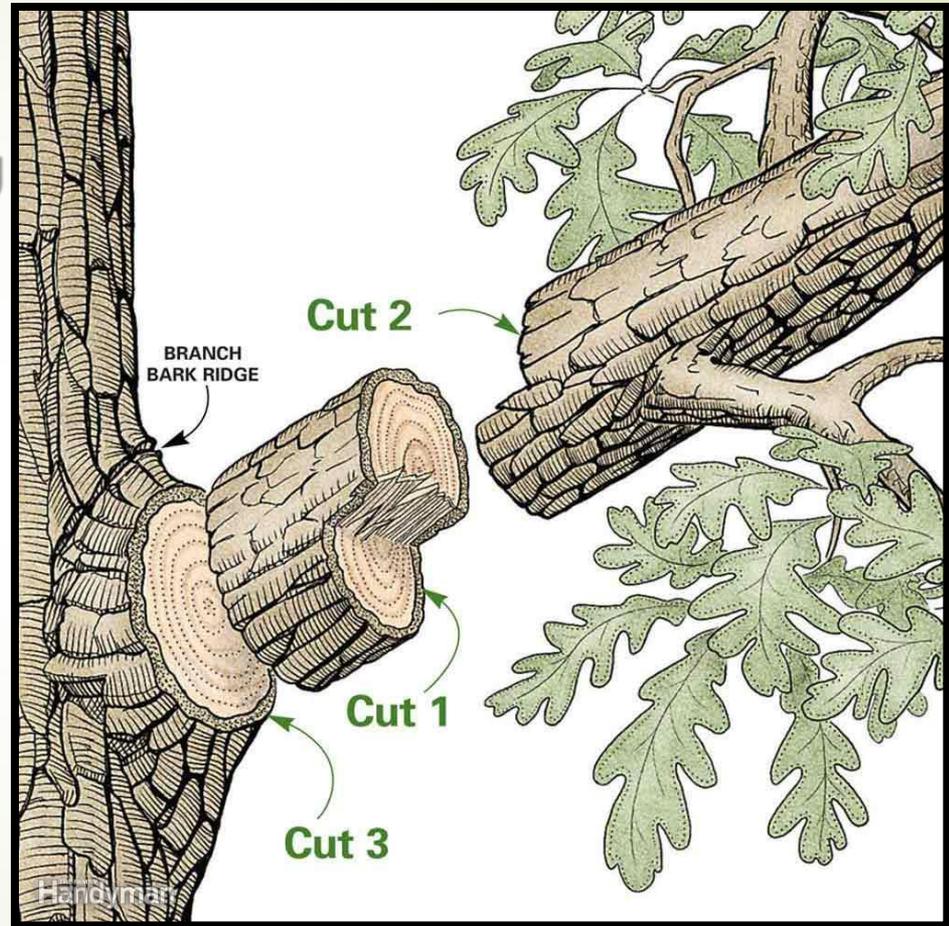
# Temporary Branches

- To encourage taper and protect young trees from vandalism and sun scald, “temporary” branches may be retained along the stem.
- Less vigorous shoots should be selected as temporary branches and be about 4 to 6 inches apart along the stem.
- “Temporary branches” should be pruned annually to slow their growth and eventually removed.



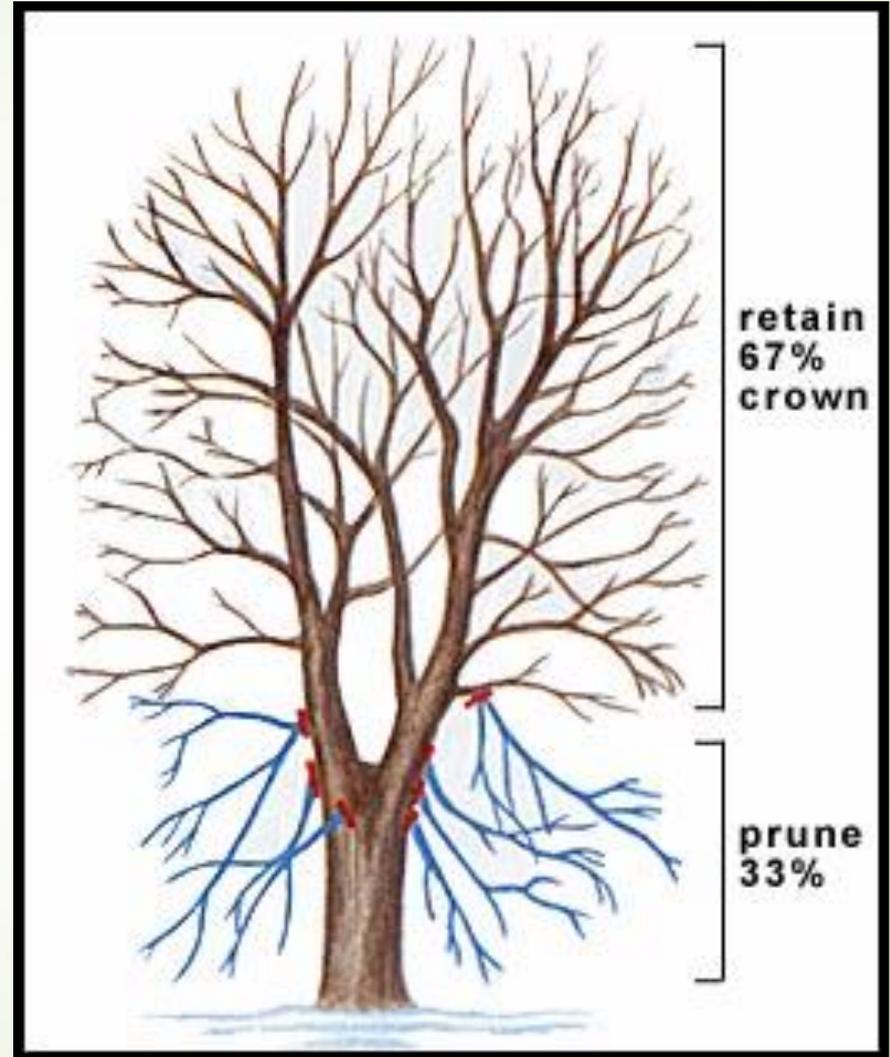
# Pruning Methods

- Depending on the objectives, the most common types of pruning include:
  - Crown Raising
  - Crown Thinning
  - Crown Reduction
  - Crown Cleaning
  - Crown Restoration



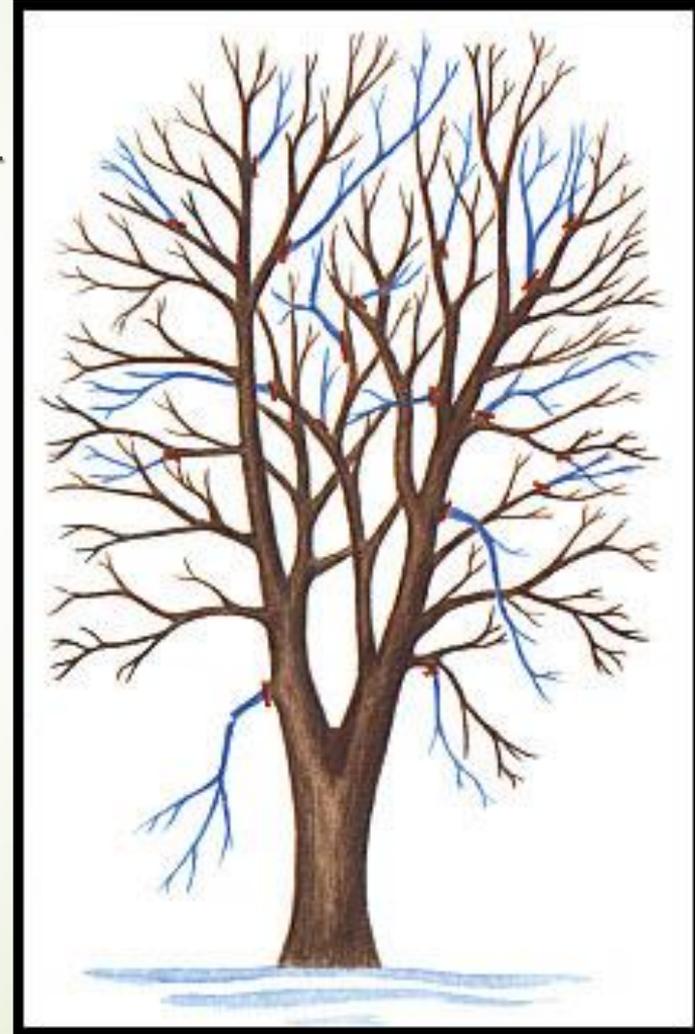
# Crown Raising

- Remove branches from the bottom of the crown of a tree to provide clearance for pedestrians, vehicles, building, lines of site, or to develop a clear stem for timber production.
- The ratio of the living crown to total tree height should be at least two-thirds (e.g., a 36 foot tree should have living branches on at least the upper 24 feet).
- Removing too many lower branches will hinder the development of a strong stem.



# Crown Thinning

- Selectively remove branches to increase light penetration and air movement throughout the crown.
- Branches that rub or cross another branch should be removed.
- To avoid unnecessary stress and prevent excessive production of epicormic sprouts, **no more than 1/4 of the living crown should be removed within a year.**



# Crown Thinning

- Assess how a tree will be pruned from the top down.
- Favor branches with strong, U-shaped angles of attachment. Remove branches with weak, V-shaped angles of attachment and/or included bark.
- Ideally, lateral (scaffold) branches should be evenly spaced on the main stem of young trees.



*Image source: <http://hort.ifas.ufl.edu/woody/pruning/>*

# Crown Thinning

- Make sure that lateral branches are no more than one-half to three-quarters of the diameter of the stem to discourage the development of co-dominant stems.
- Do not remove more than one-quarter of the living crown of a tree at one time. If it is necessary to remove more, do it over successive years.



*Image source: <http://hort.ifas.ufl.edu/woody/pruning/>*

# Crown Thinning

- Avoid producing “lion’s tails,” tufts of branches and foliage at the ends of branches, caused by removing all inner lateral branches and foliage.
- Lion’s tails can result in sun scalding, abundant epicormic sprouts, and weak branch structure and breakage.



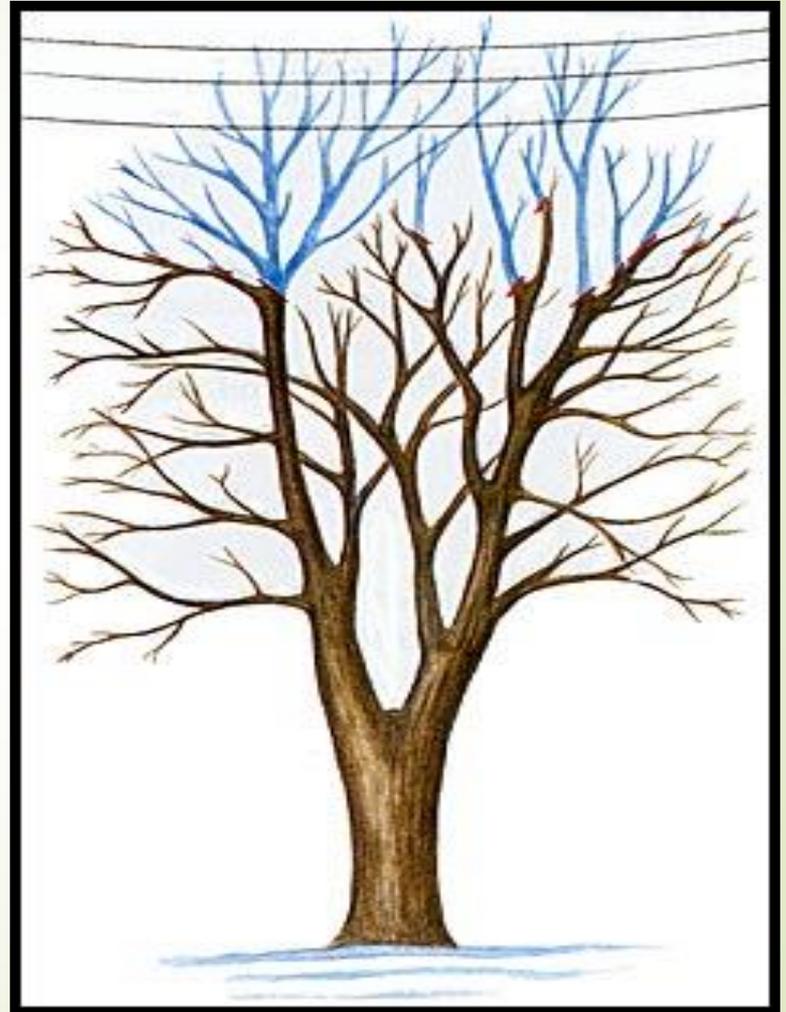
# Crown Thinning

- Classic “lion’s tail” pruning affect.
- Allows for no future reduction cuts.
- All the weight of the branch focused on the end.



# Crown Reduction

- Crown reduction pruning is most often used when a tree has grown too large for its permitted space.
- Sometimes referred to as drop crotch pruning.
- Preferred method to topping because it results in a more natural appearance, increases the time before pruning is needed again, and minimizes stress.



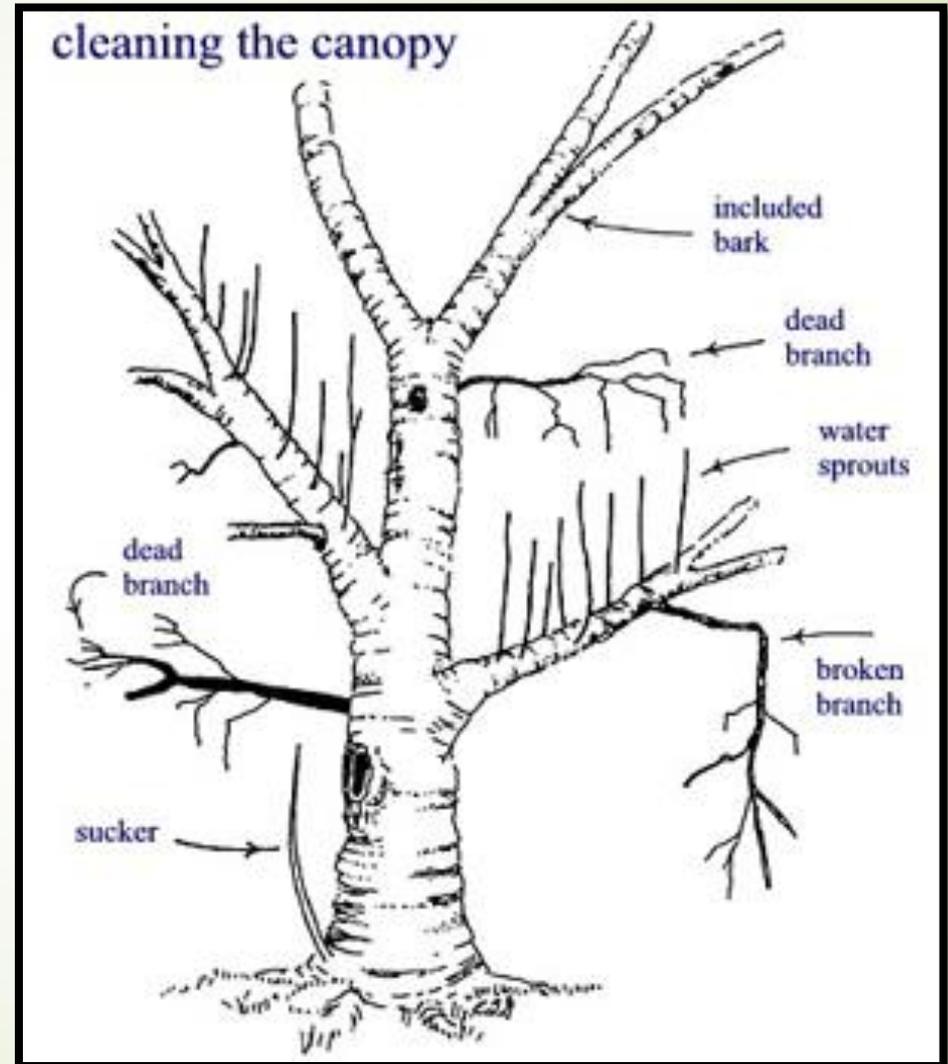
# Crown Reduction

- Use crown reduction pruning only when absolutely necessary. Make the pruning cut at a lateral branch that is at least one-third the diameter of the stem to be removed.
- If it is necessary to remove more than half of the foliage from a branch, remove the entire branch.



# Crown Cleaning

- Crown cleaning is the selective removal of dead, diseased, broken, or weakly attached branches.
- This is the most common type of pruning technique for landscape trees.



# Crown Restoration

- Crown restoration is the selective removal of some watersprouts, stubs, and dead branches to improve a tree's structure and form.
- Usually occurs on trees that have been previously topped and has sprouted vigorously or has sustained storm damage.
- Restoration requires several prunings over a number of years.

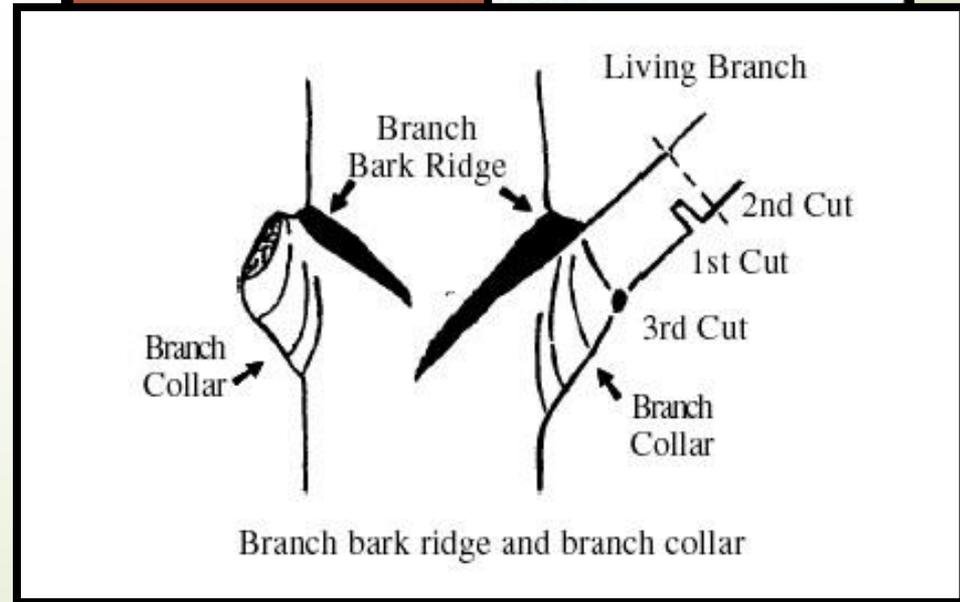
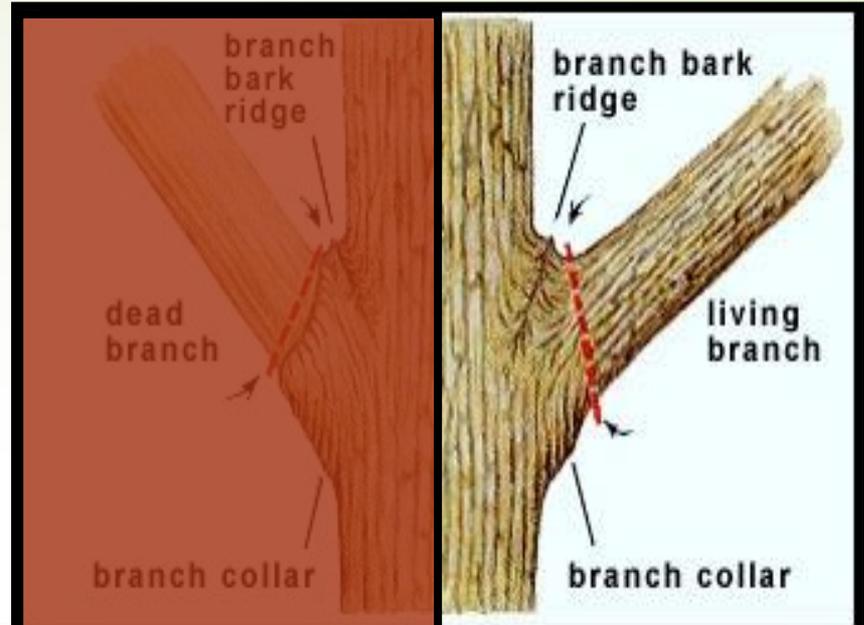


# Pruning Cuts



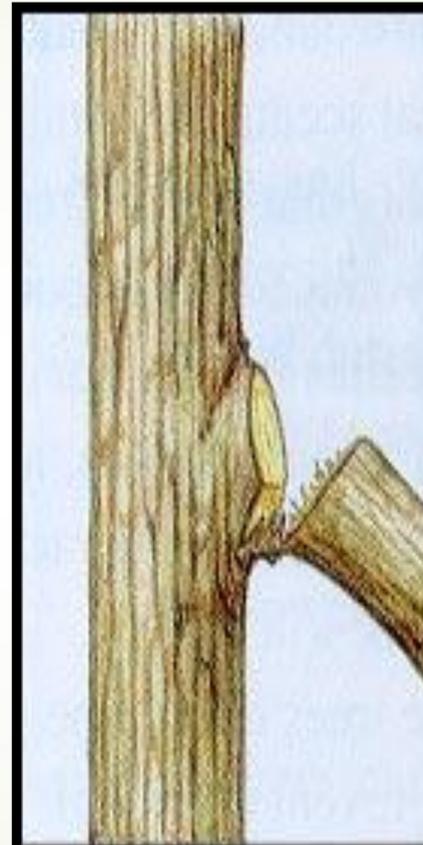
# Pruning Live Branches

- A proper cut begins just outside the branch bark ridge and angles down away from the stem of the tree, avoiding injury to the branch collar.
- Make the cut as close as possible to the stem in the branch axil, but outside the branch bark ridge, so that stem tissue is not injured and the wound can seal in the shortest time possible.

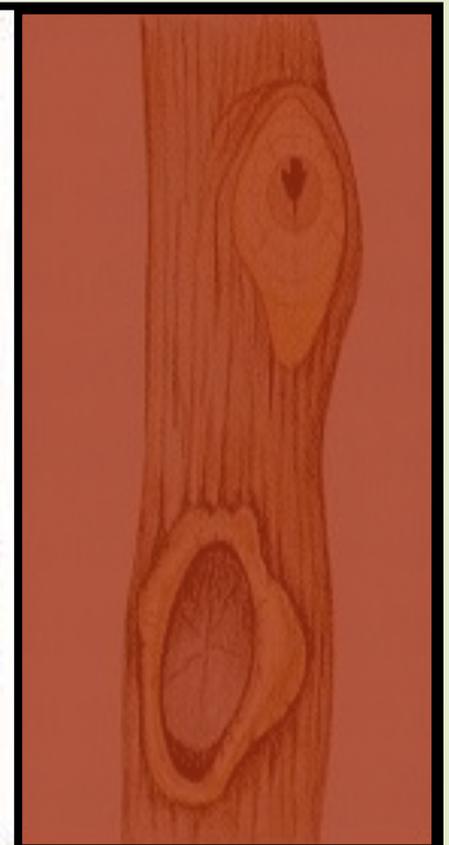


# Bark Ripping

- The quality of cuts can be evaluated by examining pruning wounds after one growing season.
- Improper pruning cuts cause unnecessary injury, bark ripping, and wounds that will not compartmentalize.



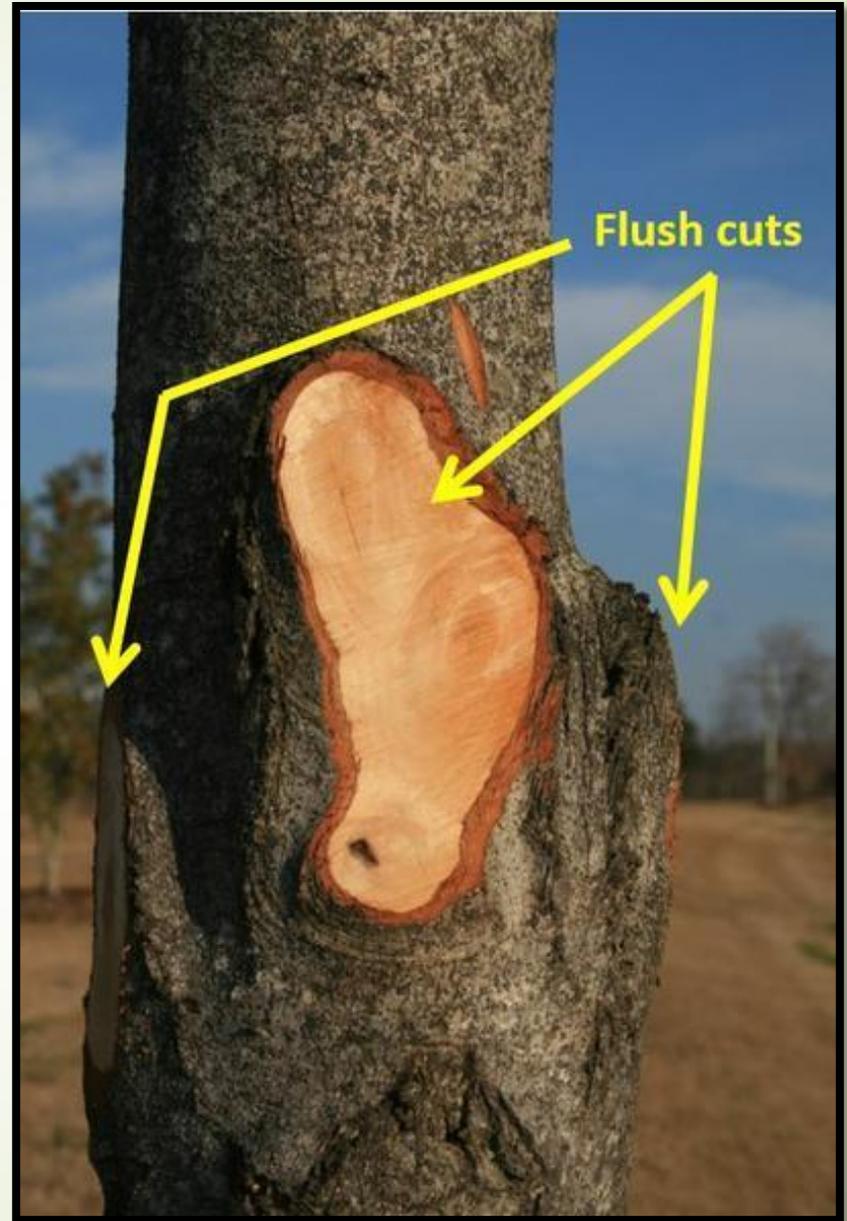
C. Bark ripping



D. Flush cutting

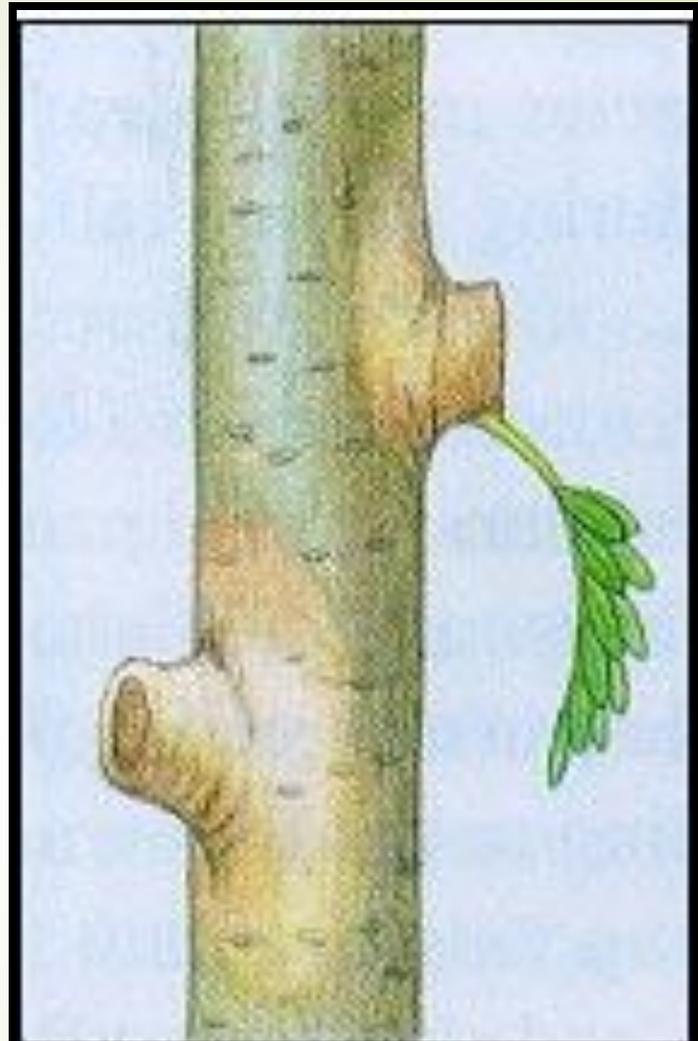
# Flush Cuts

- A concentric ring of wound-wood will form from proper pruning cuts.
- Flush cuts made inside the branch bark ridge or branch collar, result in pronounced development of wound-wood on the sides of the pruning wounds with very little wound-wood forming on the top or bottom.
- This can result in decay's ability to establish inside the tree.
- Caused by the branch protection zone being compromised.



# Stub Cutting

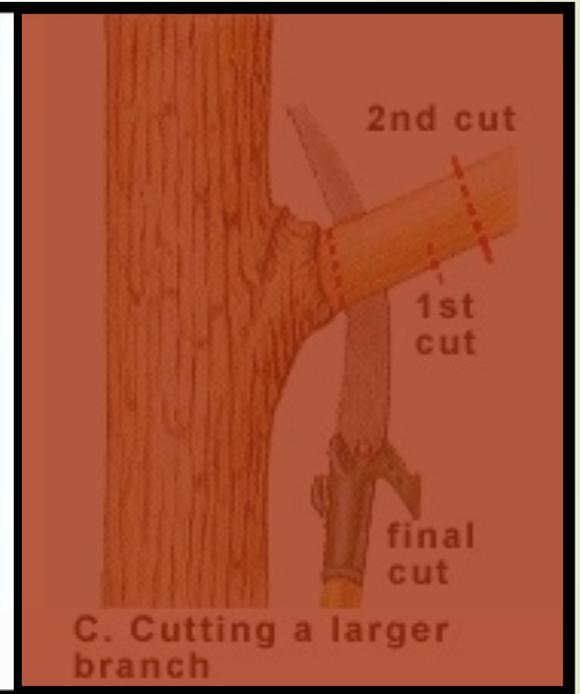
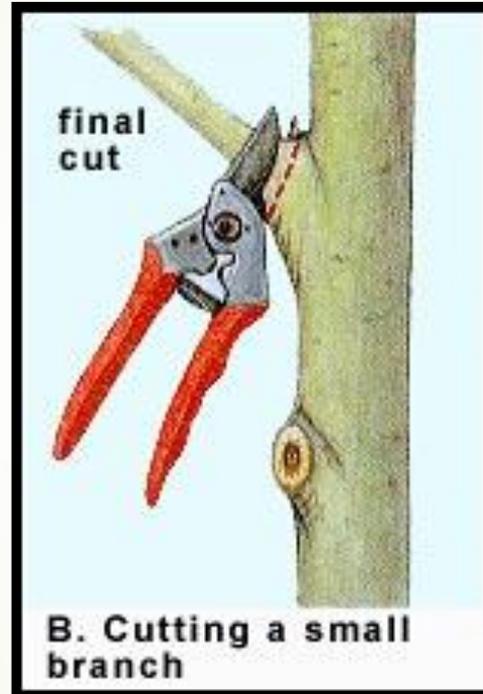
- Stub cuts result in the death of the remaining branch and wound-wood forms around the base from the stem tissue.
- Stub cuts delay wound closure and can provide entry to canker fungi that kill the cambium, delaying or preventing wound-wood formation.



**E. Stub cutting**

# Pruning

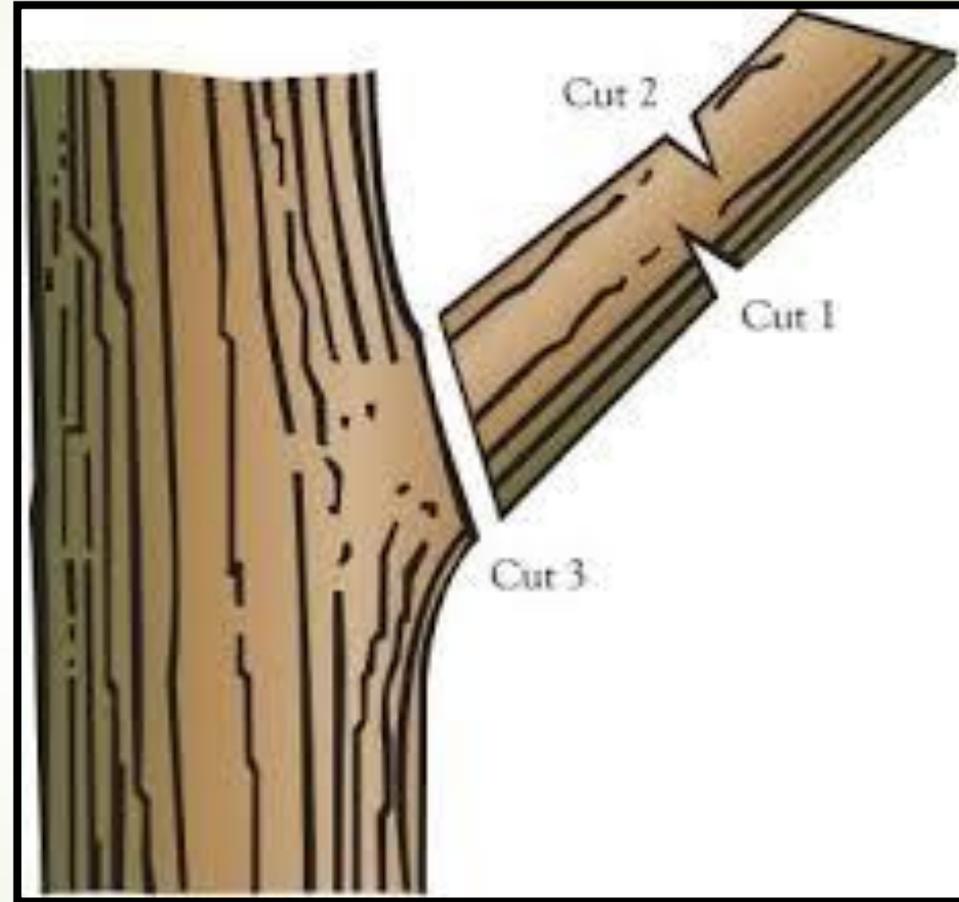
- When pruning small branches with hand pruners, make sure the tools are sharp enough to cut the branches cleanly without tearing.
- Use hand pruners with a by-pass blade v. an anvil blade on live branches!!



# Pruning

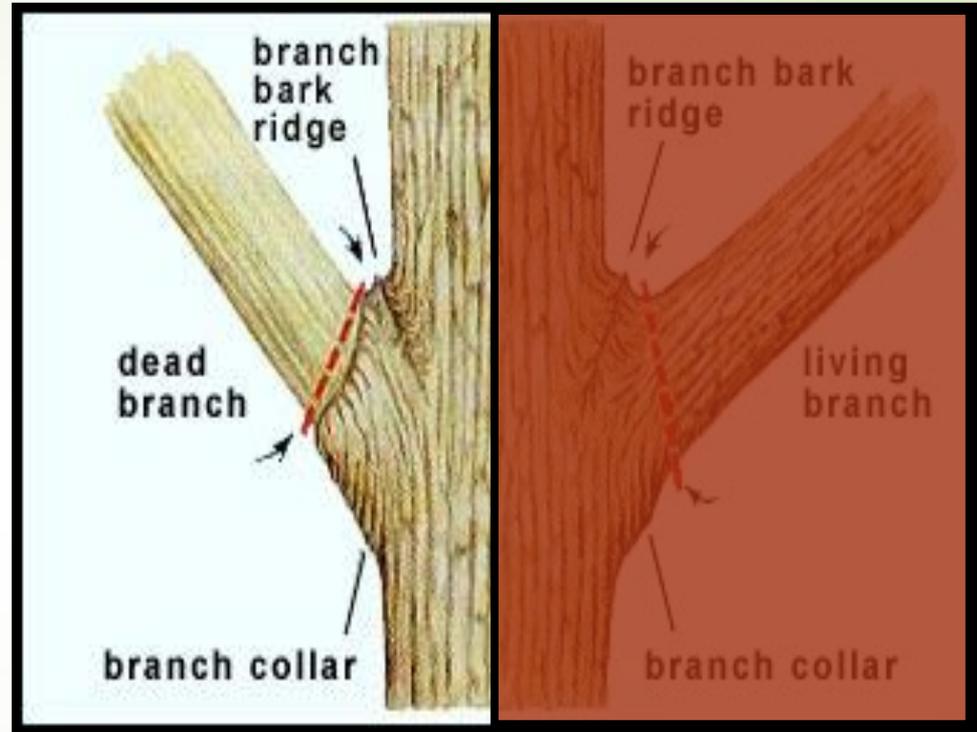
Branches that are too large to support should be cut in a three-step process to prevent bark ripping.

1. The first cut is a shallow notch made on the underside of the branch, outside the branch collar. This cut will prevent a falling branch from tearing the stem tissue as it pulls away from the tree.
2. The second cut should be outside the first cut, all the way through the branch, leaving a short stub.
3. The stub is then cut just outside the branch bark ridge/branch collar, completing the operation.



# Pruning Dead Branches

- Prune dead branches in much the same way as live branches.
- Make the pruning cut just outside of the ring of wound-wood tissue that has formed, being careful not to cause unnecessary injury.



**Figure 6A.** Targeting the cut

# Drop Crotch Cuts

- Usually the stem being removed is too large to be supported with one hand so the three step method should be used.

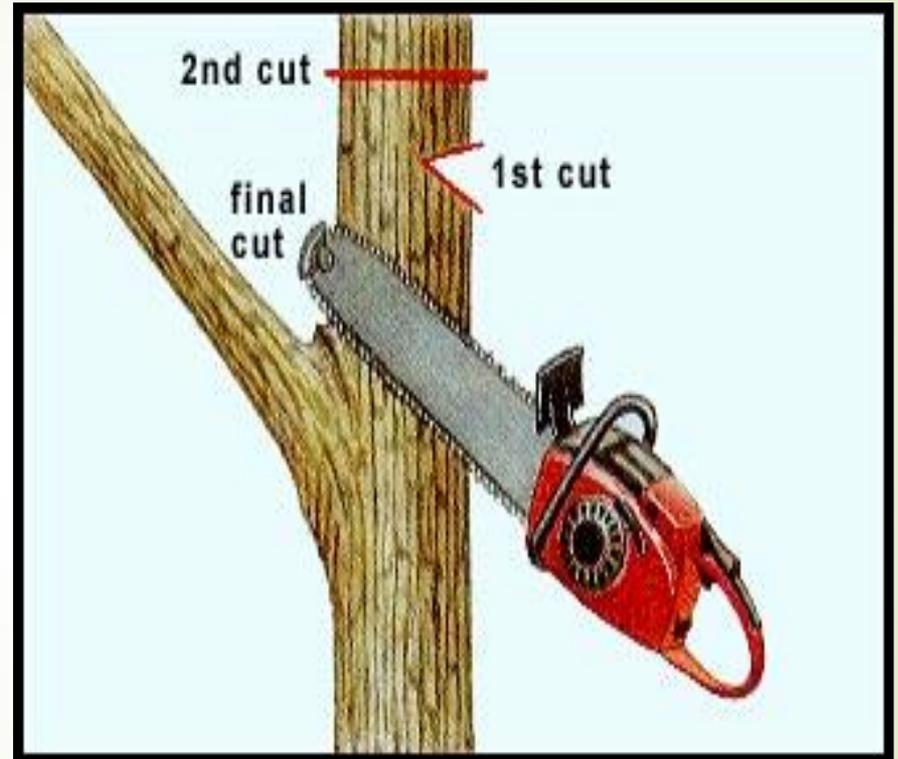
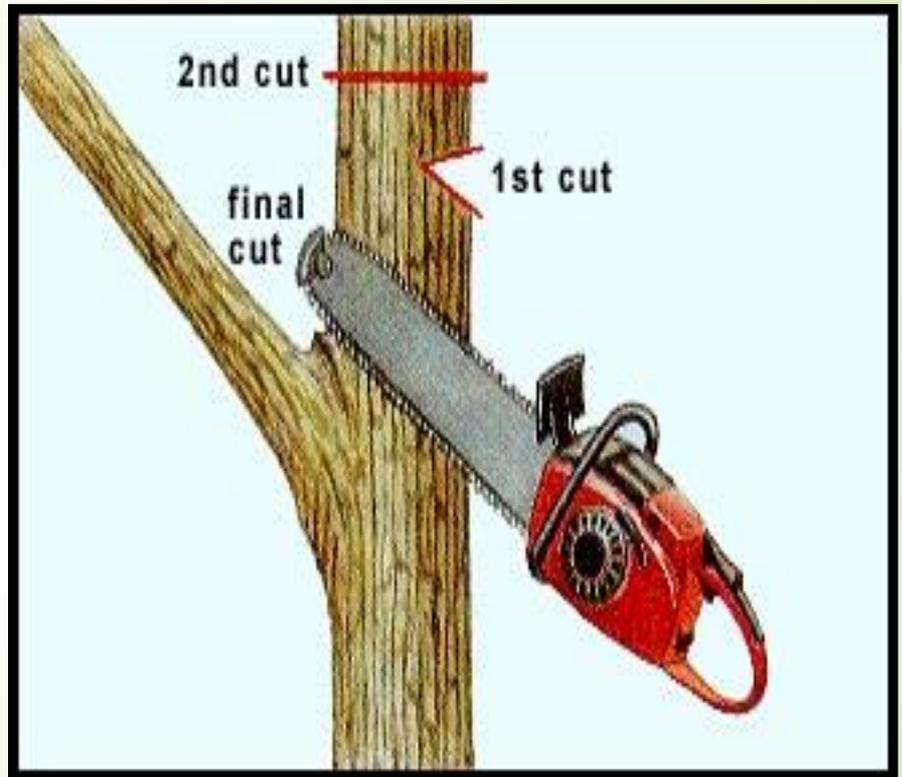


Figure 6. Pruning cuts -- crown reduction

# Three Step Pruning Process

1. Make a notch on the side of the stem away from the branch to be retained, well above the branch crotch.
2. Begin the second cut inside the branch crotch, staying well above the branch bark ridge, and cut through the stem above the notch.
3. Cut the remaining stub just inside the branch bark ridge through the stem parallel to the branch bark ridge.



# Epicormic Branches

- Prevent the abundant growth of epicormic sprouts on the stem below the cut, or dieback of the stem to a lower lateral branch, by making the cut at a lateral branch that is at least one-third of the diameter of the stem at their union.



*Image source:*

[http://www.na.fs.fed.us/spfo/pubs/howtos/ht\\_dogwd/ht\\_dog.htm](http://www.na.fs.fed.us/spfo/pubs/howtos/ht_dogwd/ht_dog.htm)

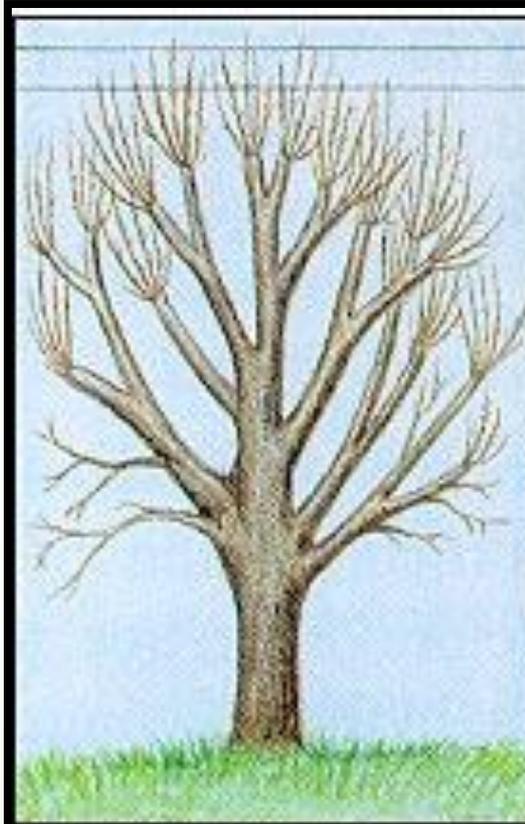
# Pruning Practices that Harm Trees

- Topping and tipping are pruning practices that harm trees and should not be used unless absolutely necessary.
- Crown reduction pruning is the preferred method to reduce the size or height of the crown of a tree, but is rarely needed and should be used infrequently.



# Topping

- Topping is the pruning of large upright branches between nodes to reduce the height of a tree.



**A. Topping**



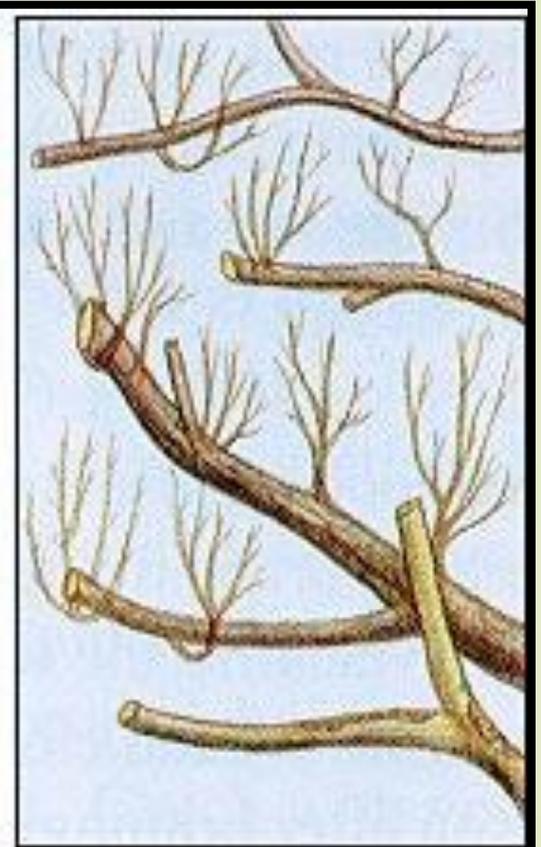
**B. Tipping**

# Tipping

- Tipping is a practice of cutting lateral branches between nodes to reduce crown width.



**A. Topping**



**B. Tipping**

# When to Prune

- Conifers may be pruned any time of year, but pruning during the dormant season may minimize sap and resin flow from cut branches.
- Dead branches, of any species, can be removed any time of the year.



# When to Prune

- Hardwood trees and shrubs without “showy” flowers should be pruned in the dormant season (late winter - early spring) to maximize wound closure in the growing season after pruning, to reduce the chance of transmitting disease, and to discourage excessive sap flow from wounds.
- Late fall after leaf drop or late winter before buds begin to swell.
- Trees that produce excessive sap or “bleed” (i.e. maples, birches) are recommended to be pruned after full leaf out.



# Flowering Trees

- Flowering trees and shrubs should be pruned during the dormant season for the same reasons stated above. However, to preserve the current years flower crop, the following schedule should be followed:



*Image Source:*  
<http://muextension.missouri.edu/xplor/agguides/hort/g06805.htm>

# Flowering Trees

- Trees and shrubs that flower in early spring (redbud, dogwood, etc.) should be pruned immediately after flowering;



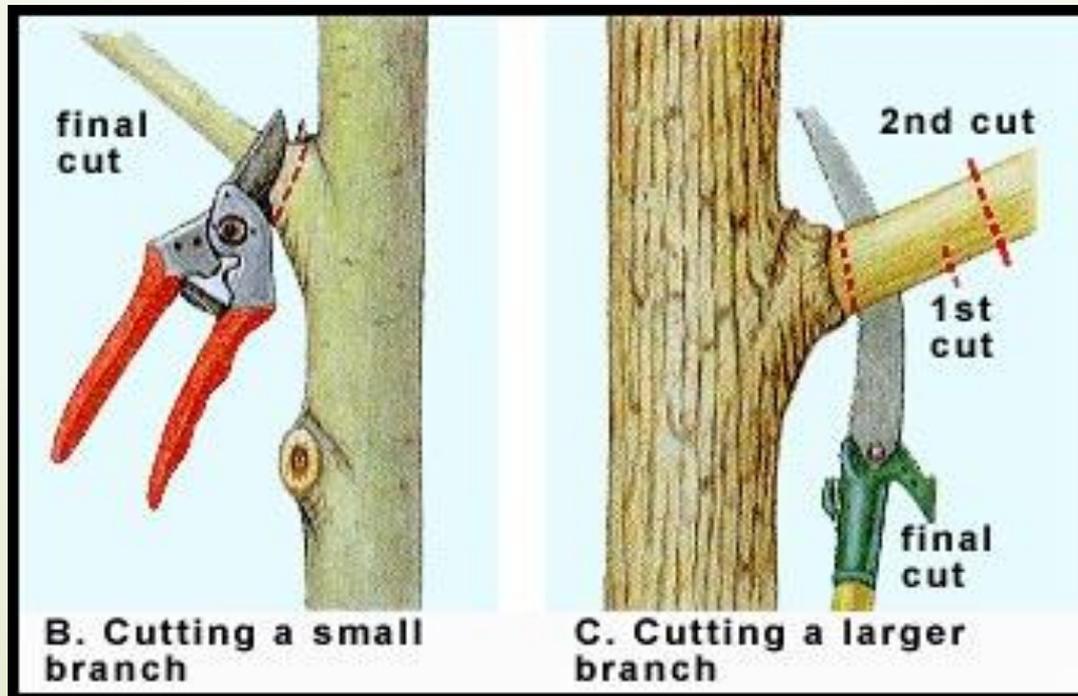
# Flowering Trees

- Trees and shrubs that flower in the summer or fall always should be pruned during the dormant season.
- Trees susceptible to fireblight, a bacterial disease that can be spread by pruning, should be pruned during the dormant season. Example: crab-apples.

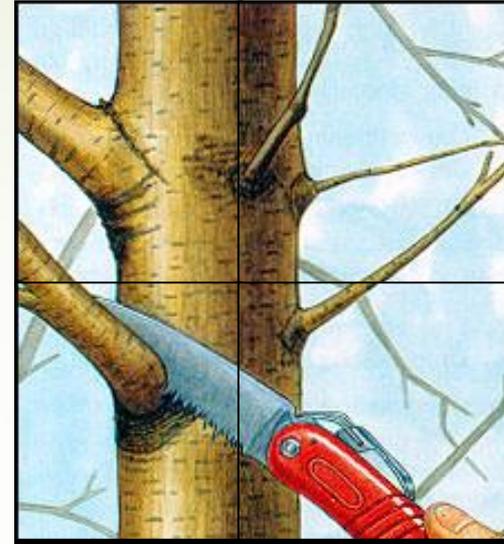
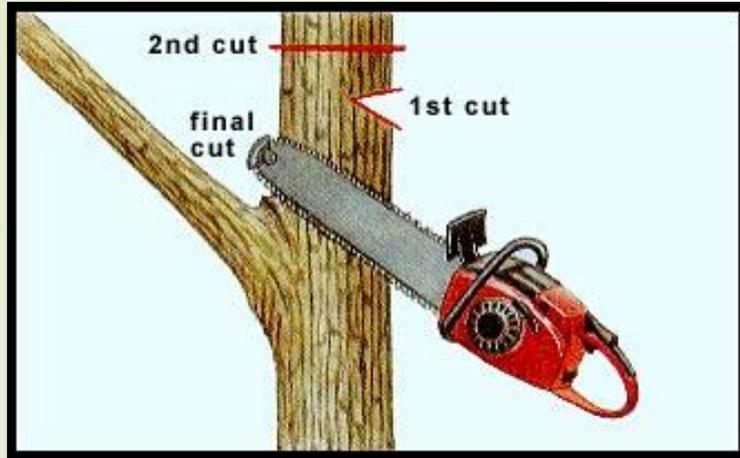


# Pruning Tools

- The choice of which tool to use depends largely on the size of branches to be pruned and the amount of pruning to be done.



# Pruning Tools



- Branches too large to be cut with a hand pruner or lopping shears must be pruned with a pruning saw. Pruning saws are unlike most other saws and cut on the “pull-stroke”.
- When pruning branches larger than 6 inches, chain-saws are preferred.

# Pruning Tools

- Use pole pruners to cut branches beyond reach.
  - Pruning heads can cut branches up to 2 inches in diameter and are available in the by-pass and anvil styles.
  - Larger branches can be cut with saw blades fastened directly to the pruning head.
  - **DO NOT USE POLE PRUNERS NEAR UTILITY LINES.** Only qualified utility line clearance personnel should prune near utility lines.



# Maintain Pruning Tools

- Keep tools sharp.
- Clean and sanitize tools
  - The need to sanitize tools can be reduced if pruning is done during the dormant season.
  - To sanitize tools, use either 70% denatured alcohol or liquid household bleach diluted 1 to 9 with water.



# Treating Wounds

- Trees naturally produce tree sap, gums and resins to combat invasion by pathogens.
- Although sap flow is not usually harmful, excessive “bleeding” can weaken trees and be unattractive.



# Treating Wounds

- If oaks or elms are wounded during a critical time of year, some type of wound dressing could be applied.
- In other species, wound dressings may actually interfere with the protective benefits of tree gums and resins and prevent wound surfaces from closing as quickly as they might under natural conditions.
- Not usually recommended.



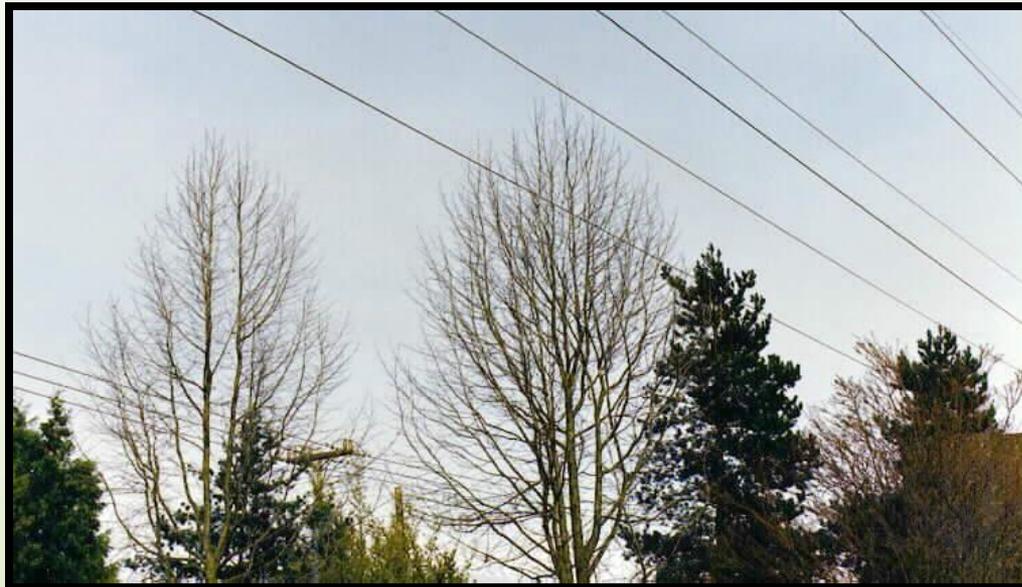
# Pruning Guidelines

- To encourage the development of a strong, healthy tree, consider the following guidelines when pruning.



# General

- Prune first for safety, next for health, and finally for aesthetics.
- Never prune trees that are touching or near utility lines; instead consult your local utility company.
- Avoid pruning trees when you might increase susceptibility to important pests.



# General

- Use the following decision guide for size of branches to be removed:
  - Under 2 inch diameter - go ahead,
  - Between 2 and 4 inch diameter - think twice, and
  - Greater than 4 inch diameter - have a good reason, proper tools and knowledge, and a plan.



*Image source: <http://hort.ifas.ufl.edu/woody/pruning/>*

# Pruning Cycle

## Pruning Cycle

- Generally 3-5 years for young to developing trees
- Fast vs. slow growing trees
- Remember never prune more than 25% of the live crown of a tree.



# Norway Maple



# Sensation Boxelder



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