

Introduction to Proper Pruning

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City of Fort Worth

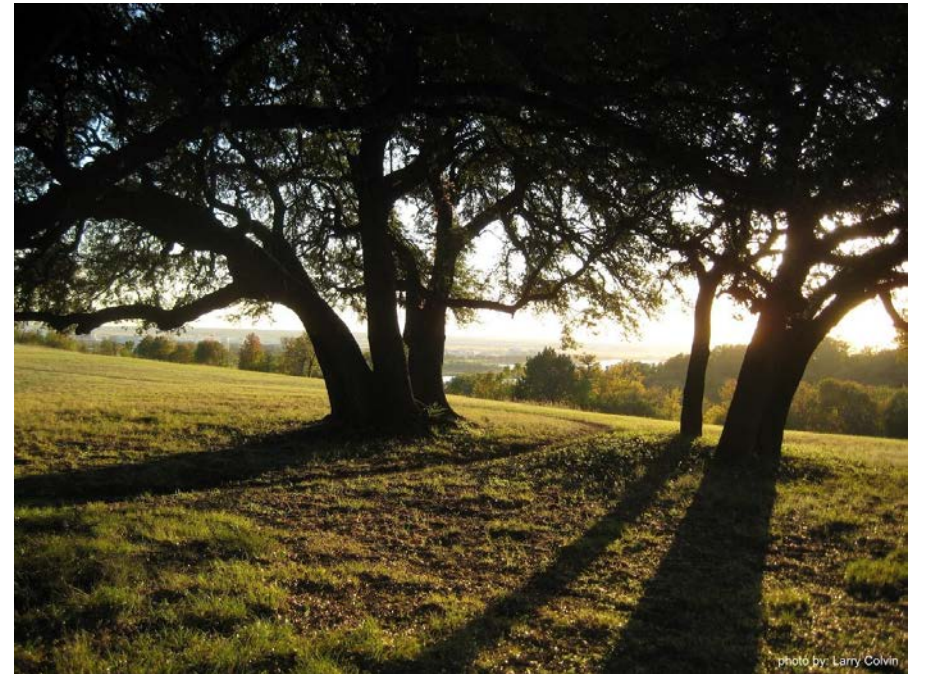
Park and Recreation Department

Forestry Section

www.fortworthtexas.gov/forestry

City of Fort Worth, Forestry Section

- Hazard Abatement
- Community Tree Planting
 - Neighborhood Tree Planting Program
 - Tree Grant Program
- Heritage Tree Program
- Volunteer Programs
- www.fortworthtexas.gov/forestry

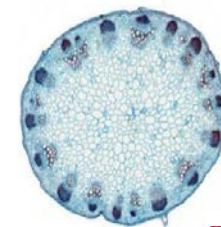
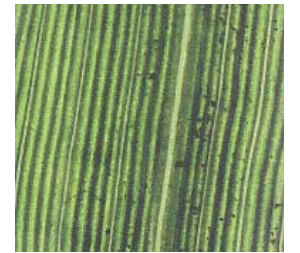
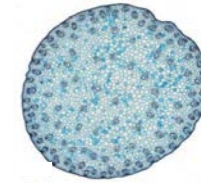


The Basics-Vascular Plants

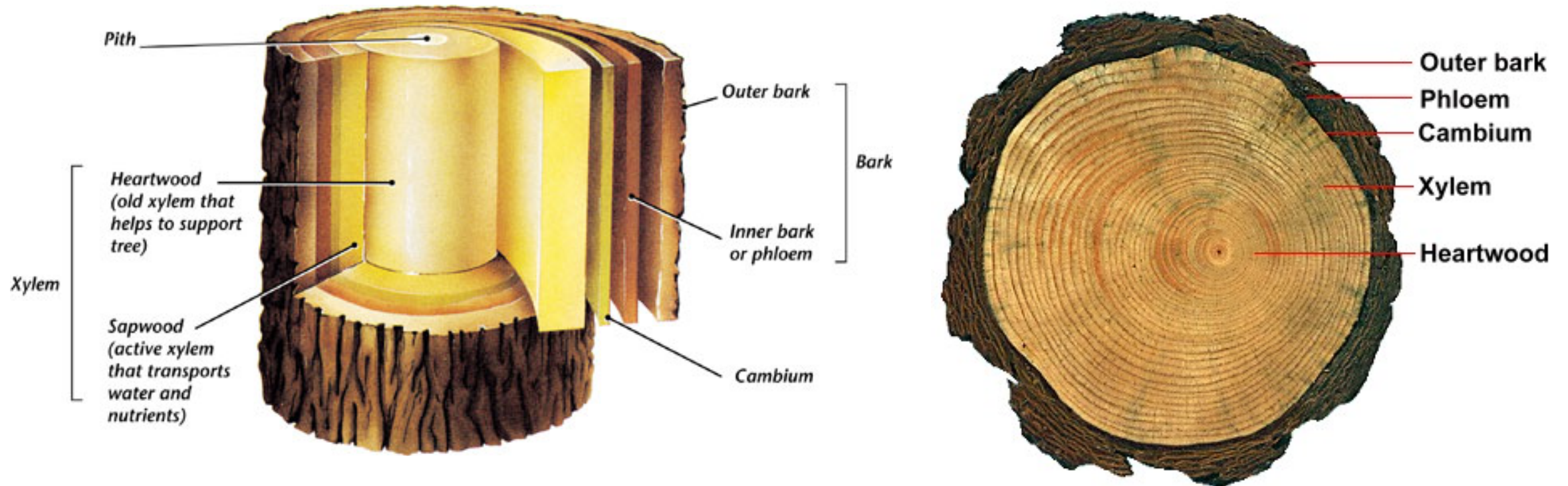
- Contain tissues which transport water and dissolved materials
- Most produce seeds as a means for (sexual) reproduction
- Divided into two classes
 - Gymnosperms-lack true flowers so they produce “naked” seeds not enclosed in fruits.
 - Most seeds produced in cones (pine, spruce, cedar)
 - Some are tricky (juniper, ginkgo, cypress, cycad)
 - Angiosperms-produce flowers and fruits which contain seeds

The Basics-Vascular Plants

- Angiosperms are divided into two groups
 - Monocotyledons (Monocots)
 - One seed leaf (cotyledon), parallel veins, vascular system arranged in bundles
 - “True” grasses, grains (corn, wheat, etc), bananas, orchids, irises, asparagus, onions, palms
 - Dicotyledons (Dicots)
 - Two seed leaves, branched or netted/reticulated veins, vascular system forms rings
 - Oaks, elms, willows, pecans, peaches, pears, cherries, lantana, begonias, tomatoes



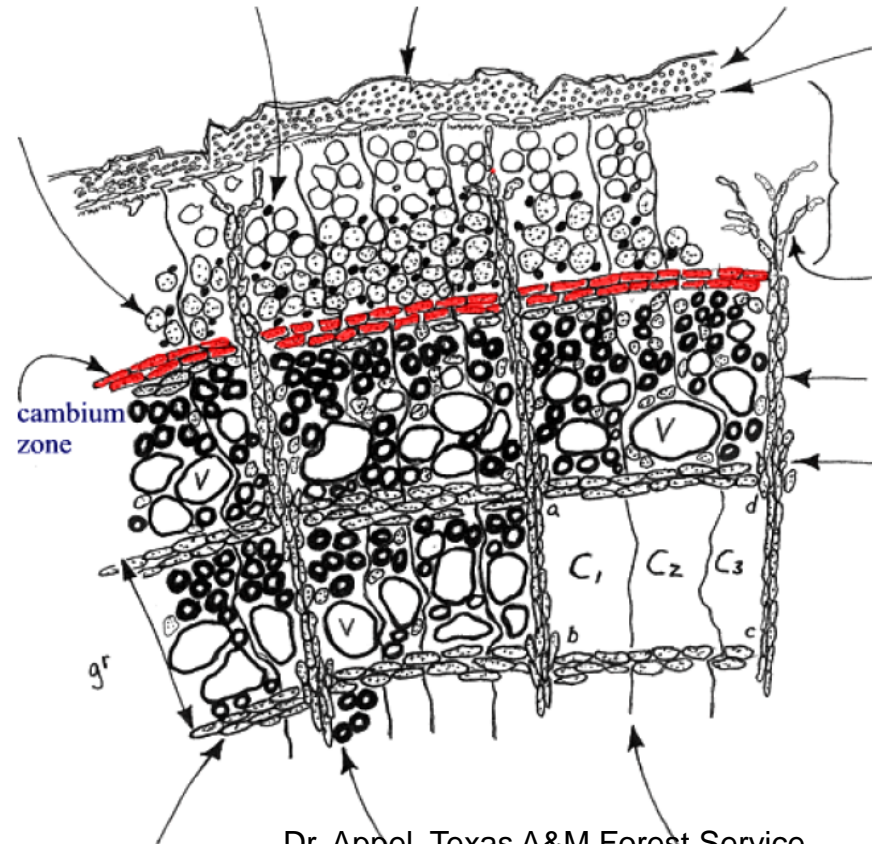
Tree Anatomy & Physiology



The cambium:

The cambium is the primary meristem producing radial growth.

It forms the phloem & xylem.



Dr. Appel, Texas A&M Forest Service

Meristem—region of actively dividing cells (creating new tissue)

Trees have 3 meristems:

Apical—primary, found at opposite ends (growth tips/buds, root tips)

Cork cambium—aka phellogen—secondary, produces cork cells (leading to bark)

Vascular cambium—secondary, produces new growth rings and forms phloem and xylem

Monocots have intercalary meristems instead of vascular cambium

The Magic of Photosynthesis

Photosynthesis



When you get hungry, you might decide to raid the cookie jar or ask your mom to make you a sandwich. You do this because humans and animals get energy from the foods they eat.

Plants use light energy from the sun to produce the food they need to survive. This process is called photosynthesis.

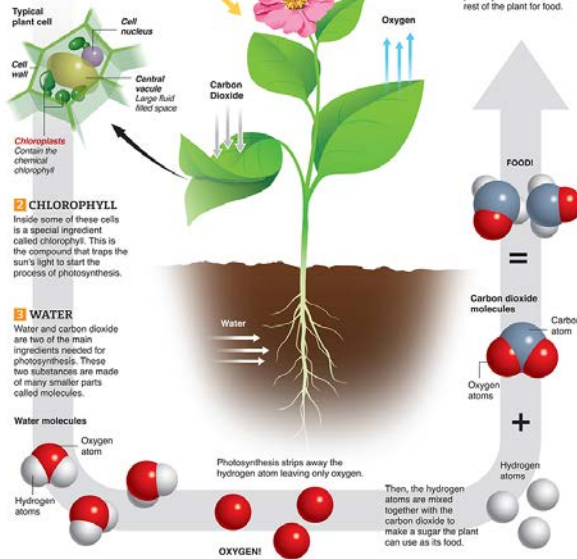
INGREDIENTS

- Light energy: Rays from the sun
- Water: Gathered by plant's roots in the soil
- Carbon dioxide: From the air
- Chlorophyll: Present in cells of green plants

1 SUNLIGHT
Light shining down from the sun is absorbed by the plant's cells. These tiny cells are what make up the plant and its leaves.

2 CHLOROPHYLL
Inside some of these cells is a special ingredient called chlorophyll. This is the compound that traps the sun's light to start the process of photosynthesis.

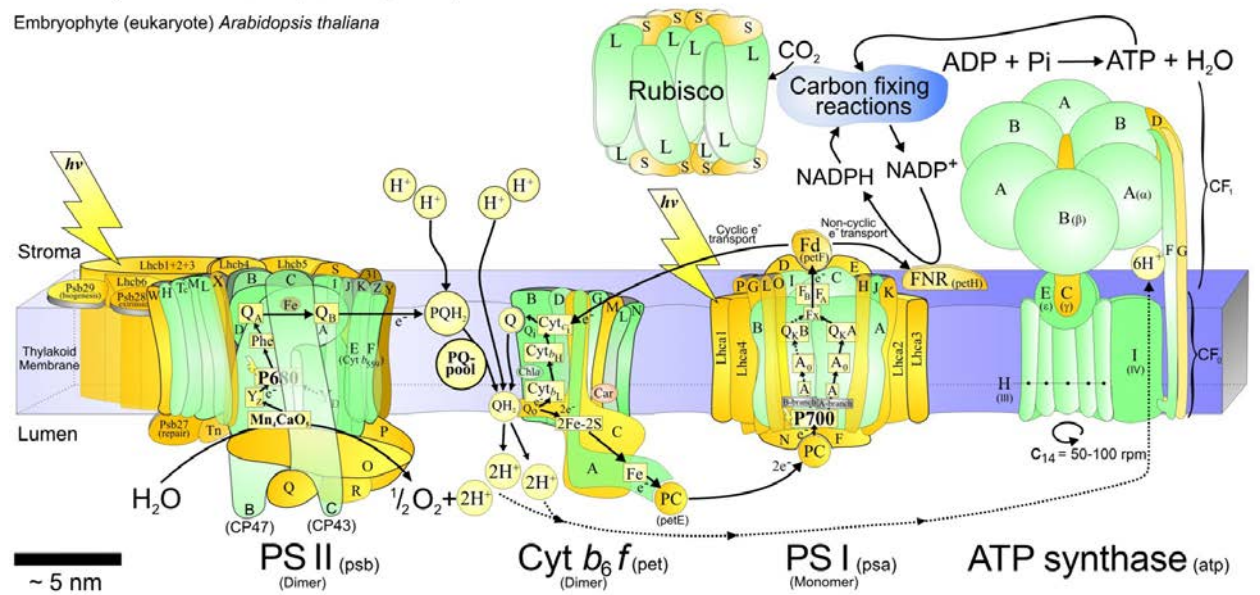
3 WATER
Water and carbon dioxide are two of the main ingredients needed for photosynthesis. These two substances are made of many smaller parts called molecules.



Source: BBC, Science and University of Arizona

A structural phylogenetic map for chloroplast photosynthesis
John F. Allen, Wilson B. M. de Paula, Sujith Puthiyaveetil, Jon Nield
School of Biological and Chemical Sciences, Queen Mary University of London

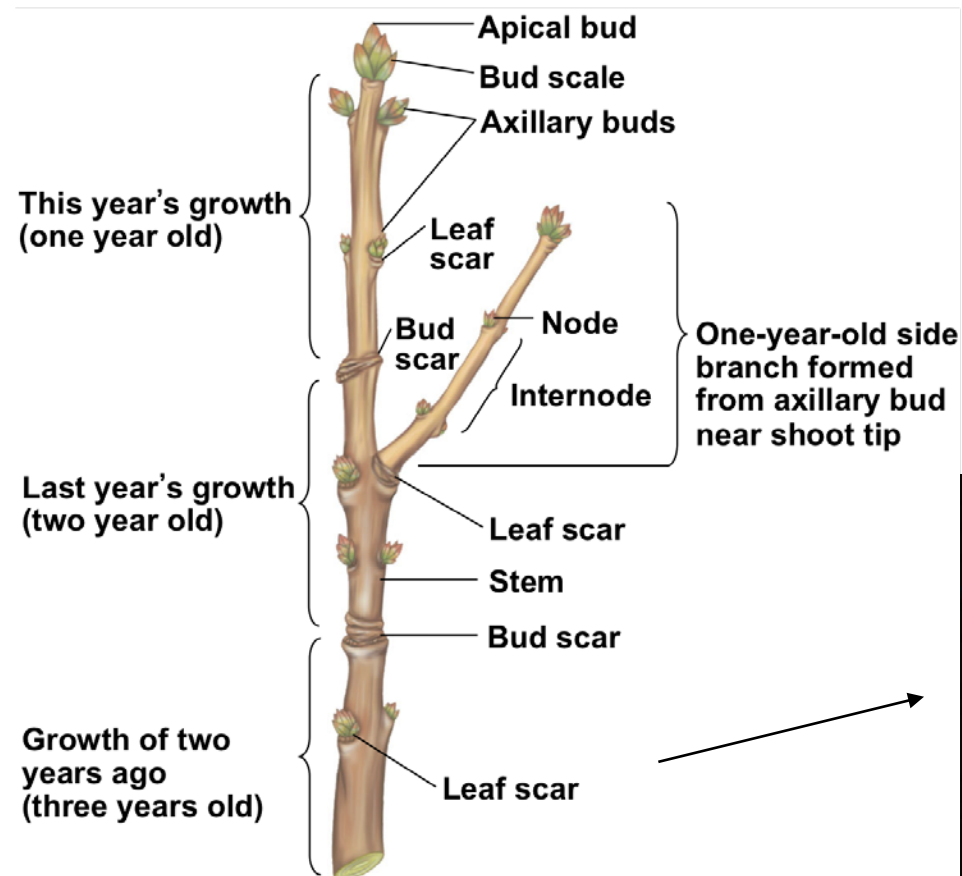
Embryophyte (eukaryote) *Arabidopsis thaliana*



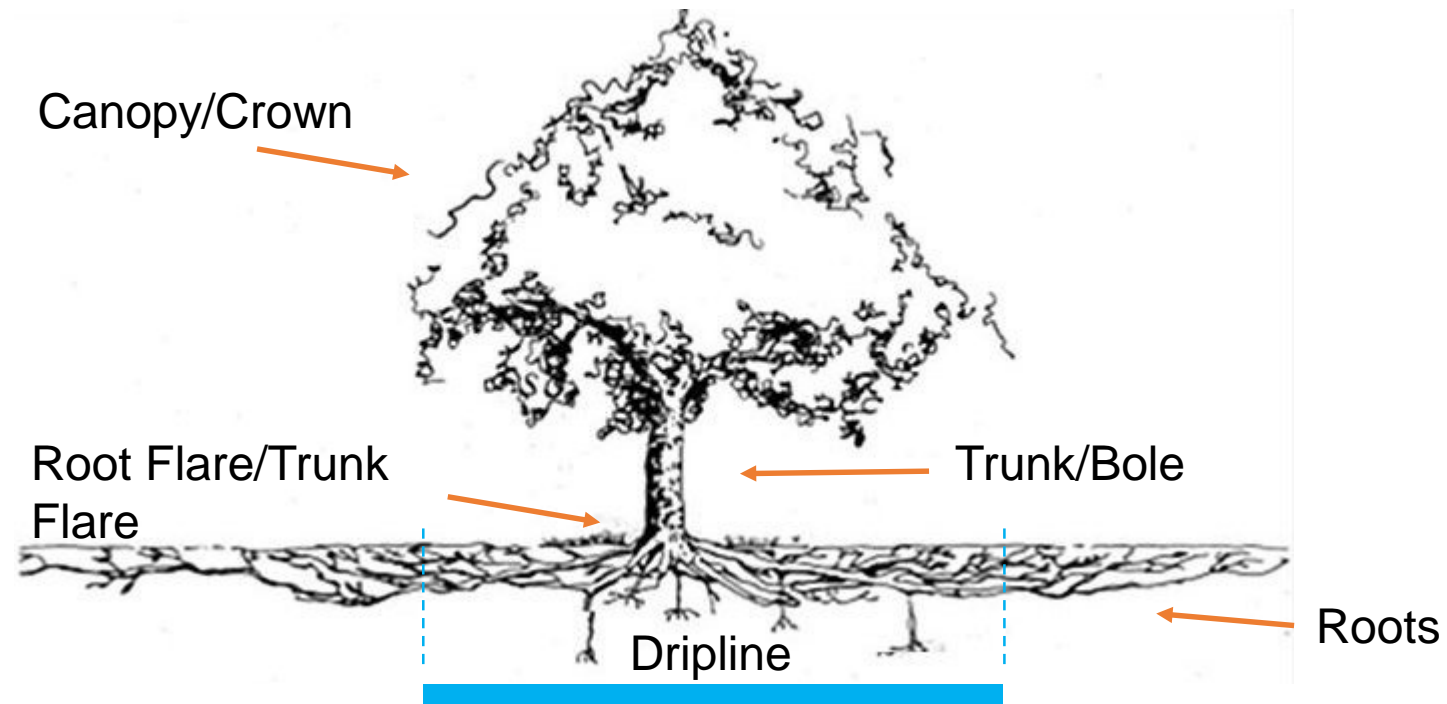
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Tree Anatomy & Physiology

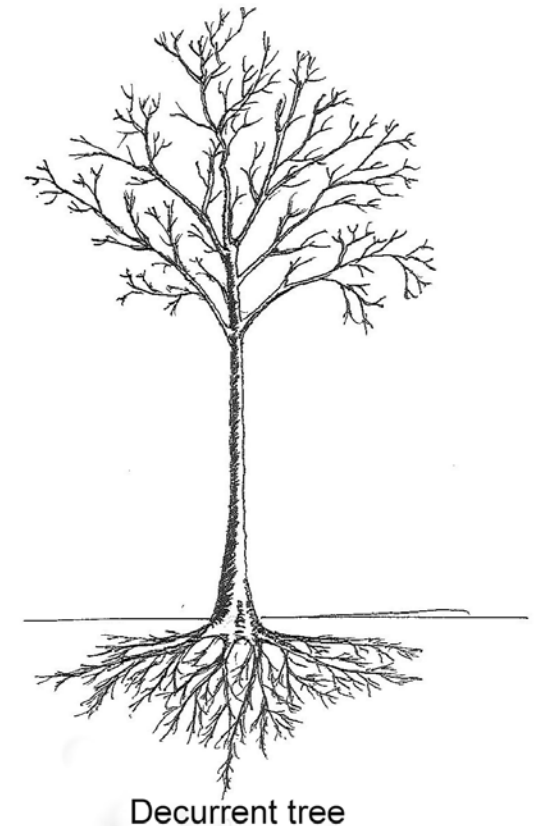
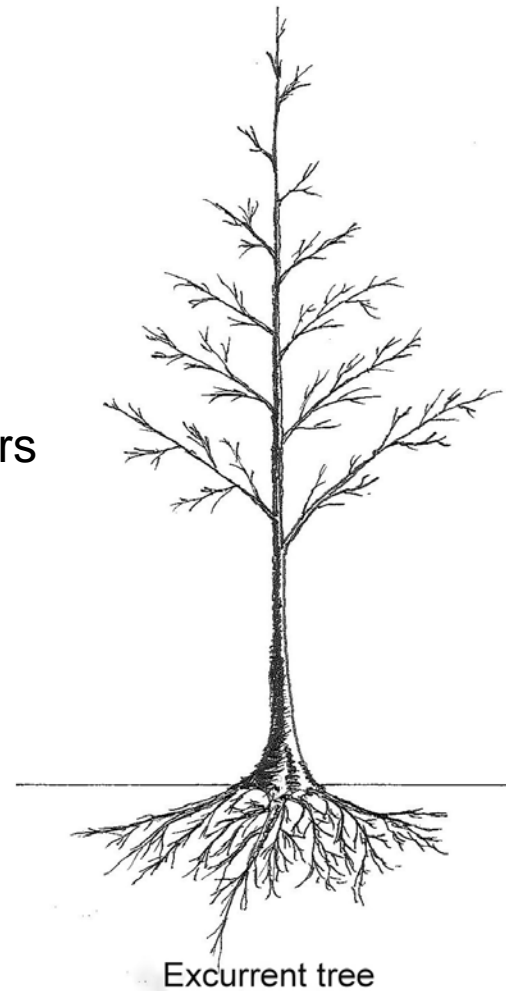


Tree Anatomy & Physiology



Growth Form

- **Excurrent**-upright with single, dominant leader
 - Pyramidal
 - Conical
 - Columnar (5:1 ratio)
 - Fastigate (10:1 ratio)
- **Decurrent**-broad, spreading with multiple leaders
 - Ellipsoidal
 - Ovoid
 - Globose
 - Vase-shaped
 - Umbrella-shaped
 - Broad/Spreading
 - Weeping
- Hybrids/cultivars
- Forested vs Open-Grown
- Effects of Aging



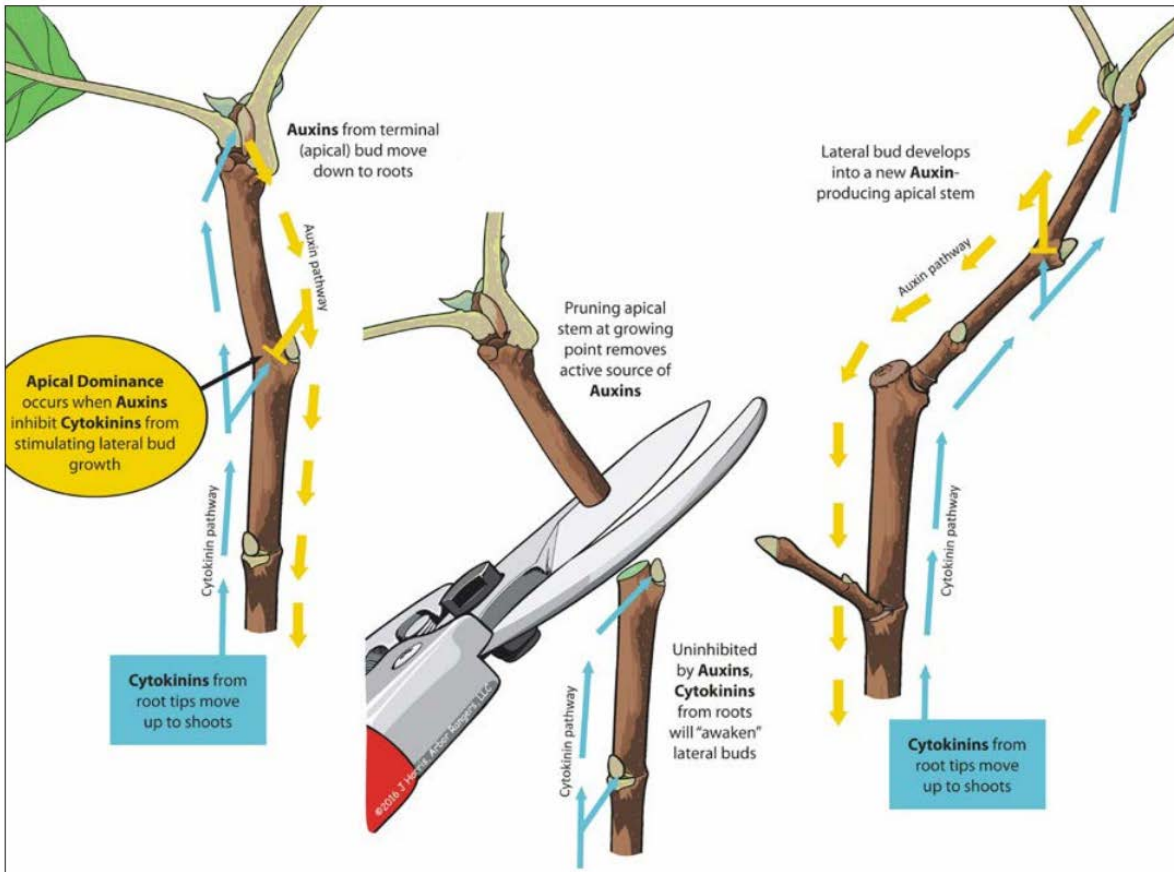
Trees are Hormonal

- Auxins, cytokinins, gibberellins, ethylene, abscisic acid, etc.
- Frequently produced in one area and translocated to another.
- Pruning causes a disruption in many of these pathways, which are also transporting water and nutrients.
- Auxins—affect root and shoot growth, move with gravity, produced in green tips.
- Cytokinins—affect lateral growth, move against gravity, produced in roots.

Apical Dominance

- Auxins in apical meristems suppress flow of cytokinins (vertical growth vs lateral growth)
- Varies with species, age, location, structure
- Strongest in excurrent species
- Can be altered by pruning
- Removing apical dominance allows cytokinins to promote lateral growth and stimulate dormant buds
- Balance between resources and growth

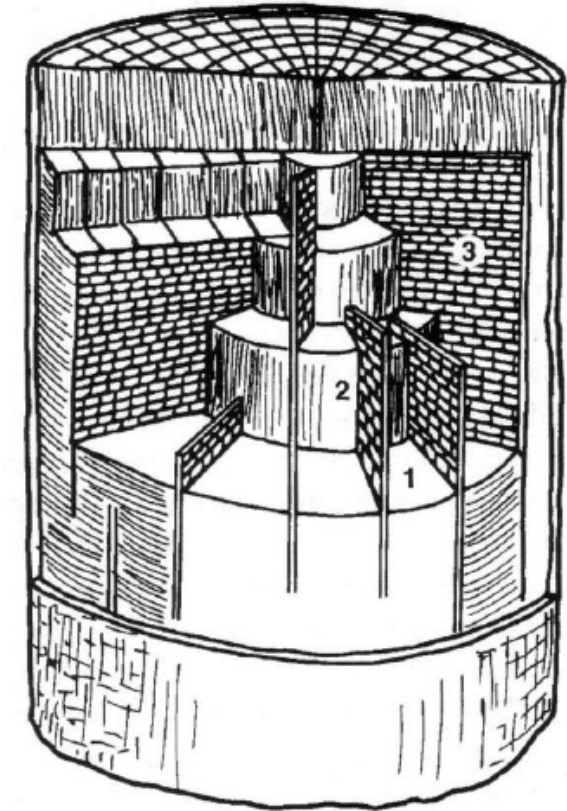
Apical Dominance



CODIT – Seal, Not Heal

Compartmentalization
Of
Decay
In
Trees

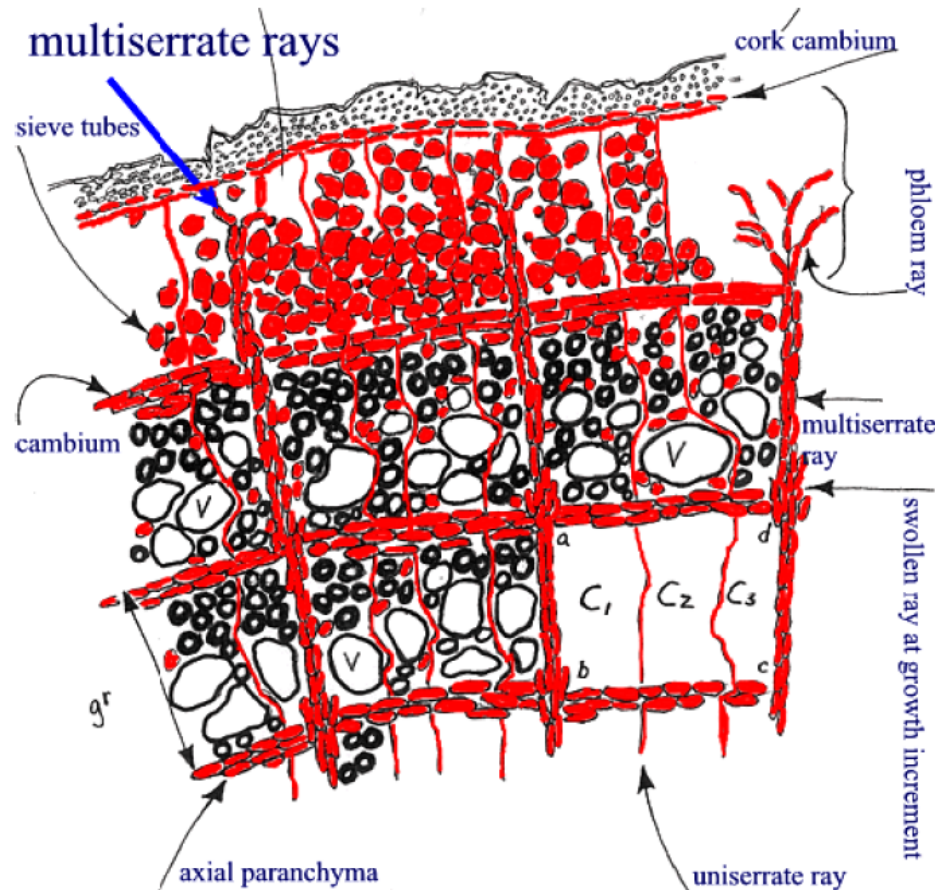
Internal walls and
wound wood
developed to prevent
the spread of decay
or disease



Helps explain how trees live longer, grow larger, can survive repeated damage or disease, meaning trees are an investment which yield an array of benefits

The symplast is the living portion of the tree.

It is all connected via plasmodesmata (tiny passages in the cell walls.)



Dr. Appel, Texas A&M Forest Service

Wall 1: xylem vessels above/below injury plugged.

Wall 2: growth rings slow advancement toward pith.

Wall 3: rays fight decay and prevent axial spread.

Wall 4: reaction zone from outermost cambium at time of injury. Wall 4 may extend up or down with time, but does not move outward. Leads to creation of wound wood.

Compartmentalization and Decay

- Some trees are better at it than others
 - Poor: most fruit trees, *Populus*, *Celtis*, *Salix*, *Fraxinus* (moderate)
 - Good: *Plantanus*, *Pinus*, *Ulmus*
 - Depends on species: *Quercus*, *Acer*
- Can vary with location in tree, size of wound, age of wood at injury, time of year, tree health



Compartmentalization and Decay



Reasons to Prune

- Safety
- Correction of a problem
- Health / Longevity
- Reduced long term costs
- Fruit production
- Aesthetics
- Inherent need to keep messing with tree(s)



Things to Consider When Pruning

- Safety-Always keep your safety and the safety of those around you as your top priority
- Ability-Realistically assess your willingness and ability to complete the task safely and properly
- Feasibility-Consider your options and alternatives before taking action
- Pruning Objective(s)-Have one and remind yourself of it frequently

When to Prune

- Shade trees
 - Traditionally pruned during dormant season (winter before bud break)
 - Shade trees can be successfully pruned after initial flush of growth has matured (slowed considerably). Wounds are most effectively sealed during this period
 - Avoid major pruning during spring when growth is active and tender
 - Avoid pruning the red oak family (Shumard oak, Texas red oak, live oak, etc.) from February to June to prevent spread of oak wilt
- Spring flowering trees
 - Prune after flowering has ceased/flowers have faded
- Summer flowering trees
 - Prune in winter or early spring



What to Prune

- Dead, broken or damaged limbs
- Competing, crossing or rubbing branches
- Limbs creating a hazard or causing damage
- Low limbs in areas requiring proper clearance
- Young trees needing corrective action(s)
- Fruit trees
- Special circumstances

Amount of Pruning

- Ideally, try to limit removal of existing foliage to less than 30% of the existing canopy
- Young trees are generally more tolerant of extensive pruning
- Removing larger limbs creates larger wounds and larger wounds take longer to close (and have greater overall hormonal effect)

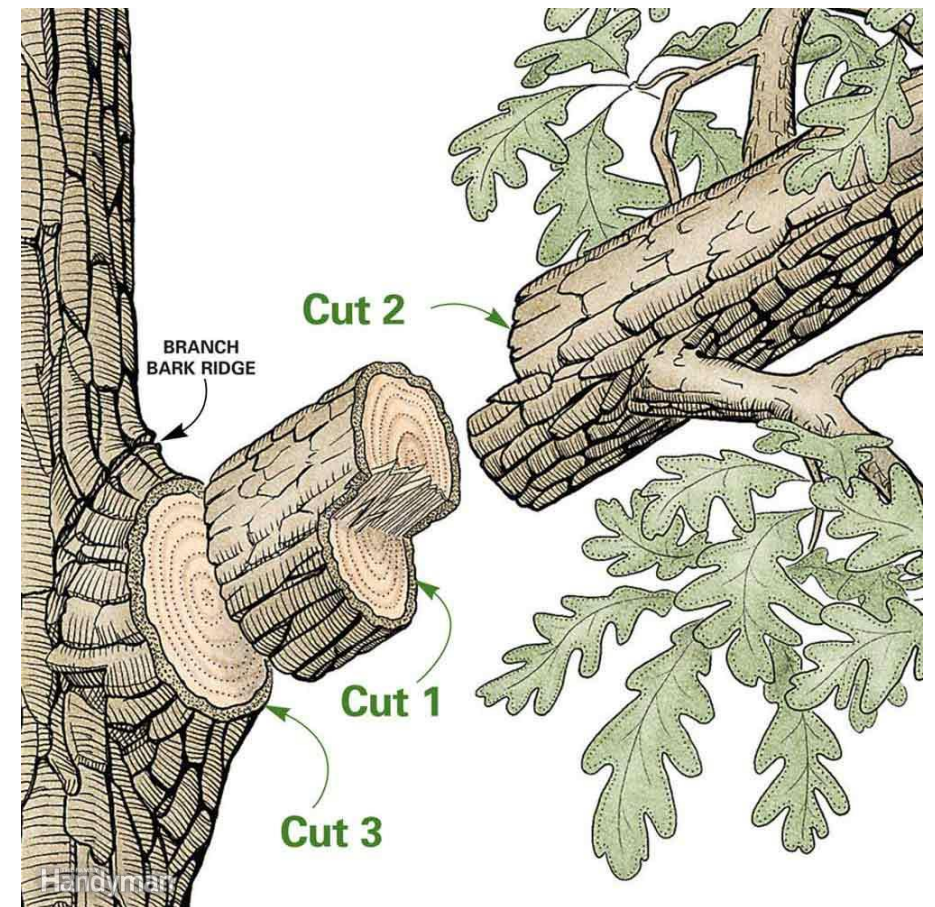


Types of Pruning

- Cleaning--removing dead, broken, diseased or dying limbs
- Raising--removing lower branches to create clearance for objects/activities
- Thinning--selective removal of branches to allow for more air or light
- Reduction--reducing the overall size of a tree or branch (sometimes called “drop crotch pruning”, NOT the same as “topping”)
- Structural--corrective pruning performed on young trees to achieve proper form
- Coppicing, Pollarding, Espalier—aesthetics and specific functions

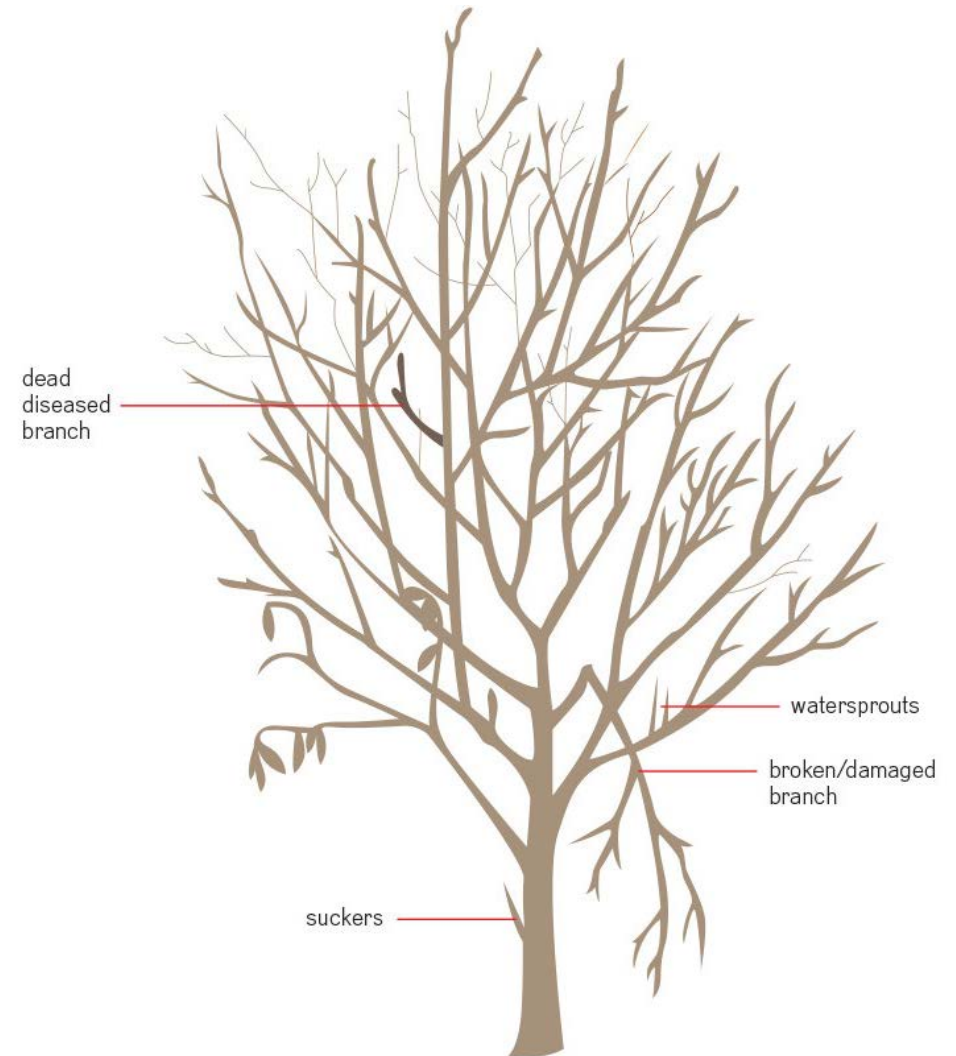
How to Prune-Removal Cuts

- Cut outside bark branch ridge (top) and branch collar (bottom)
- Use 3-cut method for larger cuts to prevent damage (tear outs, peel downs, etc.)
- Perpendicular, round cuts
- Beware of bark slipping



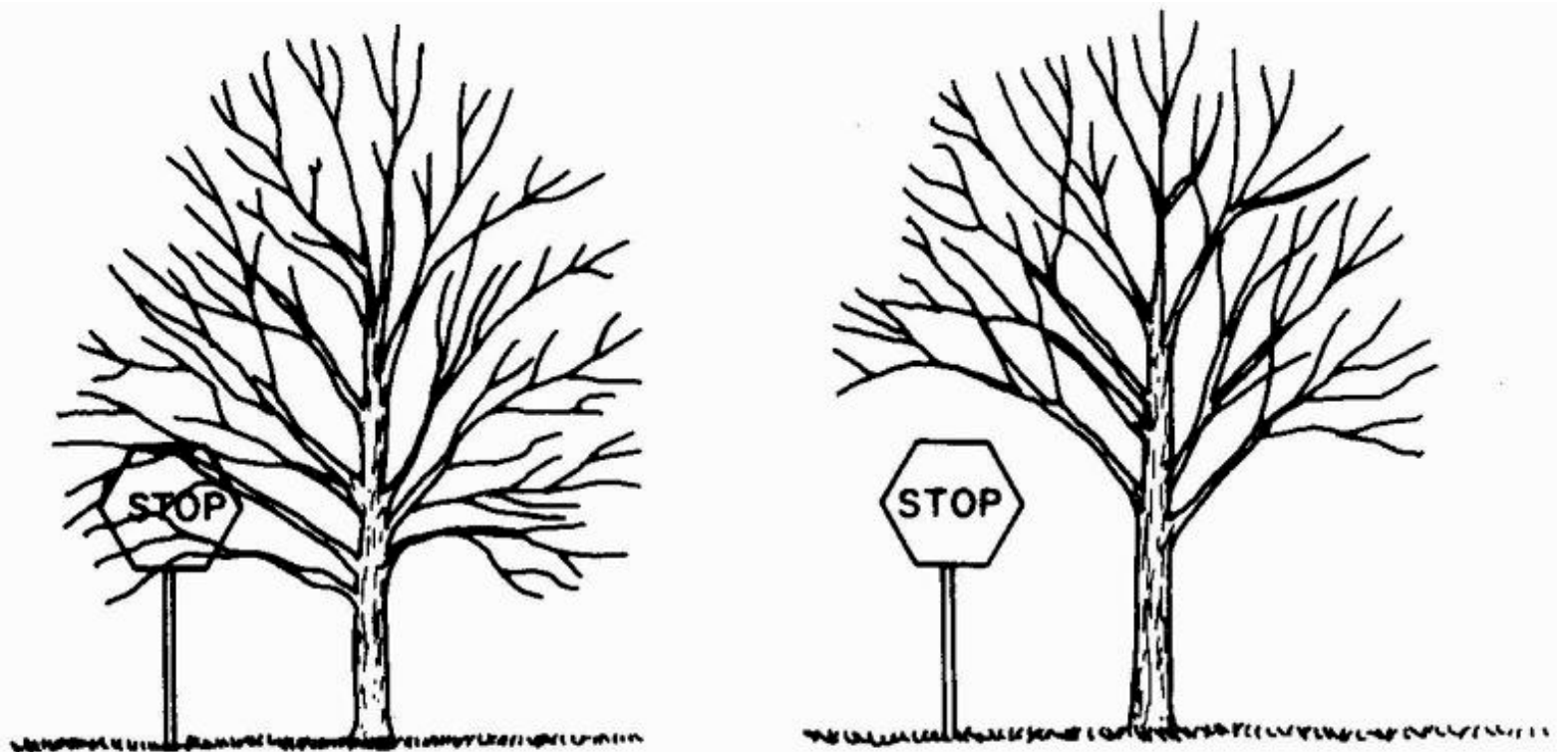
How to Prune-Cleaning

- Remove dead, broken, diseased, dying, rubbing or crossing limbs
- Directly affects health and wound recovery of tree
- Eliminates obvious issues directly and may simplify decision making



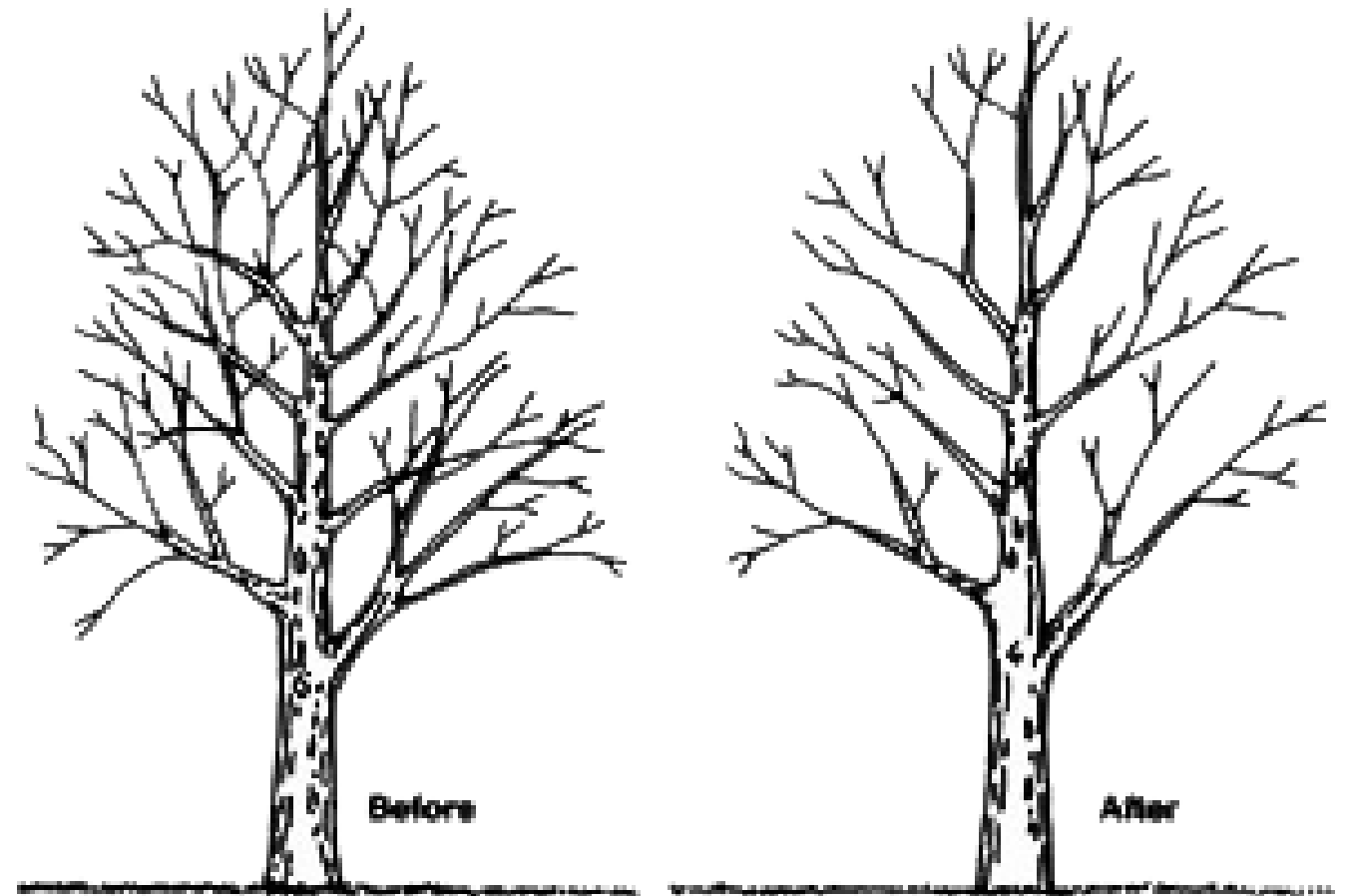
How to Prune-Raising

- 1/3 trunk to 2/3 canopy ratio (don't exceed 50% trunk)
- Remove low limbs to avoid hazards
- Note the side opposite the stop sign was also pruned (for symmetry)



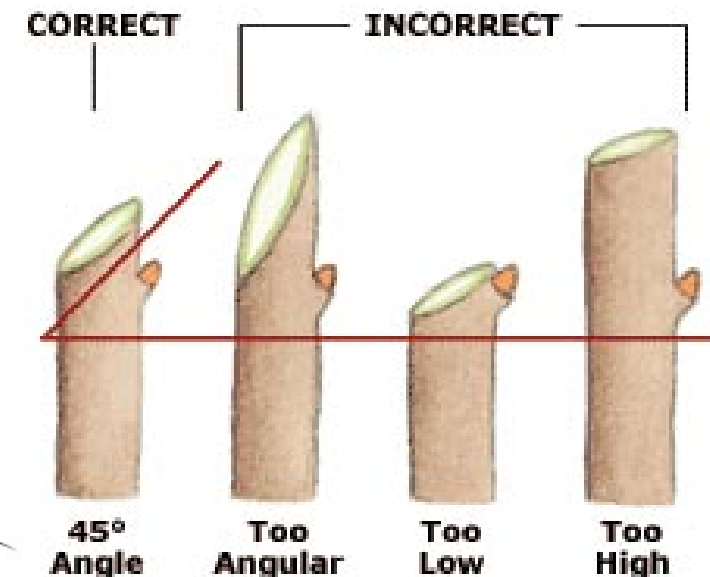
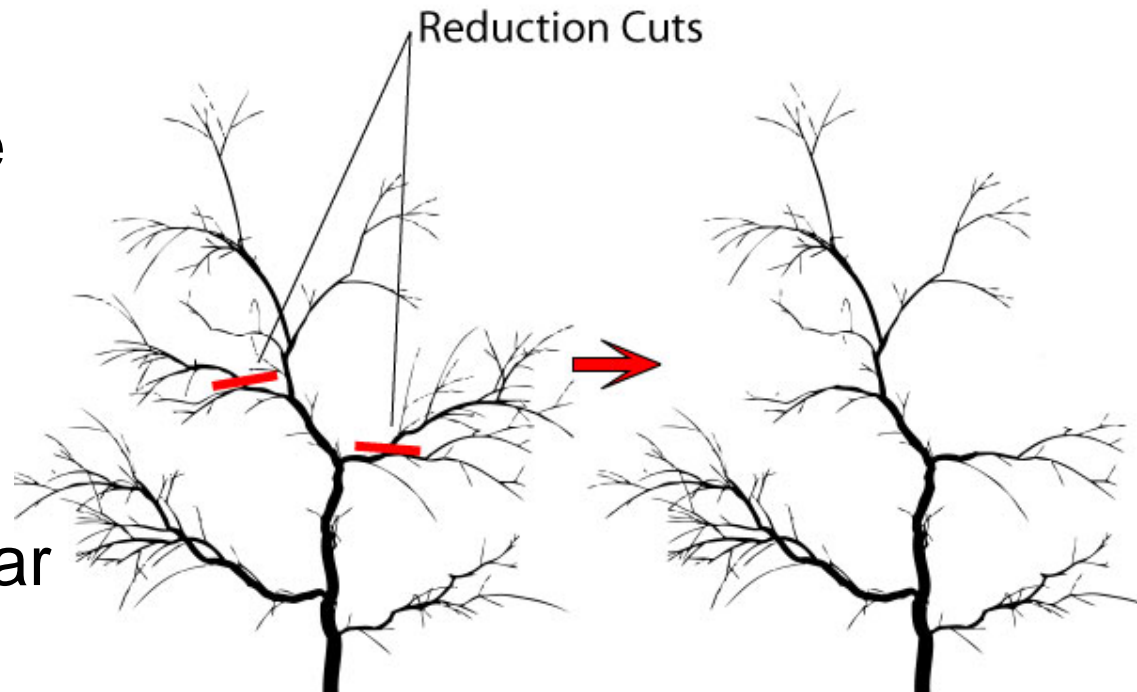
How to Prune-Thinning

- Primarily removal cuts used throughout the canopy to increase airflow or sunlight penetration
- Removals should be balanced across the length of the limb and throughout canopy
- Limit reduction cuts to control response growth



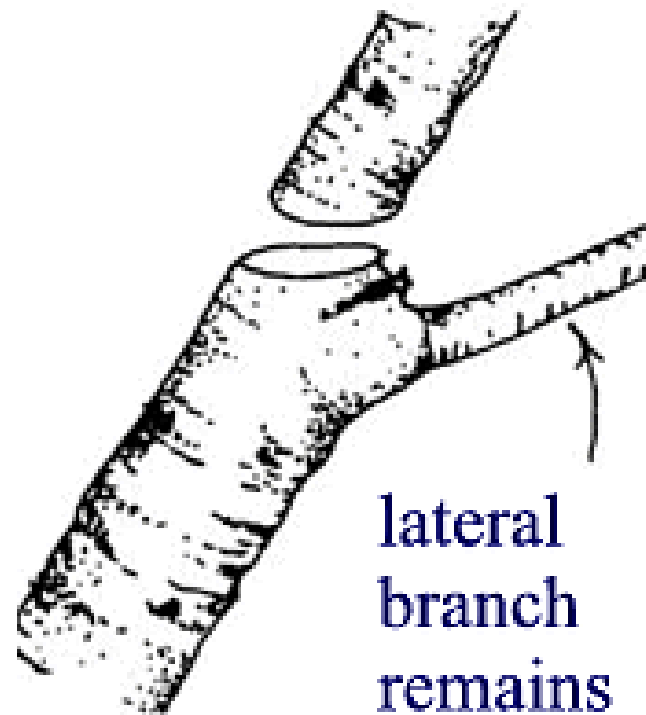
How to Prune-Reducing

- Selective cuts back to lateral branch or node
- Used to reduce/repair damage or control size
- Requires regular maintenance
- Pay attention to bud location

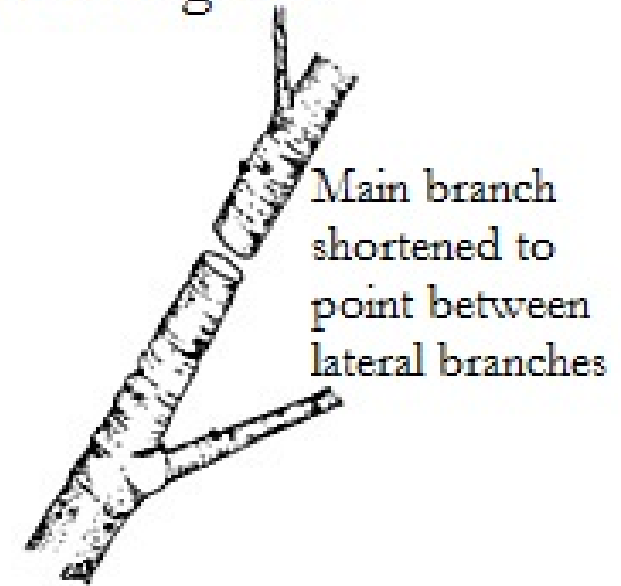


Drop Crotch Pruning

- Cut back limb to lateral that is a minimum 1/3 size of portion being removed
- Keep bark branch ridge intact
- Slow to seal
- Heading cuts are only considered appropriate on temporary limbs (structural pruning)



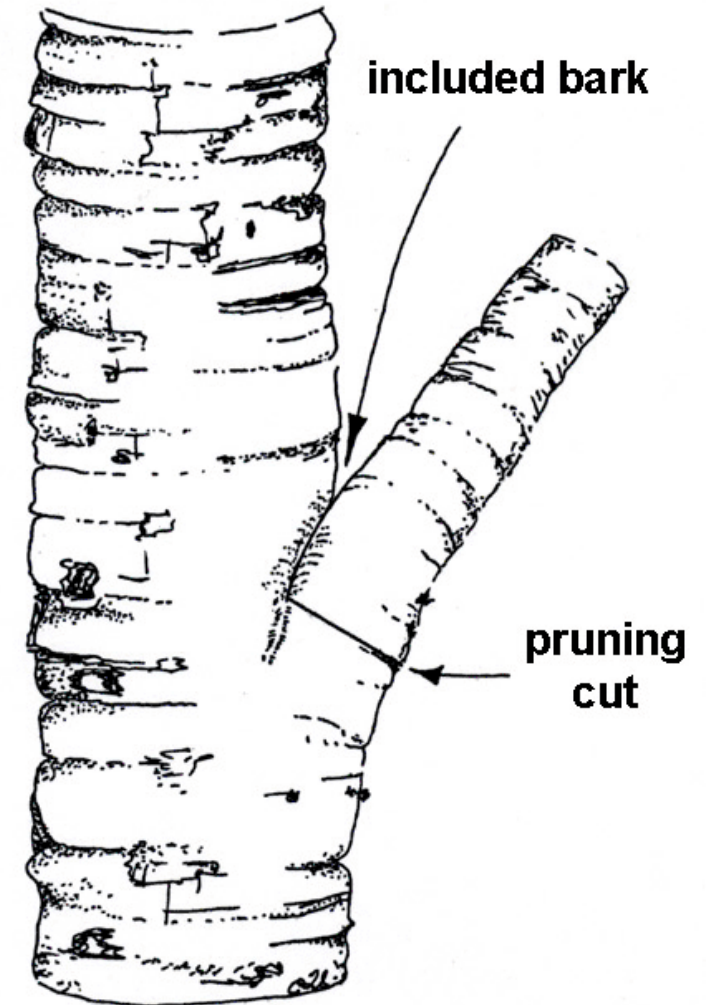
Heading Cut



Limbs with Included Bark

- Tissue is stacked and pressed together without proper overlapping lamination
- Results in weak union
- Often harbors decay
- Certain species are riddled with problems due to poor branch angles
- Improper pruning can lead to formation

no collar and included bark



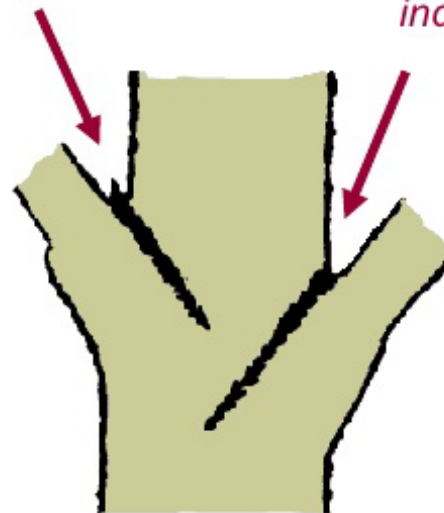
Branch Angles/Unions

A narrow crotch angle means take a closer look for *included bark*.

U - Crotch

Wide angle = strong

Branch bark ridge sticks up in crotch like "mountain range in a valley" = strong attachment



V - Crotch

Narrow angle with *included bark* = weak

Branch bark ridge disappears in the crotch = weak attachment, may develop *included bark*



Structural Pruning

- Minimizes defects which lead to failure and maximizes the energy produced by the tree—directing it for proper form and efficient growth rate.
- In situations where trees are “open grown”, structural pruning is needed to limit lateral growth and ensure apical dominance--particularly with shade trees--to mimic the natural characteristics of a “forest grown” tree and reduce potential failures due to poor form.

Structural Pruning Process

- Identify species and typical growth characteristics (multiple trunks, branch arrangement, etc.)
- Assess overall condition and health of the tree
- Identify pruning goals and objectives (correcting co-dominance, developing trunk taper, etc.)
- Identify and select tree's central leader (exception: small-maturing trees, standard or multi-trunk, such as crape myrtle, redbud, etc.)
- Remove dead, broken, damaged or rubbing branches

Structural Pruning Process-Continued

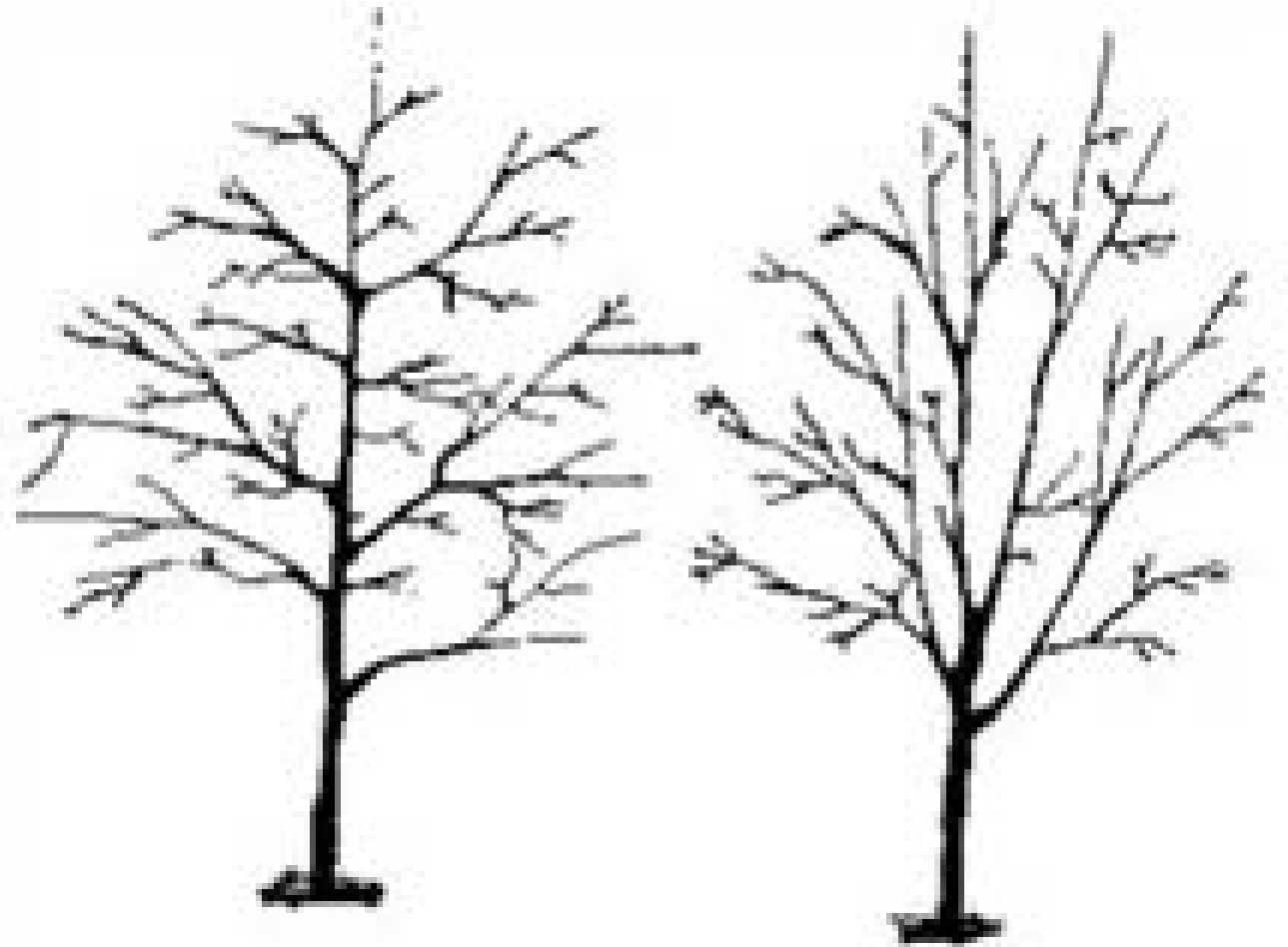
- Identify first (lowest) permanent scaffolding branch, if present
- Develop leader and trunk by removing or reducing co-dominant branches
- Remove or reduce laterals with diameter $> 50\%$ diameter of leader (at same height in tree)
- Remove or reduce any lowest temporary limbs before they become too large (anything over 1" diameter, when possible)
- Remove basal sprouts

Structural Pruning Guidelines

- A ratio of two-thirds canopy to one-third trunk is ideal—the proportion of the open trunk should never exceed one-half the height of the tree
- Removing more than 30% of a living crown should be avoided when possible
- Heading cuts are appropriate on temporary branches. Limit heading cuts on wood older than the current season when possible to avoid sucker growth
- Retained branches should have a wide angle of attachment and be arranged radially
- Reduction cuts on young, tender branches should be made $\frac{1}{4}$ " above a bud to prevent die back
- Proper cuts must be made when removing branches (cutting outside of the branch collar and bark branch ridge, without leaving a stub)

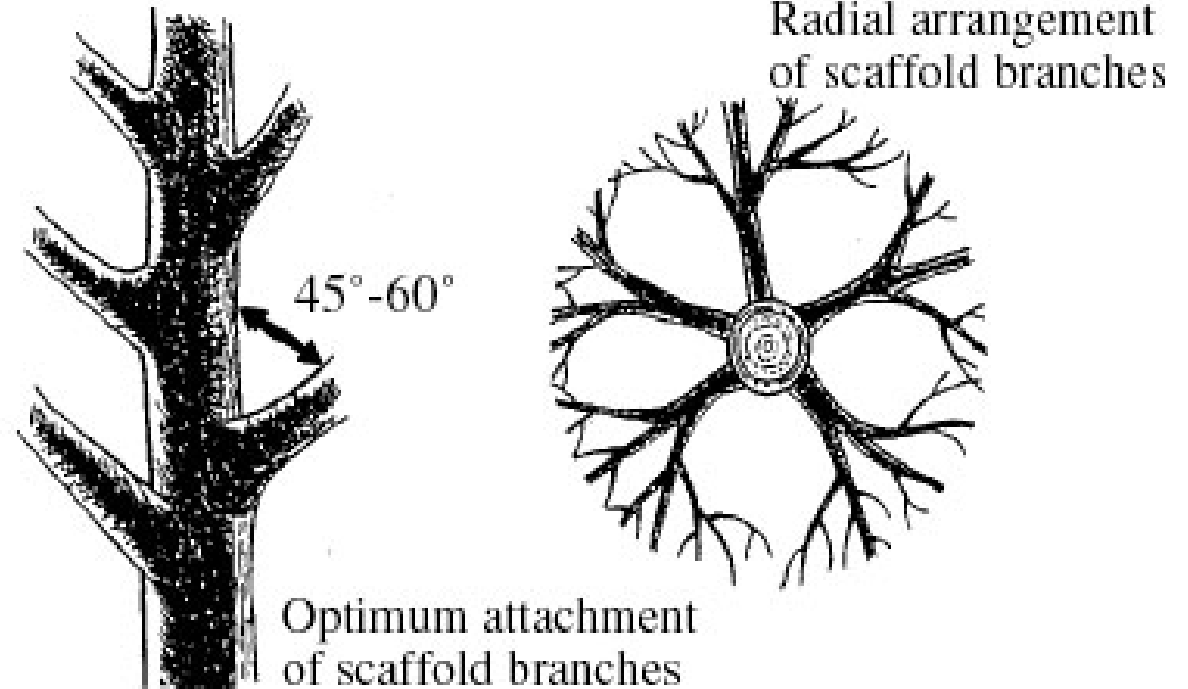
Central Leader

- Typically apparent on excurrent trees
- Can be attained through structural pruning in young trees
- Gradually disappears as apical dominance is lost or declines
- Prune to eliminate co-dominant branching



Scaffold Limbs

- Primary limbs forming canopy
- Smaller, lateral limbs arise from scaffold limbs
- Permanent vs temporary limbs
- Arranged radially with wide branching angles



Managing Temporary Limbs

- Trashy trunk promotes trunk taper
- Removal to limit size of wound
- Reduction to maintain photosynthesis, but reduce vigor
- Heading cuts are considered appropriate on temporary limbs (but can get ugly)



Coppicing, Pollarding, Espalier



What to Avoid

- **Topping**
- **Over-raising**
- **Lion-tails**
- **Stub cuts**
- **Flush cuts**



What to Avoid

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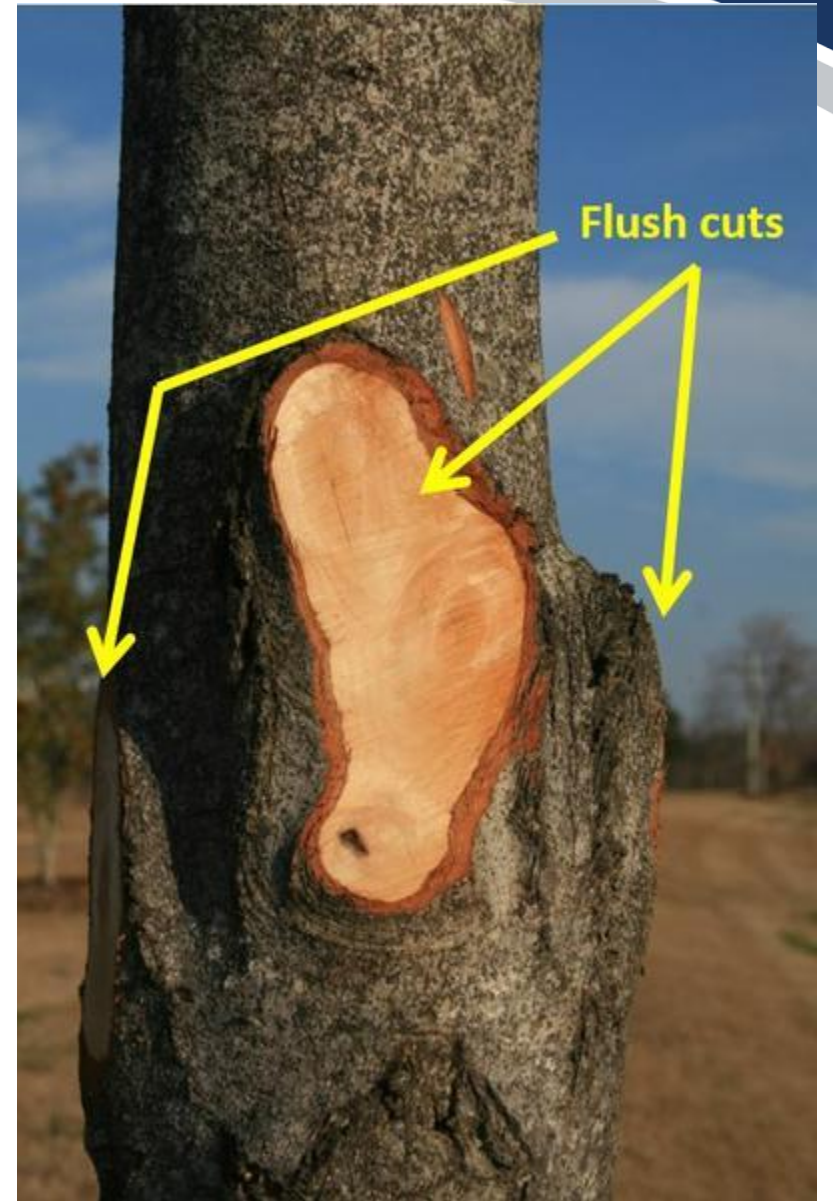
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What to Avoid

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Responses to Pruning

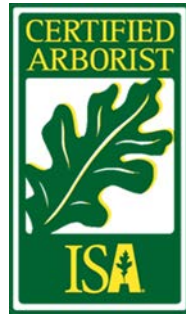


Wound Treatment

- No study has conclusively shown that a wound treatment (paint, seal, etc.) has a positive effect on the tree's health or wound recovery
- Some studies have shown that treating wounds can have negative effects
- Paint may possibly mask scent of wounds in red oaks (thus lessening the chance of attracting oak wilt carrying beetles)
- Some studies show promise in treating trees with trunk injury by preventing/slowing tissue dessication

Alternatives to Pruning

- Do nothing
- Remove/replace the tree
- Hire a contractor
 - International Society of Arboriculture
 - www.isa-arbor.com – Find An Arborist



Thank you



