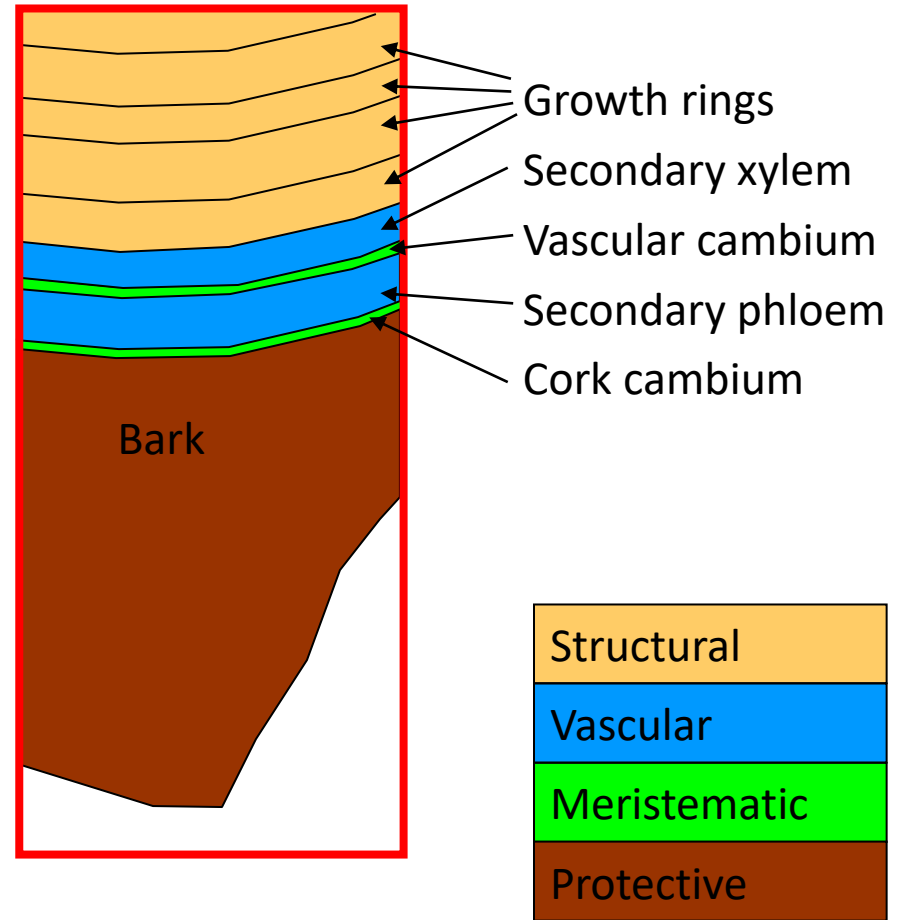
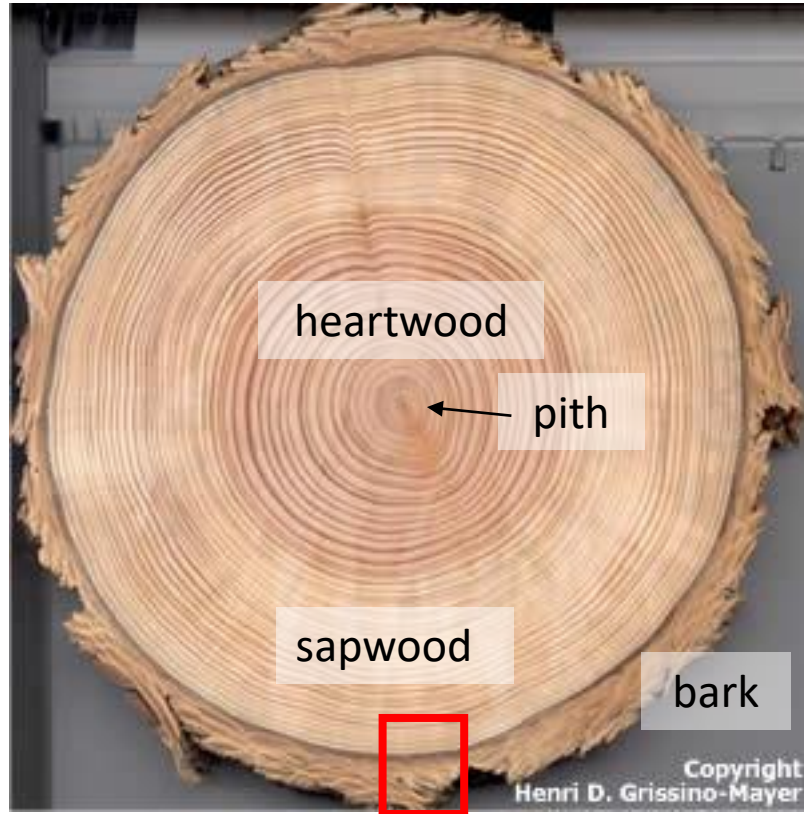


Trees & Shrubs



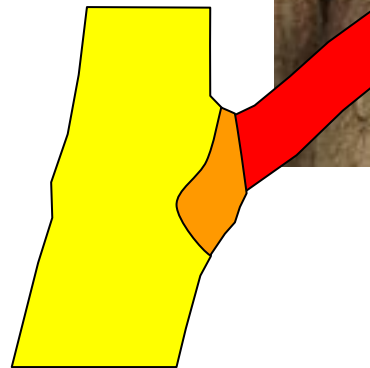
Architecture of a woody plant: trunk / branch



Architecture of a woody plant: forks & branches



Fork
No shared tissue
No special chemicals



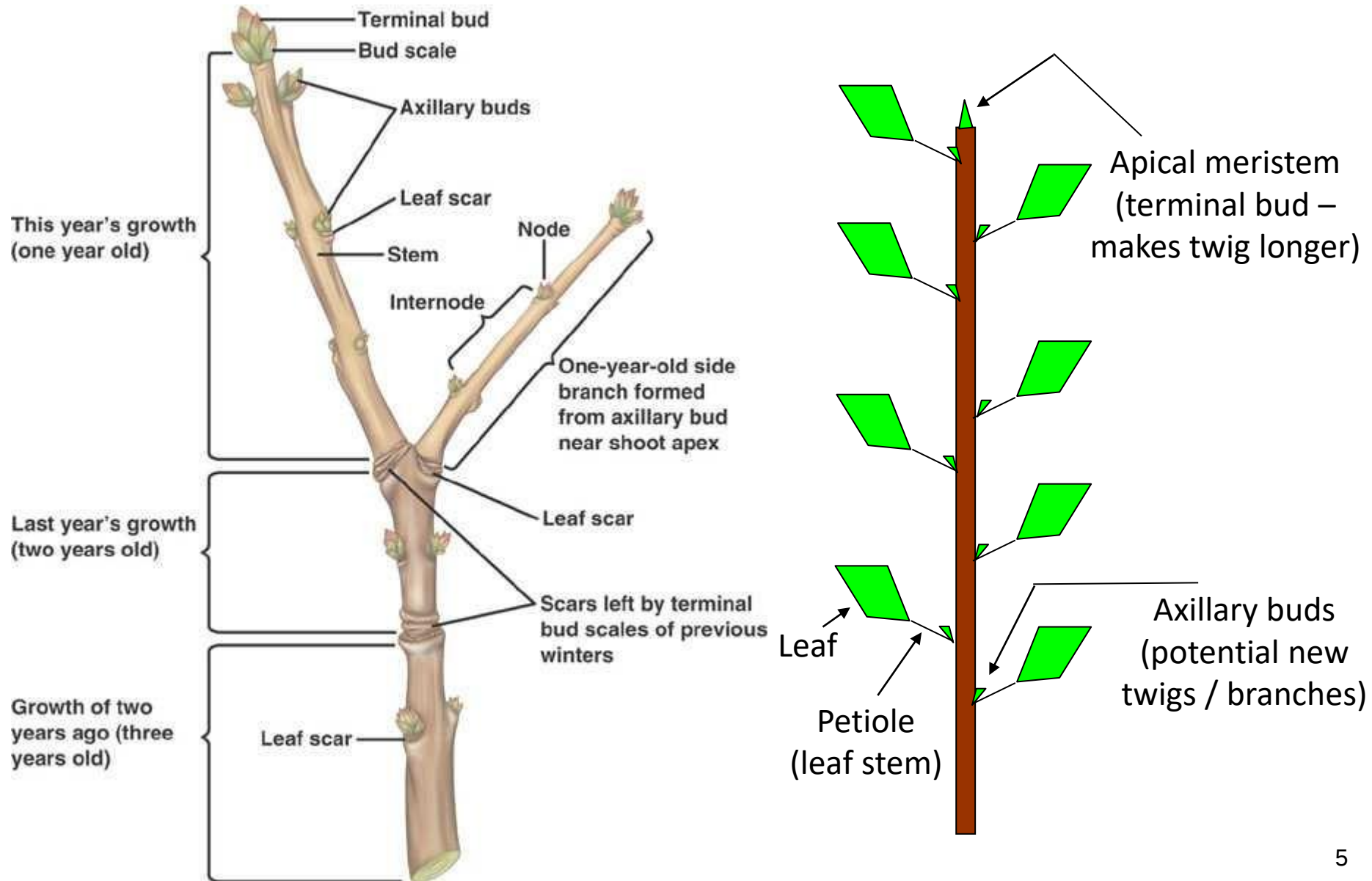
Branch
Shared tissue at branch collar
Extra fungicides and growth hormones

Architecture of a woody plant: suckers / water sprouts

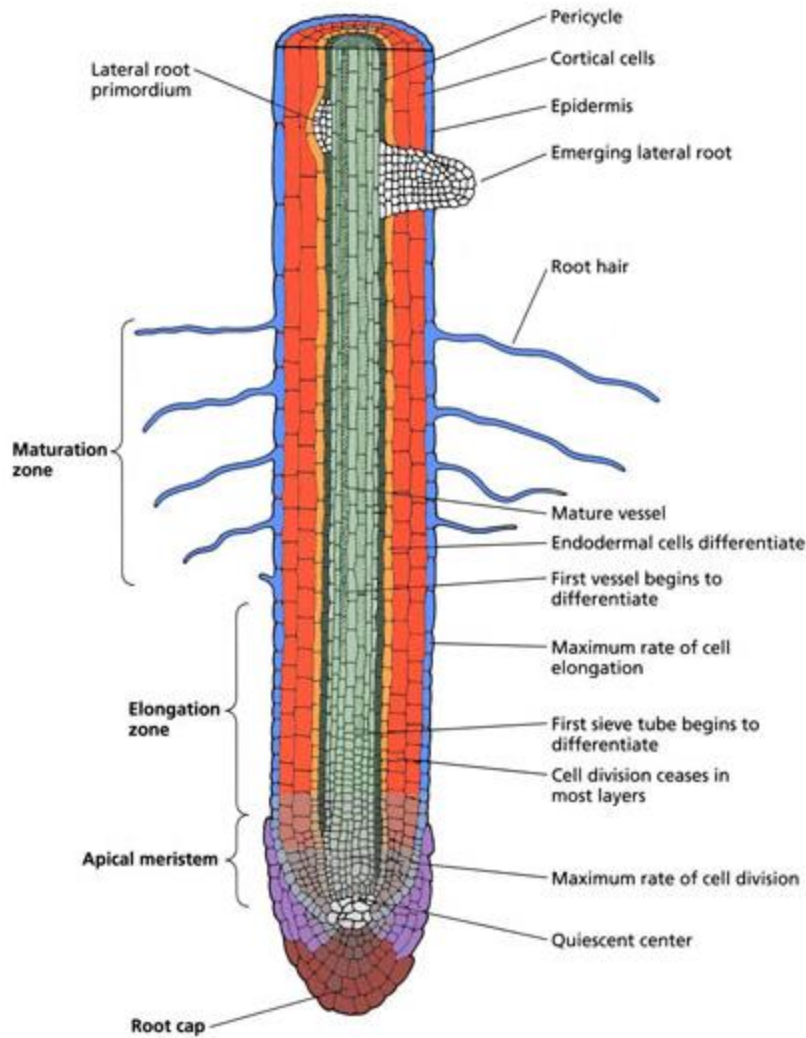


- Fast-growing, vertical shoots
- “Epicormic” – growing from dormant buds on older wood
- Suckers grow from roots or stem below graft
- Water sprouts grow from trunk above graft
- Both grow in response to plant stress (e.g. heavy pruning)

Architecture of a woody plant: twigs



Architecture of a woody plant: roots



Mature zone

- Most cells are mature
- Root hairs have sheared off
- Lateral roots may form

Maturing zone

- Root epidermis form root hairs to maximize surface area for absorbing nutrients
- Some cell lengthening

Elongation zone

- Cells differentiate (take on different functions)
- Cells grow longer – this is primary mechanism for root growth

Cell Division zone

- Makes more cells

Root Cap

- Perceives gravity
- Protects growing tip of root
- Excretes lubricant (mucilage)

Special needs

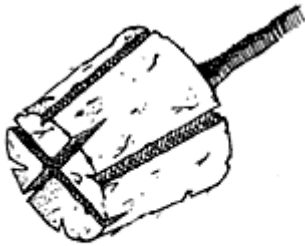
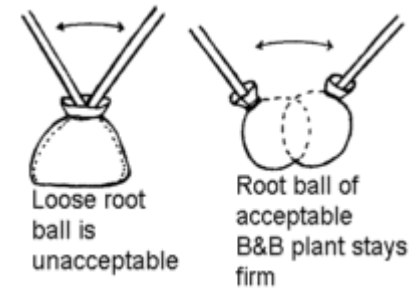


Figure 3. Cutting pattern for rootbound container stock.



Encircling root – potential to girdle the plant

Planting: Untangle / cut roots as needed



Planting: Find the root flare



Image 1. A container tree with the graft point circled. This is not the root flare.



Image 2. The visible roots are growing from adventitious buds on the trunk. This is not the tree's root flare

Planting: Find the root flare

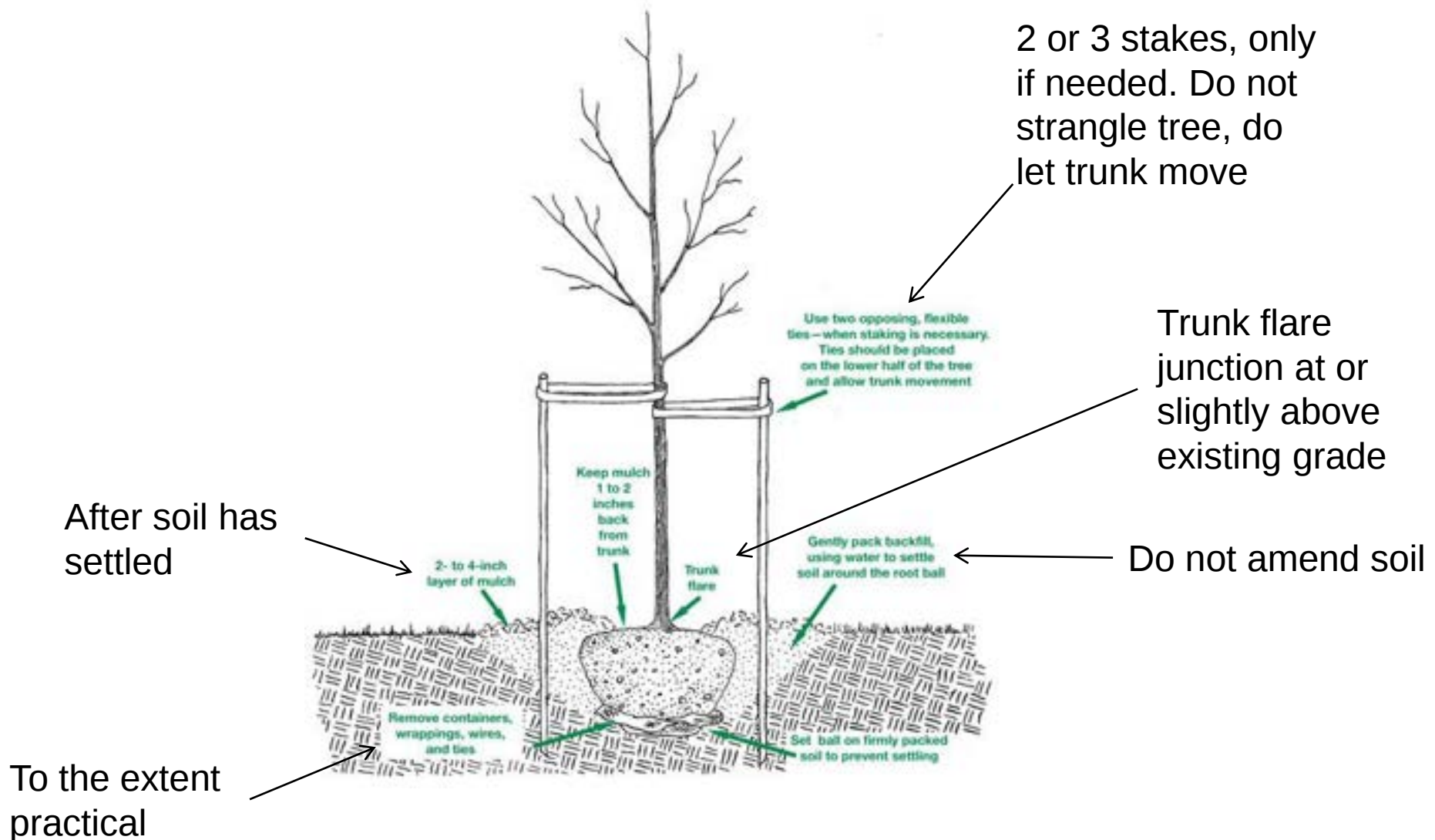


Image 3. The root growing across the trunk is considered a girdling root. It needs to be removed to allow proper future trunk growth.



Image 4. The root growing off the trunk is part of the tree's root flare. It is important that these roots are located prior to planting.

Planting a tree or shrub



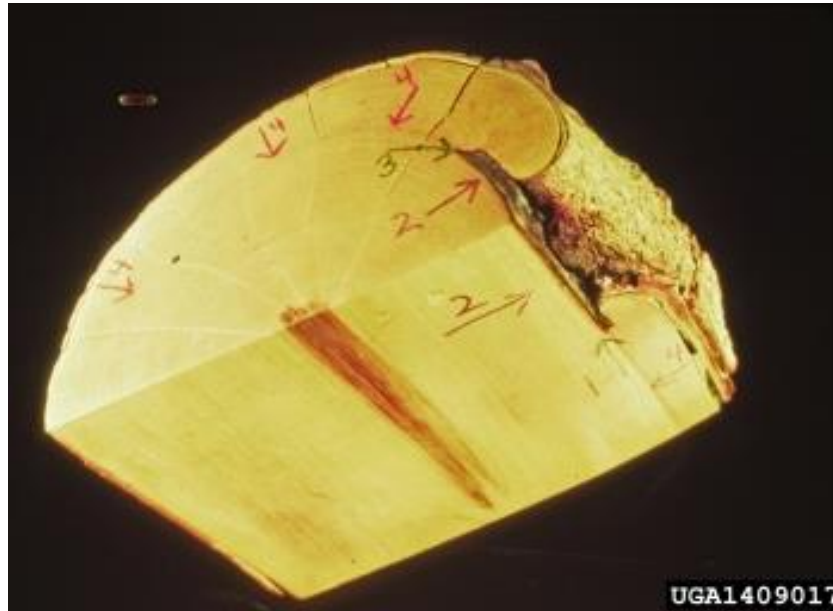
10 Rules for Planting Trees

1. Select the right tree for the site. To avoid serious problems, choose trees that are adapted to your location. Consider whether the tree produces nuisance fruit or if there are disease-resistant varieties available. For example, there are a number of crabapple varieties that are resistant to apple scab and rust diseases. Also consider the mature size of a tree to be sure you have enough room. See <https://hnr.k-state.edu/extension/info-center/recommended-plants/index.html> or ask a local nurseryman for suggestions for trees adapted to your area.
2. Keep the tree well watered and in a shady location until planting. When moving the tree, lift it by the root ball or pot and not by the trunk.
3. Before planting, remove all wires, labels, cords or anything else tied to the plant. If left on, they may eventually girdle the branch to which they are attached. The root flare (point where trunk and roots meet) should be visible. If it isn't, remove enough soil or media before planting so that it is.
4. Dig a proper hole. Make the hole deep enough so that the tree sits slightly above nursery level. Plant the tree on solid ground, not fill dirt. In other words, don't dig the hole too deep and then add soil back to the hole before placing the tree. The width of the planting hole is very important. It should be three times the width of the root ball. Loosening the soil outside the hole so it is five times the diameter of the root ball will allow the tree to spread its roots faster.
5. Remove all containers from the root ball. Cut away plastic and peat pots; roll burlap and wire baskets back into the hole, cutting as much of the excess away as possible. If you can remove the wire basket without disturbing the root ball, do it. If roots have been circling around in the container, cut them and fluff them out so they do not continue growing so that they circle inside the hole and become girdling roots later in the life of the tree.

10 Rules for Planting Trees

6. Backfill the hole with the same soil that was removed. Amendments such as peat moss likely do more harm than good. Make sure the soil that goes back is loosened - no clods or clumps. Add water as you fill to ensure good root to soil contact and prevent air pockets. There is no need to fertilize at planting. Note: Adding organic matter to larger area than just the planting hole can be beneficial, but it must be mixed in thoroughly with the existing soil and should "feather out" toward the outside edge of the area. This should be done before the planting hole is dug. Adding amendments to just the planting hole in heavy soil creates a "pot" effect that can fill with water and drown your new tree.
7. Don't cut back the branches of a tree after planting except those that are rubbing or damaged. The leaf buds release a hormone that encourages root growth. If the tree is cut back, the reduced number of leaf buds results in less hormone released and therefore fewer roots being formed.
8. Water the tree thoroughly and then once a week for the first season if there is insufficient rainfall.
9. Mulch around the tree. Mulch should be 2 to 4 inches deep and cover an area two the three times the diameter of the root ball. Mulching reduces competition from other plants, conserves moisture and keeps soil temperature closer to what the plants' roots prefer.
10. Stake only when necessary. Trees will establish more quickly and grow faster if they are not staked. However, larger trees or those in windy locations may need to be staked the first year. Movement is necessary for the trunk to become strong. Staking should be designed to limit movement of the root ball rather than immobilize the trunk.

“Healing”



Trees don't heal – they compartmentalize

1. Stops infection from traveling vertically
 2. Stops infection from traveling radially (inward)
 3. Stops infection from traveling laterally (around)
 4. Separates wood present at time of injury from new wood
- Then cambium forms new wood over the injury.

Why prune?

- Health – dead & damaged branches, disease
- Preventing future problems – crossing/rubbing branches, air circulation, structural integrity
- Productivity – flowers, fruit, aesthetics

Dead & Damaged



Disease



Black knot disease on prunus spp. (cherries)

Crossing / Rubbing



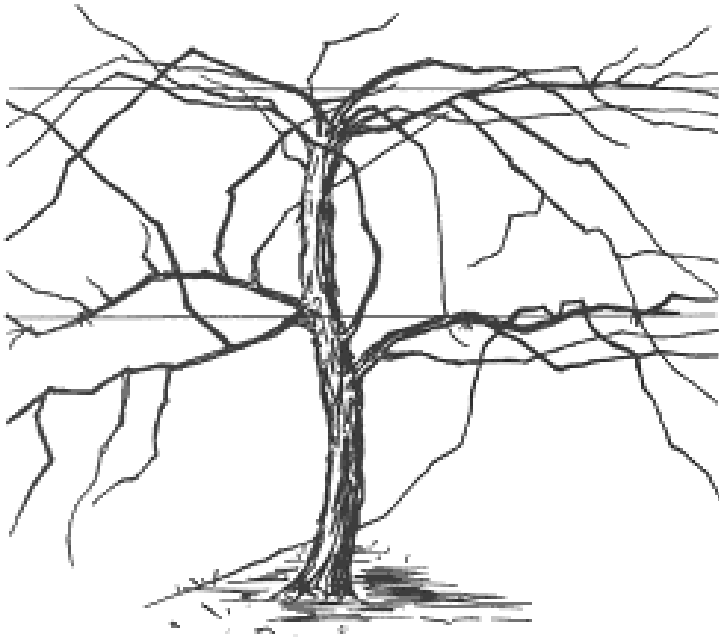
Air Circulation



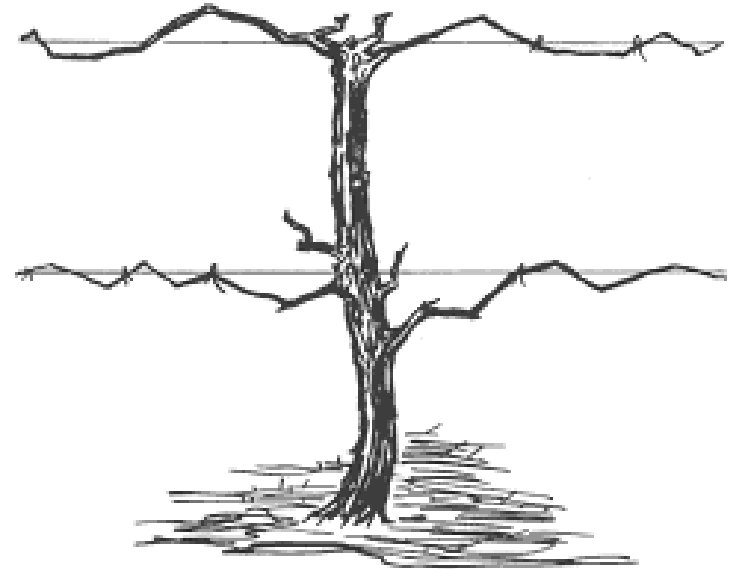
Structural Integrity



Productivity – Grapes

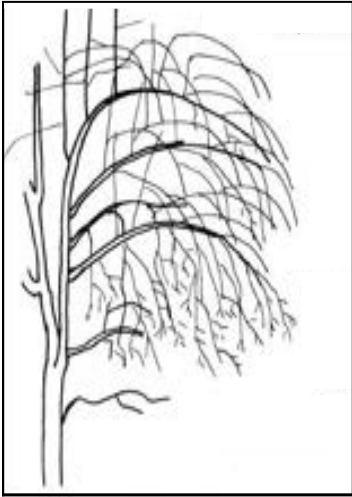


before

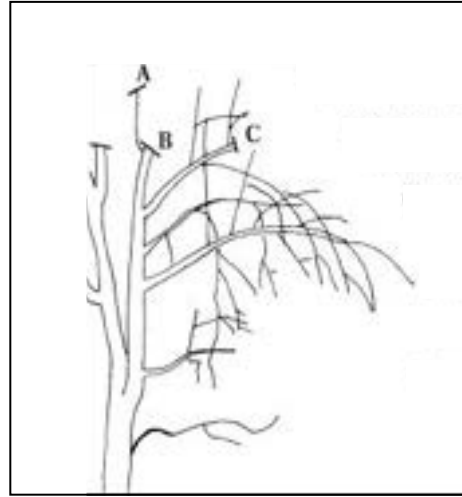


after

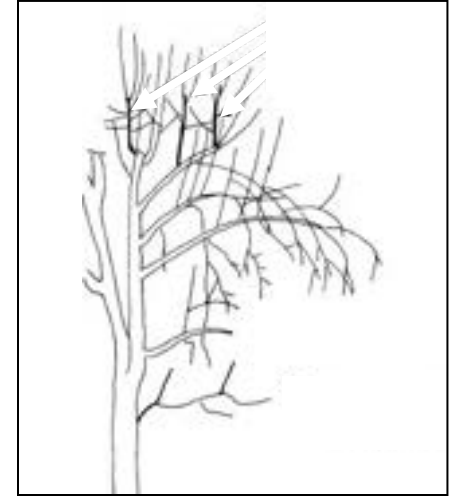
Productivity – Apples



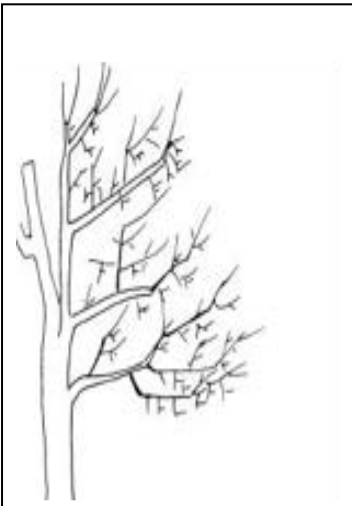
before



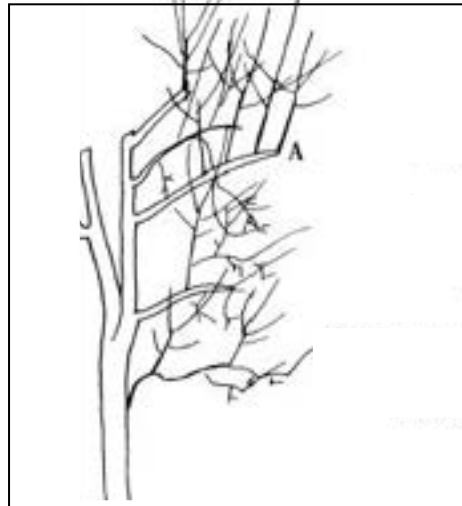
year 1



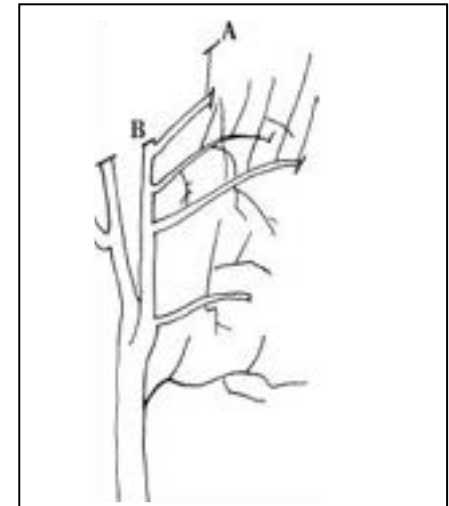
year 2



year 5



year 4



year 3

Productivity – Forsythia



before

after

<http://www.plantamnesty.org/assets/docs/Cyberlibrary/Shrubs/forsythias.pdf>

Productivity – Aesthetics



When to prune

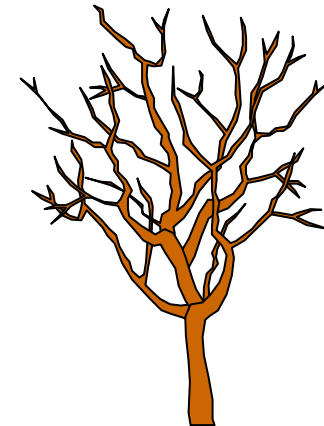
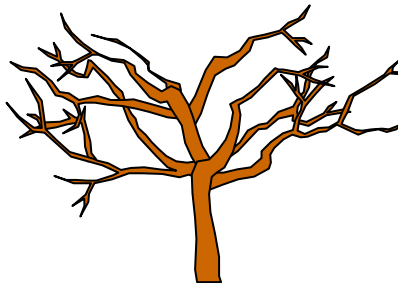
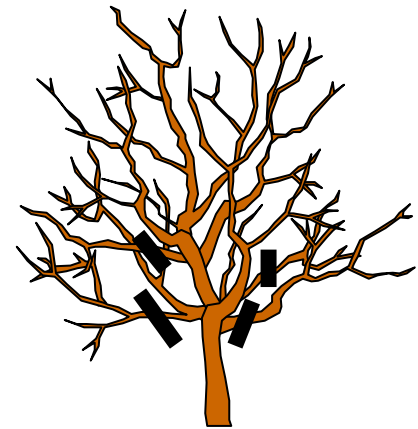
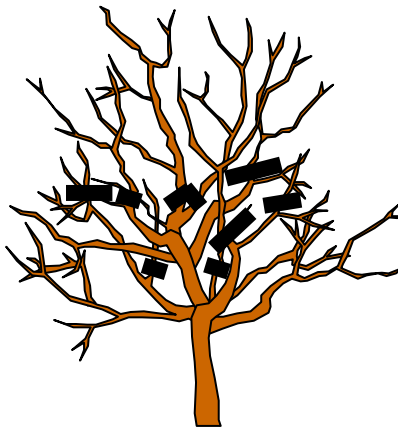
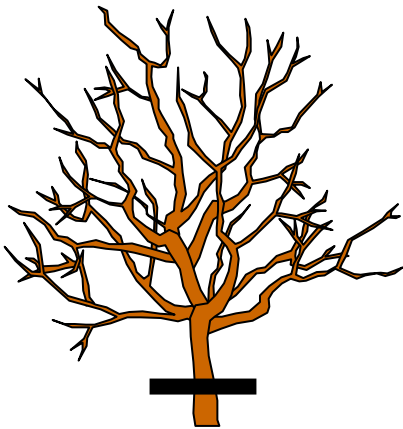
- Dormant pruning is best
 - Easy to see plant structure
 - No bugs / not much active bacteria – plant has a chance to heal before infection
 - If plant blooms on last year's growth (e.g. rhodos), will be removing some blossoms
 - Some plants bleed a lot in spring (e.g. maples) – opinions vary on whether this is harmful or just messy
- Don't prune between mid-July and leaf-fall
 - Plant may set new growth which will not harden in time for winter.
- If the plant needs pruning, just do it!

When to prune – Hydrangeas

- Fall, late winter, spring
 - *H. paniculata* (panicle hydrangea)
- Spring
 - *H. arborescens* (smooth hydrangea)
- After flowering
 - *H. macrophylla* (big-leaf hydrangea)
- Whenever you like
 - *H. macrophylla* 'Endless Summer'
- Not at all
 - *H. petolaris* (climbing hydrangea)

What to prune

- Health and prevention first
- What is your vision for this tree?





Apple tree – issue is that it's hard to mow past, in particular because of highlighted area.



Before



First cut



Before



First cut

Option 1: Remove whole trunk. I don't think I need to, but I can always do that another year.

Option 2: Remove the more horizontal branch at the fork



Before second cut



After second cut



Before

Two minor trunks are crossing/rubbing. Again, could remove both but don't need to. The one that starts on the left and leans right has a large old wound – I'll take remove one.



Before third cuts



After third cuts

There are 3 branches coming out of the middle trunk. Two of them rub against the right trunk – they needed to be removed. The third is weird but doing no damage – leave it for today.





Before fourth cut



After fourth cut

There are 3 branches coming out of the middle trunk further up. Two of them rub against the left trunk – they have to go. The third seems ok, for now.



Before

After





Four “thoughtful” cuts – 10 minutes

How to prune forks

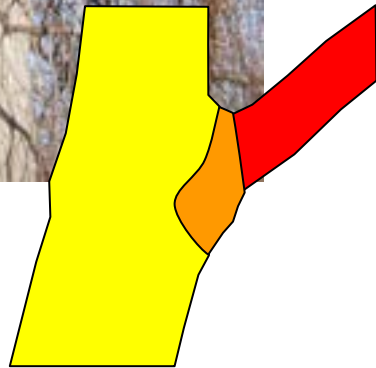


- As close to the fork as you can get without damaging the other side
- As small a diameter as you can manage, but
- Not horizontal (don't want water standing on the cut)

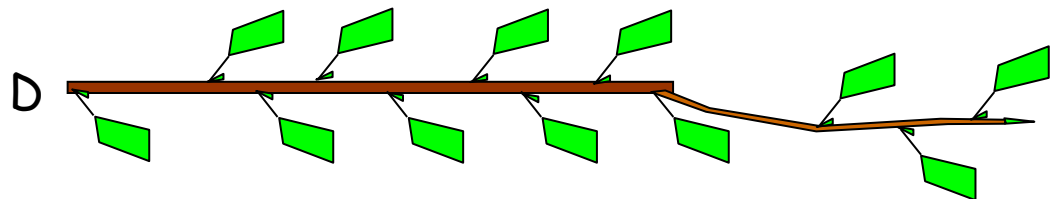
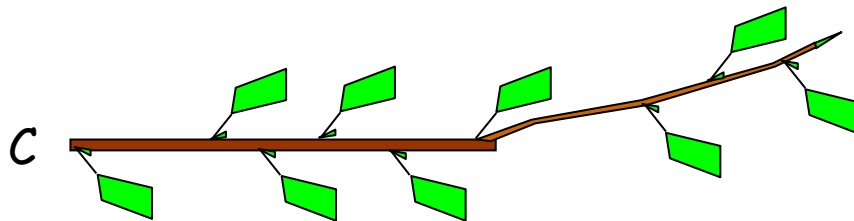
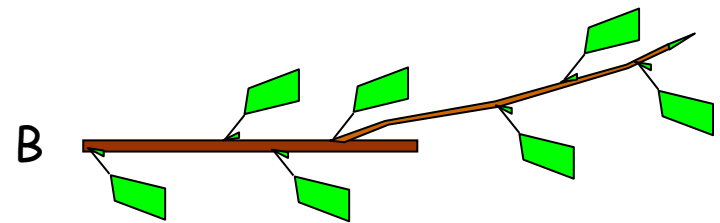
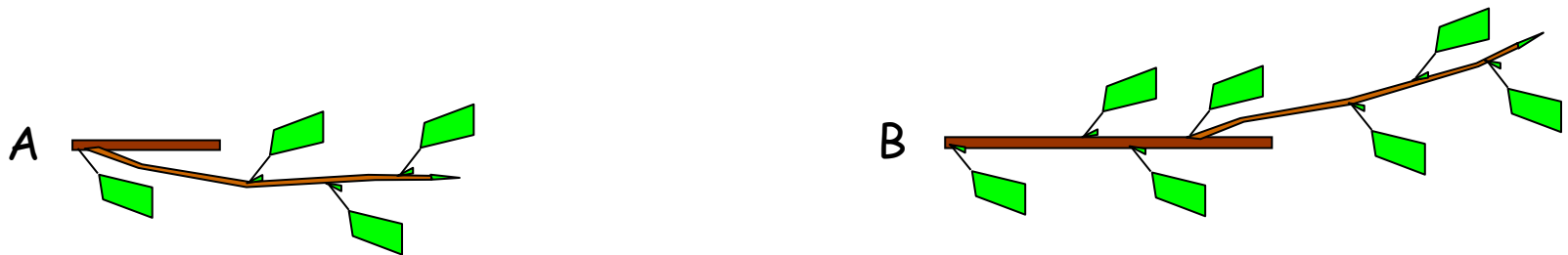
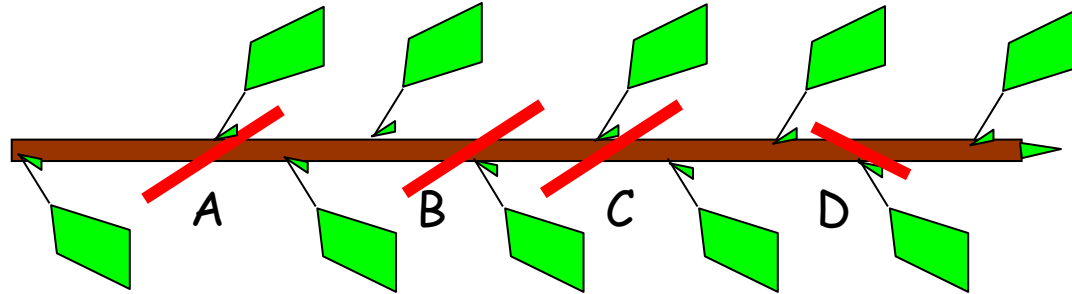
How to prune entire branches



- Flush with the outside of the collar.
- Not horizontal (not usually an issue)



How to prune twigs



Aim for about $\frac{1}{4}$
inch past a bud

How to prune evergreen twigs

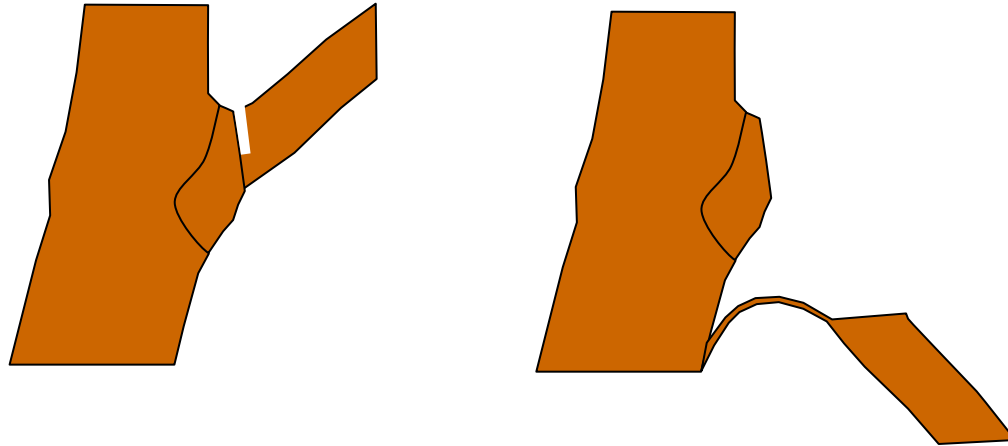
Remove this twig

Remove this twig

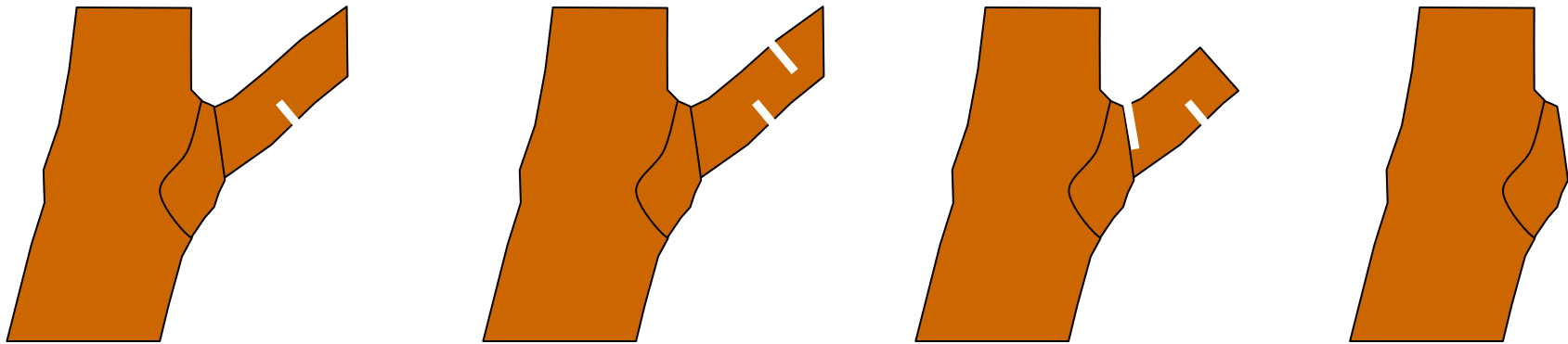


Cutting back to the nearest fork hides the pruning cut

How to prune big limbs



Single cut – limb weight may tear bark



Three cuts – ensures clean wound

How to prune giant limbs



Call a professional –
<http://www.massarbor.org/>

How not to prune giant limbs



Call a professional –
<http://www.massarbor.org/>

(This is not a professional)







Tools

- Hand pruners
 - Twigs through $\frac{3}{4}$ "
 - Bypass better than anvil
- Loppers
 - Good for rough work up to 3"
- Hand saws
 - Safe, precise, good for cleanup
- Chain saws
 - Dangerous, powerful
 - Get Engtex® cut-retardant material protection
- Electric loppers
 - Safer than a chain saw, can't cut large branches
- Saber Saw / Reciprocating Saw
 - Less work than hand saw / safer than chain saw
 - Limited by blade length



References

- Web sites

- <http://hort.cals.cornell.edu/cals/hort/extension/publications.cfm>
 - Especially “Pruning: An Illustrated Guide to Pruning Ornamental Trees and Shrubs”
 - But also “The Cornell Guide for Planting and Maintaining Trees and Shrubs”
 - And “Cornell Guide to Growing Fruit at Home”
- <https://hnr.k-state.edu/extension/horticulture-resource-center/horticulture-newsletter/>

- Books

- Dirr, Michael A. Manual of Woody Landscape Plants. Illinois: Stipes Publishing, 1990.
- Reich, Lee. The Pruning Book. Newtown: The Taunton Press, 2010.
- Lonnee, Debbie et alia, Growing Shrubs and Small Trees in Cold Climates. University of Minnesota Press, 2011.

Questions?