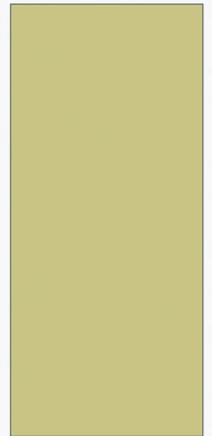


# SUSTAINABLE LANDSCAPE INSTALLATION & MAINTENANCE

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TRAINING COLUMBIA, SC 13JULY2016



# PERENNIAL PLANT INSTALLATION & MAINTENANCE

- Well-drained fertile soil
- Proper sun exposure
- Proper planting techniques
- Proper placement and spacing
- Mulch
- Proper maintenance



Photo by Walker Massey

*Echinacea purpurea* in  
Sustainable Landscape  
Demonstration Garden Clemson  
University McGinty Mall

# SOIL PREPARATION

- Test soil for organic matter
- Till soil
- Increase organic matter into soil
- Raised beds
- Avoid compaction



# ORGANIC MATTER



Photo by Ellen Vincent

6" leaf mold tilled to 12" depth in Sustainable Landscape Demonstration Garden, Clemson University McGinty Mall

# SOIL TIPS

- Drainage is essential for healthy plants
- Moderate fertility is the goal for healthy plants
- Planting too deep can cause crown rot, an ancient perennial hazard
- All plants require moisture, especially during drought, for best display
- Water deeply, but only when the soil is dry or almost dry
- Vegetative mulch increases soil organic matter content as it decomposes
- Avoid compacting soil



# PROPER SUN EXPOSURE

- Plants requiring **full sun should receive 6 or more hours** of unobstructed sunlight per day
- With inadequate sunlight, perennials may:
  - Bloom less or not at all
  - Stretch toward the light
  - Appear leggy
  - Exhibit faded foliar color

# SUN SEEKING PERENNIALS



Leaning



Color distortion

Photos by Ellen Vincent

# PROPER SUN EXPOSURE

- Plants requiring **part shade should receive less than 5 hours of direct sunlight per day**
- Prefer **shade from afternoon sun**
- Plants receiving too much sun may:
  - Exhibit foliar browning
  - Appear stunted
  - Show faded foliar color

# SUN SCORCHED PERENNIALS



Needs shade from sun

7/17/2016



Proper shaded sun exposure

Photos by Ellen Vincent

# PROPER PLANTING TECHNIQUES

- Plant right plant in the right place
- Fall planting is best because it provides time for perennial roots to become established before onset of summer heat and drought
- Loosen roots before placing in planting hole
- Crown of plant should be level with the ground or slightly higher



Photo by Ellen Vincent

Perennial installation at Sustainable Landscape Demonstration Garden, Clemson University McGinty Mall

# PROPER PLANTING TECHNIQUES



Photo by Ellen Vincent

Perennial installation at Sustainable Landscape  
Demonstration Garden, Clemson University McGinty Mall

# DEMONSTRATION



[http://www.willowaynurseries.com/gallery/photos/Echinacea%20Sombrero%20Salsa%20Red%20\(1\).JPG](http://www.willowaynurseries.com/gallery/photos/Echinacea%20Sombrero%20Salsa%20Red%20(1).JPG)

# PROPER PLACEMENT AND SPACING

- Mass planting is popular
- Space plants according to their mature widths and heights. Many perennials will be spaced 18" apart

Renee  
Byrd (Byrd  
Landscape  
Design)  
SCBG  
Children's  
Garden  
design



7/17/2016

# PROPER SPACING



Photo by Ellen Vincent

# AVOID OVERCROWDING

- Disease and insect problems
- Frequent division



# MULCH

- Mulch should not touch the stem of the plant or cover the crown



# PERENNIAL DISCUSSION

- What has been the perennial problem for you in the past?

Or

- What one thing have you learned thus far that you intend to use?

# TREE LANDSCAPE INSTALLATION & MAINTENANCE

- Planting
- Fertilization
- Irrigation
- Pruning
- Managing the waste stream

(Cook & VanDerZanden, 2011, p. 133).

# PLANTING

Planting goal: Root to soil contact

- Goal is to place plant roots in direct contact with the soil in which they will be growing.

(Cook & VanDerZanden, 2011, p. 133).

# PLANTING: BARE ROOT

Field grown bare root stock are plants grown in soil that are harvested with mechanical diggers when dormant (late fall or early winter). 95% of the roots are lost (left in the soil). Dug plants are stored in sawdust or mulch until they are shipped out in early spring prior to leaf-out.



[http://www.google.com/imgres?q=bare+root+stock&hl=en&client=firefox-a&rls=org.mozilla:en-US:official&biw=1440&bih=707&gbv=2&tbn=isch&tbnid=shgcMPaCP2VmzM:&imgrefurl=http://www.southfayetteconservation.org/Fishing%2520Run%2520Planting%2520Day.htm&docid=XYau5QHvUV-iOM&imgurl=http://www.southfayetteconservation.org/Bare%2520Root%2520Nursery%2520Stock.JPG&w=700&h=525&ei=\\_VCtTp35Bobqtgf8uLivBQ&zoom=1&iact=hc&vpx=575&vpy=164&dur=5610&hovh=194&hovw=259&tx=152&ty=104&sig=105866139933167536295&page=1&tbnh=163&tbnw=222&start=0&ndsp=18&ved=1t:429,r:2,s:0](http://www.google.com/imgres?q=bare+root+stock&hl=en&client=firefox-a&rls=org.mozilla:en-US:official&biw=1440&bih=707&gbv=2&tbn=isch&tbnid=shgcMPaCP2VmzM:&imgrefurl=http://www.southfayetteconservation.org/Fishing%2520Run%2520Planting%2520Day.htm&docid=XYau5QHvUV-iOM&imgurl=http://www.southfayetteconservation.org/Bare%2520Root%2520Nursery%2520Stock.JPG&w=700&h=525&ei=_VCtTp35Bobqtgf8uLivBQ&zoom=1&iact=hc&vpx=575&vpy=164&dur=5610&hovh=194&hovw=259&tx=152&ty=104&sig=105866139933167536295&page=1&tbnh=163&tbnw=222&start=0&ndsp=18&ved=1t:429,r:2,s:0)

(Cook & VanDerZanden, 2011, p. 133).

# PLANTING: BARE ROOT

- Plants must be planted while dormant, early in spring.
- Small window of opportunity for planting in the landscape.
- Pro: plants are purchased free of soil so roots have good soil contact.



[http://www.google.com/imgres?q=bare+root+stock&hl=en&client=firefox-a&rls=org.mozilla:en-US:official&biw=1440&bih=707&gbv=2&tbn=isch&tbnid=1ulvwb3lGFQdtM:&imgrefurl=http://hollyhillnurseries.wordpress.com/2011/09/05/bare-root-plants-are-now-available-for-pre-order/&docid=Bb9krppJuOZCvM&imgurl=http://hollyhillnurseries.files.wordpress.com/2011/09/bare-root-conifers-08-31-113.jpg&w=264&h=300&ei=\\_VCfTp35Bobqtgf8uLivBQ&zoom=1&iact=hc&vpx=991&vpy=354&dur=131&hovh=239&hovw=211&tx=116&ty=215&sig=105866139933167536295&page=1&tbnh=159&tbnw=140&start=0&ndsp=18&ved=1t:429,r:16,s:0](http://www.google.com/imgres?q=bare+root+stock&hl=en&client=firefox-a&rls=org.mozilla:en-US:official&biw=1440&bih=707&gbv=2&tbn=isch&tbnid=1ulvwb3lGFQdtM:&imgrefurl=http://hollyhillnurseries.wordpress.com/2011/09/05/bare-root-plants-are-now-available-for-pre-order/&docid=Bb9krppJuOZCvM&imgurl=http://hollyhillnurseries.files.wordpress.com/2011/09/bare-root-conifers-08-31-113.jpg&w=264&h=300&ei=_VCfTp35Bobqtgf8uLivBQ&zoom=1&iact=hc&vpx=991&vpy=354&dur=131&hovh=239&hovw=211&tx=116&ty=215&sig=105866139933167536295&page=1&tbnh=159&tbnw=140&start=0&ndsp=18&ved=1t:429,r:16,s:0)

(Cook & VanDerZanden, 2011, p. 134).

# PLANTING: BALLED & BURLAPPED

- Typically used for conifers, large deciduous trees, and many shrubs.
- Field grown stock are dug with mechanical spades and placed in wire baskets lined with burlap and secured with twine.
- 95% of the roots are left behind. Plants may be stocked and then planted anytime during the growing season.

(Cook & VanDerZanden, 2011, p. 135).



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# PLANTING: BALLED & BURLAPPED

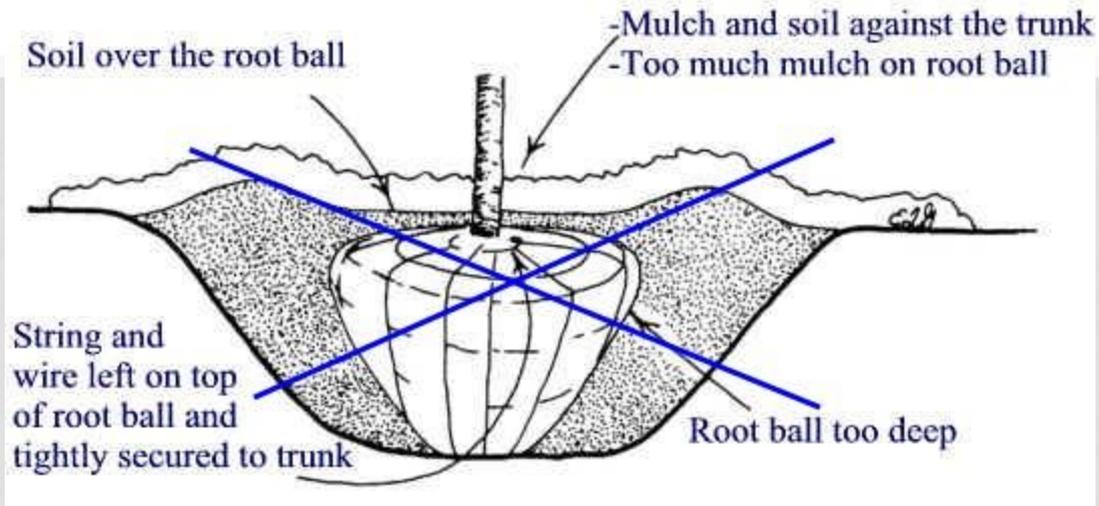
- Plants must be kept irrigated so the ball does not dry out excessively.
- Plants are heavy and care must be taken when lifting or moving to not fracture the root ball.
- Plants should be lifted and carried by the root ball not the trunk.
- Transport under cover-air exposure causes desiccation.

(Cook & VanDerZanden, 2011, p. 135).



[http://www.google.com/imgres?q=moving+ball+and+burlapped+stock&num=10&hl=en&client=firefox-a&rls=org.mozilla:en-US:official&gbv=2&biw=1440&bih=707&tbn=isch&tbnid=Ee68b\\_sNOBWHmM:&imgrefurl=http://tinaramsey.blogspot.com/2009/03/planting-balled-and-burlapped.html&docid=S2iiP4bgHyBxIM&imgurl=http://4.bp.blogspot.com/\\_VipTnDBrXd4/SbsDSx2TZrl/AAAAAAAAAD-0/QJrms-aQVI0/s400/100\\_5936.JPG&w=400&h=267&ei=t1atTuTjEse3tgfGu\\_3RDg&zoom=1&iact=hc&vpx=200&vpy=342&dur=894&hovh=183&hovw=275&tx=150&ty=103&sig=105866139933167536295&sqi=2&page=1&tbnh=160&tbnw=235&start=0&ndsp=19&ved=1t:429.r:7.s:0](http://www.google.com/imgres?q=moving+ball+and+burlapped+stock&num=10&hl=en&client=firefox-a&rls=org.mozilla:en-US:official&gbv=2&biw=1440&bih=707&tbn=isch&tbnid=Ee68b_sNOBWHmM:&imgrefurl=http://tinaramsey.blogspot.com/2009/03/planting-balled-and-burlapped.html&docid=S2iiP4bgHyBxIM&imgurl=http://4.bp.blogspot.com/_VipTnDBrXd4/SbsDSx2TZrl/AAAAAAAAAD-0/QJrms-aQVI0/s400/100_5936.JPG&w=400&h=267&ei=t1atTuTjEse3tgfGu_3RDg&zoom=1&iact=hc&vpx=200&vpy=342&dur=894&hovh=183&hovw=275&tx=150&ty=103&sig=105866139933167536295&sqi=2&page=1&tbnh=160&tbnw=235&start=0&ndsp=19&ved=1t:429.r:7.s:0)

# PLANTING: BALLED & BURLAPPED



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- Post planting irrigation problems occur when the soil of the root ball differs from the landscape soil.
- Post planting problems occurs when twine is not removed from ball or stem.

(Cook & VanDerZanden, 2011, p. 135)

- Post planting problems occur if B&B material is planted too deep (root flare is buried in the soil) both in the burlap and in the ground (E. Vincent).

# PLANTING: BALLED & BURLAPPED

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# PLANTING: CONTAINERIZED

- Plants are typically grown in plastic containers filled with lightweight organic growing media (ground bark or a mixture of bark, sand, soil, or other material).
- Container grown plants are easily transported and can be planted at any time of the year.

(Cook & VanDerZanden, 2011, p. 135)



Photo by Ellen Vincent

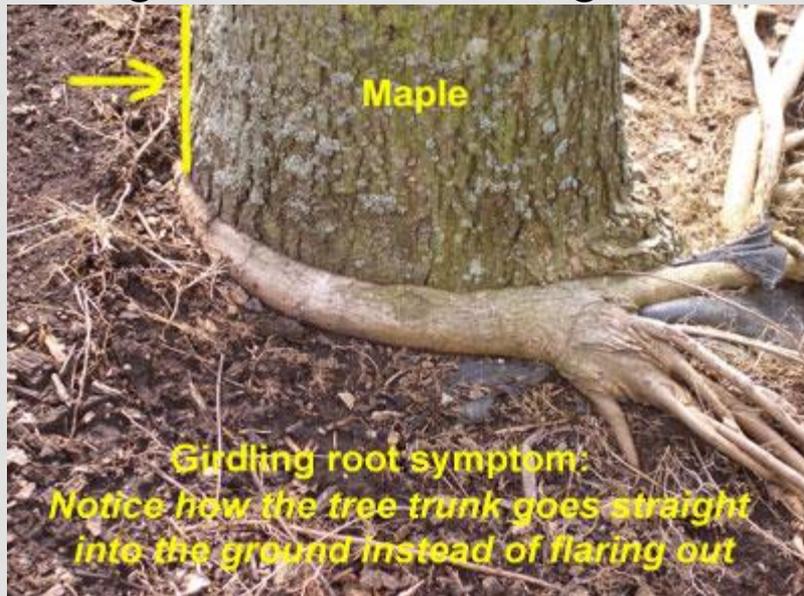
Rolling Hills Nursery & Landscape  
Rock Hill, SC

# PLANTING: CONTAINERIZED

- Root systems tend to be vigorous and may become distorted (forced to the surface or out the holes in the bottom of the pot. )
- Roots that begin to circle around the top are called girdling roots. (Cook & VanDerZanden, 2011, p. 135)

# PLANTING: CONTAINERIZED

Girdling roots restrict root growth and nutrient uptake, may cause death



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[http://www.google.com/imgres?q=girdling+root&hl=en&client=firefox-a&rls=org.mozilla:en-US:official&biw=1440&bih=707&gbv=2&tbm=isch&tbnid=3ufSPBCPa\\_R2oM:&imgrefurl=http://www.ipm.iastate.edu/ipm/hortnews/2005/5-4-2005/roots.html&docid=fXV3JY8AgRbNRM&imgurl=http://www.ipm.iastate.edu/ipm/hortnews/2005/5-4-2005/girdling\\_root\\_flynn.jpg&w=500&h=375&ei=8aqtTqCmL9LMtgef8ntDg&zoom=1&iact=hc&vpx=635&vpy=163&dur=3051&hovh=194&hovw=259&tx=139&ty=104&sig=105866139933167536295&page=1&tbnh=162&tbnw=242&start=0&ndsp=15&ved=1t:429,r:2,s:0](http://www.google.com/imgres?q=girdling+root&hl=en&client=firefox-a&rls=org.mozilla:en-US:official&biw=1440&bih=707&gbv=2&tbm=isch&tbnid=3ufSPBCPa_R2oM:&imgrefurl=http://www.ipm.iastate.edu/ipm/hortnews/2005/5-4-2005/roots.html&docid=fXV3JY8AgRbNRM&imgurl=http://www.ipm.iastate.edu/ipm/hortnews/2005/5-4-2005/girdling_root_flynn.jpg&w=500&h=375&ei=8aqtTqCmL9LMtgef8ntDg&zoom=1&iact=hc&vpx=635&vpy=163&dur=3051&hovh=194&hovw=259&tx=139&ty=104&sig=105866139933167536295&page=1&tbnh=162&tbnw=242&start=0&ndsp=15&ved=1t:429,r:2,s:0)

# PLANTING: CONTAINERIZED

- Container plants have high transplant survival rates.
- Containerized spring purchased and installed plants usually establish well.
- Containerized plants that sit in containers all season or longer may develop girdling roots or distorted roots or circling roots.

(Cook & VanDerZanden, 2011, p. 135)

- Containerized plants may be planted too deep in the container (the root flare is buried in the soil) and then too deep in the landscape (E. Vincent).

# PLANTING: CONTAINERIZED

Difficult root systems-best to avoid



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# PLANTING: CONTAINERIZED

- Remove the container and recycle.
- Identify root flare and remove excess soil across the top of the root-ball.
- Cut girdling or circling roots.
- Create an interface between container soil and landscape soil so water will travel uniformly through it.

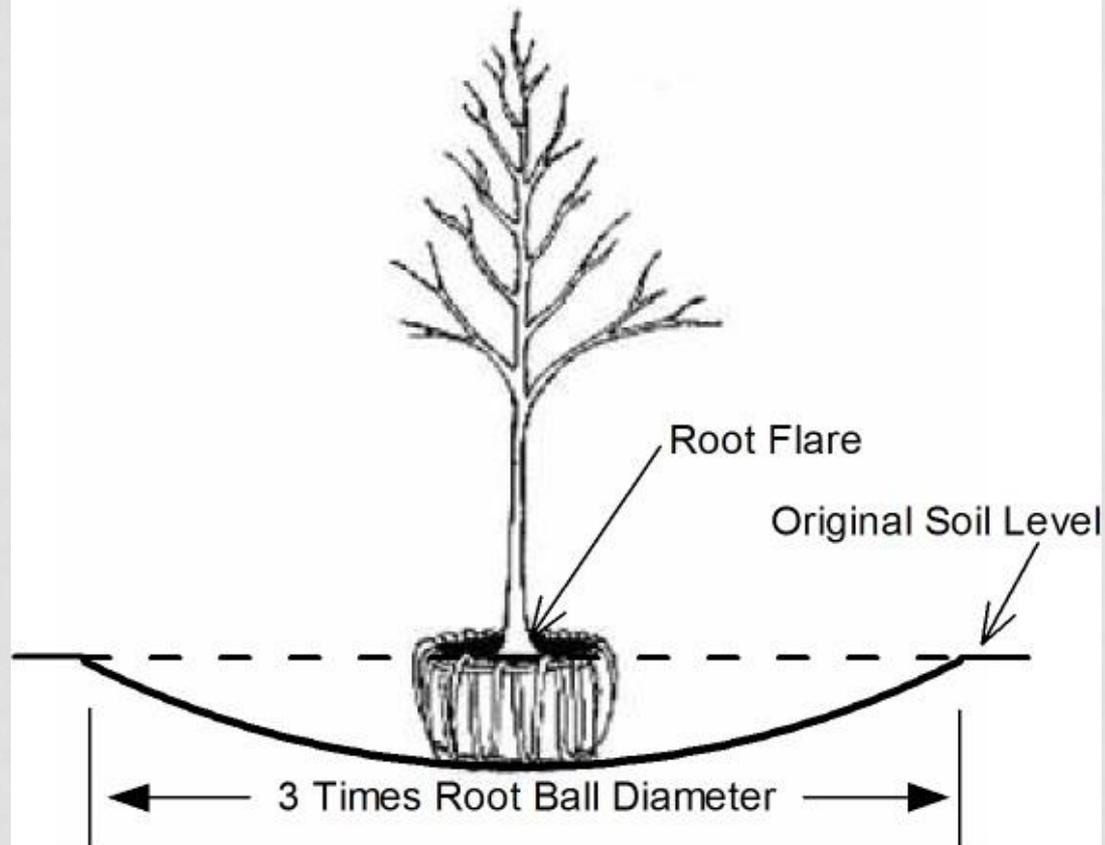
# PLANTING BMPS

- Planting hole should be wide.
- Planting hole should be 2-3 times the diameter of the root- ball.
  - A plant root ball that is 12" across should be placed in a hole that is 24-36" wide.
  - Taper the sides of the hole so it is narrow at the bottom. Most roots develop laterally (horizontally) rather than downward.

(Cook & VanDerZanden, 2011, p. 135)

- Planting holes should be just the depth of the root ball (after the root flare is identified). Never deeper due to potential of soil settling (E. Vincent).

# PLANTING BMPS



# SHOW ME YOUR ROOT FLARE!

- **Root flare is the root-stem juncture** (Cook & VanDerZanden, 2011, p. 136).
- **Root flare (root-stem juncture) should be located at or slightly above grade level.**
- Buried root flares result in plant stress, pathogen invasion, girdling roots, and or death (often slow death) (E. Vincent).

# BURIED ROOT FLARE

- Plants arrive to garden centers and landscapes in containers (including B&B) and they are **PLANTED TOO DEEP!!!**



# BURIED ROOT FLARE

- Trees that are being planted too deep in the container are also being planted **TOO DEEP IN THE LANDSCAPE!!!**



# PLANTING TOO DEEP IS EPIDEMIC

- 93% of professionally-planted trees (Smiley and Booth 2000)
- 75% of nursery-grown trees (Maynard 1995)
- Arborists intuitively know deep planted trees fail



# ROOT FLARES



*Carya illinoensis*



*Metasequoia glyptostoboides*



*Quercus nigra*

# ROOT FLARE CLARIFICATION

- **Not all trees show a distinct curve where they enter the soil.** This is okay and quite natural.
- **The root flare is the root-stem juncture.** The place where the topmost roots emerge from the trunk.



# CLEMSON UNIVERSITY RESEARCH

- Effects of deep planting on landscape tree performance
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## Two species

- 'October Glory' red maples
- Yoshino cherries

## Treatments

- Control (0 inches deep)
- 6 inches deep
- 12 inches deep

Randomized Complete Block





# Measurements

- Winter 1996: Trees planted
- Late spring 1997: Aboveground measurements
- Winter 1997: Root cores
- Winter 2000: Airspade excavations



# RESULTS FOR CHERRIES

- Two years after transplant, 50% of the 6" and 12" deep planted cherries had died.
- All control cherries lived.
- No girdling root development noticed on cherries.

# RESULTS FOR MAPLES

- Planting depth did not affect the short term survival of maples, but did influence the development of girdling roots.
- 4 years after transplant, control maples exhibited 14% of their root collar/trunk circumference encircled by girdling or potentially girdling roots; 6" deep had 48%; and 12" deep 71% formation of girdling or potentially girdling roots.

# RESULTS

- So, while cherries die from deep planting in the short term, maples are likely to suffer injury in the long-term from girdling root development.



# CONCLUSION

- Results are consistent with arborists' observations that deep planting is a significant source of stress in landscape trees.



# GROUP EXERCISE

- In the area surrounding Lakehouse locate:
- Tree root flare
- Tree girdling root

# PLANTING BMPS

- Backfill with unamended soil or with soil from an amended planting bed.
- Firmly press soil in place but do not pound the soil (avoid compaction).
- Apply mulch and water deeply.

# AMENDMENTS

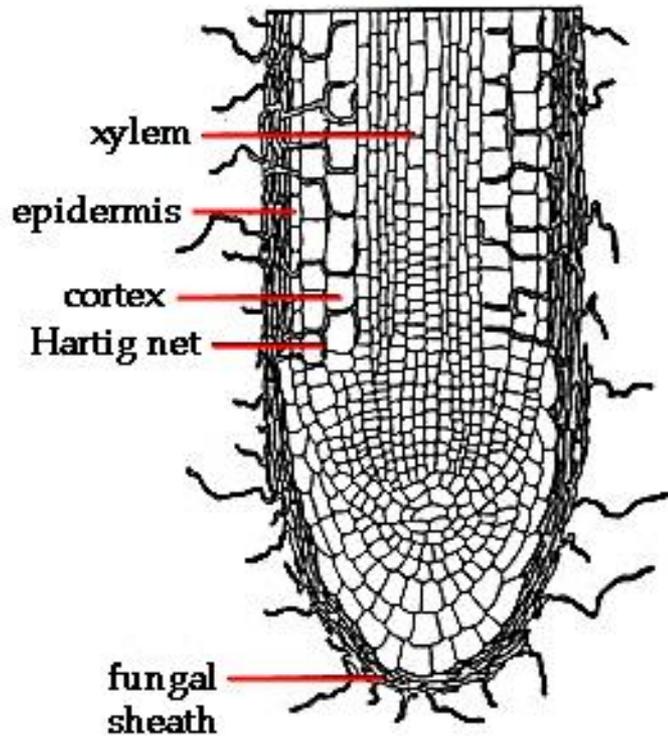
- Plants may be successfully planted in unamended soils.
- Select the plant that will live in the found soil on site (right plant right place) (E. Vincent).
- Highly compacted soils (or disturbed soils with poor structure) may require soil replacement or large scale amendments.
- Amending soil in the planting hole of highly compacted soil is not recommended due to prolonged accumulation of water in the planting hole (bathtub effect-lack of drainage).

# AMENDMENTS

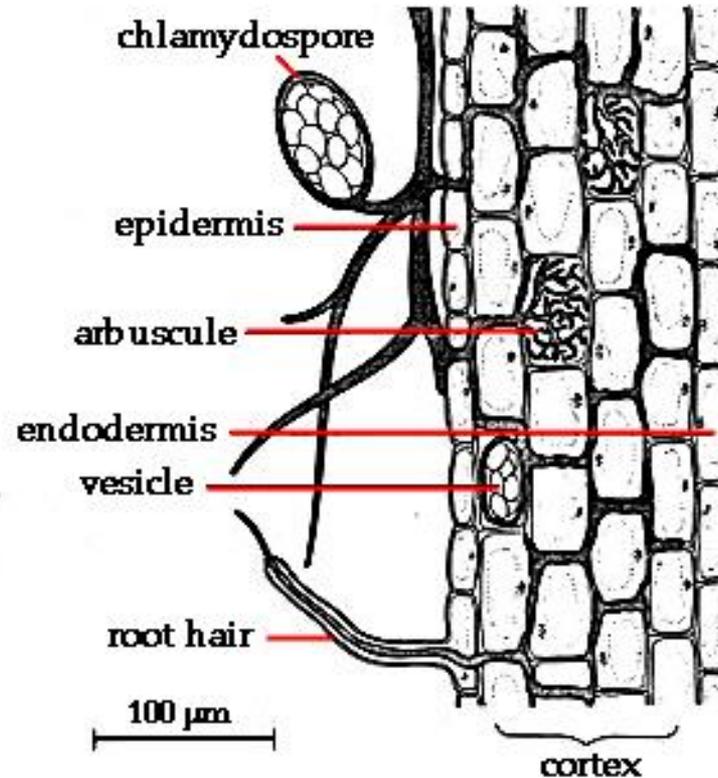
- Microbial amendments include mycorrhizae, compost tea, etc.
- The objective is to reintroduce beneficial microorganisms into the soil-root zone.
- There is a symbiotic relationship between some plant roots, soil, and mycorrhizae (fungus) in the forest environment that facilitates nutrient uptake and/or drought tolerance.
- Research at Clemson (Wells) showed that many commercial mycorrhizae products did not contain viable organisms.
- More research is needed.

# MYCORRHIZAE

**Ectomycorrhizae**



**Endomycorrhizae**



- [http://www.google.com/imgres?q=mycorrhizae&hl=en&client=firefox-a&sa=G&rls=org.mozilla:en-US:official&biw=1440&bih=707&gbv=2&tbnm=isch&tbnid=HV8jYUn8Tik46M:&imgrefurl=http://www.botany.hawaii.edu/faculty/webb/bot311/bot311-00/roots/Mycorrhizae.htm&docid=M\\_kziW6Ut\\_rYHM&imgurl=http://www.botany.hawaii.edu/faculty/webb/bot311/bot311-00/roots/EndoEctoMycDiag.jpg&w=555&h=341&ei=ILWfTontNs7LtgeGuf2bAw&zoom=1&iact=hc&vpx=178&vpy=349&dur=1939&hovh=176&hovw=287&tx=149&ty=104&sig=105866139933167536295&page=1&tbnh=124&tbnw=202&start=0&ndsp=18&ved=1t:429,r:6,s:0](http://www.google.com/imgres?q=mycorrhizae&hl=en&client=firefox-a&sa=G&rls=org.mozilla:en-US:official&biw=1440&bih=707&gbv=2&tbnm=isch&tbnid=HV8jYUn8Tik46M:&imgrefurl=http://www.botany.hawaii.edu/faculty/webb/bot311/bot311-00/roots/Mycorrhizae.htm&docid=M_kziW6Ut_rYHM&imgurl=http://www.botany.hawaii.edu/faculty/webb/bot311/bot311-00/roots/EndoEctoMycDiag.jpg&w=555&h=341&ei=ILWfTontNs7LtgeGuf2bAw&zoom=1&iact=hc&vpx=178&vpy=349&dur=1939&hovh=176&hovw=287&tx=149&ty=104&sig=105866139933167536295&page=1&tbnh=124&tbnw=202&start=0&ndsp=18&ved=1t:429,r:6,s:0)

# POST PLANTING CARE

Goal is to encourage rapid establishment of roots and to enhance plant vigor.

(Cook & VanDerZanden, 2011, p. 139)

Methods include:

- Minimizing competition
- Staking
- Mulching
- Fertilization
- Irrigating
- Pruning

# MINIMIZING COMPETITION

- Goal is to rapid establishment of roots and to enhance plant vigor.

(Cook & VanDerZanden, 2011, p. 139)



Photo by Ellen Vincent

# MINIMIZING COMPETITION

- Create a free space around the base of newly planted trees to protect them from mechanical damage (weed eaters, mowers, etc.)
- Grass roots compete for nitrogen and water. A circular space of 4-5 feet diameter can minimize competition during the establishment phase.

(Cook & VanDerZanden, 2011, p. 139)



Photo by Ellen Vincent

Gateway Park, Clemson

# STAKING

- Staking is rarely necessary.
- Staking is high wind areas or to avoid vandalism is common.
- Ties for stakes should be low and loose.
- Trees need to move (sway) in order to develop trunk diameter growth and vibrant root growth.

(Cook & VanDerZanden, 2011, p. 139)

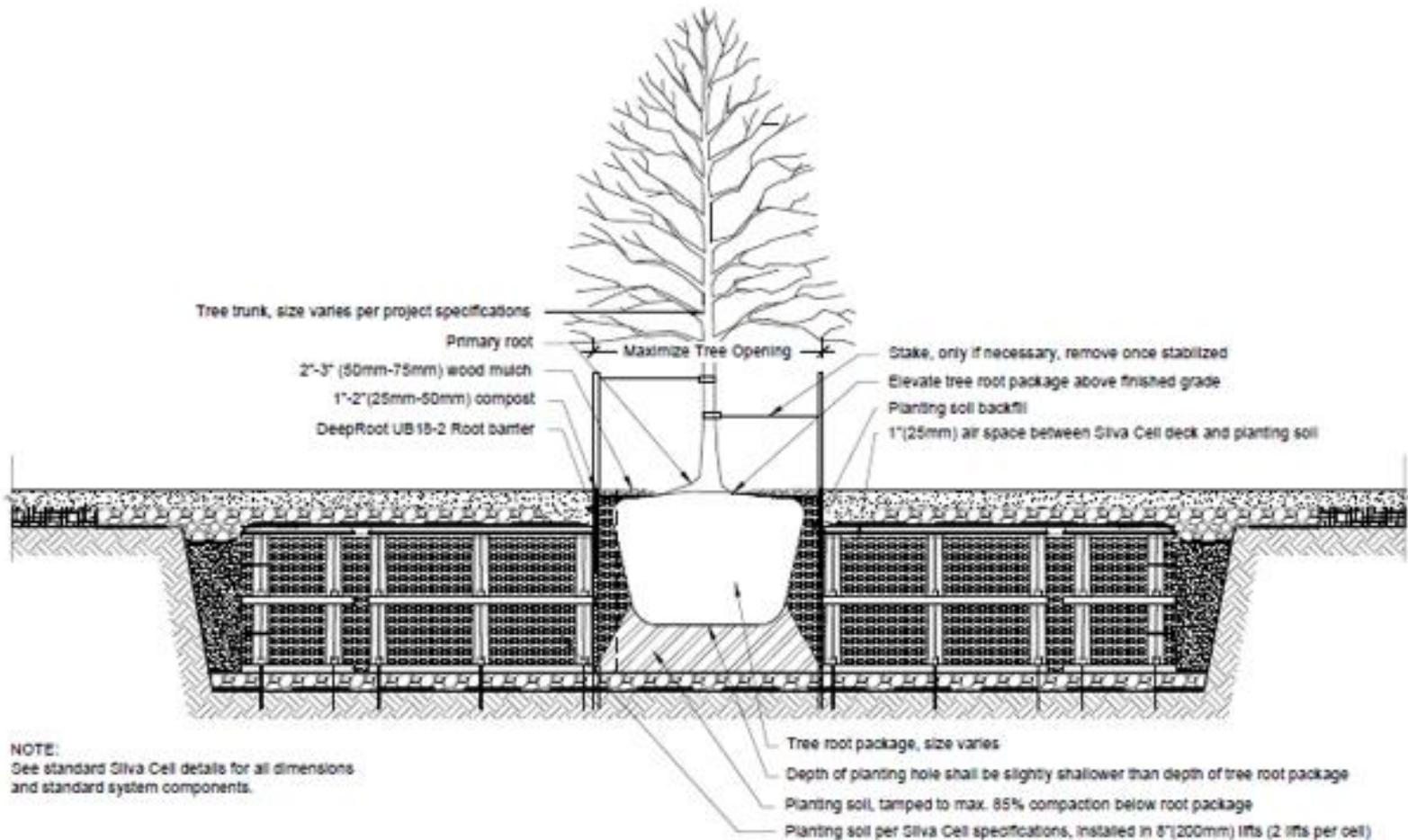
# STAKING

If staking is required:

- Place stakes away from the trunk (do not pierce the root ball).
- Place ties low and loosely.
- Remove stakes as soon as possible-usually at the end of the first growing season after planting.

(Cook & VanDerZanden, 2011, p. 139)

# STAKING

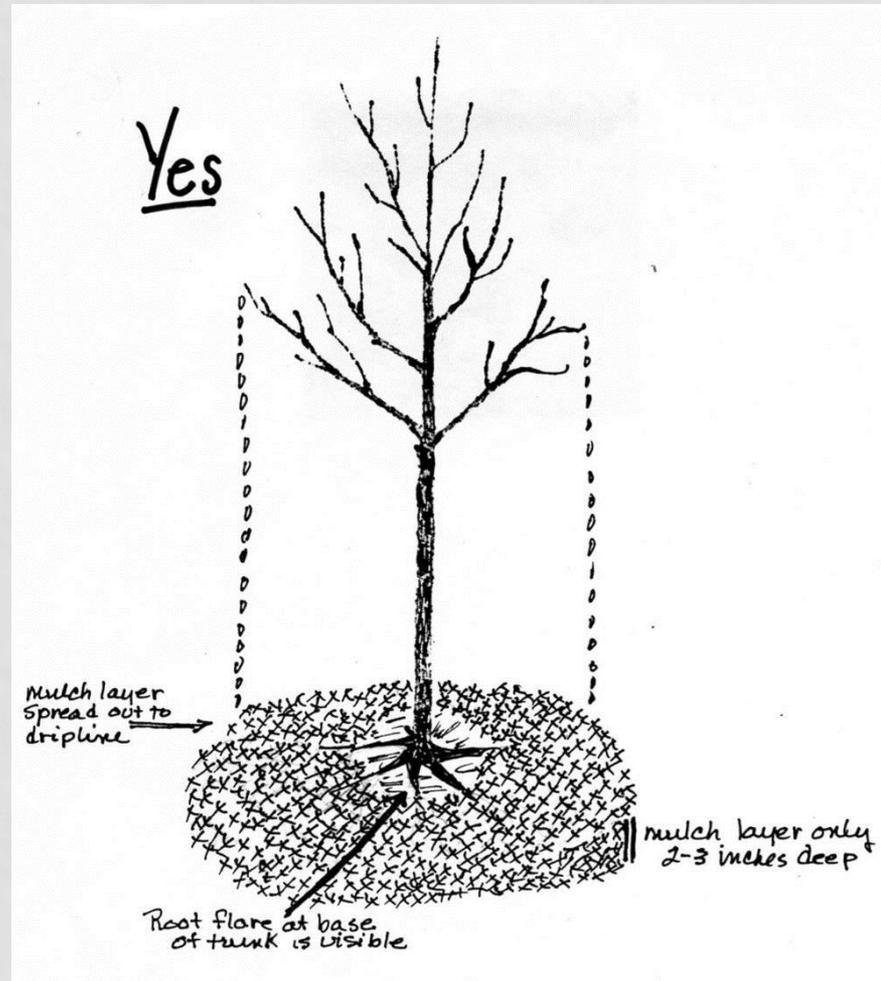


# MULCHING AFTER PLANTING

- Mulching reduces competition from weed seed germination.
- Increases soil organic matter as it decomposes.
- Helps retain soil moisture.
- May be aesthetically pleasing.

(Cook & VanDerZanden, 2011, p. 140)

# PROPER MULCHING AFTER PLANTING



# IMPROPER MULCHING AFTER PLANTING



# FERTILIZATION

## Assessment:

- Fertilizer needs should be determined by soil testing (except for Nitrogen) and plant tissue analysis.

(Cook & VanDerZanden, 2011, p. 141)

# FERTILIZATION

## Goal:

- To enhance establishment and early growth after transplanting.
  - Fertilizing some trees show faster growth during the first year while others don't.
- Maintain plant health over time.
  - Plants in landscape beds should not need fertilizer when they are mature as they are competing with lawns and/or receiving benefits from decomposing mulch.
- Manage nutrient deficiencies that affect plant health.
  - Iron deficiency occurs in soils with a pH of 7.5 or above. Right plant right place teaches us to not select plants that can't tolerate an existing pH level.

(Cook & VanDerZanden, 2011, p. 140-141)

# IRRIGATION

## Goal:

- To improve efficiency and reduce water use.
- All transplants benefit from supplemental moisture for at least one year due to transplant stresses
  - Stresses: 95% of root loss to bare-root, B&B and spade-dug trees. Container plants have root systems intact but excessive drainage of container planting porous soils result in drought stress.

(Cook & VanDerZanden, 2011, p. 144)

# IRRIGATION

## Irrigation options

- Automated irrigation
- Soaker bags for street trees
- Weather based controllers
- WOCOL
- Drip system

(Cook & VanDerZanden, 2011, p. 144-145)



[http://www.google.com/imgres?q=irrigation+bag+tree&num=10&hl=en&client=firefox-a&rls=org.mozilla:en-US:official&gbv=2&biw=1440&bih=707&tbn=isch&tbnid=QUOZaPBxB34uJM:&imgrefurl=http://greenwalks.wordpress.com/2008/10/24/tree-watering-bags/&docid=JdApv-sKaDqOXM&imgurl=http://farm4.static.flickr.com/3241/2969364747\\_89f320e224.jpg&w=375&h=500&ei=ktqfTqGyOcfAtgfpP9r33Dg&zoom=1&iact=hc&vpx=557&vpy=301&dur=288&hovh=259&hovw=194&tx=97&ty=103&sig=105866139933167536295&sqi=2&page=1&tbnh=160&tbnw=120&start=0&ndsp=21&ved=1t:429,r:9,s:0](http://www.google.com/imgres?q=irrigation+bag+tree&num=10&hl=en&client=firefox-a&rls=org.mozilla:en-US:official&gbv=2&biw=1440&bih=707&tbn=isch&tbnid=QUOZaPBxB34uJM:&imgrefurl=http://greenwalks.wordpress.com/2008/10/24/tree-watering-bags/&docid=JdApv-sKaDqOXM&imgurl=http://farm4.static.flickr.com/3241/2969364747_89f320e224.jpg&w=375&h=500&ei=ktqfTqGyOcfAtgfpP9r33Dg&zoom=1&iact=hc&vpx=557&vpy=301&dur=288&hovh=259&hovw=194&tx=97&ty=103&sig=105866139933167536295&sqi=2&page=1&tbnh=160&tbnw=120&start=0&ndsp=21&ved=1t:429,r:9,s:0)

# IRRIGATION

## Irrigation options

- Use weather based controllers
  - Using weather station data computers calculate daily evapotranspiration (ET) rates and can adjust run times to match the total ET since the last irrigation event.
  - Evapotranspiration is the water lost from surface evaporation plus the water lost from transpiration of plants.
  - ET values exist regionally for lawn grasses but research is needed for landscape plants.

(Cook & VanDerZanden, 2011, p. 145)

# IRRIGATION

## Irrigation options

- Use WUCOLS
  - Water Use Classification of Landscape Species based on expert opinions to categorize plant water requirements as low, medium, and high. Useful for designers who want to create plant grouping based on water needs. Developed for California and Canada.

(Cook & VanDerZanden, 2011, p. 145)

**WUCOLS IV**

**Water Use Classification of Landscape Species**

# WUCOLS IV

## Water Use Classification of Landscape Species

### Plant Search

South Coastal, CA

WUCOLS Region 3

[Choose new city](#)

Botanical name begins with

Find

Common name begins with

Find

Plant Type  Gc Groundcover

P Perennial

S Shrub

T Tree

V Vine

California Native

Water use  Very Low

Low

Moderate

High

Unknown

Not appropriate  
for this region

Find

[Go to WUCOLS list for all 6 regions](#)

All plants for this region

Find

# PRUNING

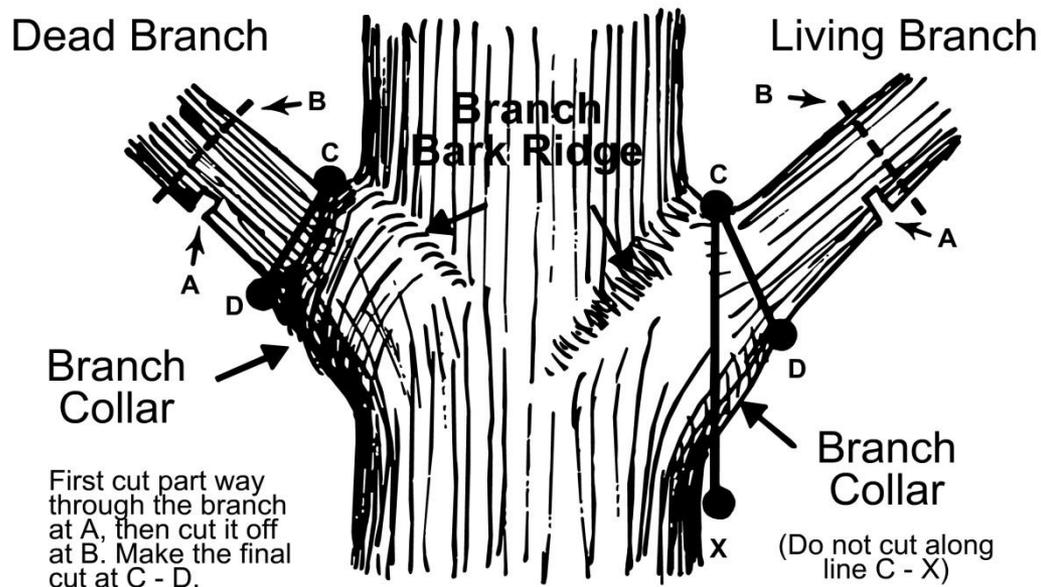
Design intent must be communicated to all landscape planners (design, installation, maintenance).

Plant centered pruning is based on:

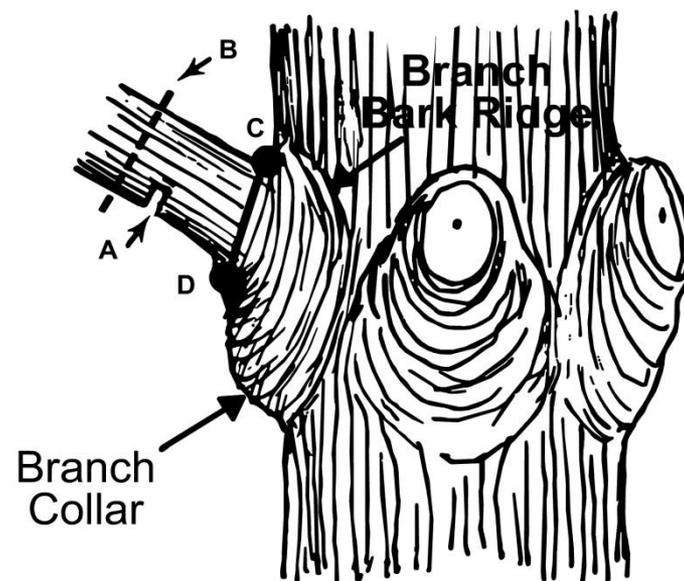
- (1) maintaining plants natural form
- (2) timing pruning to maximize flowering

(Cook & VanDerZanden, 2011, p. 147)

# Proper Pruning Principles



Hardwoods



Conifers



Trees

# PRUNING



## Roses

<http://www.marinrose.org/pruningcuts.jpg>

# PRUNING

- Maintaining plants natural form
- Avoid shearing
  - Shearing is quick, easy, and does not require training

(Cook & VanDerZanden, 2011, p. 147)



[http://www.google.com/imgres?q=residential+plants+clipped&num=10&hl=en&client=firefox-a&rls=org.mozilla:en-US:official&gbv=2&biw=1440&bih=707&tbn=isch&tbnid=okld0yC2lsK85M:&imgrefurl=http://www.fotolibra.com/gallery/picturecall/152/hot-spot/%3Fpc\\_id%3D152%26limit%3D100%26sort%3Did\\_desc%26page%3D3&docid=IVRDNZc3VkeiEM&imgurl=http://gb.fotolibra.com/images/larger-thumbnails/426392-cottages.jpeg&w=288&h=202&ei=AumfTpbuF8K4tgePn8HqDg&zoom=1&iact=hc&vpx=229&vpy=190&dur=617&hovh=161&hovw=230&tx=73&ty=109&sig=105866139933167536295&sqj=2&page=1&tbnh=161&tbnw=230&start=0&ndsp=18&ved=1t:429,r:0,s:0](http://www.google.com/imgres?q=residential+plants+clipped&num=10&hl=en&client=firefox-a&rls=org.mozilla:en-US:official&gbv=2&biw=1440&bih=707&tbn=isch&tbnid=okld0yC2lsK85M:&imgrefurl=http://www.fotolibra.com/gallery/picturecall/152/hot-spot/%3Fpc_id%3D152%26limit%3D100%26sort%3Did_desc%26page%3D3&docid=IVRDNZc3VkeiEM&imgurl=http://gb.fotolibra.com/images/larger-thumbnails/426392-cottages.jpeg&w=288&h=202&ei=AumfTpbuF8K4tgePn8HqDg&zoom=1&iact=hc&vpx=229&vpy=190&dur=617&hovh=161&hovw=230&tx=73&ty=109&sig=105866139933167536295&sqj=2&page=1&tbnh=161&tbnw=230&start=0&ndsp=18&ved=1t:429,r:0,s:0)

Cook, T. W. & VanDerZanden, A. (2011). *Sustainable landscape management*. Hoboken, NJ: John Wiley & Sons.

# PRUNING

- Tree pruning that occurs off the ground should be conducted by certified arborists or other qualified professionals.
- Lists of certified arborist available at ISA (International Society of Arboriculture) <http://www.isa-arbor.com/>

(Cook & VanDerZanden, 2011, p. 147)

**Get certified now!**

Arborists' Certification Study Guide

Available in Spanish

<http://www.isa-arbor.com/>

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# MANAGING THE WASTE STEAM

- Incorporate landscape plant debris into the landscape when possible.
  - Leave grass clipping
  - Chip wood debris and add to compost pile
  - Chop and leave fallen leaves
  - Add fallen leaves to compost pile or use as mulch in outer beds
- When green waste needs to be removed take it to a composting facility

(Cook & VanDerZanden, 2011, p. 157)



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