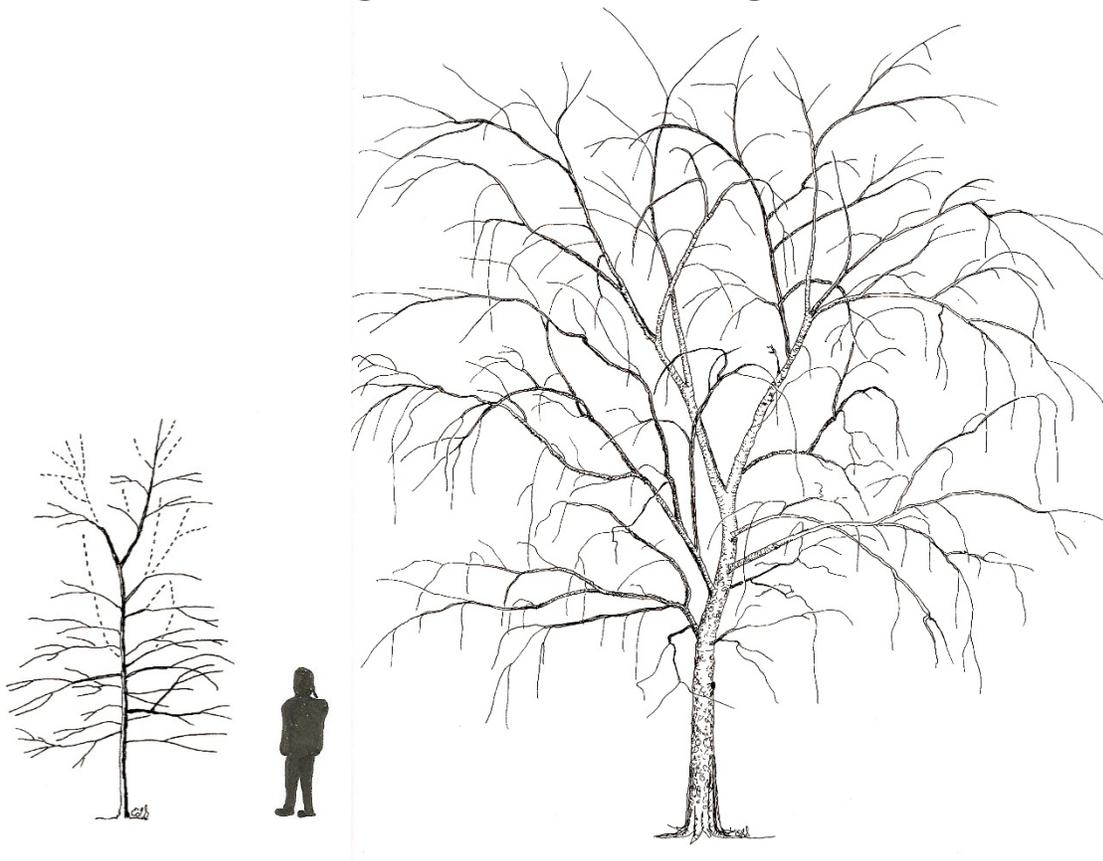


# CAL FIRE Standards and Specifications for Purchasing, Planting, and Maintaining Trees



This Appendix is a compilation of the *Guideline Specification for Nursery Tree Quality: Strategies for Growing a High-Quality Root System, Trunk, and Crown in a Container Nursery*, and the *Tree Care Cue Cards*. It has been prepared to instruct grantees on how to select, plant, and care for young trees.

Illustrations by Edward F. Gilman, Professor, Environmental Horticulture Department, IFAS, University of Florida; adaptations from *Arboriculture: Integrated Management of Landscape Trees, Shrubs and Vines*, 4th ed., by R. W. Harris, J. R. Clark, and N. P. Matheny (Prentice Hall, 2003).



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# Nursery Tree Quality

## I. GENERAL SPECIFICATIONS

**Proper Identification:** All trees shall be true to name as ordered or shown on planting plans and shall be labeled individually or in groups by species and cultivar (as appropriate).

**Compliance:** All trees shall comply with federal and state laws and regulations requiring inspection for plant disease, pests, and weeds. Inspection certificates required by law shall accompany each shipment of plants. Clearance from the local county agricultural commissioner, if required, shall be obtained before planting trees originating outside the county in which they are to be planted. Even though trees may conform to county, state, and federal laws, the buyer may impose additional requirements.

**Inspection:** The buyer reserves the right to reject trees that do not meet specifications as set forth in these guidelines or as adopted by the buyer. If a defect or substandard element can be corrected easily, appropriate remedies shall be applied. If destructive inspection of a root ball is to be done, the buyer and seller shall have a prior agreement as to the time and place of inspection, number of trees to be inspected, and financial responsibility for the inspected trees.

**Delivery:** The buyer shall stipulate how many days prior to delivery that delivery notification is needed. Buyer shall stipulate any special considerations to the nursery prior to shipment.

## II. HEALTH AND STRUCTURE SPECIFICATIONS

These specifications apply to deciduous, broadleaf evergreen, and coniferous species. They do not apply to palms. Note that leaf characteristics will not be evident on deciduous trees during the dormant season.

**Crown:** The form and density of the crown shall be typical for a young specimen of the species or cultivar. The leader shall be intact to the very top of the tree.

**Leaves:** The size, color, and appearance of leaves shall be typical for the time of year and stage of growth of the species or cultivar. Trees shall not show signs of moisture stress as indicated by wilted, shriveled, or dead leaves.

**Branches:** Shoot growth (length and diameter) throughout the crown shall be appropriate for the age and size of the species or cultivar. Trees shall not have dead, diseased, broken, distorted, or otherwise injured branches.

**Trunk:** The tree trunk shall be relatively straight, vertical, and free of wounds (except properly made pruning cuts), sunburned areas, conks (fungal fruiting bodies), wood cracks, bleeding areas, signs of boring insects, cankers, girdling ties, or lesions (mechanical injury). The terminal bud on the leader shall be intact to the very top of the tree, and it shall be the highest point on the tree.

**Roots:** The root system shall be substantially free of injury from biotic (e.g., insects and pathogens) and abiotic (e.g., herbicide toxicity and salt injury) agents. Root distribution shall be uniform throughout the container substrate, and shall be appropriate for the species or cultivar. At time of inspection and delivery, the root ball shall be moist throughout. Roots shall not show signs of excess soil moisture conditions as indicated by stunted, discolored, distorted, or dead roots.

Shade trees that grow to be large shall have one relatively straight central leader (Figure 1). Heading the tree is acceptable provided the central leader is reestablished in the nursery.



Figure 1.

Main branches (Figure 2) shall be well distributed along the central leader, not clustered together. They shall form a balanced crown appropriate for the cultivar or species.

The diameter of branches (Figure 3) that grow from the central leader, or trunk, shall be no larger than two-thirds (one-half is preferred) the diameter of the trunk measured just above the branch.

The largest branches shall be free of bark inclusions that extend into the branch union (Figure 4).

Small-diameter branches (Figure 5), particularly on trees less than 1 inch caliper, should be present along the lower trunk below the lowest main branch. These branches should be no larger than 3/8 inch in diameter.

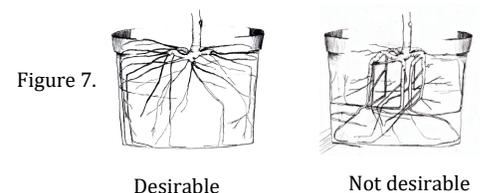
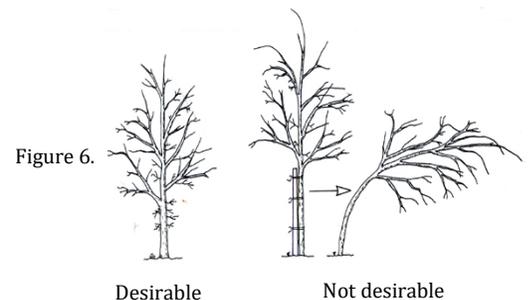
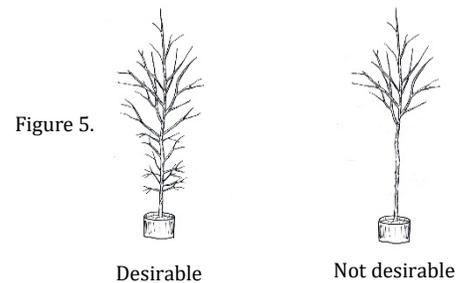
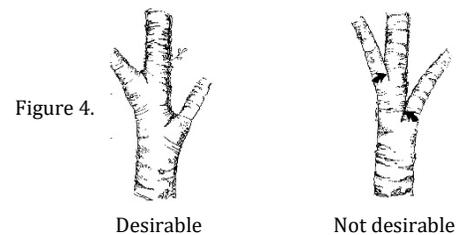
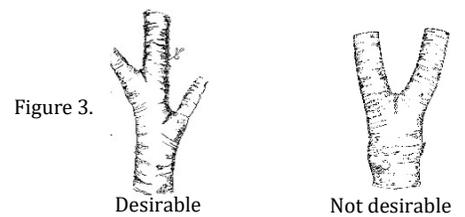
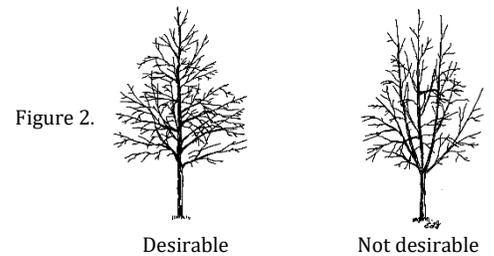
The trunk shall be free of wounds, sunburned areas, conks (fungal fruiting bodies), wood cracks, bleeding areas, signs of boring insects, cankers, or lesions. Properly made recent or closed pruning cuts are acceptable.

The trunk caliper (diameter) and taper (Figure 6) shall be sufficient so that the tree remains vertical without a stake.

The root collar (the uppermost roots) (Figure 7) shall be within the upper 2 inches of the soil media (substrate). The root collar and the inside portion of the root ball shall be free of defects, including circling, kinked, and stem-girdling roots. Roots at the surface should grow mostly straight to the side of the container. You may need to remove soil near the root collar to inspect for root defects.

The tree shall be well rooted in the soil media. Roots shall be uniformly distributed throughout the container, meaning that roots should not be concentrated at the bottom of the root ball. Some roots should contact the container wall in the top half of the root ball (Figure 7). When the container is removed, the root ball shall remain intact. When the trunk is lifted, both the trunk and root system shall move as one. The imprint of the liner or smaller container shall not be visible (Figure 7).

The root ball shall be moist throughout at the time of inspection and delivery. The roots shall show no signs of excess soil moisture as indicated by poor root growth, root discoloration, distortion, death, or foul odor. The crown shall show no signs of moisture stress as indicated by wilted, shriveled, or dead leaves or branch dieback.



# Tree Planting

**Selecting quality trees:** Planting quality trees begins by selecting the right tree for the right location and choosing vigorous, structurally sound trees from the nursery.

**Digging the hole:** A firm, flat-bottomed hole will prevent trees from sinking. Dig the hole only deep enough to position the root collar even with the landscape soil surface (Figure 8). Use a rototiller or shovel to loosen soil in an area three times the size of the root ball. This loose soil promotes rapid root growth and quick establishment.

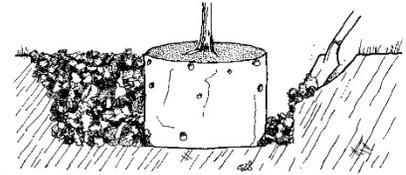


Figure 8. Loosening soil in a large area around the root ball allows for rapid root growth and quick establishment.

**Installing the tree:** Remove soil and roots from the top of the root ball to expose the root collar; cut away any roots that grow over the collar (Figure 9). Cut any roots that circle or mat along the sides and bottom of the root ball (Figure 10). The root collar shall be even with the landscape soil after planting (see Figure 9). Backfill with soil removed from the hole. Minimize air pockets by packing gently and applying water. Build a berm 4 inches tall around the root ball to help force water through the root ball. Enlarge the berm as the tree establishes.

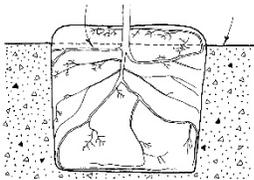


Figure 9. Remove soil and roots growing over the root collar (A) and place collar level with soil surface (B).

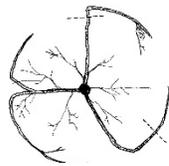


Figure 10. Cut roots at (A) to form new roots that grow away from the trunk. Do not cut roots at (B), since the root defects will regrow.

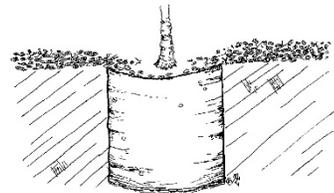


Figure 11. Mulch shall taper to a slightly thinner layer on top of the rootball.

**Mulching:** A layer of organic mulch, such as leaf litter, shredded bark, or wood chips, helps protect tree roots from temperature extremes and conserves soil moisture. Mulch also helps prevent grass from competing with the tree for water and nutrients. The mulched area makes it easier to operate mowers and weed eaters without hitting the trunk and compacting soil. Apply mulch to a depth of 3 to 4 inches (slightly thinner on top of the root ball) (Figure 11).

**Staking:** The method of staking is dependent on a tree's ability to stand on its own and the location of the planting site. Staking is used to hold trees erect, allow the root ball to anchor, and protect the trunk from damage by equipment. Stakes should be removed when the tree can stand on its own and the root ball is anchored. Stakes should be positioned away from the tree and secured to the trunk at the point where the tree stands straight. Do not use wire or any strap that will girdle the tree or damage the bark. If a tree cannot stand straight on its own after staking, a splint stake tied directly to the trunk made of bamboo, spring steel, or a fiberglass rod may be used to straighten the upper trunk and/or leader. Avoid using square wood secondary stakes. Acceptable staking examples may be seen below (Figures 12, 13, and 14).



Figure 12. Double staked

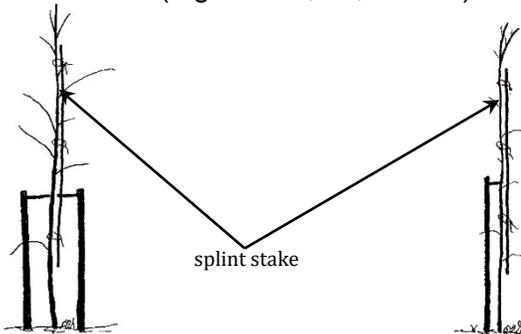


Figure 13. Double staked with splint stake.

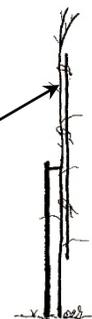


Figure 14. Single staked with splint stake.

# Tree Training at Planting and in the Early Years

Trees that grow to be large are more structurally sound and cost-effective to maintain when trained with a central dominant leader that extends 30 feet or more into the crown (Figure 15). Vigorous, upright branches and stems that compete with the central leader can become weakly attached (Figure 15).

Trees with branches spaced along the central leader, or trunk (Figure 15) are stronger than trees with branches clustered together (Figure 15). Prune trees at planting to one central leader by removing or shortening (shown) competing stems (Figure 16). All branches and stems shall be considerably shorter than the central leader after pruning is completed (Figure 16).

Reduction cuts can be used on trees at planting to subordinate branches that are codominant (Figure 20). Some upright stems and branches can be removed entirely back to the trunk. Heading cuts may have to be used occasionally.

Remove or shorten branches that are larger than half the trunk diameter at planting and every few years thereafter. Shorten them by cutting back to a live lateral branch (Figure 17). This lateral branch shall be pointed away from the trunk and it should not be growing upright. The central leader shall be more visible in the crown center after pruning. Only large-diameter branches need to be pruned because they compete with the leader and could be weakly attached (Figure 17, L). Small branches (Figure 17, S) do not need pruning because they will not compete with the leader.

The best way to shorten large or long stems and branches is to cut them back to a live lateral branch (Figure 19). This slows growth on the pruned parts and encourages growth in the dominant leader creating sound structure.

Remove larger branches by making three cuts. This prevents the bark from peeling or splitting off the trunk below the cut. Make the final cut back to the branch collar (enlarged area around union of branch where it joins the trunk).

## Structural Pruning Checklist

1. Develop and maintain a central leader.
2. Identify the lowest branch in what will become the permanent crown.
3. Prevent branches below the permanent crown from growing larger than half the trunk diameter.
4. Space main branches along the central leader.
5. Reduce vigorous upright stems back to lateral branches or remove entirely (Figure 20, next page).

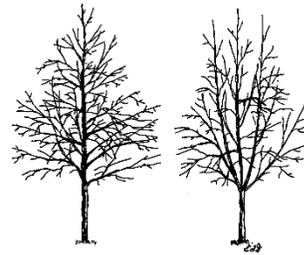


Figure 15. Good tree structure (left); poor structure (right).

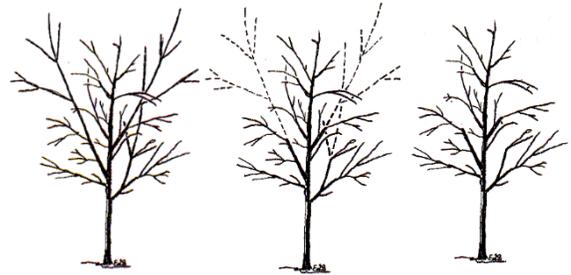


Figure 16. Shorten competing stems to improve structure.

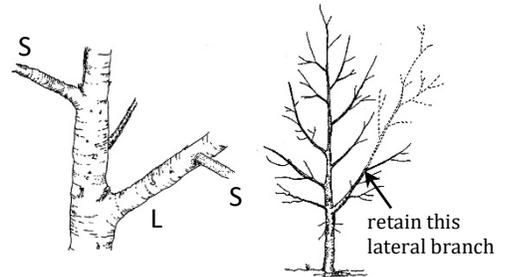


Figure 17. Only large branches need pruning (L). Small branches (S) do not need to be pruned.

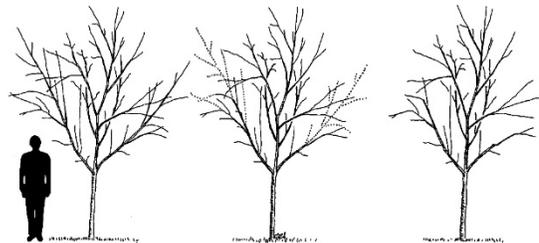


Figure 18. Shortening larger low branches concentrates growth in the leader and improves tree structure.

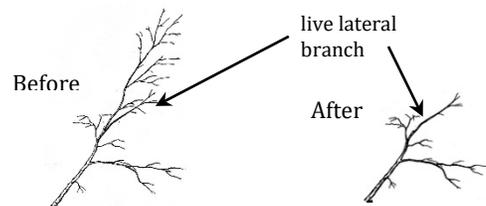


Figure 19. Reduce a stem back to a live lateral branch to slow its growth.

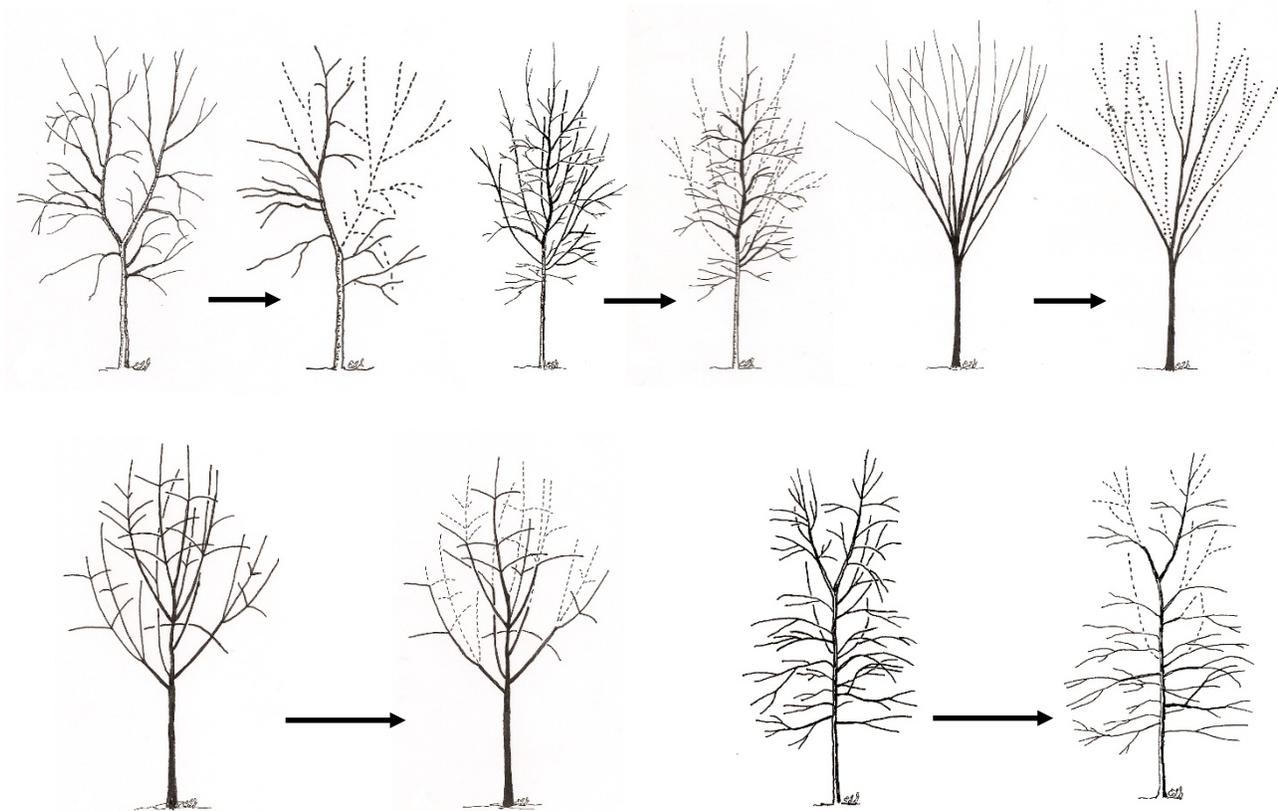


Figure 20. Before and after pruning at planting for structure.

## Irrigation

Consistent irrigation is critical for tree establishment.

- Apply about 3 gallons of water per inch of trunk diameter to the root ball 2 or 3 times per week for the first growing season.
- Increase volume and decrease frequency as the tree becomes established.
- Weekly irrigation the second year and bimonthly irrigation the third year should be sufficient for establishment.
- Once established, irrigation requirements depend on species, planting site, climate, and soil conditions.
- Irrigation devices should be regularly checked for breaks and leaks.

**IMPORTANT NOTE:** Tree species selected must be classified as very low, low, or moderate water use species in the [WUCOLS IV](#) or must be justified for the planting site(s) selected.