Trees - Proper Care for a Long Life

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Proper tree selection for Biodiversity and longevity

- As you start to debate which tree to use, consider attracting a much broader array of native pollinators, insects and foliage eating caterpillars. Consider those trees that provide flowers for pollinators as well as seeds and insects for songbirds to feed their young before they fledge.
- Even when dead, trees provide habitat and food! Where appropriate, leave some short standing boles (not as street trees!) or dead limbs on the ground.
- For trees with bark interest it is better to plant several trees of a given species (as seen at in a natural population of Aspen at right) versus planting a 'multistemmed' tree. Often nursery grown multistemmed trees consist of several individual trees planted closely together in a container or in the ground for B&B plants. Edward Gilman (An Illustrated Guide to Pruning, 3rd Edition) outlined how the large and supporting Transport Roots fail to develop below a neighboring stem in these 'multistemmed' selections and the tree will ultimately collapse.

- When purchasing or approving a shipment of budded (grafted) trees and suckers are emerging from below the bud union (as seen at right), do not accept the trees. It is a sign of a poor graft union and the tree will continue to produce suckers regardless of staff's dedication to removing these shoots. Ultimately, as the suckers enlarge, they often fail and collapse.

Proper location

- Make certain the plant is not planted too close to the curb and in imminent danger of getting hit by a parking car.

- Avoid planting large trees under utility lines. Consider small trees so long as there is room for passing delivery vans or snow plows. Consider:
    1. *Cercis canadensis* var. *texensis* – Texas Redbud
    2. *Chionanthus retusus* – Chinese Fringe Tree
    3. *Parrotia persica* – Persian Ironwood
- Consider narrow trees for tighter locations, such as:
    1. *Taxodium ascendens* – Pond Cypress

Proper roots

There are two general types of roots: Transport Roots and Feeder Roots. Transport Roots function to provide anchorage and transport water and nutrients. They range from 1/3"to 12" in diameter. The feeder roots provide the remaining 4 general functions of roots outlined below and range in size from 1/3" to .008"! Of course, it is the feeder roots which, as a group, are most in jeopardy of being removed when the tree is Balled and Burlapped. In fact, upwards of 80% of the root system is severed, as seen above by the number of roots extending beyond the basket (at the tip of the arrow).

Root function

1. Transport Roots – Anchorage and transport water/photosynthates upwards towards the tree trunk or outwards towards the feeder roots.
2. Feeder Roots - Store photosynthates or starches produced by the foliage (and bark of some species) during photosynthesis.
3. Feeder Roots - Absorb and transport nutrients from the soil to the balance of the plant.
4. Feeder Roots – Sight of hormone production, including Cytokinins, Gibberellins, Strigolactone and Abscisic Acid. Cytokinins assist in cell division, axillary bud growth and leaf senescence. Gibberellins are involved with bud break and stem elongation while Abscisic Acid promotes dormancy come fall and helps with apical dominance. Often the trees develop hormonal imbalance since the feeder roots have been severed during transplanting, but the apical buds remain intact and continue to produce Auxin hormones.
5. Feeder roots - Develop symbiotic relationships with fungi and bacterium.

Feeder roots are known to develop symbiotic relationships with over 2,500 different species of fungi called mycorrhiza through the release of the hormone Strigolactone from the root tips. The vegetative filaments of the fungi are called Hyphae and are far thinner than roots. They are able to penetrate into minute soil pores, inaccessible to roots. A teaspoon of soil contains 7-8 miles of filamentous hyphae! Not photosynthetic, the mycorrhiza receive carbohydrates from the trees. In return, the mycorrhizae provide water, phosphate (which is often in a form plants cannot absorb) and micronutrients. This relationship is believed to have begun 430 million years ago!

Plants can also use the Hyphae to transfer sugars from a strong, mature plant to a smaller shaded or otherwise impaired plant, unable to manufacture enough sugars on its own. Dr. Suzanne Simard, an expert on mycorrhizae calls these supporting trees the Mother Tree or Hub Tree. It is thought trees assist other trees for selfish reasons - by keeping other trees in good health, the woodland floor remains moist and cool, ideal for Mycorrhiza growth and the Hub Tree's health!

Plants in the Fabaceae or Legume family develop an association with the Rhizobium Bacterium, which fixes Nitrogen from the atmosphere. The plant receives some of the nitrogen while the bacteria receive a share of the sugars produced via photosynthesis. The two develop their relationship together via a courtship:

1. The courtship begins by the root tip releasing chemical compounds called flavonoids. The flavonoids attract only certain species of the *Rhizobium* bacteria and 'turn-on' the genes of the bacteria.
2. The next step is taken by the attracted bacteria. It releases sugars, causing the root hairs to wrap around the bacteria and the bacteria to enter a 'tunnel' within the hair.
3. The plant then produces a semi-permeable membrane around the Bacteroid, allowing for the exchange of ammonia and sugars.
4. The last physical step of courtship is the responsibility of the plant – developing the tissues around the Bacteroid, creating the nodule.
5. However, there is still one more step to 'cement' the relationship. Nitrogenase will only operate in the absence of Oxygen. To create this Oxygen-free 'work environment' the Bacteroid is coated with an iron rich liquid called Leghemoglobin. Much like the Hemoglobin of human blood, it is rich in iron and readily bonds with Oxygen.

Cercis canadensis – Redbud

Cladrastis lutea – Yellowwood

Gymnocladus dioicus – Kentucky Coffee Tree

Maackia amurensis – Amur Maackia

Styphnolobium japonicum – Scholar Tree

Proper planting

- For container grown trees, make certain the roots are thoroughly teased apart so as to prevent girdling roots. The images below right show a before and 'in process' of the roots being torn apart. A girdling root grows adjacent to the trunk of the tree and as both the root and the trunk expand, the flow of water and sugars in the trunk is compromised, decreasing the vigor of the plant.
- Dig the hole only as deep as the root ball to prevent settling.
- Make certain the root flair of the trunk is clearly visible and the Transport Roots are visible on the top of the ball for B&B trees. This will require removal of the burlap on top of the root ball. Trees that are planted too deep often develop girdling roots. Removing the burlap on top of the ball is also beneficial for allowing water to more readily soak into the ball.
- For 2-3" caliper trees moved in a basket, I prefer to remove the basket by
    1. Cutting and removing the base of the cage (blue arrow in image at right).
    2. Cut the horizontal wires below a wire loop used for tying off the top of the cage (green arrows).
    3. Roll the tree into the hole.
    4. Cut the last wire and remove the cage.
    5. Backfill and remove the burlap on top of the ball.
    6. For larger balls, the uppermost portion of the cage can be removed once in the hole.
- Try to get the trunk as straight as possible.
- Unless branches are broken or rubbing severely, avoid pruning the canopy of the plant until the following year or the year after. The carbohydrates produced by the canopy aids in new feeder root formation. The one exception is when a codominant leader is present, as seen below right. The smaller of the two leaders (the branch) should be removed before the stem becomes too large due to the very slow process by which the wound will heal. The branch

located on the right side of the tree in the image originates at the arrow, 12" below where it actually appears to originate!

- Stake the tree if it appears feeble and rocks excessively in the wind. If staked, allow the plant to still move slightly in the wind as this movement develops a stronger trunk.

Proper mulching

- Do not use Weed Barrier Fabric or Black Plastic beneath the mulch to reduce weeds. It reduces the amount of oxygen reaching the root system and causes the roots to grow closer to the surface, once again increasing the risk of girdling roots. In addition, organic leaf litter and decomposing mulch accumulates atop these barriers, resulting in weed growth.
- Use organic mulches such as woodchips, shredded bark or – best yet – shredded or whole leaves where they are deemed socially acceptable!
- Goes without saying that 2-3 (4)" of mulch is adequate and mulch volcanoes are bad.
- Where room is adequate, plant groundcovers or shrubs, negating the need to add mulch annually. The mulch and eventually the groundcovers or shrubs will keep the soil cool, benefiting the mycorrhizae. Think beyond the normal groundcovers as well. *Hydrangea arborescens* (Smooth Hydrangea) spreads over time to form an attractive 3' tall groundcover for sun and shade. A 14-year-old planting of 'Annabelle' is pictured below.

Proper pruning of the crown

- As mentioned, unless a branch is rubbing, broken or codominant, try not to remove any branches during the establishment period.
- Once the establishment period is complete, remove branches that are rubbing, growing into the canopy or otherwise unacceptable.
- As the lowest branches approach 1-2" in diameter, they should be removed and the tree limbed up in locations where the branches could interfere with pedestrian, vehicles or sight lines.

Proper follow-up care

- In general, for every inch of caliper equates to an additional year of watering and general

and attention. Hence, a 3” caliper tree will require 3 years of additional care!

- Water! With most of the feeder roots initially removed and the mycorrhizal relationships reduced, the plant is unable to absorb needed water.
- After the period for additional care has past, remove guy wires and stakes.
- As mentioned prior, start to prune and potentially remove some of the lower limbs as they approach 1-2” in diameter and prove to be an issue with vehicles or pedestrians.

Proper Benefits for the Home and Community

- According to the USDA Forest Service, Deciduous Trees planted on the SW side of a home can reduce air conditioning expense by 30%!
- Evergreens planted on the NW side of a home can reduce the heating costs by 20-50%
- Improving human health. Texas A&M University found that visual exposure to settings with trees produced a significant recovery from stress within a 5-minute period, as denoted by changes in blood pressure and muscle tension. Hence, hospitals have been installing gardens to reduce the length of patient stay.
- A green canopy reduces death! The loss of trees caused by the spread of emerald ash borer across 15 states – first recorded in 2002 – was associated with an additional 15,000 deaths from cardiovascular disease and an additional 6,000 deaths from lower respiratory disease! Happy Planting!