Technical Information Sheets

-Complete Set-

Written by Helen Stone and Dr. A. James Downer

Covering topics of interest and importance to arborists in the WCISA region and beyond, these ten sheets were funded by The Britton Fund and are offered free of charge. Visit www.thebrittonfund.org to download your digital copy and to learn more.

Planting and Early Care of Trees

The BRITTON Fund
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Although arborists generally care for mature trees, it pays to go beyond basic tree maintenance and acquaint yourself with all aspects of tree care, including selection, installation and post-planting care of young trees.

You have probably heard the term "right tree, right place." ***Matching the tree species to the planting site is critical for its success.*** Yet too many times trees are planted because they are on sale at the local nursery or on a landscape architect's short list.

SITE SPECIFICATIONS DETERMINE SPECIES SELECTION

Look at the site's exposure—trees grow best in full sunlight. Ensure ***that there is enough room for the tree to grow and mature.*** Many homes have small lots where large species such as oaks, cottonwoods or Ornamental Figs will endure a lifetime of hardscape conflicts and severe pruning before they are finally removed.

Good soil drainage is essential to most trees' health. To check drainage, dig a hole to the depth that you will be planting the tree. Fill it with water and note how long it takes to empty. If the hole is still filled with water a day later, either chose another location or consider building a raised planter, mounding the soil or creating physical drainage solutions such as drains.

Planting too deeply, plus circling roots doomed this tree from the start. Photos Courtesy: Helen M. Stone

SHOPPING FOR A SUPERIOR SPECIMEN

Once you have decided on the species, ***choose a tree that is free from defects, both above- and below-ground.*** The leaves should be turgid, without brown margins, spots or holes. Look for a smooth, straight trunk free from nicks, tears and large scars. Be sure the tree has a sound central leader and temporary lateral branches. ***Inspect the roots for symptoms of root rot.*** Roots should not be brown or mushy but crisp and vigorous in appearance.

Avoid selecting trees that are topped or headed back in the nursery to create fullness. It is more difficult to train these trees and maintain a central leader necessary for development of good branch architecture in the young tree.

Girdling roots are a common problem in containerized trees. Sometimes, the roots begin circling when the tree is in a "liner," a 3.5-inch container used for propagation. Circling roots keep doing so as the tree is transplanted into larger and larger containers. As the tree grows and matures, these circling roots also grow larger until they literally encircle the trunk and girdle the tree. The main stem then fails at or below the soil line, often when it is at or nearing mature size.

You can often detect circling roots by simply moving the trunk back and forth in the container. If the soil lifts on the surface, chances are there are circling roots below. For larger boxed trees, gently remove the soil to a depth of about two inches around the trunk to see what lies beneath. You should also check that the tree has not been buried above the root flare during transplanting, another common problem.

TRANSPORTATION, PREPARATION AND PLANTING

When transporting a tree to the planting site, be sure that the crown is covered with burlap or landscape fabric to minimize desiccation and sun scald. Water the tree well when it arrives at the site and again prior to planting if the tree is not planted right away.

Often tree specifications call for holes dug deeper than the existing rootball with straight sides. Instead, ***dig the hole only as deep as the rootball and as wide as possible***, with sloping sides.

Never plant a tree deeper than the existing rootball. Recent research recommends planting so that the root ball projects slightly from the hole. The trunk flare should never be buried with soil or mulch.

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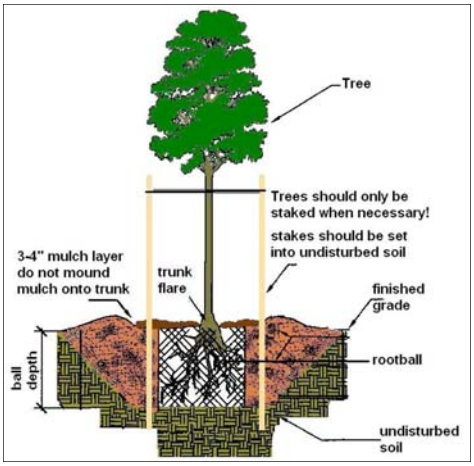
Trunk tissue and root tissue differ physiologically. While roots need water to function, trunk tissue will eventually decay and lead to the death of the tree if constantly watered. This is a slow process, but inevitable.

If using an auger, shape the hole with a shovel so it is bowl-like instead of can-like. Granular fertilizer or planting tablets can be used according to manufacturer's directions if soil conditions require the addition of nutrients

The use of soil amendments in the planting backfill is no longer recommended, as research indicates that amendments offer few or no benefits and can be detrimental if the organics decompose around the rootball. Backfill the hole with the soil that came from it but do not place it over the tree rootball; this creates an interface and leads to drying of the root ball and tree death.



Courtesy: Russ Thompson

Cover the rootball with a mulch of coarse organic matter. A mulch layer about three to six inches deep will help soil under the mulch retain moisture and keep the soil temperature even. Be sure to keep the mulch away from the trunk of the tree.

STAKING AND SOAKING

Although trees are routinely staked, ***evaluate each situation and skip the stakes if possible.*** A tree that moves and bends will build strength ,caliper and taper. Temporary lateral branches also support stem growth and taper and should be left on the stem if possible. A nursery stake is similar to a cast on a broken leg — when the cast is removed, the leg is weak and won't support weight.

If landscape staking is necessary, use soft, flexible ties. Hose with wire running through it may damage the tender trunk tissue. Tie the tree as low down on the trunk as possible. Remember, you want the tree to move with the breeze even though it's staked. ***Be sure to remove the stakes as soon as possible*** — usually a year after planting or less if possible. Stakes and ties left on too long cause damage and girdling.

In most areas of the west, almost all trees need supplemental irrigation for establishment. The tree's rootball needs to be kept moist during its critical first year of establishment.

EARLY PRUNING

Pruning at planting time should be confined to removing only broken or damaged branches. Once the tree is established, begin early pruning and training. As always, remove any diseased, dying, dead or broken branches.

Select a strong central leader. Remove any competing leaders. If the tree has been topped in youth (as is the case with many nursery trees), this step is critical for a sound structure in maturity.

Select the lowest permanent branch. Since branches do not move as the tree matures, the ***lowest permanent branch should allow for future traffic, be it pedestrian or vehicular.*** Permanent scaffold branches should radiate from the central leader like ascending spokes, evenly spaced around the tree's trunk. The branches should be attached at about a 45 degree angle to the trunk. Remove any codominant stems.

Keep temporary branches on the lower trunk to provide shade for the tender trunk tissue. These branches increase photosynthesis and help the tree establish. If they are too vigorous, cut them back to about six inches. Remove the branches when they are an inch in diameter or less.

Prune young trees at least on an annual basis to establish a strong structure. This pays off in reduced maintenance in maturity, as well as better overall health, aesthetics and safety.

Further Reading/Links:

SelectTree: A Tree Selection Guide
http://www.selectree.calpoly.edu/

Pruning and Training Young Trees
http://www.treesaregood.com/treecare/pruning_young.aspx

First in a series of 10 Technical Information sheets by Helen M. Stone and Dr. AJ Downer. Funded by The Britton Fund, Inc. and supported by the Western Chapter of the International Society of Arboriculture.

Caring for Old Native Oaks

The BRITTON Fund
www.thebrittonfund.org

Oak trees are beloved throughout the world, with more than 600 species found in the northern hemisphere. In the West, they occur throughout California and Arizona, from coastal climates to the mountains – in almost all ecosystems with the exception of the high desert.

Mature specimens are prized and add substantial value to a home or commercial property. Yet too often we see a stately giant in a slow state of decline. How can arborists make sure that these priceless treasures survive and thrive?

As a general rule, less is more. ***The closer a tree's native surroundings can be simulated, the better off it will be.*** Keep in mind that the tree's most active roots are close to the surface of the soil—no deeper than one to three feet, with absorbing roots prolific in the top six to 12 inches. Roots can also extend far beyond the "drip line" or canopy of the tree—an astounding two to three times the distance in optimum conditions.

PRESERVATION DURING CONSTRUCTION

Preserving mature oaks starts before any construction project, with a plan and design that keeps the trees' needs in mind. Provide room for leaves and mulch to accumulate on an undisturbed root system. ***Traffic should be directed away from specimen trees when possible, and raising or lowering existing grades avoided***. Placing soil on top of the roots will literally suffocate them, while scraping away the soil will destroy absorbing roots.

Chain link fence is preferable to orange plastic fencing to protect oaks during construction. Photo courtesy: HortScience, Inc.

Once construction begins, the area beneath the tree(s) should be fenced off and strictly off-limits to vehicles, equipment and personnel. Chain link fence is preferable to the commonly seen orange plastic fencing, which can be easily breached. ***Fencing should extend beyond the trees' canopies if possible***. Mulching with a thick layer of wood chips also helps protect the root zone. The site should be monitored and any restrictions enforced immediately.

LANDSCAPING UNDER OAKS

Once the building construction is complete, landscape construction is the next challenge. Again, caring for oaks starts at the design phase. If at all possible, ***landscaping and planting under established oaks should be kept to a minimum***.

If supplemental landscaping is necessary, try to limit plantings to accent plants, rather than blanketing the soil surface beneath the trees' canopies. Aim to disturb the roots as little as possible.

Turfgrass should be avoided, as should plants that require copious summer water such as azaleas, rhododendrons and the like. Ornamental grasses and native, drought-tolerant plants such as *Mahonia* or *Heuchera* (coral bells) are suggested.

IRRIGATION ISSUES

When rainfall is at normal levels, native oaks do not need supplemental irrigation. If landscape plantings require irrigation, use drip lines with emitters placed at each plant rather than sprinkler systems that flood the root zone. Avoid sprays on the tree's trunk at all costs.

During drought years, oaks will benefit from supplemental irrigation, especially during the normal rainy season. If the winter has been dry, irrigate during early spring. Irrigation can continue into summer, but limit cycles to once a month or less. During warmer months take care not to irrigate near the base of the tree as this can exacerbate any possible oak root fungus infections.

The "irrigation zone" should be approximately half way between the tree's drip line and the trunk and extend a few feet beyond the canopy. Irrigate deeply. A soil probe should be used to test the soil moisture content. Avoid woody roots when inserting the probe. The soil should be moist to the depth of approximately 12 inches. Proper irrigation at a slow

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rate can take several hours per tree to avoid runoff and ensure that the water penetrates deeply.

It was long thought that younger mature oak trees would adapt to frequent irrigation. This is false. Although young trees tolerate irrigation, their lives will be shortened if root diseases set in.

PRESERVING ROOT ZONE BIOTA

Oak trees require organic matter around their root systems. ***Do not remove leaf litter if at all possible.*** Fallen leaves provide nutrients slowly as they decompose, help moderate soil temperatures, prevent water loss and encourage earthworms and other beneficial insects in the soil. Oaks are unique in that they can absorb forms of nitrogen in organic litter that other trees cannot uptake.

Mushrooms at a tree's base are a sign that Oak Root Fungus is present. Photo courtesy: Jim Downer.

With sufficient mulch and water, oaks should not require supplemental fertilization. However, if they are located where leaf litter is regularly removed or there is extensive landscaping, supplemental nitrogen might be required.

Broadcast one to three pounds of actual nitrogen per 1,000 square feet in the irrigation zone and water in. Calculate the actual nitrogen in a fertilizer by multiplying the weight of the bag by the percentage nitrogen.

Do not fertilize stressed or declining trees in the mistaken notion that fertilizer is curative. Determine the cause of the stress and make corrections.

COMMON PESTS AND DISEASES

Oak trees are highly susceptible to root and crown rots. When carelessly irrigated, a seemingly healthy tree can suddenly topple over with no warning. Examining the failure will show no visible roots past the trunk.

The two major oak diseases are Crown Rot (*Phythophthora* spp.) and Oak Root Fungus (*Amillaria mellea*). In both cases, signs include slow or reduced growth, dieback, premature leaf drop and general symptoms of decline. ***By the time symptoms such as trunk cankers, canopy dieback, or defoliation occur, it is usually too late to save the tree.***

The best treatment for these oak-destroying diseases is to avoid them in the first place. ***Improper irrigation, root cutting and fill over the root ball are primary predisposing factors for oak diseases.*** Although a variety of insects can appear on oaks, treatment is usually not recommended or necessary with the exception of ambrosia beetles in Northern California and Oak bark beetles and polyphagous shot hole borers in Southern California, which can destroy weakened oaks.

PROPER PRUNING PRACTICES

Oaks need pruning to structure their canopies as young trees in urban settings. ***Mature oaks need little pruning and old specimens require little or no pruning.*** Pruning removes leaves and stored carbohydrates in wood that mature oaks depend on for annual growth. Even deadwood removal is not necessary if that deadwood can become a part of the litter/mulch under the tree.

Mature oak canopies shade the main stem or bole of the tree and rely on that shade to prevent stress. Do not "skirt up" oaks as this places them in higher stress. Let branches provide shade as much as the site will allow.

Many oaks are also reliant on their inner canopies of "shade" leaves which continue to transpire and function during hot summer months. Crown cleaning is deleterious to most oaks if green leaves are removed.

Most oaks are easily attacked by decay fungi and so large cuts should be avoided. Frequent light prunings as the trees reach maturity will ensure good structure. As trees enter old age, respect for their canopies and litterfall zones will ensure their survival.

Further Reading/Links:

Compatible Plants Around Oaks
http://www.californiaoaks.org/ExtAssets/CompatiblePlantsUnder&AroundOaks.pdf

California Oak Disease and Arthropod (CODA) host index database
http://phytosphere.com/coda/

A Field Guide to Insects and Disease of California Oaks
http://www.fs.fed.us/psw/publications/documents/psw_gtr197/psw_gtr197.pdf

Second in a series of 10 Technical Information sheets by Helen M. Stone and Dr. AJ Downer. Funded by The Britton Fund, Inc. and supported by the Western Chapter of the International Society of Arboriculture.

Improving Soil Conditions Around Existing Trees

The BRITTON Fund
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Tree root systems are sometimes overlooked by arborists. Attention is given to trunks, branches and leaves, but rarely do arborists focus on the "landscape below ground." However, it is proven that a healthy root system is critical to a tree's overall vigor.

As a quick review, ***most of a tree's absorptive roots are in the top 6 to 12 inches of soil and may extend well beyond the "drip line" or edge of the tree's canopy***. These roots take in water and nutrients, which the tree converts to energy that results in growth. Larger roots serve as a storehouse for unused carbohydrates. Roots also produce hormones that regulate the tree canopy.

Many roots are small, even microscopic in the case of "root hairs." ***Small roots are easily damaged beyond repair.*** Although trees have the capacity to regenerate roots, if soil conditions are not conducive to root growth, a tree will be unable to function properly and will slowly decline and die.

Usually, if a mature tree is thriving, roots need little or no manipulation. So why would an arborist need to improve soils around an existing tree? Trees can maintain their canopy with relatively few roots, so a tree's root system can be in decline for months or years before it actually dies.

Protecting the root zone of a tree before construction begins is the best way to prevent soil compaction. All photos courtesy: Russ Thompson

COMPACTION PREVENTION

In general, ***one of the greatest impacts on tree root health is soil compaction.*** Soil compaction causes stunted growth, or prevents any growth from occurring. Compaction-based stress leads to insect infestations/or disease infections that contribute to tree demise.

Compaction often occurs due to construction around or near a tree. Heavy equipment, excessive foot traffic and grade changes kill absorptive roots.

Established native trees also can be adversely impacted when newly surrounded by human activities. For example, natural areas are desirable settings for parks or outdoor venues for concerts, nature paths and trails. These activities all result in traffic and compaction.

As with many maladies, prevention is the most desirable control method. Protecting root zones from foot traffic can be as simple as mulching heavily with organic matter or as complicated as redesigning the site to direct traffic away from trees. ***During construction, mulching and sturdy fencing, along with regular inspections by an arborist to ensure compliance, can insure that the fragile root zone remains undisturbed.***

STEPS TO ALLEVIATE COMPACTION

But what if the damage is already done? This is a common occurrence and arborists are often called to "rescue" ailing trees that are declining months or years after construction is complete.

Extremes in soil moisture are not favorable for tree root growth. ***Keeping soil moisture at an optimum level for the species is critical for its health.*** At the same time, insure that drainage is adequate and that the roots are not "drowning" in standing water. Extremely dry or wet conditions can predispose trees to root rot diseases.

Preserving natural tree "litter" is the least expensive and easiest way to begin addressing soil compaction. Leaf litter is alive with biological activity. It provides food and shelter for many invertebrates such as earthworms and millipedes. In addition, eggs and larvae of spiders and other beneficial insects thrive in leaf litter. Leaf litter is also a carbon source for the underlying soil microbial community.

Leaf litter moved through the soil horizon by earthworms decomposes quickly. Mineral nutrients are slowly released from the microbial community to tree roots. Added carbon from leaf litter causes micro-aggregate formation in soils, thus lessening compaction. In addition, this "free" mulch results in well known benefits such as reduction in soil temperature, water evaporation and weed growth.

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In addition to allowing leaf litter to accumulate, mulch can be applied to speed up the recovery process. Clean, disease-free coarse wood chips from a chipper are an excellent resource easily obtained by most arborists. ***Spread mulch about six to eight inches or so*** (it will compress to about three to four inches) everywhere that litter would naturally fall and accumulate. If the tree has a nutrient deficiency, fertilizer can be broadcast before the mulch is applied. Water thoroughly, then be sure that the roots remain undisturbed.

A thick layer of mulch is one of the easiest and most inexpensive ways to improve conditions in a tree's root zone.

MECHANICAL METHODS

While there is little research supporting vertical mulching, the more invasive (and expensive) technique known as radial trenching, also referred to as soil replacement, is effective. In 2002, at the Morton Arboretum in Chicago, IL, Dr. Gary Watson's follow-up research showed that trenched trees had significantly more new root growth than controls, even after 14 years.

Radial trenching removes soil between the root buttresses perpendicular to the trunk, out to the edge of the tree's canopy or further. The trenches are then filled with compost or a compost/topsoil mixture. A layer of mulch can be spread over the surface of the soil to provide a "finished" look.

Watson's original experiment used a backhoe to dig the trenches. ***Today, tools such as the air spade can literally blow away the soil, a much less invasive procedure that preserves much of the existing fine root system.***

Although an expensive tool, the air spade can also be used for root collar excavations, trenching around existing trees for utility and irrigation installation and other projects. Equipment is also available for rent.

After creating radial trenches, soil is replaced with rich organic material.

SLOW RECOVERY

Whenever trenches are made to invigorate trees, results will not be immediate. ***Root regrowth and renewed tree vigor can take years.***

Mature trees should be protected from activities that can compact the soil beneath the canopies and beyond. However, although there are no miracle cures, in some cases trees can be saved and even thrive in the future.

It is essential that mature trees have room for litter fall and or mulch applications. This promotes longevity of their root systems.

In the worst-case scenario, recovery of declining mature trees can be an impossible goal to achieve. In other cases, recovery is a slow, long-term process that can literally take years. However, sometimes a tree's recovery is spectacular if soil conditions for root growth are improved. Considering the value of a mature tree, the return on investment of time, effort and materials is a payoff that is worth the attempt.

Further Reading/Links:

Soil Compaction & Trees: Causes, Symptoms & Effects
http://www.extension.iastate.edu/forestry/publications/pdf_files/for00-003.pdf

Ease Post-Construction Tree Damage with Radial Trenching
http://www.air-spade.com/literature/Tree_Care_Industry_Sep_2004.pdf

Soil Replacement: Long Term Results
http://www.mortonarb.org/images/stories/pdf/research/watson/soil_replacement.pdf

Third in a series of 10 Technical Information sheets by Helen M. Stone and Dr. AJ Downer. Funded by The Britton Fund, Inc. and supported by the Western Chapter of the International Society of Arboriculture.

Maximizing Benefits of Trees in Hot Climates

The BRITTON Fund
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Everyone appreciates cool shade on a hot day. But in urban settings in the arid west, trees provide benefits beyond the shade they cast. Researchers at the Center for Urban Forest Research in Davis, CA, have been working since 1992 to quantify the benefits that trees provide. However, with water supplies dwindling as population grows, arborists must help educate the general public on how to maximize these benefits while conserving resources.

Trees provide a multitude of benefits. During hot months, the obvious benefit is savings on air conditioning, usually powered by electricity. ***Saving money on power bills*** will be the most apparent advantage that can be "sold" to residential and commercial clients, as well as to municipalities that are implementing tree care budgets.

There are other less obvious yet quantifiable benefits. ***Mature trees increase property values.*** Not only do they increase "curb appeal," research shows that residential properties with trees fetch a higher selling price than those without. The HomeGain.com 2012 National Home Improvement Survey stated that landscape improvements provide a whopping 215 percent return on investment when selling a home.

BENEFITS BEYOND AESTHETICS

Through photosynthesis, trees use carbon dioxide and produce oxygen. Climate change has increased concern for reducing carbon "footprints." ***Trees absorb carbon and sequester it in their the leaves, branches, trunks and roots*** while alive. This storage continues with wood in service as buildings and furniture. Trees also facilitate the storage of carbon in soils by fueling the growth of mycorrhizae on their roots.

The shade that trees provide in hot climates go beyond aesthetics and can be quantified. All photos courtesy: Helen M. Stone

Air quality is improved by the trees that are planted and properly maintained. Trees absorb pollutants such as ozone and "grab" drifting smoke, dust and other particulate matter.

Finally, ***trees intercept storm water and turn it into a resource*** instead of a liability. Storm water may contain a cocktail of pollutants such as gasoline, pesticides and fertilizer nutrients that end up in oceans, rivers and wetlands. Trees divert torrential rains with their leaves and their roots absorb water, holding the soil and slowing erosion.

RUNNING THE NUMBERS

Tree benefits are often calculated using "Leaf Surface Area" (LSA). The greater the LSA, the greater the benefits. What this amounts to is the bigger the tree, the bigger the benefits. Along the same lines, the longer the tree grows and thrives, the bigger the payback.

While calculating LSA can be a complex procedure, there are many resources available to determine a tree's value. For example, the National Tree Benefit Calculator allows a user to input a zip code, then a tree's species and size to calculate an overall benefit in dollars, as well as storm water retention, increase in property value, energy savings, air quality benefits and atmospheric carbon capture, all monetized. Using the calculator, a five-inch diameter yellow palo verde tree in the Las Vegas area provides $44 in benefits a year. The benefit more than doubles to $103 if the tree grows to 10 inches in diameter.

LOCATION, LOCATION, LOCATION

Maximizing these benefits requires proper tree selection, placement, planting and maintenance. Sources for species selection include the Cooperative Extension, numerous books available from any major bookseller and even the local water authority.

To reap the greatest energy savings in hot climates, trees should be planted on the east and west sides of a building, to provide shade to the west or southwest exterior windows. Trees should be planted so the mature canopy edge is as close to the building as possible to maximize summer cooling, although access and fire safety must be considered. Deciduous trees allow the sun to provide winter heating, thus reducing winter fuel use and cost.

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For optimal carbon capture, ***grouping plants with similar needs*** will make irrigation and other maintenance procedures more efficient, which will reduce carbon inputs. Woody plants such as trees and shrubs sequester more carbon than grasses and other herbaceous plants.

Trees in mulched areas are better carbon collectors than trees in turfgrass. While fast-growing trees sequester more carbon early in their lives, they usually have a shorter lifespan than slow-growing trees, so *plant a diversity of species* for the best long-tem results.

For optimum cooling, trees should be planted so that the mature canopy is as close to the building as possible.

For improving air quality, ***trees planted near streets and parking lots collect dust and other particulate matter***. Not only do they intercept and remove pollutants, their mitigating qualities also reduce gases and hydrocarbons emitted by parked cars as the engines cool down.

SIZE MATTERS

Although large trees provide more cooling than small ones, be sure the tree has room to grow. A massive oak in a four-by-four foot cutout in a parking lot will only struggle and succumb, while an acacia can adapt to the small space and provide cooling for years. Parking lots can be designed so that trees have adequate soil volume to establish a large, healthy root system.

Minimize pruning by adopting structural pruning practices that build a strong tree architecture. Avoid thinning trees, as this reduces their effectiveness as cooling and shading features in the landscape. ***Prune in the dormant season*** when leave area reduction is less important to energy saving requirements of the warmer months.

WATER ISSUES

When storm water interception is a concern, look for trees that have big, rough leaves or dense thick canopies such as conifers. Conifers are also a good choice when choosing "air cleaners" because they provide shade and foliage all year. Trees with long leaf stems such as maple or ash and rough or fuzzy leaves (i.e. sycamore and oak) are especially efficient at scrubbing air pollutants.

Water is a major issue in arid climates, and ***the benefits that trees provide must offset the water they need to thrive***. Choosing desert species such as mesquite, acacia and palo verde is recommended, as well as low-water-use species from Mediterranean climates with little summer rainfall.

According to the Arizona Municipal Water Authority (AMWA), ***a mature desert tree will use 4,000 gallons of water a year.*** Obviously, trees use more water in summer than winter, so irrigation systems must be designed to accommodate mature trees at peak usage. However, proper scheduling is crucial. Schedules must be adjusted so that irrigation is decreased (or even eliminated), during rainy winter months. Mulch also conserves soil moisture.

A wise native plant restoration specialist once said that ***people don't live in deserts — they live in oases***. Trees provide incomparable benefits to the health and well being of desert dwellers, but proper selection, design, planting and maintenance are critical to make the advantages outweigh the inputs they require.

Further Reading/Links:

Tree Benefit Calculator
http://www.treebenefits.com/calculator/index.cfm

Desert Southwest Community Tree Guide
http://www.fs.fed.us/psw/programs/cufr/products/cufr542_72dpiDsrtSWCommTreeGd04.pdf

Potential of Tree Shade for Reducing Residential Energy Use in California
http://joa.isa-arbor.com/request.asp?JournalID=1&ArticleID=2704&Type=2

Fourth in a series of 10 Technical Information sheets by Helen M. Stone and Dr. AJ Downer. Funded by The Britton Fund, Inc. and supported by the Western Chapter of the International Society of Arboriculture.

Managing Trees During Drought & Water Restrictions

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Drought and water restrictions are a part of life in the Western States. Arborists must cope with these adverse conditions by offering clients drought survival strategies when water budgets are implemented and irrigation is curtailed.

The west is an arid region. Although Hawaii enjoys greater rainfall in many areas, prolonged drought and water restrictions are still an issue.

Large trees are an easy target when water is restricted. However, the benefits trees provide usually pay back the water they use. Trees protect water sources by reducing topsoil erosion and intercepting rain and reducing runoff during storms. Tree roots capture nutrients and act as pollution filters. Couple that with additional tree services of energy reduction, air quality improvement and aesthetics and these tree benefits "pay" for the water applied.

Dieback is an advanced symptom of drought. Photos courtesy: Russ Thompson

SURVIVING WATER RESTRICTIONS

Many water districts offer incentives to remove turfgrass, often around mature trees. This has led to the decline of tree canopies in some urban areas.

Depending on the tree species, symptoms of drought can be slow and subtle or quick and deadly. Symptoms include wilted, yellowing and/or scorched leaves. Whole branches can die back, usually starting at the top. Drought stress can cause secondary disease and insect infestations that can accelerate decline.

Large trees can thrive even with turf removal if they receive adequate irrigation. Drip or low-flow irrigation can keep trees healthy with little or no water waste.

A ***drip (or "low flow") irrigation system*** is comprised of a valve, pressure regulator, filter, delivery tubing or piping and emitters. New technology in drip emitters can prevent clogging and pressure loss, two major drawbacks in a drip system.

Subsurface irrigation tubing has emitters built in at regular intervals. These can be installed in spirals, radial patterns or grids around trees. Subsurface systems can provide good uniformity using less components and labor.

Drip systems are capable of providing adequate water for tree health with little or no waste, but caution must be used. Too many times, only one or two emitters are installed. On a new installation, the tree can decline and fail just as it is reaching a beneficial size. On retrofits, using too few emitters can lead to rapid decline and death.

Traditional irrigation systems, using PVC pipe and bubblers, are still a viable choice. Since they are aboveground, it's easy to see if they are functioning properly. They are also less prone to breakage and clogging.

START WITH SELECTION

The best way to deal with drought is to select trees that are well adapted to the site. Start with native trees. Keep in mind, though, that just because a tree is native to your state, it does not necessarily mean it is the right choice for your particular location. Obviously, a coastal or riparian tree is not a good choice for an inland, high elevation, exposed location. Improper tree selection requires more applied water.

When selecting trees, matching them to the soil and exposure of the site is critical. Trees from similar geographic regions can be a better choice than "natives" that may prefer a very different climate zone and soil texture Plant lists for specific regions are available from several sources. Try your local water district, Cooperative Extension or even the local utility.

SMART SCHEDULING

Once a new tree has been properly planted, sound irrigation practices are critical to its survival and how well it can handle drought in the future. ***Newly planted trees need their existing rootballs to be evenly moist, with the surrounding soil irrigated to encourage rooting.*** As the tree matures, the wetted area should extend past the canopy to ensure that its water needs are met.

Managing Trees During Drought

Arborists need to be familiar with two key concepts of irrigation—frequency and duration. As irrigation frequency (the number of times a day, week or month the system is run) decreases, the duration (amount of "run time") should generally increase. Run times cannot be standardized because soil textures and the depth of soil also determine the amount of potential wetted area and potential soil water content and thus the run time.

Care must be taken when scheduling to be sure that water does not runoff, especially in heavy clay or "tight" soils. Tree berms may be required to minimize runoff.

Be sure that a tree's entire root system will be wetted when using drip irrigation. Photo courtesy: Joseph Fortier

PRUNING AND FERTILIZING

Once trees are established, providing adequate soil moisture is still one of the most important factors in their health. Pruning and fertilization, while viable, are not as much of a concern.

In times of drought, fertilization, especially with high nitrogen levels, should be reduced if not eliminated. As soils dry out the concentration of salts increases. Fertilized trees are more susceptible to salt burn during drought. If water is in limited supply, eliminate fertilizations. Try to apply longer run times less frequently to move salts lower in the soil profile.

Pruning can also encourage release of dormant buds and stimulate new growth. Heavy pruning can leave branch and bark tissue exposed to the sun and elements, resulting in sunburn of exposed stems. ***Prune only to remove dead wood, remove crossing competing branches and to maintain overall health.*** Light thinning (no more than 25% live foliage) that removes foliage will also cut transpiration and prevent water loss from water-stressed trees.

MULCH MATTERS

Another important tool for droughty times is mulch. The benefits of mulching are well established. Mulching a young tree will save about every other irrigation once established in the site soil. Mulching trees after turfgrass removal will help prevent water loss from the soil surface, but will not take the place of applied water. Mulched trees still need irrigation.

Organic mulch is preferred. As it decomposes, it improves soil quality. Tree trimmings run through a well-maintained chipper makes an ideal mulch. Avoid diseased or infested materials. This mulch can be laid up to a depth of up to 12 inches; it will rapidly compress and meld to form a "mat" that will retard moisture loss while also allowing rain and irrigation to reach the soil surface and prevent runoff. Mulched soils also take water in at a higher rate, so irrigation can be applied with higher flow if necessary; useful when irrigation time and days are restricted.

Organic mulches should be replenished annually. Avoid composts; because of their fine texture they hold moisture, allow for weed germination, and can also promote water loss from underlying soils. The best mulches are coarse chips.

Inorganic mulches are a popular option in desert landscapes. Rock, gravel and decomposed granite are used to a depth of one to three inches. Although they are durable and can be aesthetically pleasing, they can also reflect heat, driving up temperatures.

In times of drought, arborists must acquaint themselves with the numerous benefits trees provide. Unfortunately, sometimes trees lose the battle, and replacement is the only option. Mature trees in arid climates that were planted when water was plentiful might not survive water restrictions. In that case, arborists can provide safe removal and offer options for replacement using water-efficient trees.

Further Reading/Links:

Managing Trees During Drought (Dr. Ed Gilman)
http://hort.ifas.ufl.edu/woody/drought.shtml

Tree Irrigation Overview
http://www.snwa.com/land/install_drip_trees.html

Fifth in a series of 10 Technical Information sheets by Helen M. Stone and Dr. AJ Downer. Funded by The Britton Fund, Inc. and supported by the Western Chapter of the International Society of Arboriculture.

Managing Infrastructure Conflicts with Trees

The BRITTON Fund
www.thebrittonfund.org

Trees provide quantifiable benefits in urban areas -- anywhere from a few to hundreds of dollars a year each. But when confronted with heaving sidewalks, dangling branches and clogged sewers, public entities and homeowners can only see the costs associated with a leafy canopy. ***Keeping trees from damaging infrastructure, while a challenge, is a goal that is within reach of cities, counties and individuals.***

Trees can affect infrastructure several ways. The first is damage to sidewalks, curbs, gutters, streets and other paved surfaces. Tree roots can infiltrate sewer lines. Trees grow into power lines and other overhead utilities, which creates major hazards. Finally, tree branches block signs, traffic lights and sight lines at traffic intersections and other potentially dangerous sites.

RIGHT TREE, RIGHT PLACE

As with most tree "problems," smart landscape design and tree selection is the key to preventing problems. Pavement damage can be greatly minimized or avoided by proper planning. ***If the planting area is less than three feet between paved areas, trees should be avoided.*** Large shrubs can be trained into small trees if desired.

Small trees can be an option if the area is three to four feet across, but for the best results, the planting area should be at least five to six feet for small trees (less than 30 feet at maturity) and at least eight feet for large trees.

The right tree in the right place can prevent infrastructure damage. Photo Courtesy: PasadenaNow

STRUCTURAL SOIL

Structural soil, introduced in the 1990s by Cornell University, is a mixture of gravels, clay loam and hydrogel that supports tree growth in urban landscapes. ***Structural soils installed beneath sidewalks, streets and parking lots offers greater rooting volume for trees while maintaining compaction specifications.***

Trees can be selected to minimize root damage, as well as conflicts with power lines. Resources are available on the Internet to assist in proper tree selection; SelecTree (see link below) can even filter tree selection according to root damage potential.

Palms can be used in smaller parkway openings with less damage to hardscape. ***Slower-growing trees are usually less damaging than fast-growing trees.***

SAVING EXISTING SPECIMENS

Pruning can minimize conflicts with overhead wires, signage and underground root conflicts. A lopsided tree can be pruned to preserve its health and benefits. Many utilities use V-shaped pruning profiles to minimize conflicts with overhead wires, which can result in complaints about aesthetics but ultimately saves trees.

Pruning retards growth of not only root systems but also of the stems and branch systems that are removed. If more pruning is necessary, a thorough appraisal needs to be made regarding the ultimate safety of the tree. ***Do not heavily prune trees in an attempt to slow root growth or otherwise "fit" a large tree into a small space.***

To reduce growth, increase pruning frequency but not intensity. ***Several pruning cycles removing less than 20% of foliage are more effective than one severe pruning event.***

DOWN TO THE ROOTS

Tree root damage to sidewalks can be treated with several strategies. Many municipalities use root pruning to save sidewalks. Trees should be carefully evaluated for overall health before root pruning is attempted, as the potential to destabilize a tree can lead to a hazardous situation.

If root pruning is deemed necessary it should only be undertaken after considering the species tolerance for root loss, the room available for root growth and the species ability to compartmentalize decay. If the wrong species is planted in a narrow strip, perhaps removal and replacement is a better use of resources.

Managing Infrastructure Conflicts with Trees

While some specialists recommend a greater distance, ***a general rule of thumb is to root prune no closer to the trunk than five times its diameter.*** Research by Dr. Thomas Smiley at Bartlett Tree Research showed that a very young tree can have all roots on one side pruned off completely using that rule with no impact on the tree's stability.

Although root pruning may slow sidewalk damage, less invasive techniques are recommended when possible.

SIDEWALK SOLUTIONS

Sidewalks that are lifted slightly can be ground down to minimize tripping hazards. ***Sidewalks can be cut to "share" the space with a mature tree.*** This is generally a temporary measure, as the tree will continue to grow. Sidewalks also need to have a minimum width to accommodate ADA (Americans with Disabilities Act) standards.

Six years after installation, a rubber sidewalk provides safety while the trees still provide shade. Courtesy: Walter Warriner, Consulting Arborist.

One step up from a cutout, a "meander," where the sidewalk is curved around the tree's trunk, can require major construction and permission from adjacent property owners (or conversely, the municipality). This technique can be both attractive and effective.

Sidewalks can also be ramped upwards to accommodate roots. Damaged concrete is removed, then a few inches of topsoil placed over the roots and a sand base installed over that. Then a new sidewalk is installed. The gentle grade over the roots keeps users safe, and the tree roots are not disturbed.

Root barriers are often specified by landscape architects and sometimes recommended in conjunction with root pruning. Physical barriers, usually panels made of heavy plastic, are used to either circle the tree's rootball or as liners for the planting pit. Another often-seen alternative is landscape fabric with nodules containing triflualin, an herbicide, or coated with Spin Out, a root growth regulator.

The use of root barriers has been a point of contention. Root barriers reduce the amount of roots in a given space. Care must be taken if the top of the barrier is above grade. Mulch or topsoil often allows roots to grow over the barrier. ***Because of increased incidence of root defects associated with some root barriers, they are not as commonly used or recommended as in the past.*** Rather than install barriers, plant trees appropriate to the site.

INNOVATIVE REPLACEMENTS

Rubber sidewalks made their debut around 2000 and remain a popular option, now employed by more than 60 municipalities across the nation. These sidewalks are high-density and sturdy, and as an environmental bonus, are often made of recycled tires. Although the initial cost is higher than concrete, used in new installations they will reduce infrastructure damage. In a retrofit situation, rubber sidewalks can save tree roots while offering pedestrian safety.

Sidewalks are not the only infrastructure that can be damaged by tree roots; several of the solutions above can be considered for patios, driveways and even invasive roots in sewers. In addition, poured concrete can be replaced with interlocking pavers or bricks. Using sand instead of solid grout allows water and air to reach tree roots, and individual pavers can be replaced when the need arises.

As with most tree concerns, selecting the right tree for the right place is the preferred method to avoid conflicts.

Further Reading/Links

Root Growth Near Vertical Root Barriers after Seven Years
http://joa.isa-arbor.com/request.asp?JournalID=1&ArticleID=3082&Type=2

Healthy Trees, Smooth Sidewalks
http://www.techtransfer.berkeley.edu/newsletter/07-1/sidewalks.php

Root Pruning Guidelines
http://hort.ufl.edu/woody/root-prune-guidelines.shtml

Select Tree/Cal Poly Pomona
http://selectree.calpoly.edu/

Sixth in a series of 10 Technical Information sheets by Helen M. Stone and Dr. AJ Downer. Funded by The Britton Fund, Inc. and supported by the Western Chapter of the International Society of Arboriculture.

Maintaining Palm Trees

www.thebrittonfund.org

From the dazzling glitz of the Las Vegas strip to the sandy beaches of Hawaii to the laid back California coast to the sizzling Arizona desert, palms are an iconic symbol of the West. Limited only by freezing temperatures (and there are a few species that tolerate some freezing), these monocots are derided by some arborists as not being "real" trees. However, it is inevitable that most arborists in the West will be responsible for palm tree maintenance or maintenance recommendations at some point in their careers.

Properly planted in a hospitable site, palms are a favorite because of the low maintenance required to not only survive but perform well. ***However, for optimum performance and aesthetics, palms need some regular attention.*** There are several aspects involving palm maintenance that an arborist should be aware of: irrigation, fertilization, pruning and pest and disease control. There are no absolutes regarding any of them; each aspect will require a different approach and largely depends on the type of palm being maintained.

PROPER IRRIGATION

Palm irrigation is often misunderstood. Many palms survive with minimal irrigation. For example, one or two drip emitters are installed at planting time and left throughout the lifetime of the plant. This is certainly not adequate for the sustained growth of specimen palms, but often they scavenge water from other places in the landscape such as turfgrass or emitters for other landscape plants.

What's wrong with this picture? Practically everything! The palms are too large for the space, the chain-sawed "pineapples" are a gateway to infections and the ties are unnecessary. Photos: Helen M. Stone

Keep in mind that roots can only grow in the presence of adequate soil water. ***As the palm grows, additional irrigation should be provided.*** Some palms are actually an oasis plant (rather than a desert plant); regular, thorough irrigation is required for optimum health. The larger the palm, the more water it will require. During the heat of the summer, a large palm can require 20 gallons of water two or three times a week. In the winter, the irrigation frequency can be dialed back to once every 10 days to two weeks, depending on the amount of rainfall.

On the other hand, ***if soil drainage is poor, it can be easy to overwater palms.*** Palms are sometimes planted in pure sand or in highly amended soils; in hard soils with no drainage, this is the equivalent of planting in a container.

Since irrigation scheduling is dependent on factors such as soil texture, exposure, temperatures and more, ***the best way to schedule irrigations is to use a soil probe to determine soil moisture.*** Note how long it takes for the soil to become somewhat dry before irrigating again. However, do not allow the soil to become completely dry and rock-hard. This will damage or kill roots.

A three- to four-inch layer of organic mulch placed around the trunk of the palm will prevent evaporation and increase water efficiency. It is recommended that turf, groundcovers and other plants be removed to about two feet away from the base of a palm's trunk.

For the oasis effect, palms are often planted in or near lawns. Since most lawns are irrigated with sprinklers, palms often are regularly sprayed with water on their trunks. ***There are few, if any, trees that tolerate constant moisture on their trunk tissue.*** Although palms do not have bark such as dicotyledonous trees, constantly spraying the trunk with water can lead to decay.

FERTILIZATION AND PRUNING

While palms often can survive without fertilizer, they are sensitive to deficiencies and regular fertilization can prevent symptoms before they start. Most fertilizer manufacturers offer a special blend for palms, which contain extra potassium and magnesium, as well as nitrogen. Follow label directions and apply when the tree is actively growing or beginning a growth cycle – usually early to late spring.

Beware of applying too much fertilizer too often. This can lead to salt build-up in the soil, especially if drainage is marginal and irrigation is spotty.

Palms will thrive with no pruning at all. Pruning palms consists of flower, leaf, or entire stem removal. Most palm "pruning" is leaf removal.

Palms are pruned in order to co-exist with urban sites. Pruning reduces or eliminates the chance of fronds or fruit dropping in an untimely fashion. Pruning green foliage reduces photosynthetic potential of palms and can create wounds through which pathogens can enter. Ideally, only dead or dying leaves and fruit clusters should be removed.

Maintaining Palm Trees

www.thebrittonfund.org

Better yet, never remove any green leaves . Palms can be safely pruned up to the 3 to 9 o'clock position if necessary, but removal of all the expanded leaves or "pencil pointing" a palm should be avoided.

Although skinned trunks and "pineapples" on Phoenix canariensis (Phoenix date palms) are thought to look tidy and elegant, it is actually detrimental to the palms health and can become a gateway to pests and diseases. Keep in mind that pruning is wounding and these practices actually produce large wounds. Clients and the general public should be educated about the harm that skinning and ball shaping can do. Because of the prevalence of palm wilt disease in California, chainsaws should be avoided when pruning these palms because they can move and transmit disease propagules.

Use a hand saw and aerial lift to prune tall palms.

Tall palms can be a challenge to prune; the height and lack of branches are justification for use of gaffs or tree climbing spikes. ***While these tools are widely and legitimately used for take downs, they create deep wounds on healthy trees that can introduce disease.***

Aerial lifts provide enough height to prune most palm trees. If there is a need to climb trees to conduct pruning, a static line climbing system has been show to be fast and efficient way to enter and work in the tree. Better yet, use equipment such as climbing platforms (link below).

MOST DISEASES ARE PREVENTABLE

If palms are selected, planted and maintained properly, pests and diseases should not be an issue. However, there are a few relatively common diseases to be aware of.

Sudden Crown Drop is thought to be caused by Thielaviopsis. The interior of the palm decays with no visible symptoms for long periods of time. ***As the disease progresses, the palm stem becomes weaker and weaker and eventually the heavy crown falls without warning.*** If Thielaviopsis is suspected, using a wood mallet to pound the tree and listen for decay and probing with a sharp spike can detect it. However, there is no cure. Only fresh trunk wounds will become infected by the fungus; wounding the palm trunk, especially the upper third, should be avoided.

Fusarium wilt has been devastating Canary Island Date Palms for several years. This fatal disease first affects leaves in the lower part of the crown and then moves up through the entire canopy. Leaves are often dying or dead on one side and green on the other. Although there is no cure, it is preventable. Pruning tools should be sterilized between trees by soaking in a 10% household bleach solution or holding the saw blade in a blow torch, flaming each side for at least 20 seconds. Always use hand or short pole saws, since chain saws are impossible to sterilize.

Diamond scale occurs on California fan palm (Washingtonia filifera) and is characterized by diamond-shaped fruiting bodies on the palm fronds about the size of a rice grain or larger. It is most common in coastal regions.

Pink rot is a infection that can be found on palms that have all the diseases listed above. It is an opportunistic disease that takes advantage of a weakened or wounded plant. ***However, once it has a foothold, it be the cause of a palm's death.*** Although there are fungicides that can diminish its presence, as long as the primary disease remains, the tree is at risk. Pink rot has a cool temperature optimum and is not a problem during warm weather. King palms that have had old leaves torn from the stem are especially susceptible to pink rot infections.

Since palms are so easily moved as specimens, many of them are transplanted as large trees. While the industry standard has been to tie palm leaves up with string until they resume growth, there is no advantage to the practice unless they are being planted in the hottest deserts.

Irrigate properly, fertilize occasionally and avoid pruning unnecessarily and a palm tree will reward you with a long life and with minimal maintenance.

Further Reading/Links

Video: Spikeless Palm Climbing Platform
http://www.youtube.com/watch?v=W1AvcA1F7uM

Palm Diseases in the Landscape
http://www.ipm.ucdavis.edu/PMG/PESTNOTES/pn74148.html#FUSARIUM

Arizona Landscape Palms
http://ag.arizona.edu/pubs/garden/az1021/az1021.html

Seventh in a series of 10 Technical Information sheets by Helen M. Stone and Dr. AJ Downer. Funded by The Britton Fund, Inc. and supported by the Western Chapter of the International Society of Arboriculture.

Diagnosing and Rectifying Salt Toxicity

www.thebrittonfund.org

Soil and water salinity are covert killers. Although there may be no symptoms at first, as salts build up to a toxic level, a tree receives fewer and fewer nutrients and less and less water until it gradually exhibits symptoms. Without remediation, this condition can lead to decline and death.

Salinity kills in two ways. High concentrations of soil salt ions leads to osmotic stress in roots that limits water uptake and other root functions such as specific mineral uptake. Specific ions can also accumulate in tree foliage and become toxic to chlorophyll, killing the machinery necessary to gather energy for a tree.

If you irrigate, you are leading to salinization of your soils. In the United States, the USDA estimates a 30 percent yield reduction in irrigated agriculture sites due to salinity.

THE SALTY SOUTHWEST

Sodium, calcium, magnesium, potassium, sulfate chloride, and boron all form salts that can be present in irrigation water. Water has been called the "universal solvent". When water flows over or through land, these salts dissolve from rocks, ravines and other geologic features it passes by. In the arid West, soils are often high in these elements.

Salt burn on a bay tree scorches the tips of the leaves. Photo courtesy: Russ Thompson

According to research scientists in Nevada, Las Vegas water carries about one ton of salt per acre foot or 326,000 gallons. ***This adds nearly 400 pounds of salt for every 1,000 square feet of fescue turf per year.*** While most trees do not require that much supplemental irrigation, these figures illustrate how salts can build up in soils.

In some areas of the Southwest, soils can exhibit a white crust of surface salts. This usually occurs during dry spells after irrigation has stopped. As the water rises through the soil to evaporate at the surface, salts are also drawn up. Since the salts don't evaporate, they accumulate and leave a crust.

Plants have different degrees of salt tolerance or salt resistance, which is the ability to withstand high salt levels in their leaves or in the root zone. Research on salt tolerance has primarily been on agricultural crops and use of deicing salts, usually sodium chloride. Salts containing sodium and chlorides are the most damaging to plants (boron is also an issue in some parts of the Southwest).

RECYCLED WATER AND SALT ACCUMULATION

As drought tightens water supplies in the West, more and more large properties are using recycled water for irrigation. Also known as reclaimed or effluent water, it is simply former waste water (yes, that means sewage) that is filtered and treated so that it is safe for irrigation. (Technically, wastewater can be treated to a potable level, but public perception has not embraced the "toilet to tap" process.)

Although safe, most recycled water is high in salts, especially in the Southwest. The level of salinity is dependent on the amount of soluble salts in the source water and the method of water treatment. Recycled Colorado River water will usually have higher salt levels than Northern California waters, for example.

Irrigation water containing large concentrations of sodium can actually destroy the physical structure of the soil. This effect is called a sodium hazard, and is noted on soil and water tests as SAR (sodium adsorption ratio). SAR is determined by the ratio of sodium to calcium and magnesium. The higher the SAR, the greater the risk of soil structural damage. For example, the SAR of water from Hetch Hetchy reservoir in California is .78, while water recycled from South Bay Water Recycling read 4.1. ***For this reason, it is important to test recycled water to understand its potential effects on landscape trees.***

Soil salinity is also measured by determining the electrical conductivity (EC) of a soil sample at or near the root zone of a plant. Filtered water is mixed with and extracted from soil, then measured as deciSemiens per meter (dS/m). For example, the EC of water from Hetch Hetchy reservoir in California is .2, while the South Bay Water Recycling sample read 1.21. For comparison, the EC of distilled water is approximately 0.002 dS/m, while seawater is approximately 58 dS/m.

Diagnosing and Rectifying Salt Toxicity

Total Dissolved Solids (TDS) measures suspended solids, most of which are salts. It is noted as milligrams per liter (mg/L). Again, the higher the level, the greater potential for salt damage. Rainwater usually has a TDS of 20 mg/L or less; the EPA suggested maximum for drinking water is 500 mg/L. Most landscape plants can tolerate 200 to 800 mg/L TDS.

SALTS AND SOILS

Sodium attaches to soil particles. The soil then becomes harder and more compacted when dry, and eventually becomes impervious to water. This is a slow process that can take years.

Soil types can also affect plant response to salt levels. ***Since clays can hold and exchange more salt than sands plants will tolerate more salt in a clay soil than in a sand soil.***

Salts accumulated on this pine tree due to overhead irrigation. Photo courtesy: Russ Thompson

Salts accumulate in the leaf tissue of trees until symptoms become visible. Roots absorb salts with water, which moves up the trunk to the branches and leaves and eventually transpires into the air. Salts are left behind and increase gradually. ***Sometimes plants can go for years before exhibiting symptoms.***

Salt toxicity symptoms often starts with interveinal chlorosis (yellowing of the leaves between the veins with the veins remaining green). Burning on leaf surface or margins is also a symptom. As salts accumulate, the damage increases. Leaf burn becomes more severe until defoliation and twig dieback occurs.

Examine the oldest leaves on a tree for salinity damage since they have had the most transpirational time to accumulate salt. Damage observed on younger leaves may be from other causes such as pathogens, injurious sprays or other forms of injury.

Trees have varying levels of salt resistance or salt tolerance. Tamarix (salt cedar) can actually sequester salt in salt glands. Eucalyptus polyanthemos (silver dollar gum), Morus alba (fruiting mulberry) and Platanus x acerifolia (London planetree) can all tolerate higher levels of salts. On the other hand, Magnolia spp., most Prunus spp. and Sequoia sempervirens (Coast redwood), will suffer in salty situations. (See the links below for lists of salt-tolerant trees.)

A leaf that is burned by accumulated salts will never recover. However, saline water and/or soils can sometimes be compensated for with thoughtful management practices.

Keep in mind that salts are drawn up and deposited when soils dry out. If there is a large amount of salts accumulated, thoroughly irrigating so that they are flushed below the root zone of the plant can offer some relief. Leaching with pure water such as rainfall is the best cure of salt affected soils. This is why drought can be so damaging—there are few or no leaching rainfall events during droughts.

Practically out in the field, this means that trees should occasionally be irrigated deeply, beyond the root zone. Since most absorptive roots are in the top 12 inches of the soil, this can be determined using a soil probe after irrigation. In addition, soils in the root zone should not be allowed to dry out completely, as this will increase the accumulation of salts in the root zone. Applying mulch can help keep the soil's surface from drying out and prevent salt accumulation.

Although a complex issue, salinity will become a greater concern as water supplies tighten. Arborists need to have a working knowledge of the basic concepts, symptoms and irrigation techniques necessary to tree survival.

Further Reading/Links

Boron and Salt Tolerant Trees and Shrubs for Northern Nevada
http://www.unce.unr.edu/publications/files/ho/2012/sp1204.pdf

Salt Tolerance Of Various Temperate Zone Ornamental Plants
http://www.coopext.colostate.edu/TRA/PLANTS/stable.shtml#contree

Salinity Management Guide
http://www.salinitymanagement.org/Salinity%20Management%20Guide/index.html

Eighth in a series of 10 Technical Information sheets by Helen M. Stone and Dr. AJ Downer. Funded by The Britton Fund, Inc. and supported by the Western Chapter of the International Society of Arboriculture.

Responsible Wood Waste Management

The BRITTON Fund
www.thebrittonfund.org

Gone are the days of cheap landfill space. Many urban landfills will not accept greenwaste or charge large tipping fees for the privilege of disposal. Fortunately, "waste" is probably a misnomer; tree care by- products should be considered assets.

Clean chipped wood and leaves have many uses. The first and most obvious is as a mulch. Chippings can be spread to a depth of 6 to 12 inches; they will compress and form a water-permeable mat.

MULCHING MADE SIMPLE

Mulches have both short-term and long term functions: short-term, mulches will moderate soil temperatures, slow evaporation, decrease runoff, prevent salinity buildup in the rootzone. Long-term, woody mulches prevent weeds, add mineral nutrients to soil, help promote mycorrhizae formation, decrease compaction, change soil texture, increase water holding capacity, prevent root disease, promote increased rooting, and gradually improves soil chemical, physical and biological qualities.

The best use of mulch is onsite where a tree pruning job occurs. Photo Courtesy: HortScience, Inc.

In order to benefit trees, mulches should be placed over soil areas where the majority of roots form—generally where leaves naturally fall. One of the biggest barriers to using mulch is that there is often no place to put it in many landscapes. Counseling clients to add mulch under shrubs, and/or to remove some plants or turfgrass to make mulched areas will improve the health, longevity and function of shade trees in landscapes. Converting non-mulched to mulched space takes planning and careful implementation, but in the long run trees benefit and it gives a place to put tree trimmings created on-site.

Freshly chipped tree trimmings can be used immediately—they don't require composting to be used as mulch around trees or shrubs. As long as the mulch is not mixed into the soil, it will not take mineral nutrients from underlying roots. Even woody mulches will not deplete nitrogen from underlying soils.

FRESH THINKING

Fresh mulches made from Eucalyptus trees do not pose harm to other landscape plants. They are safe for most landscape mulching applications. ***Tree chip mulches should not be moved across county lines because there are many pests of trees that could be moved from one county to another.***

Whether or not to charge will depend on what your local market will bear. Companies who charge generally price clean wood chips at $15-20 per cubic yard; delivery charges vary from none to $25. However, some companies are happy to deliver wood chips to eager customers who are near the work site.

How do you find clients for this service? With today's technology, it is easy to add wood chip delivery to your web site. Your customers can contact you by phone or email. Social networking sites such as Facebook are also a way to connect with potential clients (both for your primary arboricultural services and wood chip delivery). Online classifieds such as Craigslist also can generate leads.

The best use of tree trimming chips is under the trees that they were trimmed from. This will take client education so that consumers can understand the value of their own tree chips.

BIOMASS AND BEYOND

Are there biomass energy plants in your area? These plants use organic waste to generate energy instead of coal, gas or dams. It is considered ecologically friendly and currently is used more than solar or wind power.

Responsible Wood Waste Management

Biomass as a fuel type is biological material that is "recently alive." Burning biomass is considered CO2-neutral because when it is burned, it only releases the quantity of CO2 that the plant absorbed during growth. Although these plants have high standards for uniformity and cleanliness, if one is in your area (see the listing below), it is definitely worth researching.

Speaking of heat, selling firewood is a popular way to use up larger tree pieces. ***Since moving firewood is now so strongly discouraged, providing it for local clients can be an excellent source of additional income.*** Firewood that is split and tarped under clear plastic will have fewer bark beetles and the chance of moving exotic pests is reduced.

Even in warmer climates, many people enjoy the ambience of a fire in the winter. If you live in an area that has campgrounds, they are often eager consumers of local wood so that they can resell it to campers.

Commercial composting companies also use woodchips in their operations. Some have tub grinders, which further reduce the chips into smaller-sized particles that decompose more rapidly, producing saleable compost in a matter of a few months.

Wood sequesters carbon, but lets it back into the atmosphere when it is burned or decomposes. One way to reduce carbon almost permanently is to use the wood for an item that will be used indefinitely. Think furniture, picture frames, decorative artwork and even pens.

Urban trees lend themselves to many beautiful uses, and can also provide additional revenue. Photo courtesy: West Coast Arborists

WOODWORKERS WANTED

Starting small, woodworkers seek unusual urban tree species to create such items as pens and picture frames. Handcrafted pens sell for anywhere from $10 to $100, as do picture frames. Contact your local woodworkers club to get started on your new source of income (see listing of woodworking clubs below).

Moving up the scale is selling large tree pieces to be milled into lumber that can be used for fine furniture. Special trees that must be removed because of hazard can be memorialized by milling the lumber and making furniture, sculpture or other products that have meaning to the tree owner.

Urban trees offer a source to hardwoods more valuable than traditional woods such as black walnut or oak. Black acacia, red gum eucalyptus, elm and many others make fine dimensional lumber when milled and dried correctly.

If you work with large tree removals, you can either contact a local small mill or consider renting or purchasing a small saw mill on your own. "Saw logs" or logs saved for milling, should be painted on their cut ends to slow drying, bark left on, and cured for up to a year before milling. Wood can be slowly dried outdoors or in a shed or barn.

Freshly cut boards should be "stickered" so that drying is even and heavy weights placed on top to prevent warping. For faster results, a dehumidification kiln can be used to bring wood down to desired moisture contents, generally under 10 percent for most species.

Arborists have access to some of the most exotic urban hardwoods, many not available from any other source. ***Properly cut and handled a valuable saw log can return thousands of dollars in wood sales.***

Sustainability is a huge issue in today's culture. Recycling the by-products from a tree care company lends itself to this model, and can provide profits as well as environmental benefits.

Further Reading/Links:

List of Biomass Energy Plants
http://biomassmagazine.com/plants/listplants/biomass/US/page:1/sort:state/direction:asc

Woodworking Clubs
http://www.finewoodworking.com/how-to/article/woodworking-clubs-directory.aspx

Ninth in a series of 10 Technical Information sheets by Helen M. Stone and Dr. AJ Downer. Funded by The Britton Fund, Inc. and supported by the Western Chapter of the International Society of Arboriculture.

Trees, Water and Irrigation

www.thebrittonfund.org

While the West is home to some of the most spectacular forests on earth, trees in urban settings often have a more stressful existence. Compacted soils, reflected heat and confined rooting areas usually require that even native trees receive supplemental irrigation. Although irrigation consultants devote their entire careers to landscape irrigation, arborists should have a working knowledge of irrigation concepts, systems and terminology to provide thorough tree care.

HOW MUCH WATER?

One of the first questions most clients have is ***"How much do I water?" As in most arboricultural responses, the answer is "It depends."*** There are many factors that are involved in determining the amount and frequency of tree irrigation.

First and perhaps foremost is the size of the tree. Obviously large old trees will use more water, but they may also have access to large soil profiles because of sinker roots. Large trees, even though they use more water than small trees, may be able to grow without irrigation in a normal rain year.

In drought years, even large trees may need irrigation. ***For large trees, a large volume of soil must be irrigated; slow, low precipitation rate sprinklers, drip or soak hoses will be necessary.***

Next most important is soil type. Soils in the West range from pure sand to pure clay. Sandy soils drain well, but hold little or no water. Clay soils are excellent at holding water, but can be difficult to irrigate because of potential runoff. The rate that water can be applied without running off is known as the infiltration rate. In addition, there can be less pore space (air pockets that surround the mineral particles in a soil) in a clay soil, so that roots may not be able to extract as much oxygen as they need.

Trees need more than two emitters for successful establishment and emitters should be added as the tree grows. Photo Courtesy: Russ Thompson

The species, size and age of the tree, the exposure and the tree, the time of year, and the amount of rainfall during a year all play into irrigation scheduling. In general, irrigation should wet at least half of the root zone surface and as deep as the rooting zone – at least 12 inches.

If you are evaluating an existing system, run the irrigation system and check the soil the next day. You should be able to insert a soil probe or a metal rod into the soil to the depth of at least 12 inches. You may have to repeat the process until you determine how long the system "run time" is, to thoroughly irrigate the rootball.

IRRIGATION SYSTEM BASICS

You will see many types of irrigation systems out in the field. A typical system consists of several components. ***To begin with, both drip and traditional irrigation systems usually require a back flow preventer.*** These are installed between the "point of connection" to the main line and the irrigation systems. Also known as cross-connection devices, these assemblies basically stop irrigation water (which once applied is considered contaminated with soil particles, fertilizers, pesticides, etc.) from being drawn back into the main water supply should there be a failure such as a line break or frozen pipe. There are many types, and they are required by law in most areas.

Next in line will be a valve. Valves control the flow of water into a system. Although there are manual valves, today they are generally operated by an irrigation controller (clock), which is programmed to turn the system on and off.

Traditional irrigation systems use PVC pipe from the valves to sprinklers, bubblers and spray heads. Sprays can be used beneath tree canopies, but they must not hit the trunk of the tree. Bubblers are often specified for tree irrigation and have several designs. If bubblers are used, care must be taken that they do not apply water too quickly and cause runoff.

The advantage to a traditional irrigation system is that breaks can easily be seen – often in the form of a "geyser." ***"Smart" controllers can sense the increased flow and shut the valve down until a repair is made.***

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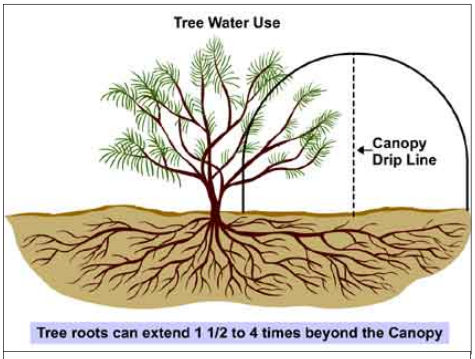
LOW VOLUME DELIVERY

Drip (or "low volume") irrigation systems are thought to be the most efficient way to irrigate. Drip systems pinpoint water where it is needed; there is no overspray and if the system is well-designed, there will be no runoff.

For any irrigation system to be efficient, it must have an even uniformity of application or distribution uniformity (DU). Just like sprinkler systems, the DU can be calculated for drip systems; if not designed correctly, they can be very inefficient. ***Drip systems should be designed to evenly wet the soil over a tree's root system.***

In a drip system, after the valve there is usually a filter and pressure regulator. While filters may not be required with clean urban water, since water is delivered through such small orifices, they can clog easily and filtration will add insurance that emitters keep flowing. They will also keep the pressure regulator from becoming contaminated. ***Even so, drip emitters should be periodically checked so ensure adequate and even flow.***



Tree roots grow beyond the canopy, but can only grow where there is water. Graphic courtesy: Elizabeth Davison

Since drip systems are designed to apply water slowly, they require lower pressure than found at residential or commercial properties, usually between 20-40 PSI. (45-60 PSI is recommended for plumbing systems.)

There are many different drip irrigation delivery devices. Standard emitters are probably the most familiar, but even they come in many shapes and sizes. Emitters that deliver 1-2 GPH (gallons per hour) are recommended to eliminate concerns about runoff. In addition micro-sprays and micro-bubblers are also available and can cover a larger area than pinpoint emitters.

Inline drip tubing simply has emitters installed in the poly pipe at uniform intervals. ***Inline tubing is often recommended for trees, as it can soak the entire root zone uniformly.***

Inline tubing can also eliminate the "sticker shock" that occurs when clients learn how many emitters are required to adequately water a tree. So many times, only two or three emitters are installed during landscape construction. At 1 or 2 GPH, it is obvious that trees need more than a couple of emitters running 20 minutes a day Also, drip systems rarely are upsized as trees grow larger and require more water.

MORE IS BETTER

In the 1990s, Dr. Jimmy L. Tipton of the University of Arizona published a chart with recommendations that raised eyebrows throughout the Southwest. ***For a tree with a 20-foot diameter canopy, the recommendation was between 28-450 emitters, depending on the delivery amount.***

One concept must be thoroughly understood: ***Tree roots will not grow in dry soil.*** This means tree roots do not "search" for water. Tree roots only grow where there is water. However, there may be more water in the soil than it appears, especially below the surface.

Use the method outlined above to determine how much water is needed to thoroughly wet the rootball. There are also formulas that can be used to deliver water with complete precision (see the first link below).

Keep in mind that irrigation systems designed to establish trees will not be adequate for growing trees or maturing trees. Plan to upgrade by adding more emitters as the tree grows larger.

Apply the same amount each time the tree is irrigated. During longer days, irrigate more often. When days are short, scale back the irrigation frequency. ***However, the irrigation duration should always be the same.*** Remember that day length or total sunlight is the driving force for transpiration and water use by trees.

The exception is that in times of low rainfall or multi-year droughts, salts may build up in the root zone. In this case, irrigate longer to wash the salts past the root zone.

In urban areas, trees are often overwatered as much as underwatered. It is important to determine a precise irrigation schedule for both water savings and optimum tree health.

Further Reading/Links:

Drip Irrigation for Trees
http://forestry.usu.edu/htm/city-and-town/tree-care/drip-irrigation/

Tree Irrigation: Water Where Roots Need It
http://landscapeonline.com/research/article/9308

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