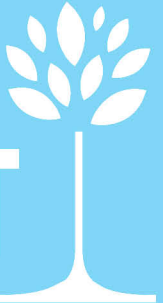


HELP YOUR TREES SURVIVE THE DROUGHT



BE WATER-WISE. IT'S EASY. HERE'S HOW.

Trees and water are both precious resources. Trees make our houses feel like home—they also improve property values, clean our water & air, and even make our streets safer & quieter. When we water wisely and maintain our trees carefully, we enjoy a wide range of benefits at a low cost and with little effort.

YOUNG TREES

The roots of younger trees are less established & need easier access to water to establish deep root systems.

MATURE TREES

Mature trees require MORE water when growing near heat traps such as driveways & foundations.

EXPOSED TREES

Water loss is greater where trees are exposed to hot afternoon sun & strong or constant wind.

DECIDUOUS TREES

The critical time for water is during later winter/early spring when new buds and leaves are forming.



THE RIGHT AMOUNT

Water young trees twice per week (about 5 gallons) & mature trees once per week in several places (the equivalent of 1 to 1.5 inches of rain).

IN THE RIGHT PLACE

Water the “drip zone,” area directly beneath the foliage & shaded by the tree. Also, add mulch to lower soil temperatures & reduce water evaporation.

CONSERVE & RECYCLE WATER

Inside: Place buckets in the shower to collect warm up water. Recycle water from the dehumidifier, collect air conditioning condensation, & “save a flush” to conserve. Outside: Convert irrigation systems to drip, low-flow or micro spray & fix leaks.

THE RIGHT TIME

Water early in the morning or after the sun has set, as this is when trees replace the water they’ve lost during the day. Also less water is lost to evaporation at these times. Mulching your tree will also keep soils warmer in winter & cooler in summer.

DON'T WASTE WATER

Water should soak into the ground rather than running off into the drain.

THE RIGHT WAY

During drought, water directly with a hose or 5-gallon bucket.

THE RIGHT DEPTH

Deep watering helps deep root growth & healthier trees.

THE RIGHT CHOICE

Plant native or drought resistant tree species that require less water. Choose trees over lawn, as trees are a long-term investment.



VISIT US:
www.InvestFromTheGroundUp.org
Facebook.com/InvestInTrees
@InvestInTrees

SUBSCRIBE:
For more tips to keep your trees healthy.

**COMMUNITY FOREST ADVISORY BOARD
CITY OF SAN DIEGO**



Tree Preservation and Watering Under Drought Conditions

Excerpts from letter to Mayor Faulconer, Council President Lightner, Councilmembers, and City Directors, April 10, 2015.¹

Most San Diegans are unaware of the benefits that trees provide in our daily lives, and the importance of regular, deep watering of trees to keep them healthy. Trees require surprisingly little water during and after establishment, and provide shade, save energy, improve air quality and public health, sequester carbon and mitigate climate change, reduce stormwater runoff and erosion, increase property values, create wildlife habitat, and enhance walkability and quality of life.

Trees should be given a higher priority when cutting back on landscape watering, because lawns and shrubs can easily be removed and replaced but trees take many years to mature.

Public information messages and materials about water conservation are generally silent about tree watering. Yet even the most severe level of Drought Response (Level 4) allows for the watering of trees.²

Trees can be watered without waste. Set up separate irrigation zones for trees, to water enough to soak the soil under trees monthly. Select trees for their low and medium water requirements, and plant them in the fall and winter when rains and cooler weather reduce the irrigation needs of new trees.

The Australian response to their drought crisis in 1997 to 2009 offers important lessons about successful and failed approaches,³ as San Diego now faces similar conditions and challenges.

“Water demand in excess of supply resulted in water restrictions for private and public landscapes and increased water prices. Historically, most trees were located in turf and irrigated with sprinkler systems. The restrictions on irrigation resulted in significant damage to the health of many trees. Expenditures for managing drought-stressed landscapes and removing dead trees skyrocketed, while ecosystem services produced by formerly healthy trees were foregone. The increased water prices accelerated landscape water conservation efforts, further stressing trees least able to adapt.

“At a time when health advocates, stormwater managers, and sustainability city planners were promoting the environmental, social, psychological, and economic benefits of healthy urban forests, trees were dying at unprecedented rates. Whether reasoned or unintentional, water policy decisions closed the tap, turning much of the urban forest’s lifeline to a trickle. Policy makers and researchers began to consider a new question, ‘How much water should be allocated for urban landscapes?’ In response to catastrophic tree losses, municipal foresters, landscape architects, and others began developing and testing new irrigation technologies, harvesting and reusing rainfall, selecting drought-tolerant species, and managing soil to detain and infiltrate runoff.”

¹ For further information contact Community Forest Advisory Board chair, Anne S. Fege, Ph.D., afege@aol.com

² San Diego Municipal Code, Chapter 6: Public Works and Property, Article 7: Water Systems, Emergency Water Regulations, at <http://docs.sandiego.gov/municode/MuniCodeChapter06/Ch06Art07Division38.pdf>

³ Special issue of *Arboriculture & Urban Forestry* on urban trees and drought in Australia, at <http://joa.isa-arbor.com/articles.asp?JournalID=1&VolumeID=39&IssueID=3>.

Watering Trees in Drought Conditions

Suggested Key Messages, City of San Diego, April 10, 2015 (in letter to Mayor and City Council)

As water is rapidly becoming a more limited and expensive resource, trees are also recognized as a precious resource. Trees require surprisingly little water during and after establishment, and provide many benefits that include shade, save energy, improve air quality and public health, sequester carbon and mitigate climate change, reduce stormwater runoff and erosion, increase property values, create wildlife habitat, and enhance walkability and quality of life.

Trees can be stressed, become more susceptible to pests, decline, and die if they are in landscapes where watering is decreased due to shortage or drought. **Trees should be given a higher priority** over lawns and annual plants when cutting back on landscape watering, because they can easily be replaced but trees take many years to mature. Removing dead trees often requires professional help, which can cost \$1000 or more per tree.

Even Drought Response Level 4 (the most severe) allows for watering trees on residential and commercial properties, and landscape vegetation in parks, schools, and other public places. Trees must be watered no more than two assigned days per week, and one day per week from November to May. As established trees need to be watered monthly, they are low-water users and provide many benefits for the monthly watering investment.

Trees need deep, infrequent watering. Most absorbing tree roots are in the upper 18 to 24 inches of the soil, under the tree and beyond the edge of the canopy (also named drip line). Set up separate irrigation zones for trees, to water monthly with enough gallons to soak the soil under trees. Water under and just beyond the canopy, and expand drip irrigation rings as the tree grows. Keep 2"-4" of mulch around each tree and out to the drip line, to reduce soil evaporation. Prevent trunk rot by pulling mulch 4-6" away from the trunk.

Deep watering recharges deeper soil layers and enhances tree resilience during periods of drought. This generally requires long run times—hours not minutes—and slow application rates, if drip emitters are being used. Water will only move down the soil profile under saturated conditions, so this requires the wetting of the shallower soil layers prior to the deeper layers being wet.

Water without waste. Small trees need only about 15-20 gallons a month—the amount most people use in one shower! Large and mature trees need about 30-40 gallons a month – the amount of a load of laundry. New trees need water twice per week for the first three months, weekly for the rest of the first year, every two weeks for the next two years. Most established trees do not need irrigation in the wet (winter) months, and only need supplemental watering once a month in the dry (summer) months and in any winter months without rain. The average cost of a gallon of water in San Diego is less than a penny so the monthly cost of watering is less than \$1.00.

Trees need water in the rainy season (winter) if rainfall is below normal or if weather is extremely hot or windy. Water before, during and after Santa Ana winds to reduce stress. Well-watered trees don't have dead branches and rarely ignite.

Trees provide benefits for decades and require limited water. Plant trees that have low and medium water requirements, generally labeled as "drought tolerant." Save water by planting in fall and winter when rains and cooler weather reduce the irrigation needs of new trees.

Resources. Learn more about how to water trees in drought conditions and newly-planted trees. [Provide links to brochures and other tree watering information.]

Restrictions Relating to Trees in Emergency Water Regulations

The City is currently in Drought Response Level Two: Drought Alert Condition, outlined at <http://www.sandiego.gov/water/conservation/drought/prohibitions.shtml>. These restrictions apply only to properties within the City of San Diego Public Utilities Department's service area.

Sections applying to trees and parks, from the San Diego Municipal Code, Chapter 6: Public Works and Property, Article 7: Water Systems, Emergency Water Regulations, <http://docs.sandiego.gov/municode/MuniCodeChapter06/Ch06Art07Division38.pdf>:

§67.3803 Water Waste Prohibitions

(j) A customer may only irrigate potted plants, non-commercial vegetable gardens and fruit trees, residential and commercial landscapes, including golf courses, parks, school grounds and recreation fields, before 10:00 a.m. and after 6:00 p.m. during the months of June through October and before 10:00 a.m. and after 4:00 p.m. during the months of November through May. A customer may irrigate at any time the following:

- (1) as required by a landscape permit;
- (2) for erosion control;
- (3) for establishment, repair, or renovation of public use fields for schools and parks;

§67.3805 Drought Response Level 1 – Drought Watch Condition

(b) Limit all landscape irrigation to no more than three assigned days per week on a schedule established and posted by the City Manager. This provision does not apply to commercial growers or nurseries, nor to the irrigation of golf course greens and tees.

(2) Use a hand-held hose equipped with a positive shut-off nozzle or hand held container or a garden hose sprinkler system on a timer to water landscaped areas, including trees and shrubs located on residential and commercial properties that are not irrigated by a landscape irrigation system.

§67.3806 Drought Response Level 2 – Drought Alert Condition

All of the restrictions for Level 1 plus:

(2) Landscaped areas, including trees and shrubs not irrigated by a landscape irrigation system governed by Section 67.3806(b)(2) shall be watered no more than three assigned days per week by using a hand held container, hand-held hose with positive shut-off nozzle, or low volume non-spray irrigation (soaker hose.)

§67.3807 Drought Response Level 3 – Drought Critical Condition

All of the restrictions for Levels 1 and 2, plus:

(b) (1) Limit all landscape irrigation to no more than two assigned days per week on a schedule established and posted by the City Manager. During the months of November through May, landscape irrigation is limited to no more than once per week on a schedule established and posted by the City Manager.

§67.3808 Drought Response Level 4 – Drought Emergency

All of the restrictions for Levels 1, 2 and 3, plus:

(b)(1) Stop all landscape irrigation, except crops and landscape products of commercial growers and nurseries. This restriction does not apply to:

(A) Maintenance of trees and shrubs that are watered no more than two assigned days per week on a schedule established and posted by the City Manager, and by using a hand held container, hand-held hose with an automatic shut-off nozzle, or low-volume non-spray irrigation;

(E) Maintenance of landscaping within active public parks and playing fields, day care centers, school grounds, cemeteries, and golf course greens, provided that such irrigation does not exceed two days per week according to the schedule established under Section 67.3807(b)(1)

Did you know that trees...

- Cool your yard and home, cut energy bills, increase property values and attract songbirds
- Create privacy, provide sound buffers and even slow traffic
- Clean the air by absorbing pollution
- Reduce urban temperatures by cooling streets and buildings
- Help to clean our water by decreasing storm water runoff and erosion, and taking up nitrates, phosphorus and cadmium
- Are a great investment—they return \$2–\$5 in benefits for every \$1 spent on water and maintenance



The larger the tree, the greater its benefits. Watering wisely gives immediate benefits and high payback.

FOR MORE INFORMATION:

Tree selection:

www.selecttree.com

Tree watering needs:

www.ucanr.edu/sites/WUCOLS

Benefits:

www.arboday.org/trees/benefits.cfm and
<http://actrees.org/resources/about-trees/tree-facts/>

Soil percolation rates:

www.treepeople.org/soil-percolation-rates

Invest from the Ground Up:

www.investfromthegroundup.org

California Urban Forests Council:

www.caufc.org

Tree Benefits Calculator:

www.treebenefits.com



Invest From the Ground Up is a statewide campaign to show California's home and business owners the true value of investing in our trees, parks and green spaces. To find out more, go to InvestFromtheGroundUp.org.

Invest From the Ground Up is a program of the California Urban Forests Council.



Water-wise Tree Care

LOCAL PARTNERS

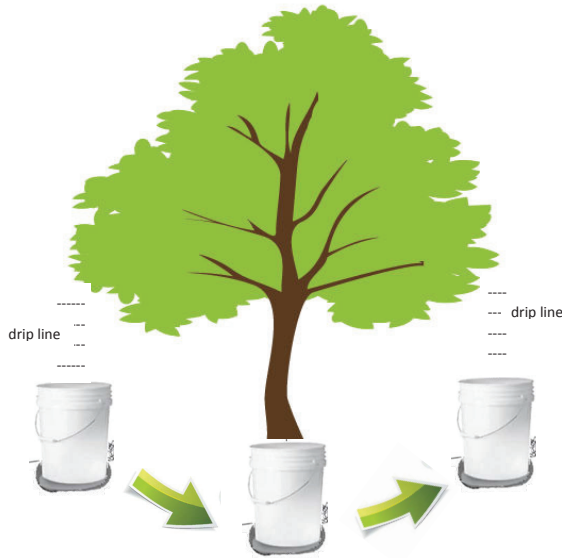


STATE PARTNERS



Overwatering Wastes Precious Resources

The Bucket Method: A simple, low-tech way to water without waste. Three 5-gallon buckets deliver 15 gallons every time.



Drill two 1/4" holes into the bottom of three 5-gallon buckets. Place the buckets around the tree's drip line. Fill almost to the top with a hose (about one minute). Let the water drain from the buckets (about 10 minutes). Repeat for 30 gallons. If you only have one bucket, rotate it around the tree's drip line and refill.

Full buckets are heavy; place them in the proper location before filling. Each time you water, place in slightly different locations around the drip line. It's so easy, even kids can do it!

You can use drip irrigation, low flow bubble heads, micro sprayers or soaker hoses. To determine the time needed to apply the right amount of water check manufacturer's label, use a P3 (or equivalent) water meter or note the time it takes your system to fill a 5-gallon bucket. Multiply that time by the number of 5 gallon increments needed. Then, set a timer!

Drip irrigation "grows" with your tree (see cover). Place the largest ring at the tree's dripline, and smaller rings 12 to 24" apart inside. Determine how long irrigation needs to run to saturate soil 10" deep, and then program this amount of time, at the suggested frequency. Every few years, add a ring under the drip line and remove rings that are touching or too close to the trunk.

Enjoy trees and conserve water too!

- Trees use far less water than lawns. Keep existing trees or plant new ones when removing thirsty lawns.
- Save water by planting in fall and winter when rains and cooler weather reduce the irrigation needs of new trees.
- Water early in the morning or after the sun has set.
- Mulch! Keep 2–4" of mulch around your tree and out to the drip line. Prevent trunk rot by pulling mulch 4–6" away from the trunk.

Slow the flow! Water without waste.

- Small, low water trees need only about 15–20 gallons a month – the amount most people use in one shower!
- Large and mature, low water trees need approximately 30–40 gallons a month – the amount of water used in a load of laundry.
- The average cost of a gallon of water in San Diego is half a penny. A low-water tree costs less than \$5 to water the first year and drops to less than \$3 after the third year. A medium-water tree costs twice as much.
- New trees usually need 5 gallons of water twice per week for the first three months and 10 gallons once per week for the remainder of the year. Be sure to soak the root ball every time you water.
- In the second and third years, water every two weeks, including dry winter months and when weather is extremely hot or windy.

Trees need deep, infrequent watering.

- Roots often extend far beyond the edge of the canopy, or drip line. Water under and just beyond the drip line.
- Most absorbing tree roots are in the upper 18 to 24 inches of the soil. Water only needs to reach that deep.
- In clay soils, water all at once. In sandy soils, water half of the recommend amount every two weeks. Clay soils hold water longer than sandy soils but may take longer to saturate when the soil is very dry. Replenish mulch to reduce soil evaporation.
- If weather is hot and dry, check soil moisture at 4" below surface and water if soil is dry.
- Water before, during and after Santa Ana winds to reduce stress. Well-watered trees rarely have dead branches and don't ignite.

Waterwise Tree Care

Help trees survive drought: Tips for inland Southern California

Water, or the lack of it, should never be far from the minds of southern Californians. Whether it is due to drought or climate change, water is rapidly becoming a more limited and expensive resource.

Like water, trees are also a precious resource. Trees can suffer and decline if they are in landscapes where watering is decreased due to shortage or drought. During those periods, you may be asked to cut back on watering your yard. Trees should be given a higher priority over lawns and shrubs, because trees take many years to mature. Grass and small shrubs are relatively quick to replace. Make sure you keep your trees alive and healthy by providing adequate water.

Urban trees provide many benefits worth preserving, including shade, energy savings, improved air quality, higher property values, wildlife nesting sites and food sources, improved quality of life, plus control of storm water, erosion and climate extremes. According to research by the USDA Forest Service* an average tree in the Inland Empire provides \$3880 of benefits.

*Trees Pay Us Back by the USDA Forest Service Pacific Southwest Research Station: http://www.fs.fed.us/psw/programs/uesd/uep/products/18/804uesd_uep_tpub_InlandEmpire.pdf



PHOTO BY DIANA RUIZ



PHOTO BY NANCY SAPPINGTON

How can you tell if a tree is under stress?

- Wilting, curling, graying or yellowing of leaves and browning of leaf edges
- Dieback of twigs and branches
- Lack of new growth and shoot lengthening in spring
- Disease and/or insect infestation.

Did you know? Trees that are stressed may curl their leaves up or down to reduce the amount of solar radiation they absorb.

Several Riverside area park trees were uprooted during strong winds, August, 2013. This example shows that the roots never developed adequately to provide a strong support, perhaps due to shallow and deficit-irrigation. Irrigation systems designed to water turf do not sufficiently water deeper rooted trees. In addition, the grass was allowed to grow close to the trunk, utilizing water and nutrients that were needed for tree growth.

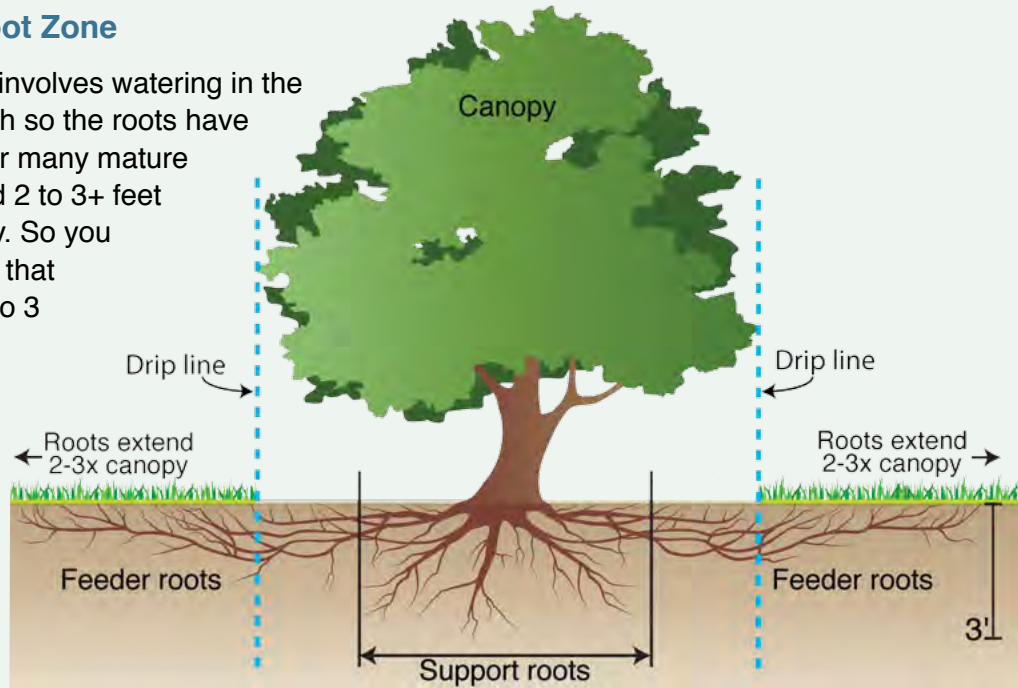
Watering Tips

How often you will need to water depends on many variables, including weather, soil type, site conditions, irrigation system, tree age/size, and kind of tree. The following few pages provide some simple approaches to help you evaluate conditions and apply water to keep trees healthy.

Water the Entire Root Zone

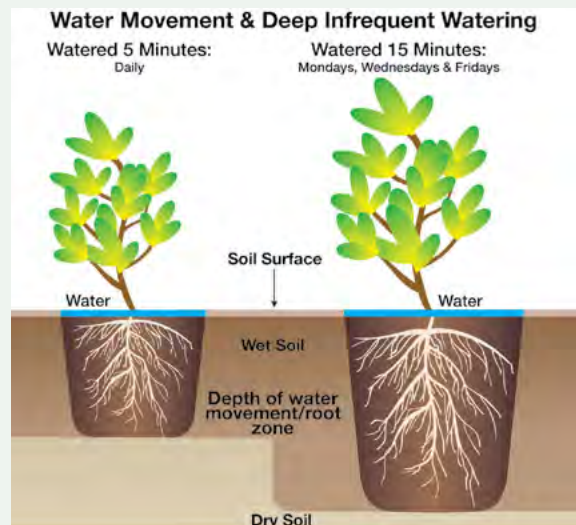
Keeping trees healthy involves watering in the root zone, deep enough so the roots have adequate moisture. For many mature trees, roots are located 2 to 3+ feet deep under the canopy. So you will need to make sure that water is percolating 2 to 3 feet deep.

Wet the surface of the soil beneath the area shaded by the tree's canopy and beyond. In some situations, feeder roots extend 2-3 times beyond the distance of the canopy.



Soak Deeply

Shallow watering encourages shallow root development and limits the volume of soil a tree uses for water and nutrient uptake, making a tree more susceptible to drought, disease, and uprooting during strong winds.



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Use a soil probe, auger, or small shovel to determine if water is reaching the entire root zone.



Simple Methods

If you don't have a separate irrigation line for your trees, try other simple ways to water the root zone:

- let a hose drip and move it around to soak under the canopy and beyond the drip line
- coil soaker hose under the tree and run for a few hours
- build a circular berm and fill with water.

For newly planted trees, water the root-ball area deeply one or more times per week to encourage the growth of deep roots. It's important that the root ball be moistened frequently to encourage rapid root growth. Check for moisture 6 inches into the soil on the sides of the root ball.

When to Water

Sun and wind increase evaporation. To reduce evaporation, apply water in the early morning, not during the heat of the day, especially if using a sprinkler system. With sprinklers, avoid watering during wind.

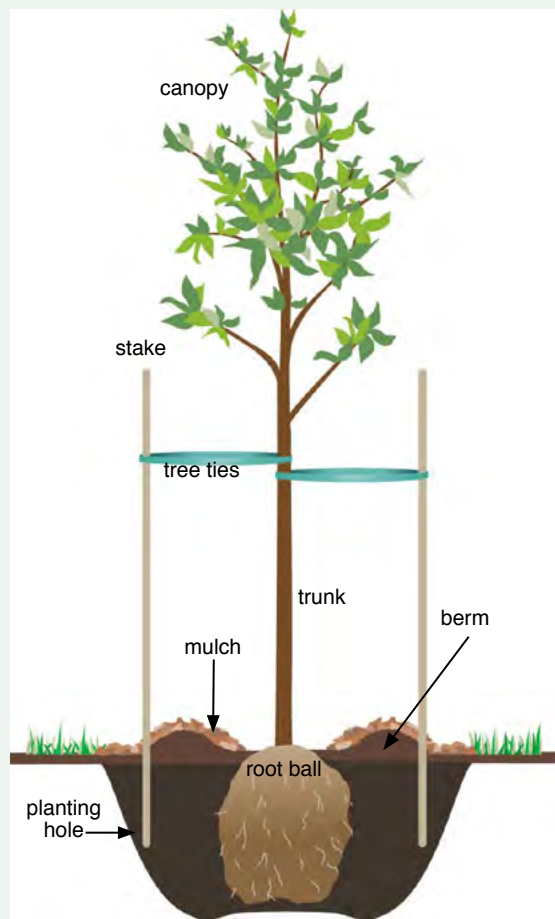
Frequency

Water mature trees every 1 to 4 weeks during the dry season, which is generally from May to November. If there is a lack of rainfall, you will need to extend watering into the winter months. Well-timed fall and winter watering may allow a tree to survive on less water than a regime of plentiful water during the growing season. Waterwise (drought tolerant) trees require less frequent irrigation.

Soak infrequently until the soil is moist, not mushy, allowing it to dry in between irrigations to prevent diseases that thrive in warm, wet conditions. Prevent mulch from touching the trunk of the tree, also, direct sprinkler spray onto the soil surface and not at the trunk.



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Newly planted and young trees require more frequent irrigation. Initially upon planting, build the berm so its inside edge is just above the edge of the root ball to direct water above and into the soil of the root ball. As the tree becomes established, move the berm out to under the drip line, and continue to widen as the tree matures.



Mulch!

Apply mulch 2-6 inches deep under the canopy and, if possible, throughout the feeder root zone area. Place mulch 6 inches away from the trunk. Also, avoid using weed cloth, plastic sheeting, or inorganic mulch, such as gravel or stones under trees.

Mulches of organic matter (dead plant parts: chipped bark, leaves, grass clippings, etc.) conserve water by holding moisture, preventing weed growth, and reducing evaporation from the soil surface.

Organic matter creates a favorable environment for soil life, including helpful bacteria, earthworms, and beneficial fungi, which help break up the soil to allow water to penetrate. Prevent compaction by keeping off wet soil, and avoid parking cars on the soil surface above the roots.

Mulch prevents the growth of highly competitive annual weeds, but not perennial weeds such as Bermuda grass or Kikuyu grass.

Fresh organic material is better for mulching the soil surface than compost. (Compost is used as an organic fertilizer that can be mixed into the soil at planting time.) Don't be concerned that mulch will absorb nutrients from the soil surface as it decomposes. This has been studied and found not to occur unless mulching material is incorporated into the soil rather than placed on the surface. Also, some trees are known to be able to prevent the growth of neighboring plants, but this is not true of their chips.

Bulk, fresh mulch can sometimes be obtained from tree services. Some cities, such as Riverside, provide free chipped mulch for pick up.



Mulch away! Place mulch onto the wetted area, but to prevent disease, don't let mulch touch the tree trunk.



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Soil Type

Soil is composed of tiny fragments of rock or minerals, plus the spaces between those particles (pores) which drain and hold water and air. There are many variations of soil, as every soil has a different composition of minerals and organics, and every soil has been subjected to different environmental conditions. However, the basic concept to understand is soil texture, because particle size determines the pore size which holds water and air and affects how much water is needed to replenish the root zone and how frequently water should be applied.

What is the texture of your soil?

Soil texture can be determined by using the “feel” method: rub moist soil between fingers. Soil texture varies by proportion of sand, silt, and clay. When soil is moist, make a ball of soil and press it into a ribbon shape. In general, the longer the ribbon, the more clay you have in the soil. If you can't make a ribbon, you probably have a lot of sand.

- Sand particles, the largest size, feel gritty and are generally visible to the eye. Sandy soils drain relatively quickly, but very coarse sand (sandbox size) drains too quickly to support root growth.
- Silt particles feel slippery or silky when moist.
- Clay particles, the smallest size are microscopic. Clay holds significant amounts of water. Clay feels sticky when wet and hardens into clods that are like rocks. If you've ever sculpted with clay you know how sticky and hard pure clay can be.

For an online guide to texturing soil by the feel method, see: http://www.nrcs.usda.gov/wps/portal/nrcs/detail/soils/edu/kthru6/?cid=nrcs142p2_054311

Soil Texture and Water

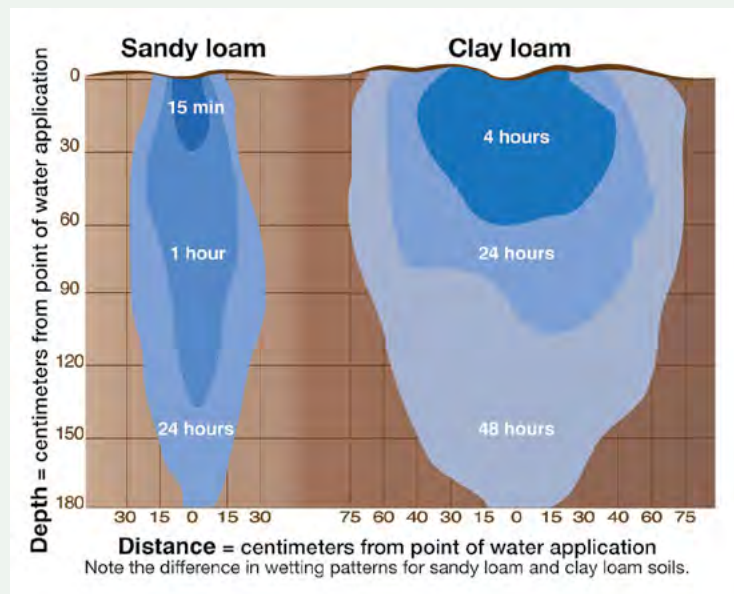
Sandy soils drain quickly, retain less water, and require more frequent irrigations. For soils high in clay, one foot of soil depth holds more than 2 inches of water. A soil that is a mixture of sand, silt and clay (a loam) is ideal because it both holds water (available for roots) and drains excess water, providing for air. Soggy or waterlogged soil can “suffocate” roots.

Most of our local soils are loam, a mixture of sand, silt and clay. For loamy soils, one foot of soil depth holds 1 to 2 inches of water. So for a small tree, a simple way to get water deep into the root zone is to build a circular earth berm below or beyond the canopy drip line and fill the basin with water a few times with 2 inches per foot of estimated rooting depth.

Example: If you think your tree has deep roots to 3+ feet:

2 inches of water X 3 feet of depth = 6 inches of water needed.

Each time you irrigate, fill water inside the berm a total of 6 inches, such as 6 times at 1-inch depth.



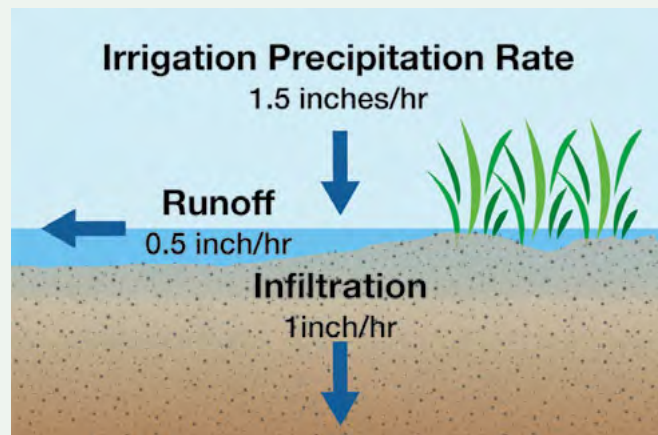
Water spreads out in soil that is high in clay. Water moves downward and drains more quickly through sandy soil, because the spaces between sand particles are larger.

Irrigation Systems and Different Soils

Just as different textured soils move water through them at different rates, they absorb water at different rates. When using an irrigation system, apply water at a rate according to the infiltration rate of the soil to prevent runoff.

A soil that is predominately clay absorbs water slowly as compared to sandy soil that has the most rapid infiltration rate. Apply water using components that don't exceed the soil's infiltration rate. Check your emitters, sprinklers, and/or sprayers for their application rates (irrigation precipitation rates). The speed at which an irrigation system applies water over a given area is referred to as the precipitation rate, measured in inches per hour.

You may have to adjust your watering run/s for site conditions including slope and amount of vegetative cover. For example, bare soils on a steep slope will shed water (and erode soil) quicker than those with a cover of mulch or vegetation.



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Water was ponding, in spite of a low-flow emitter. By watering slowly, you will prevent runoff and allow time for moisture to move downward through the soil. In areas with ponding, runoff, or compaction, schedule 2-3 short run times rather than one longer run.

Maximize Efficiency = Minimize Water Use

An efficient irrigation system is one that applies the right amount of water for the plants and uniformly over the yard or grove. If you are only watering a tree or two, uniform distribution of water may not be an issue. However, if there are dry spots in your landscape that you have to water more frequently or for longer periods of time, then you have an inefficient irrigation system. It may mean that each head on the system does not have the same precipitation rate (doesn't put out the same amount of water). Look for mismatched irrigation heads.

To get the right amount of water to each plant, efficient systems have specific zones or stations for plants with like water requirements (*hydrozones*). That is to say, low water-usage plants would not be on the same station as higher water-loving plants. For example, if you have shade plants in a shaded area, they would be on their own station and would be watered less than sun-loving plants in a sunny area.

For Smart Irrigation, Use Smart Controllers

“Smart” irrigation controllers tailor watering schedules and run times automatically to replenish only the amount of moisture that the landscape needs. Generally, there are two types of smart controllers, those that are based on soil moisture (SMS), which utilize soil sensors or tensiometers, and those that are based on weather information. Weather-based smart controllers draw upon a variety of climatic conditions, including temperature, incoming solar radiation, wind, and precipitation to calculate evapotranspiration (ET). ET is moisture lost from the plant to the atmosphere (through transpiration), as well as evaporation from the soil surface. In addition to onsite weather stations, some controllers use historic weather data, while others use a subscription service to download daily ET values.

Smart controllers, soil moisture sensors, and rain sensors are available at hardware stores and irrigation supply stores. Technologies change quickly, so compare controllers by Toro, Rainbird, Hunter and more. Many inland cities offer rebates for the professional installation of approved smart controllers.

If you’re not using a climate based controller, manually manage run times and days to water according to soil conditions and seasonal weather conditions. Most controllers have built in functions called “seasonal adjust” or “water budget” to easily adjust for seasons. Adjust at least four times per year.



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Even if you are using a smart controller, to be smart, you will need to monitor its use.



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The California Irrigation Management Information System (CIMIS) collects data from over 140 automated weather stations throughout the state. CIMIS provides reference evapotranspiration (ET_o) and weather data to the public for irrigation scheduling and other purposes such as pest management, energy generation, fire-fighting, weather forecasting, and scientific research.

Maintain!

Irrigation Maintenance

For efficient operation and uniform distribution of water, watering systems need continual maintenance. At a minimum, conduct monthly inspections and correct deficiencies, or hire a licensed maintenance contractor with water conservation expertise. Look for broken and worn components, clogged and missing emitters, leaks, overspray, and sprinkler misting, which may indicate that water pressure is too high. A doughnut shaped water pattern may mean the pressure is too low. Every few years, have an irrigation professional conduct a water audit. Some Resource Conservation Districts (RCDs), cities, and water districts provide irrigation evaluations free of charge. Irrigation system plans should be saved to verify that system components match the original design criteria.

Herbicides and Fertilizers

Trees already stressed by drought can be harmed by heavy applications of herbicide. Some tree species are harmed by herbicides used in the lawn.

If your trees have an insect or disease problems, treat them to reduce their overall stress. Additionally it's not helpful to fertilize a tree that is stressed by drought.

Pruning

The International Society of Arboriculture (ISA) recommends pruning trees only when necessary, such as to remove dead, diseased or damaged branches. Never top or over-thin a tree. Well-meaning tree owners often do irreparable damage, so check with a professional arborist before pruning, especially during times of drought. It's normally OK to properly prune trees during times of drought to improve structure and to remove dead and weakened branches. Leaving broken, insect-infested, or diseased branches can further weaken a tree.

Berm Maintenance

If you have a water basin with an earth berm around the base of your tree, it will be important to move the circular berm out, as the tree grows and canopy expands, at least to below the canopy drip line. As roots mature and increase in girth close to the trunk, they become buttress roots and serve more in a capacity to support the tree than for water absorption. It's not uncommon to see a person watering a mature tree right at the trunk, rather than away from the trunk, where water is needed most.



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Water is not getting to plant roots. Sprinklers can be adjusted to prevent overspray onto the sidewalk.



On slopes, build berms on the downhill side of the trunk to help capture runoff and allow the water to infiltrate.



Drought Sensitive Trees and Shrubs

Some species are so susceptible to drought that one summer in southern California without irrigation can be lethal, even to established plants. At the top of the list are coast redwood, camellia, and azalea. If exposed to more than one dry summer, any of the tropical species associated with wet conditions can be included in the “drought sensitive” list. Water-loving trees usually need more watering, so please only plant waterwise trees in the future.

A number of diseases and insect pests have been shown to be more severe when plants are exposed to summer drought, even if the susceptible plant is considered resistant to drought injury. Types of diseases that are drought related include cankers, Armillaria root rot, and surprisingly, even root rots caused by water molds such as Phytophthora. Several kinds of borers, especially pine bark beetles are commonly associated with drought. Plants that are susceptible should be irrigated deeply at least twice during the summer and into the winter if the drought continues. Common species meeting this description include:

- | | |
|--------------------|---------------|
| Aleppo pine | Incense cedar |
| Blue gum | Madrone |
| Canary Island pine | Monterey pine |
| Coast redwood | Sugar gum |
| Most fruit trees | Willow |
| Giant sequoia | |

Even native trees, including oaks may need a few deep soakings during the summer of a hot, dry year. Many factors affect tree watering needs including lowering water tables, removal of mulch or leaf litter and site disturbances such as paving and hard surfaces. Normally, native oaks do well with no summer water when they receive adequate winter rainfall.



Armillaria is a fungus that causes root and root crown rot. It has white/cream colored spores and usually has an annulus (ring-like remains) found around the stipe (stalk or stem). A frequent sign of Armillaria is a clump of mushrooms attached to the root crown/root.

PHOTO COURTESY OF SIMS TREE HEALTH SPECIALISTS, INC.



Gold spotted oak borer adult.

PHOTO BY MIKE LEWIS; CENTER FOR INVASIVE SPECIES RESEARCH; BUGWOOD.ORG



Coast live oak, *Quercus agrifolia*

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Planning for the Future

1. **Select the right tree for the right place.** (See suggested websites pg. 11). In southern California, that means selecting a low-water using, drought-tolerant species (*waterwise*).
2. **Xeriscaping** is the practice of landscaping in ways that minimize the use of irrigation water and utilize *waterwise* (less thirsty) plants. Group plantings and design irrigation systems by *hydrozones*, or sections that have plants with the same watering needs, and the same slope, sun exposure and soil conditions.
3. Use **Smart Irrigation**. Design irrigation systems that apply water with uniform precipitation rates. Plan separate irrigation lines for watering trees and large shrubs, preferably with drippers or low-volume sprinklers/sprayers to provide deep water for tree roots. Select water-conserving irrigation components, such as pressure regulated spray heads, rain switches, high efficiency nozzles, flow sensors to detect leaks, and smart controllers (timers).
4. Incorporate **Low Impact Development (LID)** methods, such as rain gardens (infiltration basins), rain barrels, and swales to capture water or allow it to percolate into underground water basins. Use non-potable (not drinking water quality) water for irrigation, when available, such as runoff water collected in rain barrels
5. **Preserve existing native trees** and non-invasive vegetation. Natural habitat that is not disturbed will not require irrigation. Irrigation will be needed to establish newly planted natives. If the ground has been disturbed with disking or weed clearance, the trees may need a good soak in a dry year.



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Often trees in city parks are only watered to 12 inches of soil depth, enough water to support a lawn with shallow roots, but not deep rooted trees.

Find excellent resources online about proper tree care, selection and irrigation.

Gardens to Visit

LandUse Learning Center

4500 Glenwood Dr, Bldg A, Riverside, CA 92501
(951) 683-7691, www.RCRCd.org

Sims Tree Learning Center

6111 Appaloosa Ave., Riverside, CA 92509
(951) 685-6662, www.simstlc.com

Landscapes Southern California Style

450 Alessandro Blvd., Riverside CA 92508
www.wmwd.com

Chino Basin Water Conservation Garden

594 San Bernardino St, Montclair, www.cbwcd.org

University of California, Riverside Botanic Garden

www.gardens.ucr.edu

Rancho Santa Ana Botanic Gardens

1500 North College Avenue, Claremont, CA 91711
www.rsabg.org

Organizations and Agencies

The Irrigation Association

www.irrigation.org

The International Society of Arboriculture

www.isa-arbor.com
www.TreesAreGood.com

California Urban Forest Council

www.caufc.org
www.InvestFromTheGroundUp.org

California ReLeaf

www.CaliforniaReleaf.org

Alliance for Community Trees

<http://ACTrees.org>

Cal Fire

www.fire.ca.gov/

National Arbor Day Foundation

www.arborday.org

UC Agriculture and Natural Resources

<http://ucanr.edu/>

USDA Forest Service

<http://www.fs.fed.us>



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www.FreeSprinklerNozzles.com

Tree Database Websites

Be Water Wise

www.BeWaterWise.com

Cal Flora

www.Calflora.org

USDA Plant data base

www.plants.usda.gov

Tree Selection Guide for California

www.selecttree.calpoly.edu

Water Use Classification of Landscape Species (WUCOLS) <http://ucanr.edu/sites/wucols/>

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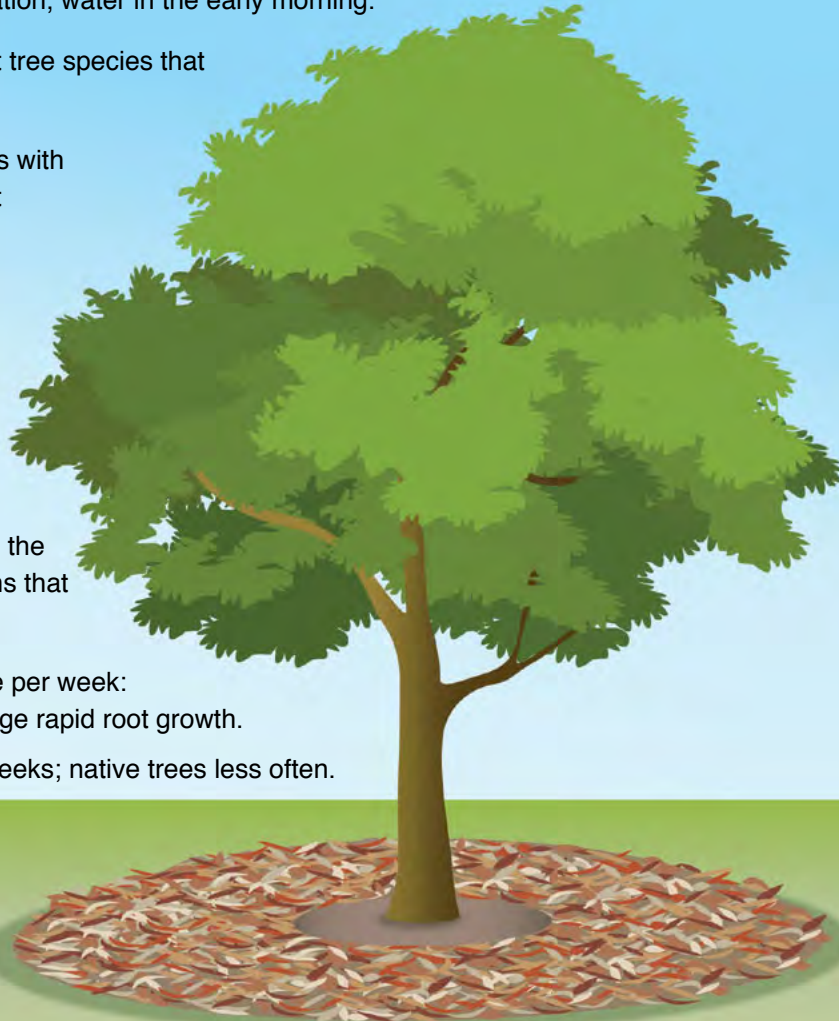
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Trees and Water Are Precious Resources.

Prioritize watering trees during a water shortage.

- To reduce water loss to evaporation, water in the early morning.
- Plant native or drought resistant tree species that require less water.
- Install efficient irrigation systems with uniform components and “smart controllers”.
- In areas with ponding, runoff, or compaction, schedule 2-3 short run times, rather than one longer run.
- Wet the surface of the soil beneath the tree’s canopy and beyond. Direct water away from the trunk, to prevent moist conditions that foster disease.
- Water young trees at least twice per week: moisten the root ball to encourage rapid root growth.
- Water mature trees every 1-4 weeks; native trees less often.
- Spread mulch under and beyond the canopy, but not touching the trunk.
- Repair broken and worn components, clogged and missing emitters, and leaks. Look for overspray, sprinkler misting, and ponding.
 - Deep, infrequent watering encourages deep root growth for drought resistance.
 - Evaluate your soil type and rooting depth.



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