

Keeping Plants Alive under Drought or Water Restrictions.... And Planning for the Future

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The purpose of this publication is to provide credible information regarding keeping outdoor plantings alive during drought and under water restrictions. Topics covered include symptoms of water stress, tips to conserve water in your current landscape, minimum water needs of various types of plants, and the best time to plant a drought-resistant landscape and tips for its success.

Overview

Plants that do not receive enough water will eventually show signs of water stress. During a drought or under governmental restrictions aimed at water conservation, keeping plants alive can be particularly difficult. Although plants vary in the amount of water they require for optimal growth and development, most exhibit characteristic symptoms when they are in need of water. Because plants need to be watered before irreversible damage occurs, it is crucial to check plants regularly for symptoms of drought. Also ensure that damage identified as drought stress is not due to other conditions that can mimic drought such as salts, diseases, insects, and frost.

Common symptoms of water stress include:

- wilting or drooping leaves that do not return to normal (without additional water) by evening
- curled or yellow leaves that may fold or drop, or foliage that becomes grayish and loses its green luster
- new leaves that are smaller or stem sections that are closer together than normal
- lawn grasses that retain a footprint for several minutes



Figure 1. Drought damage on leaves of a rose plant. *Source:* UC ANR, Jack Kelly Clark.



Figure 2. Salt damage on avocado can mimic drought damage. *Source:* UC ANR stock photo.

Incorporate the tips below to reduce water waste in your current landscape and garden:

Correct sprinkler system problems. It is usually the irrigation delivery system that is the real water waster rather than the plants themselves. This is particularly true of sprinkler systems used to water turf and groundcovers. Avoid expending a lot of time and labor replacing a perfectly good landscape with a new one only to discover that the original cause of your water waste still exists. On average, twenty to forty percent of water applied to lawns and groundcovers by sprinkler systems is wasted due to system leaks, low/tilted heads, broken sprinklers, unmatched sprinklers, and pressure and spacing problems. You can greatly improve the distribution uniformity (evenness of watering applied across your lawn or groundcover planting) and fine-tune the performance of your system by checking your system for these problems and performing a straightforward uniformity and precipitation rate test as described in the UC Lawn Watering Guide

<http://anrcatalog.ucdavis.edu/pdf/8044.pdf>, a free downloadable UC ANR publication.

Water based on climate zone. Water needs vary across the state based on climate zones. As figure 3 illustrates, reference evapotranspiration (ET_o) rates are much lower in the San Francisco Bay area than in Riverside and Palm Springs. Evapotranspiration is the loss of water into the atmosphere from the soil and plant surfaces (evaporation) and through plant stomata (transpiration). Reference ET is the amount of water taken up by established healthy cool-season turfgrass receiving unlimited water. Plant water demand and ET are closely related although most mature, well-established landscape plants remain healthy even when irrigated below their ET.

Note that the highest water demand occurs during summer and the lowest during winter. This is true throughout California in all climate zones. A list of all ET_o zones in California is found here:

http://www.cimis.water.ca.gov/App_Themes/images/etozonemap.jpg

Regardless of which ETo zone you reside in, remember to adjust automatic timers downward going into the fall. Not doing so leads to wasted water and unhealthy plants prone to disease-forming pathogens and other disorders.

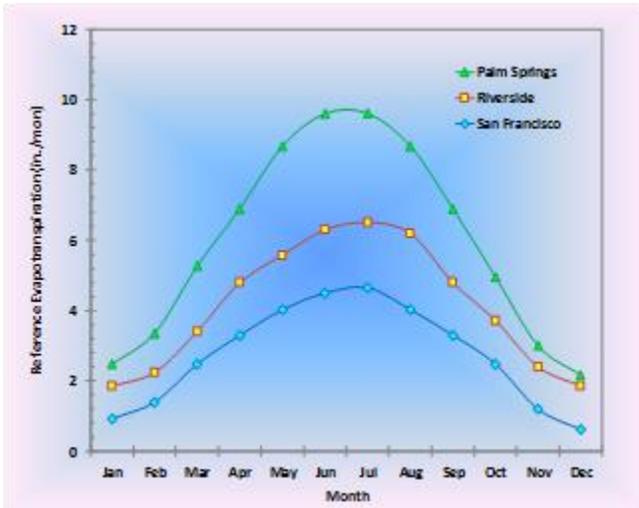


Figure 3. Monthly reference evapotranspiration (ET0) in the San Francisco Bay area, Riverside, and Palm Springs. *Source:* Richard Snyder, Department of Land, Air and Water Resources, university of California, Davis.

Irrigate slightly below the root zone to encourage deeper rooting leading to enhanced drought resistance. A simple and effective way to do this is to gently dig into the soil to determine how deeply the water penetrates the soil following irrigation.

Irrigate based on soil texture (type). Water plants growing in sandy soils more often but for shorter periods of time than those growing in heavy clay soils. This will reduce water waste and the chance of groundwater pollution from fertilizers and pesticides leaching below the root zone in sandy soils, and water and chemical runoff from the surface of soils high in clay. Figure 4 illustrates the drainage patterns that occur from irrigating sandy, loam (similar to compost-amended soils) and soils high in clay. Note how much longer it takes the same amount of water to penetrate deeply into a clayey soil compared to a sandy one and how much broader the water spreads horizontally in the high clay soil.

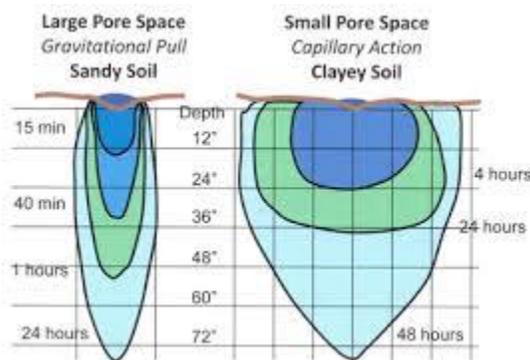


Figure 4. Comparative movement of water downward and outward in sandy and clayey soils. *Source:* <http://www.ext.colostate.edu/mg/gardennotes/213.html>.

Irrigate early in the morning. Soil evaporation is lower than later in the day. While evaporation is also low during the night, fungal diseases may develop, particularly when overhead systems wetting leaves are used.

Don't irrigate plants showing signs of physiological drought. In the heat of a mid-summer day, many plants cannot absorb available water as quickly as necessary to compensate for water lost due to ET. This leads to temporary mid-day wilting known as physiological drought, which will not be alleviated by adding more water. Affected plants will recover on their own during the evening.

Avoid summer planting. Converting a thirsty landscape to a drought tolerant one should be done in fall or spring rather than during the heat of summer. New transplants need more frequent and shallow irrigations than established plantings.

Consider installing a 'laundry to landscape' graywater system. The state and most local jurisdictions have lifted or greatly lessened restrictions on these types of systems which allow irrigating landscape plants with water from a washing machine if certain conditions are met. The updated code and its provisions for use of graywater to irrigate landscapes can be found in its entirety here: http://www.hcd.ca.gov/codes/shl/2007CPC_Graywater_Complete_2-2-10.pdf. Contact your local city public works department for specific information on local laws which may be more restrictive. Download UC ANR Drought Tip 'Use of graywater in urban landscapes in California' <http://anrcatalog.ucdavis.edu/Details.aspx?itemNo=8536> for more specific information.

Consider installing a rainwater harvesting system. These systems collect rainfall from roofs and channel it via gutters, pipes, or swales, keeping it on the landscape rather than allowing it to run off. Properly functioning rainwater harvesting systems can significantly reduce the need for supplemental irrigation in areas of measurable rainfall.

Mulch. Apply and maintain a three to four inch layer of mulch around garden plants and trees to keep the water in and the weeds out. Be sure to keep mulch at least one foot away from tree trunks to avoid wet trunks and crowns, which can be subject to disease-forming pathogens.



Figure 5. A 3-inch layer of wood chip mulch conserves water, reduces weeds and water runoff. *Source:* Gabriel Frank, <http://www.gardensbygabriel.com>.

Avoid overfertilizing. Applying too much nitrogen leads to an overabundance of foliar (leaf) production and the need for more water. Most mature landscape plants will get through a season or two with no supplemental fertilizations. Fruit trees and vegetables require adequate nutrients for crop production. When water is scarce fruit trees should not be fertilized; while the crop may be sacrificed, this practice reduces water requirement and will help keep the tree alive. Annual vegetables may get by on slow release nutrients supplied by organic matter and compost.

Control weeds. Weeds usually outcompete garden plants for water. Pull them when they are small making sure to remove all the roots.

Dust off the old broom. Sweep garden debris off of sidewalks and driveways rather than hosing them off.

Below are suggested methods to keep various types of plants alive during drought and water restrictions.

Trees: Most homeowners wisely choose to use whatever water is available to save their mature landscape ornamentals and fruit trees. Watering older trees slowly and deeply with a garden hose slightly below the current root zone once in mid-spring and once or twice again in mid-summer will keep most established trees alive at least one season. Trees growing in sandy desert soils may require more frequent irrigations to keep them alive. Two seasons or more of drought stress can result in severe damage and death of some species, even in cooler coastal areas.

Drought-stressed trees are often more prone to damage from diseases and insects, as well.

Studies have shown that California native oaks may benefit from supplemental summer irrigation during prolonged drought even though they are relatively drought tolerant. However, they are also easily over-irrigated leading to fungal diseases such as oak root fungus (*Armillaria mellea*) and crown rot (*Phytophthora* spp). Letting the soil dry out some between irrigations will help prevent these diseases. Water should be kept at least ten feet away from tree trunks and most should be applied in the outer two-thirds of the root zone which may extend two to three times beyond the canopy of the tree.

Although fruit and nut trees can be kept alive during severe water shortages a season or two, fruit production may be greatly reduced or stop altogether. To produce a standard crop, deciduous fruit and nut trees need water applied steadily from bloom until harvest. Citrus trees need adequate soil moisture during spring to set fruit and steady water in summer and fall to produce acceptable size, number, and quality of fruit.

Mature trees have extensive root zones that often grow laterally two to three times the canopy width and two to three feet deep (depending on the soil texture, any compaction issues, and the irrigation schedule). Active water uptake by roots occurs in this area. This requires moving drip lines and emitters further and further away from the trunk as trees mature. Irrigating too close to tree trunks can result in crown and root rot and does not apply water into the root uptake zone of the tree.

Vegetables: Vegetables are not drought resistant plants and are difficult to maintain during a drought. It is often wise to reduce the overall size of the garden and plant only your favorite types of vegetables

when water is limited. Scheduling irrigations based on the water needs of the specific crop during critical periods of growth is essential for vegetable production. Hydrozoning (placing plants with similar water needs in the same area of the garden) allows gardeners using automated drip irrigation systems to target water applications based on water needs of individual zones, reducing water waste.



Figure 6. Plant only family favorites and avoid an oversized garden that is larger than your needs. *Source:* <http://ucanr.edu/blogs/blogcore/postdetail.cfm?postnum=13130>.

Mixing organic soil amendments (such as compost) evenly into garden soil six inches to one foot deep helps retain soil moisture in the rooting area of the plant, which can significantly lengthen the allowable interval between irrigations before drought symptoms develop. While the plant still requires the same amount of water, stretching the time a plant can go between waterings can make the difference in whether garden plants live or die during a drought or under imposed water restrictions. This is especially true of tomatoes, beans, lettuce, and root crops such as carrots which require regular watering and are not tolerant of long, dry periods. Vine crops such as cucumbers and squash often fare better and can be kept alive by watering once or twice a week throughout the season. As a rule of thumb, water is most critical during the first few weeks after sowing vegetable seeds, immediately after transplanting seedlings and small plants, and during flowering and fruit production. Don't forget to add a three inch layer of mulch to reduce evaporation from the soil surface.

Shrubs. Most established shrubs can survive long periods of dry soil. One thorough spring watering and one or two thorough waterings in the summer keeps most mature shrubs alive for at least one season. As with other plants, prolonged drought can result in severe branch die-back and eventual plant death.

Groundcovers: Groundcovers often survive on about half the amount of water they would receive under optimal conditions, although some dieback may occur. To avoid serious drought stress, they should be watered once every three to six weeks from April through September, depending on location and soil conditions.

Lawns: Warm-season lawns, such as bermudagrass, zoysiagrass, and buffalograss, are more drought-efficient than cool season grasses (e.g. tall fescue and ryegrass) and may survive several weeks of

dryness even after partial dormancy. Conversely, cool-season grasses may die within a month or two of receiving no water. Signs of drought include wilted leaves and a bluish-gray appearance followed by yellow leaves that eventually turn brown. Established lawns, like all mature plants, prefer infrequent deep irrigations over frequent, shallower ones.

Once a lawn stops receiving adequate moisture, it will gradually turn brown and go dormant. A lawn that recently turned brown from drought can often be revived with thorough watering, but it may be difficult to save a lawn that has been deprived of water for several weeks. This depends on the turf species, soil texture, length of time since last irrigation, weather, and other parameters. During a water shortage, reducing the amount of water applied to your lawn to one-half of that recommended in the UC ANR Lawn Watering guide <http://anrcatalog.ucanr.edu/IntegratedPestManagement/8044.aspx> gradually will help ensure the survival of warm and cool-season lawns.

Additional methods to reduce water waste in your lawn are to maintain the highest recommended mowing height based on species and to reduce fertilization rates to ½ or less of recommended rates. Specific information on these topics may be found in the UC ANR ‘Managing turfgrass during drought’ publication: <https://anrcatalog.ucdavis.edu/pdf/8395.pdf>.

What about replacing your current landscape plants with more drought resistant ones?

As previously stated, the heat of the summer is not the time to remove and replace your current landscape plants with drought resistant species. Plants that are not established – even drought resistant natives - require more frequent watering than the same species growing for a season or two that have developed a deeper, more extensive root system. Fall is the best time to establish native plants and fall or spring are both good times to swap thirsty plants with more drought-efficient non-natives.

Also keep in mind that often it is the irrigation delivery system that is the real water waster – **not the plant**. This is particularly true of sprinkler systems used to water turf and groundcovers. Avoid expending a lot of time and labor only to discover that the original cause of your water waste still exists. While cool season lawns are not drought resistant, warm season turf takes about the same amount of water as many other plants. [Maintain even water distribution across the lawn to reduce water waste.](#)



Figure 7 (left): Beautiful, drought-efficient landscapes save water and time. *Source:* <http://www.cholmquistgardens.com/portfolio/> Figure 8 (right): Drip irrigated drought-efficient landscape on slope with mulch minimizes runoff. *Source:* <http://www.ecolandesign.com/california.html>.

Here are tips for planting a new water-efficient landscape:

- Select water-efficient plants that grow well in your climate. Use Sunset climate zones <http://www.sunset.com/garden/climate-zones/climate-zones-intro-us-map> rather than USDA cold hardiness zones since Sunset zones are smaller and more precise. The exception is in cold mountain regions; USDA zones are often a better choice.
- Apply water directly into the root zone of newly planted ornamentals until roots become established and expand outward and downward.
- Hydrozone. Place plants with similar water needs together and irrigate them accordingly in high, medium, low, and very low categories. This is especially important when landscape and edible plants are irrigated by automated systems allowing precise scheduling valve by valve.
- Mix soil amendments (compost, etc.) evenly and deeply into sandy and clayey soils (40% or more by volume) at least six inches deep before planting small herbaceous and woody plants to improve water retention in sandy soils and drainage in soils high in clay. Avoid adding soil amendments to holes dug for individual trees since roots often grow in circles in the confines of the amended soil rather than expanding outward and downward into unamended soil. This practice can result in poor anchorage and support for the maturing tree and lead to tree failure.
- Drip irrigate areas of your landscape not planted in turf and groundcovers unless hand-watering is practical and you are regularly home to ensure that plants receive adequate water (particularly during the first few weeks after planting). Drip systems apply water directly into the root zone of the plant greatly minimizing evaporation from soil. In addition, drip systems apply water much more slowly than sprinkler systems, reducing surface runoff.
- Download other free UC ANR resources such as Sustainable Landscaping in California, <http://anrcatalog.ucanr.edu/Details.aspx?itemNo=8504> for additional ideas to save water, recycle organic matter, reduce waterway pollution, reduce pests, conserve energy, and attract wildlife.

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