Watering Native Plants

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WHY WATER

You are watering the **soil** in order to provide for the **plants'** needs.

Soil is the bank where water is deposited and stored, and where all withdrawals originate. Water enters the soil as rainfall or through irrigation. Water exits the soil by evaporation into the atmosphere and through transpiration, which is the term describing its use by plants. Taken together, the total water loss/use is called evapotranspiration.

Flowering native plants watered once a month in summer

WHAT TO WATER

Plants use water to cool themselves and to grow. Plants draw water in through their roots and transport it through their entire system. Roots grow in soil. Different plants have different water needs. Plants can absorb some water through their leaves as well, though most natives are adapted to not need this source of water, especially in the summer months.

WHEN TO WATER

Rain is the best water. It comes at the best time, it is free and it is pure. Native plants love rain and they grow during the rainy season. You should build swales, check dams, micro-topography and soil surface profiles in your garden in order to direct and retain rainfall so that it will soak in rather than run off. Take advantage of all the natural waterings we might get. You can also capture rainwater in rain barrels or reservoirs, for use later during the dry season.

Irrigation is the water supplied as a supplement to rain. In the dry season, you need to water before the plant needs it. Put water in the soil (like savings in the bank) so plants can make withdrawals as needed. In California it rains in winter, usually enough to carry natives through summer, especially if you have made provisions for rainwater to soak in rather than run off. In our gardens, our plants might appreciate a little extra water in summer to keep them looking fresher than their cousins out in the dry hills.

But be careful with summer watering. The goal is to promote root systems that reach extensively into deep soils. You achieve this goal with **deep infrequent irrigations**. Shallow waterings alone will not promote healthy, sustainable landscapes.

Waterlogged soils will cause root rots on plants that need oxygen in their root zones, especially in summer when soil temperatures are warm. Root rots and other disease organisms are most likely to infect plants in summer, in instances where there is too much water, not enough oxygen, and soil temperatures above 72° F. Frequent shallow waterings often provide the conditions fungal root rots need to attack native plants.

As a general rule, it is time for an **irrigation** (a deep soak) when the soil has become dry at a depth of 3 - 4 inches. On newly planted gardens, you need to keep the soil a bit more consistently moist, but don't water every day or too frequently as you will create waterlogged situations.

DEFINITIONS

Rainy Season - typically October thru April. "Average" rainfall amounts throughout southern California, 12-14 inches.

Precipitation rate - the rate, measured in inches per hour, that rainfall or an irrigation method uniformly applies water to the site.

Irrigation - in this article this term refers to a deep soak watering event, equivalent to 1-2 inches of rainfall.

Refreshing sprinkle - in this article a refreshing sprinkle refers to a washing of the leaves, and cooling the area, and slight moistening of the soil surface. These can be beneficial when timed correctly (late afternoon) to "freshen up" the garden between irrigation events. This can be done by running the sprinklers for a short time, (i.e.; 5-7 minutes), or with a spray nozzle on a garden hose.

Contour Grading - Swales, mounds, and basins constructed to make a "rain garden." Look for a kind of "microtopography" you create with dry creek beds, mini dry ponds, basins, and mounds (the soil that comes out of the swales and basins). Careful placement of these contour features slows down rainfall runoff so that it soaks into the ground. Sprinkler irrigation will be far more effective as well. Include boulders, rocks, stones, and pebbles for a natural look.

FACTORS DETERMINING WATERING FREQUENCY:

Season - During the cool season, most native plant landscapes will do fine on rainfall alone with no supplemental watering. Of course new plantings will need watering, and in a dry winter, you may want to provide water during an unseasonal dry spell. Rain is best, so watch the forecasts and hold back on watering when rain is anticipated. Conversely, in a dry winter, you may want to water immediately after a very light rain event, artificially providing additional precipitation.

KEY POINT

Most native plantings will thrive with a deep-soak **irrigation** once every 3-4 weeks during the dry season. New plantings or landscapes with herbaceous, shallow rooted plants can receive lighter irrigations in between, but for all plantings, be prepared to irrigate thoroughly about once a month, May through October. A thorough irrigation is considered applying enough water to equal a rain event totaling approximately 1 -1.5 (up to 2) inches. Though not absolutely necessary, most gardens will also benefit from a weekly refreshing sprinkle in addition to the monthly deep soak irrigation. See **HOW MUCH TO WATER** on page 14.

Location - Sites near the coast are cooler in summer and the nighttime humidity helps the vegetation during the summer months. Inland sites are much hotter and drier. Of course you need to choose the right plants, and understand that plants in inland sites will usually require more water than plants in coastal gardens.

Exposure - Plants in full sun grow in soil that will become hotter and drier than soil that is shaded. Plants have figured this out, so their strategy to shade their own root zone is actually pretty clever. Low branches and fallen leaves provide shade and mulch to keep the root zone cool and moist. Soil in the shade of trees, fences, buildings, etc., will stay moist longer than soils in the sun.

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Weather - This factor might seem too obvious. The point is you should be watering "ahead." Farmers (the good ones) do not play catch-up in watering their crops. They water for the plants' future needs. In summer, watch the weather forecasts and soak your garden several days before the heatwave, otherwise the plants will be trying to make withdrawals from an overdraft account.

Soil type - Different soils store water differently. Clay soils have a greater water holding capacity and they retain moisture a long time. Sandy soils dry out quicker and retain less water to be made available to the plant. Loam soils are ideal, providing a perfect blend of moisture retention and pore space where roots can find the water and the oxygen they need to be healthy. Clay soils hold moisture but can become waterlogged to a point where there is no oxygen for the roots. Sandy soils can easily dry out to the point where roots cannot find water.

Plant types - Plants from dry climate regions (like California) are adapted to require less water than plants from temperate or tropical regions. California natives are accustomed to getting their water during the cool rainy season, and then toughing it out through the dry summer. In the garden, they will benefit from a little summer water, but it has to be applied correctly.

The plants in these photos are being hand watered 10 months after planting. Note the watering basins and the secondary watering rings, well outside the dinemsions on the original planting holes. This special deep soak done by hand is only necessary a few times during the first summer to get the plants established. The goal is to promote healthy root systems in deep, cool, moist soil.

HOW TO WATER

Cycle/soak or Pulse Irrigation - In each of the irrigation methods described below, you may find it beneficial to water using a technique called "cycle/soak" or "pulse" irrigation.**"**

Here's how it works: Water three days in a row to achieve a cumulative irrigation total of 1 - 1.5 (up to 2) inches. This is especially important in heavy (clay) soils where penetration is difficult and absorption is slow. The premise is simple and based on natural rainfall. By example, our most effective rains come as showers falling over an extended period. If we get 2 inches of rain in showers scattered over a three-day period, it is much better than a single 2-inch downpour. The same with summer waterings. If you apply 1 - 1.5 (up to 2) inches of precipitation over three consecutive days, you will get better penetration, better oxygenation, and better root uptake. Your three days of watering will be considered one irrigation "event."

Hand water - For home landscapes and all small accessible spaces, don't underestimate the simple act of standing with a garden hose and soft rain nozzle and watering your plants by slowly and methodically soaking the soil. It takes a little while but it is time well spent and you will see details in your garden you may miss otherwise. Do this in the early morning or late afternoon, and not in the heat of the day. If you have watering basins and micro-topography built into your planting, this will be an easy way to get a good deep soak. You can water thoroughly about once a month, and include a few light sprinklings in between if you like, always avoiding the midday heat. This pattern would establish your **irrigation** frequency at approximately once every 3-4 weeks, with a **refreshing sprinkle** once or twice a week.

Hose-end mini sprinkler with 9 - foot radius supplies approximately 1/4" precipitiation per hour, ideal for cycle/soak or pulse irrigation deep soak.

Sprinkler (hose-end) - Since native plants only need an **irrigation** about once a month, it is very easy to set up an old fashioned sprinkler on the garden hose, turn the water on at a gentle flow, and leave the sprinkler running long enough to thoroughly soak the ground where the sprinkler covers. You will need a sprinkler with a very low precipitation rate to avoid wasting water to runoff. You can move these "sets" around until your entire garden is watered. Believe me, grandpa used to water his very thirsty lawn this way. For natives, find a sprinkler that supplies water with low volume flow (provides deep soak), small droplets (prevents soil compaction), and low trajectory (keeps most of the leaves dry). Tree of Life Nursery makes and sells micro-sprinklers as singles or with multiple sprinklers in-line for simple cost effective watering. With micro-sprinklers, pulse irrigation described above is best because of their very low precipitation rate, less than .25 inches per hour. You may need 6-8+ (up to 12) hours of run time to get a good deep soak, so it is better to apply it over a three day period, three pulses of 2-3+ (up to 4) hours each.

HOW MUCH TO WATER

Remember, soil stores water where plant roots can find it. Clay soils effectively retain more moisture for a longer time, but absorb water more slowly. Sandy soils dry out quicker, and while water readily sinks in, the water which actually adheres to the outside of each sand particle (capillary water) is easily lost. Loam soils retain moisture and allow space for oxygen.

Plants differ in their water needs. This and many factors have to be considered in determining how much to water. Water exits the soil through evaporation into the atmosphere and through transpiration, which is the use by the plant in cooling itself and growing. The rate at which all water is lost and used in the landscape in called the evapotranspiration rate. In areas of high evapotranspiration (hot, dry, windy) you will need to apply water more frequently. In sandy soils, you will also need to water more often effectively using more water than in clay soils. Plants should be selected based on their soil preference and their corresponding water needs.

KEY POINT

Our rains come during the cool season when evapotranspiration rates are low. In summer, the plants limit their use of precious soil moisture through ecological adaptations to reduce transpiration, i.e; making leaves that are grey, fuzzy, small, thick, leathery, waxy, succulent, oriented vertically on the stem, or leaves which reduce in number (leaf drop, summer dormancy), or various combinations of the above. We can manage summer water for the benefit of the plants, keeping them attractive and verdant through the season, but too much water, especially in soggy soils can harm them. Most are simply not adapted to grow in warm wet soils. With deep infrequent irrigations, we provide a place for healthy roots in cool moist soil, and plenty of valuable oxygen in the root zone.

WHERE TO WATER

Water where the roots are, and where you want them to be, or where you know they should be as the plant matures. As a general rule, a plant's root system is most active in the zone equivalent to its outermost branches.

Do not over-water right next to the crown of the plant, which is the spot where the stem comes out of the soil. Many plants suffer from fungal rot if the soil at the crown is continually saturated, particularly during warm weather.

On new plantings you need to make sure the nursery root ball does not dry out, *and* you need to promote rooting into the surrounding soil by applying water well outside the dimensions of the planting hole.

On established plantings, you simply need to get all the ground uniformly wet, just the way a rain event does, *and* you need to get the water to soak down deep.

CONTOUR GRADING – SWALES, BASINS AND MOUNDS

Contour grading will allow water to flow, sit, and puddle (especially during rain) in such a way that it will soak the ground down deep. This deep moisture will spread laterally in the deeper horizons of your soil, effectively moistening the entire root zone of the whole planting.

When you include subtle grade changes, (micro-topography), you increase the ability for your site to absorb and retain water, either from rain or irrigation. Dig swales and basins to build mounds. Use boulders, rocks, stone and pebbles to make a dry streambed. Include logs, stick piles, and stumps, located to prevent runoff while providing valuable habitat for wildlife species that will start as garden visitors and soon become residents... sharing the space with you.

Pop-up stream rotor sprinkler in a 7-month-old, properly graded, mulched landscape with native plants spaced correctly allowing for future growth.

Spray head nozzles apply water at a high rate = approx 3/4-1"/hr.

Mini sprinkler nozzles apply water at a very low rate = approx 1/4"/hr.

Stream rotor nozzles apply water at a low rate = approx 1/2"/hr.

WATER DELIVERY METHODS

Sprinklers (systems overview) - You can estimate your **precipitation rate** by placing several empty coffee cans in your garden, running the sprinklers for 30 minutes, measuring each can and taking an average, then multiplying by two (since you watered for half an hour) to get the average "inches per hour" factor for your sprinkler system. This will help you know how many minutes you need to apply the recommended 1 - 1.5 (up to 2) inches of water per **irrigation** event. You can also calculate your **precipitation rate** if you know the gallons per minute (GPM) flowing through the sprinkler valve as follows: (GPM x 96.3) / square footage of your irrigated area = **precipitation rate** in inches.

Sprinklers (spray heads) - If you have spray heads from a previous lawn or garden, or have installed them for native plants, you can use them to water. Since they apply water rather rapidly (high flow rates), with high precipitation rates, (average 1.5 - 2 inches per hour), be careful to avoid runoff or overspray. "Misting" (too much pressure) and wind drift can be problematic as well. Cycle soak or pulse irrigation will help make spray head irrigation more effective. Know your precipitation rate and water accordingly, measured in inches per hour.

Pulse irrigation with conventional spray heads might mean watering three consecutive days, 20-30 minutes per day in the early morning, approximately once a month. In the long interval between **irrigation** events you can provide **refreshing sprinkles** by occasionally running the sprinklers for 5 minutes in early morning or late evening, a couple times a week during hot weather.

Sprinklers (stream rotors) - Many older spray head sprinkler systems have been converted or adapted to high efficiency rotating nozzles. These newer heads apply water more slowly, (average .5 inches per hour) making them more efficient with less runoff and wind drift. If you know

the **precipitation rate** (estimated, calculated or as stated by manufacturer) you can easily apply the recommended 1 - 1.5 (up to 2) inches per **irrigation** event. These high-efficiency rotating nozzles allow for better penetration into the soil, but they will need to run a longer time to deliver the desired amount of water. Know your **precipitation rate** and water accordingly, measured in inches per hour.

Pulse irrigation with high efficiency rotating nozzles might mean watering three consecutive days, 45-60+ minutes minutes per day in the early morning, approximately once a month. In the long interval between irrigation events you can provide **refreshing sprinkles** by occasionally running the sprinklers for 5-10 minutes in early morning or late evening, a couple times a week during hot weather. Do not sprinkle during the heat of the day.

Sprinklers (all types, practical tip) - Run the sprinklers approximately once a month to achieve an **irrigation** totaling 1 - 1.5 (up to 2) inches precipitation, May through October. On new plantings and young gardens you may need to water lightly, (i.e.; 5 minutes once or twice a week) in between and in addition to the deep soak irrigations. On any garden, the light **refreshing sprinkles** will freshen the plants, wash the leaves, and keep the soil surface a little cooler and somewhat moist. However, these **refreshing sprinkles** will not effectively water the root zone nor promote long term sustainability. All sprinkler watering, whether deep soak **irrigation** or light sprinkles, should be done in the cool of the day, **irrigations** in early morning and **refreshing sprinkles** in the late afternoon or early evening.

Drip irrigation (systems overview) - Drip was developed in dry Mediterranean zones over 40 years ago in commercial agricultural applications. A single species (monoculture), planted in straight lines, (i.e.; vineyard, orchard, row crop) can be effectively watered by drip because the root systems, crop age, growth rate, desired yield, soil type, and evapotranspiration rate are uniform throughout the entire planting. Drip irrigation has been tremendously successful in dryland agricultural settings. Transferring this technology to ornamental gardens is not as easy as it might sound.

In many cases it can be quite difficult to make drip work well in horticultural settings. In a native landscape, where many different plants are involved, the goal remains the same: Thoroughly wet the soil with a deep soak to the bottom of the root zone approximately once a month. With drip, it will be a challenge to provide a few additional **refreshing sprinkles** in between **irrigation** events. Since there are no sprinklers on the site, you will have to use a garden hose with a spray nozzle, or forgo the refreshing sprinkles.

Proper in-line drip installation — before growth.

Drip irrigation (point-source drip or in-line drip) - You need to know your **precipitation rate** and how long it takes for capillary action to wet all the soil laterally. Given these factors, you can run the system to apply 1 - 1.5 (up to 2) inches of water per irrigation event, approximately once a month for deep soak.

Point source drip refers to a system of small tubing (sometimes called spaghetti) snaking through the garden,

with emitters installed in the tubing and at the tubing ends. The most common errors include too few emitters usually placed too close to the plants, and too short a run time to effectively water at deep levels. Installed properly, the root zone of each plant will be thoroughly and evenly soaked with each **irrigation**. In a garden bed with diverse plant types, sizes and root depths, point source drip is a complicated proposition. In windbreaks, hedges and applications similar to a vineyard or orchard, point source drip can be an efficient way to put water directly at the root zone of the plants.

In-line drip refers a system of tubing installed on a pattern of parallel lines. The tubing is precisely manufactured with holes (emitters) regularly spaced along the length of the entire hose. Several considerations make design with in-line drip a bit of a challenge. The soil type and desired depth for effective irrigation are the determining factors in calculating the emitter flow rates, (measured in gallons per hour, GPH each), emitter spacing along the hose, and hose spacing on the grid pattern and the duration of each **irrigation** event to allow capillary and gravitational water to soak the entire root zone.

In-line drip is the most recent drip innovation and was developed to supply super efficient irrigation to many agricultural crops; vegetable fields, vineyards and orchards. The engineers, designers, and manufacturers all claim that its most effective use will be in applications where the root zone is maintained consistently moist, which requires frequent irrigations to replace water lost in evapotranspiration. While this may be good for actively growing, water-loving row crops such as broccoli, beans, leafy vegetables, etc., with high and continuous evapotranspiration, or for encouraging summer growth on grapes or citrus, it does not provide the proper soil environment required by drought resistant or dry-season adapted plants, especially in summer months when **irrigation** is assumed to be needed.

As stated earlier, natives are adapted to cool wet winters and warm dry summers. In general, their period for active growth is fall, winter and spring, extending into early summer, utilizing rainfall and soil residual moisture from the rains. During the heat of summer, they tough it out by truly using very little water and conserving moisture deep in the soil. They do not put on new growth during the hot season, except for desert plants.

We irrigate natives infrequently to allow the root zone to dry out a bit and "breathe" in between waterings and to keep the moisture at deep levels fairly consistent. If in-line drip were to be used according to manufacturer's

Proper in-line drip installation — after growth.

Proper in-line drip installation — uniform coverage.

recommendations, the frequent irrigations needed to maintain consistent moisture levels near the surface will provide conditions not ideal for promoting healthy native plants. Use in-line drip in situations where you want to maintain steady levels of soil moisture. For natives, in-line drip will work best in small areas, in the shade, or on center medains and parkways where space is tight.

Drip irrigation (all types practical tip) - All the principles of irrigation apply equally to all the various drip configurations. "Point-source drip" irrigation applies a slow steady flow of water at one spot, the installed emitter. "In-line drip" functions a bit more like a soaker hose in that the emitters are spaced regularly along the entire length of pre-fab tubing. The tubing is usually hidden under the soil surface or under a layer of mulch. In both examples, water is measured in gallons per hour (GPH) rather than gallons per minute (GPM), because of the low flow rates. Drip is operated under low water pressure as well.

The technique of drip irrigation has its challenges in all stages; design, installation, application, maintenance and water management. Many systems require in-line filters, air relief valves, pressure regulators and specialized fittings to operate at maximum efficiency. The list below outlines a few of the factors to consider when using drip irrigation in an native garden. It is a common misconception that a drip system will allow you to simply water your garden on auto-pilot. Quite the contrary. Drip requires careful planning, proper installation, good management, and a lot of maintenance.

At all costs, avoid placing the emitter too close to the crown. This will cause crown rot. With in-line systems, avoid planting a plant right next to an emitter. This is one of the most challenging aspects of natives on drip. Install sufficient number of emitters or set the grid at the proper spacing to wet all the soil where the roots will grow. See WHERE TO WATER, on page 5.

Avoid dry spots and/or over-saturated spots. Here's how it works: water moves vertically (down) through soil by gravity and capillary action. Water moves laterally (sideways) through soil only by capillary action. Capillary action is the way each soil particle holds water on it's surface, and then passes any free water on to it's neighboring soil particles. Drip irrigation relies on capillary action to get moisture uniformly distributed throughout the root zone. In sandy soils, the lateral movement of water is very limited. In clay soils, capillary action and lateral movement are strong, but absorption rates are slow. In every soil type, drip systems must be engineered, installed and maintained correctly.

The key to drip design is to have the emitters properly spaced and their flow rates properly calculated so that the entire root zone will be saturated uniformly at the proper depth on every irrigation event. The sad fact is that on many systems you see both very wet and very dry spots, shallow moisture levels, uneven plant growth, and a harmful accumulation of salts resulting from short, frequent waterings with poor quality water, containing high levels of total dissolved salts with high pH.

The factors to be considered in designing any irrigation system including drip are the evapotranspiration rates of the plants (their water needs), and the soil type which affects penetration of water, capillary movement, and the soil's water holding capacity. In designing drip systems without this information you cannot properly determine the flow rate, the proper spacing of the emitters, and the frequency and run-times for your irrigations. When a system is installed without a calculated design, the effects are often very detrimental to the planting.

Since drip systems water from slightly below the surface, you cannot know for certain that the water is running or has run by simple observation, as the surface may appear dry or be hidden by a layer of mulch. You have to test the soil with a soil probe or by digging a small hole to

inspect the moisture level at the source, 4 inches down. Estimating watering needs with drip, by only observing the soil surface is very misleading. It might be bone dry or sopping wet down where the roots are, and you have to see it in a soil probe to know. This is also true with conventional overhead sprinklers, but with experience, an irrigator can see when the soil surface is uniformly wet after an overhead irrigation, and knowing the run time, can also know that the roots are in moist soil. Too often, wilted or dead plants become the indicator that the soil is dry beneath a drip system; at which point it is too late. This is especially true when the emitters are located beneath the soil surface.

Since drip systems irrigate with no spray or sprinkle, leaves and branches can become very dry, dusty and unsightly. Just like with sprinkler irrigation, the plants will benefit from an occasional **refreshing sprinkle** or hosing off during the cooler hours of a summer day, in between the deep-soak **irrigation** events. These light sprinkles are not considered effective irrigations, but they do promote good plant health and water conservation, as the planting area is occasionally cooled and moistened. Native plants do not depend on absorbing water through their leaves during the dry season, but they may benefit from it. Be careful to not wet the leaves during the heat of the day... the best time is late afternoon.

If you depend on drip to consistently and uniformly apply water to to your plants, you have to frequently inspect the invisible system while it is running. Breaks in the line, coyote chews, gopher damage, or clogged emitters will ruin the system and your plants will suffer. The watering source is effectively hidden from view, and you need to periodically make sure everything is OK.

With point-source drip, you will have to relocate the emitters (move them farther from the crown) and continually add new ones as your plants grow and their root systems become more extensive. Consider doing this every 6 months for the first 2 years. This will create a yet more complex network of tubing snaking through the landscape, and effectively more gardening chores.

If you plan on digging or cultivating, hoeing weeds or planting new plants, you have to be careful to not cut the drip hose with your garden tools. Always have repair kits and spare parts handy. In a truly sustainable landscape, it is assumed that cultivating and digging activities are minimal. That said, a garden is never truly finished and many avid native plant enthusiasts like to add plants or change things a bit now and then. It is quite discouraging to embark on an exciting gardening project only to find that you have severed drip hoses with your tools.

Contrary to popular belief, drip is not always a hands-off, auto-pilot answer to irrigation. Careful monitoring and maintenance are important.

Incorrect. This desert tree is not self sustaining and it will eventually blow down in a future storm because the root system has only been watered in the area of the original planting hole. Better to create a big basin and secondary ring to soak the soil well away from the crown.

KNOW YOUR SOIL AND KNOW HOW TO APPLY WATER

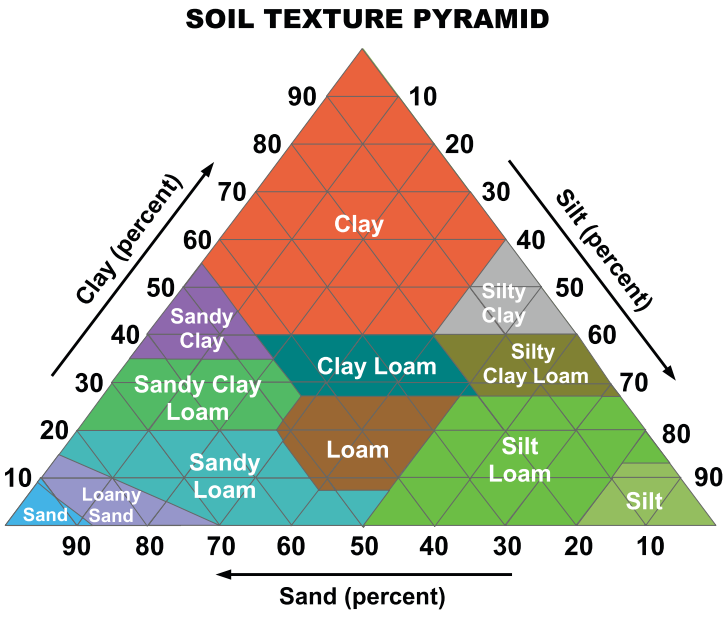
You can conduct two simple tests to determine what kind of soil you have and how water will move through it.

Test - Soil Texture - Identify soil type based on percentage sand, loam and clay. Fill a clean quart jar about half full with soil. Take your sample in an area representative of root depth about 6-10 inches deep. Put in a few drops of detergent or dish soap, fill with water to within one inch of the top, cover and shake it all up. With a few minutes the **sand** component, being the heaviest, will sink to the bottom. In a few hours the **silt** level will be apparent resting atop the sand layer. After 24 hours or so, the clay layer will be visible on top of the silt. The water above the layers of soil might still be a bit murky. Measure each layer with a ruler, **sand**, **silt** and **clay** and calculate or estimate the percentage of each in relationship to the measurement of the total soil profile. Use the Soil Triangle below to determine what type of soil you have.

Test - Percolation Rate - Dig a hole about the size for a 5-gallon plant, 16" across and 14" deep. Rough up the sides and bottom. Fill the hole about half full of water. If water will not stay in the hole, you probably have pure **sand** as a soil type. On completion, mark the water level and wait about 60 minutes. If your soil has absorbed no water, you have a **clay** soil. This means you will need to water infrequently and deeply because the soil takes a long time to get wet, but it will stay wet a long time too. If your water level has subsided an inch or more in one hour, you have a **loam** soil, which is an ideal combination of **sand** (40%), **silt** (40%) and **clay** (20%). If water is absorbed faster, you have a sandy loam or loamy sand or sand. You can research the more technical aspects of percolation rates on the web if you want more detail. For practical purposes, the information above should suffice.

Note - Infiltration Rate - Infiltration is the downward entry of water into the soil or the soil's ability to absorb water. It is related to percolation and is perhaps more important to the gardener because we are providing for plants' needs. Infiltration rates are higher in dry soils and as the soil becomes wet to a point call field saturation (when soil cannot accept more water), the rates become lower. Percolation rates and infiltration are determined by soil type, but infiltration rates take into account soil conditions as well. If your soil is moist or wet, you do not need to water.

The goal is to understand **infiltration** as a process in which water flows downward through the soil (**percolation**) and is followed by air. Roots need oxygen too. Our goal is to manage water and irrigate so that both water and air are available to plant roots on as-needed basis. Remember, soil is the bank where water is stored so that plants can use their roots to make withdrawals when they need it.



DRIP DO'S AND DON'TS (ILLUSTRATED)

Salvia 'Skylark'. Accumulated summer water concentrated too close to the plant creates conditions for crown rot or fungal root rot. Better to make sure water runs away from the crown and that the deep soak takes place at the drip line, outside the perimeter of the branches.

Organic bush beans at Tree of Life Nursery. Drip irrigation's highest and best use is in agriculture; single species, straight rows, and uniformity in both root depth and the crop's water needs. As a general rule, it is difficult to correctly install, maintain and operate drip systems in most diverse ornamental plantings.

Manzanita. If the plant is planted too deep, root rot with summer irrigation is almost inevitable, as the roots are deprived of oxygen. Regardless of the irrigation method, if water collects in the basin at the plant's crown, it is susceptible to root rot.

White sage. The single drip emitter for watering this plant is placed directly at the crown. This is wrong. To promote healthy roots and prevent root rot, multiple emitters should be placed away from the stem and periodically relocated further. Also, as the plant grows you need to add new emitters. After a couple years, a mature white sage would likely have 5 - 6+ emitters in a circle 3 - 4 feet in diameter, for deep watering at the drip line.

Turf replacement project. This in-line drip system is not installed correctly. The emitters are too close to the plants. In-line drip should be engineered to wet all the soil through gravitational and capillary action. You need to match the soil type and the plant's root depth/water needs to the emitter flow rate and hose spacing. The goal is to provide 1 - 1.5 (up to 2) inches of precipitation with each irrigation to all the soil, with no soggy spots or dry spots.

In-line drip installation. If engineered correctly, all the soil will be uniformly irrigated because the designer chose the emitter flow rate and the hose spacing based on the soil type and the water needs of the planting.

All wrong for all the reasons. If you read this paper, you can identify all the problems.

THINK ABOUT PLASTIC

For everyone considering plastic pipe or drip irrigation, especially homeowners with relatively small, easy to manage outdoor spaces, you need to ask a timely question. Do I really want scads of non-degradable plastic, snaking every which way in my garden? In the long run, the destiny of all used plastic including water bottles, shopping bags or watering systems, will be (at best) the landfill. One more reason to carefully plan your water delivery system, and strive to make every garden clean and efficient. In addition, drip hoses, arbitrarily peeking into daylight though mulch layers or topdressing, are not particularly attractive in the garden.

REGIONAL CONSIDERATIONS - California's south and north

A note on established mature plantings - Depending on the type of plants, established mature native plantings may need **little or no** summertime irrigation, or slightly **increased quantities** (not increased frequency) compared to when they were first planted. This guide is written with a focus on the southern California region. If the plants are native in the southern California region, they very well might naturalize and get by mostly on rainfall. If the plants are native to a cooler and wetter part of California (i.e.; north coast), as mature specimens they will need continued irrigation and the garden may actually need a little more water than when it was initially becoming established, because with more leaves, higher levels of transpiration will occur. This is somewhat mitigated of course by extensive roots, low branches, and leaf drop which shade the ground around the plants, conserving soil moisture.

Practical example - if you are watering a garden with established shrubs in southern California, i.e., Mission Viejo or Escondido, and the two example plants below are growing in the same planter bed, you would water to meet the needs of the plant that requires more summer water.

Lemonade berry, (*Rhus integrifolia*) - native to the southern California region and will naturalize. Once established, no summer water needed, but added water will be fine.

Manzanita cultivar, (*Arctostaphylos densiflora* 'Howard McMinn') - native to northern California, Sonoma County. Judiciously applied summer water will be needed for this plant in southern California gardens, 1 - 1.5 (2 further inland) inches precipitation per irrigation, deep soak, approximately once a month, May through October.

In summary, as southern California regional natives become mature in southern California gardens, they might need less water (or none) because they become naturalized with deep roots and extensive branches that shade their root zones. As horticulturally introduced natives from cooler, wetter regions in the northern part of the state become mature in southern California gardens, they will continue to need irrigation, and maybe with more water than initially applied during their establishment, in order to satisfy the needs of increased transpiration of larger plants (more leaves). Even the natives from the cooler, wetter north will be far more thrifty with water use than most so-called "California Friendly" exotic plants.

BENEFITS - HIDDEN AND APPARENT

Aside from the simple fact that naturalistic gardens use less water (70 - 90% savings) as compared to a typical turf/flower/shrub bed garden, they also become, in their own right, functional "ecosystems." Sustainable native landscapes are wonderful places to visit and spend time, interacting with song birds, butterflies, hummingbirds, beneficial pollinators, lizards, and other of our (to borrow a term from John Muir) "fellow mortals." With good horticulture, we create healthy soils, clean air and water, and experiential spaces where we can realize renewal and healing. Our engagement in tending these intimate gardens proves to be in itself a healing activity. We invite the best of nature to come close, where we can be part of it (and it a part of us) every day.

CRADLE TO MATURITY

General tips for the first two years as water needs will change.

New planting, the first 3 - 6 months

- Deep soak **irrigation** - hand water the plants, apply water in the basins, the swales, and the secondary watering rings, for deep soak approximately every 3 - 4 weeks. In areas of higher evapotranspiration, you may need to water every 2-3 weeks. The most effective way to hand water is with a soft rain nozzle on a watering wand on a garden hose. Early mornings are best for **irrigations**.

- Light **refreshing sprinkle** - hand water or use sprinklers once or twice a week to lightly water the leaves and wet the soil surface. With sprinklers, a 3-5-minute run time should be plenty. Do not sprinkle in heat of day and preferably not during heat waves. Water ahead. Late afternoon times/early evenings are best for **refreshing sprinkles**.

Young planting, becoming established, 6 - 18 months

- Deep soak **irrigation** - hand water or run sprinklers (hose end or system) or drip (point-source or in-line), approximately once a month to apply the recommended 1 - 1.5 (up to 2) inches precipitation. Cycle/soak or pulse irrigation method is best. Make sure you are watering in a soil zone that includes the area around the planting hole as well as a good distance 3 - 4' away from the original planting hole. Contour the soil surface so it can absorb water.

KEY POINT

Native plants need a fraction of the water required to maintain traditional gardens. Native landscapes use about 10% the amount of water to keep turf alive and green (90% savings), and use approximately 30% of what is needed for most ornamental shrubs, (on average, a 70% savings).

- **Refreshing sprinkle** - approximately once a week run sprinklers for 5 minutes or so late afternoon/early evening.

- Do not water in heat of day and preferably not during heat waves. Water ahead.

Mature planting, fully established, 18 months onward

- Deep soak **irrigation** - set hose-end sprinkler, run sprinkler system or drip system (irrigate by your normal method) to apply approximately once a month to apply the recommended 1 - 2 inches precipitation. Cycle/soak or pulse irrigation method is best.

- **Refreshing sprinkle** - Not absolutely necessary, but you can wash the leaves and freshen up the garden occasionally in summer by sprinkling or hosing down the foliage in early morning or late afternoon/evening, approximately every 7-10 days.

Do not water in heat of day and preferably not during heat waves. Water ahead.

Matilija poppy. This simple planting is watered approximately once a month with a hose-end micro sprinkler. In winter, the sprinkler goes into storage and the rains take over. Watering native plants is easy. Most native plantings will thrive without complicated systems and automatic controls, if the people in charge simply know when, where, how, and why to water.

Tree of Life Nursery, native plants in a production shadehouse.

NOTES AND SKETCHES

Scale: ¼" =

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Tree of Life Nursery is the largest grower of California native Plants in the state. Specializing in a line of plants from the Southern California region, Tree of Life is dedicated to providing the finest quality of commercially available plants to the landscaping trade and to the public. Tree of Life believes in creating spaces that look and feel authentically 'Californian'.

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