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Removing turf under and around existing trees

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WE ARE ALL WELL AWARE of the drought across the southwestern United States. Every time it rains these days we hear a chorus of weather experts say, "One storm won't end the drought." In fact, researchers say there may not be enough storms to end this dry spell for a decade or more. For many, this drought has been a rude awakening. For the rest of us, it is something we've been anticipating. Finally, we're beginning to appreciate our predicament and recognize the need for conserving water—our most precious natural resource.

Drought has forced many of our communities to take a long, hard look at how we landscape our homes, offices and businesses. Removal of turf grass, for the purpose of reducing water usage, has recently become one of the more popular answers. Aside from saving water, the costs of related tasks associated with lawn care such as the mowing, fertilizing, irrigation repairs, etc., are either reduced or eliminated completely. Additionally, the decrease in use of small engine equipment such as blowers, mowers and trimmers reduces air and noise pollution.

Removing turf grass from a landscape does not necessarily mean that one has to sacrifice the entire lawn and give up its cooling effects. The idea is to target those non-functional or hard to maintain areas. Focus on eliminating sections of turf grass that are: without a purpose, prone to runoff, difficult to maintain or adjacent to structures that suffer water damage. Reducing 25-50 percent of the turf grass can result in big savings without sacrificing aesthetics.

In-line tree irrigation system installed after turf removal.

Trees and turf, as many of us know, are usually not very compatible. It would follow then, that turf removal under and around trees will be a good thing. Right? Well, not necessarily! Once a tree has established itself in a lawn, disrupting growing conditions by removing turf can result in problems. Most trees planted in an irrigated setting become reliant on the regular, and sometimes excessive, applications of water and/or fertilizer needed to keep turf vigorous and attractive. Additionally, lawn thatch can serve as a temperature buffer for tree roots. If turf grass is removed, the tree can become stressed. When this occurs it becomes vulnerable to secondary insect and/or disease infestations. All these factors can lead to further decline and possibly premature death. So, the trees must be protected and the turf reduction project executed properly to avoid numerous stress factors. To fully appreciate the risk involved, we must first understand the relationship between trees and turf grass.

"Reducing 25-50 percent of the turf grass can result in big savings without sacrificing aesthetics."

The roots of trees, turf grass, and other landscape plants compete for available water and mineral nutrients, space and sunlight and generally grow close to the surface where oxygen is most abundant. We've all seen thinning grass under large shade trees; large surface tree roots that cause safety hazards and mowing obstacles; young trees that don't seem to grow; and tree trunks badly damaged by lawn equipment. All of these undesirable effects can be the result of trees and turf grass growing too closely together.

A given area of soil can only support so much root mass. Turf roots, though, usually have an advantage because they typically respond to resource availability. Research indicates that turf roots sharing soil space with tree roots often take up the majority of available nitrogen. Conversely, trees have the ability to absorb large quantities of water from the soil. On a hot summer day, a grove of mature trees can easily pull hundreds of gallons of water from the surrounding soil, leading to stress in both the trees and surrounding turf.

The root system of a tree performs many vital functions. Roots function to support and anchor the above ground portion of the tree, absorb and transport water and minerals from the soil to the rest of the tree, store food reserves needed to produce spring foliage, and produce important growth-regulating hormones.

Although some tree species are known for their surface rooting, soil environmental conditions and cultural practices are more likely the cause of such rooting. Again, plant roots grow where the conditions are conducive to their growth—near the surface. Therefore, most of the fine absorbing roots are found in the uppermost foot of soil. As a tree root grows in length, it also increases in diameter. Those near the surface may push through the soil surface, causing serious problems in lawns. Besides ruining the appearance of the turf, surface roots can interfere with mowing equipment and can even become a safety hazard.

Perceptions about tree roots are quite different from reality. Trees growing in urban areas seldom develop a taproot, particularly if they were planted from container stock. Active root systems actually consist of large perennial roots and smaller, short-lived, absorbing 'feeder' roots. The large, woody tree roots and their primary branches increase in size and grow horizontally. The majority of a tree's roots are usually located in the top 6 to 24 inches of the soil.

In contrast, small absorbing roots, averaging only 1/16 inch in diameter, constitute the major portion of the root system's surface area. These roots grow outward and usually upward from the large roots near the soil surface and are mixed in with the lawn and shrub roots. The major function of feeder roots is the absorption of water and minerals. About 50 percent of the active root system grows beyond the dripline and can often be three to four times as far from the trunk as the crown.

Avoiding injury to tree roots either during lawn maintenance activities or the removal of turf grass is the challenge. It's safe to say that considering the extent and shallowness of the absorbing roots, even under the most carefully executed projects, much of the tree's root system is frequently torn out during the lawn removal process and/or other types of construction. Without the temperature buffer and water supply that the lawn and sprinkler system had provided, the remaining roots may be adversely affected, leading to additional root loss.

Root system damage during construction. Note rooting depth.

So, how can we protect our trees and minimize stress during the landscape transformation? First, conduct an inventory of the existing trees. Make certain that the trees are healthy enough to undergo a major environmental change. Are the trees already declining? Are they worth saving? Will they be able to adapt to their new environment? The evaluation of health could be a formal inventory for large landscapes or simply a checklist for smaller conversions. Those trees that will not be retained should be removed prior to the start of the project. Those that will be saved should be marked prominently. Once this decision is made, the remaining trees should be carefully treated. Protect them from undue disturbance and stress. If needed, they should be deeply irrigated prior to construction. Protect the trunk from potential damage by equipment. Limit construction traffic under the canopy to minimize soil compaction. Lift branches to allow easy access under the canopy. The less stress the better.

Once the inventory is complete, examine the area around the trees and attempt to identify the active root zone, noting where large roots are close to the surface. Note their location and keep removal and/or damage to them at an absolute minimum. Trenching close to the trunk of a mature tree can affect water uptake or sever anchoring roots. Soil compaction from construction equipment restricts water and oxygen uptake by roots.

Landscape conversion projects should be conducted during the best season for turf elimination, while causing minimal stress on the trees. Depending on turf grass species, chemical elimination of the turf may be effective when done during the late summer and early fall months. This allows for conversion during the cooler fall and winter season to minimize the impact on existing trees. Once started, the operation should be conducted quickly and efficiently.

In a nutshell, reducing turf grass helps save water and money. Furthermore, the existing trees, if properly protected during the turf removal process, will generally benefit. So, congratulations to all those taking water conservation seriously! Now, let's get busy!

What is the best way to convert a landscape? That is a tough question. Each case is different. Each species of tree varies in the manner in which it grows. Soil types vary. The style of a new landscape often differs widely from the previous design. The bottom line is to protect the tree(s), especially the root system.

The use of herbicides and a dethatcher are preferred over tractors to kill and remove the grass. Heavy equipment can crush existing tree roots and/or compact the soil. As a general rule, the deeper the removal process, the more extensive the damage may be. Sod cutters do

considerable damage to tree root systems. Skid-steer loaders do even more. Tree roots are intertwined within those of the turf, and the mechanical removal process will do considerable harm, not to mention the compaction of the soil beneath the tree from the equipment. There are better ways to do this.

If the turf is a cool season grass like fescue, the elimination process is fairly simple. An application of a non-selective herbicide such as glyphosate will effectively kill the turf. Often only one application is necessary if applied properly. Then the grass to be eliminated may be scalped with a mower to soil level. Shrubs and groundcovers may then be planted and the irrigation system installed. The surface may be covered with a geotextile fabric if desired, but this will add considerably to the cost of the project.

If the turf is bermuda grass, the process may be more difficult and will often require a more lengthy operation. Here is where many mistakes take place. Some believe that by turning off the water, the grass will die and the turf can be removed several weeks later. Unfortunately, this only stresses the trees in the lawn but does little to kill the grass. Others feel that by removing several inches of soil, the root system of the bermuda grass will be removed as well. In each case, bermuda grass will eventually recover and only the trees will be seriously impacted. The only way to do this job is with herbicides, often repeatedly, until the very core of the grass's root system is dead.

During this transition, the trees should be treated with care, providing regular and consistent irrigation. Once the turf is pronounced dead, then the bermuda grass thatch may be scalped, dethatched if necessary, and covered with a geotextile fabric if desired after the installation of the irrigation system.

How we provide water to the trees so they survive will depend on several factors, e.g., the existing active root system, soil type, the water requirement for the type of tree and the irrigation system. All these factors need to be taken into consideration or the trees' appearance and health may decline. Soil type and climate conditions will also influence irrigation scheduling and water usage.

When designing and installing the new irrigation system, keep in mind that in an ideal world for trees, the active root system could extend one and one-half to four times beyond the drip-line. Trees typically absorb much of their water from the soil beyond their dripline.

The new irrigation system should provide water throughout the current active root zone and hopefully allow for root expansion. Sometimes due to economical reasons a suitable irrigation system that extends at least two times the diameter of the tree canopy may not take place. At a minimum, the irrigation system should cover 75 to 100 percent of the 'drip-zone' (diameter of tree crown) in order to sustain the tree and minimize stress.

Soils are one of the most overlooked items when it comes to designing and installing most irrigation systems, especially when it comes to drip irrigation. With drip irrigation, the soils will determine the spacing between emitters. An emitter in a sandy soil will allow the water to move deeper in the soil, but will not have a very wide wetted area. Clay soil will not allow the water to move very deep, but the emitters will have a wider wetted area. The following chart will help you determine the spacing of emitters based on soil type.

When analyzing the soil, don't overlook a potential 'soil interface'. This sometimes happens during landscape conversions, where additional soil of a different type is added to the surface. If two different types of soil are layered, the top layer must be completely saturated before the water will move to the lower layer. Typically, the top layer needs to exceed field capacity before water reaches the next layer. When this happens, surface runoff or puddling may be evident. The perception that

Wetting Pattern of Emitters

Soil Type	Dripper Flow (gph)	Wetted Area	
		Diameter (ft)	Area (sq. ft.)
Sandy	.05	2 - 3	3 - 7
	1.0	3 - 3.5	7 - 10
	2.0	3.5 - 4	10 - 13
Sandy Loam	.05	3 - 4.5	7 - 16
	1.0	4.5 - 5	16 - 20
	2.0	5 - 5.5	20 - 24
Loam	.05	3 - 5	7 - 20
	1.0	5 - 6	20 - 28
	2.0	6 - 7	28 - 38
Clay Loam	.05	4 - 6	13 - 28
	1.0	6 - 7	28 - 38
	2.0	7 - 8	38 - 50
Clay	.05	5 - 7	20 - 38
	1.0	7 - 8	38 - 50
	2.0	8 - 9	50 - 64

the tree has received sufficient water will present itself, when indeed very little water is reaching the absorbing roots. Use a soil probe to find the actual watering pattern and if the water is soaking in deep enough to create a favorable root zone.

The next challenge is to estimate the water needs of a particular tree. This can be tricky because sufficient scientific data regarding water use is not available for most ornamental tree species. Complicating matters even further, different species have vast differences in their watering preferences. Remember to provide enough water for the mature size of a young tree to minimize potential stress or stunting.

The California Cooperative Extension Service has spent thousands of hours working with horticulturists and landscapers to develop *A Guide to Estimating Irrigation Water Needs of Landscape Planting in California*. This informative guide may be found at:http://www.owue.water.ca.gov/docs/wucols00.pdf. The guide is a good starting place to estimate the water the trees need to survive on. Other sources of information include local water utilities, Cooperative Extension offices, and professional organizations such as the Irrigation Association's book, *Drip Irrigation in the Landscape*.

Using the following formula is one way to estimate water use, provided the landscape coefficient and reference evapotranspiration (ET_o) are known. Consult your Extension Service office for this information.

The water needs of the tree are suggested to be estimated for the mature plant. Consider the following example for an average water use tree, with a 20 foot canopy in an area, with a maximum weekly ET_o of 2.5 inches:

WR = 0.6234 x 314 x 0.5 x 2.5
WR = 245 gallons per week

After estimating the water needs for the plants, design the irrigation system to provide sufficient water to the active root zone area.

It is highly recommended that the irrigation systems for trees should be zoned separately from other vegetation in the landscape. The turf, shrubs and groundcovers have individual watering needs that must be addressed. It is virtually impossible to provide the correct irrigation requirements for both trees and the plants below the canopy on the same zone. As a rule, trees on the same zone as other plants are generally under-watered as they require a slower, deeper irrigation cycle.

Selecting the right controller is as important as the overall irrigation design. Older landscape systems often have inferior controllers that do not allow for custom scheduling.

One of the biggest challenges in landscape conversions is the installation of the piping for the irrigation with minimal damage to the active root zone of the trees. If possible trenching should not occur near the tree. This will limit the damage to tree roots by the equipment. Hand trenching is a necessity to avoid cuts or damage the major roots. In many cases, irrigation may be supplied by the surface application of in-line drip tubing or conventional drip systems.

There are three suggested types of irrigation systems recommended for use on trees after turf removal: micro sprays, bubblers or drip irrigation.

Micro sprays are similar to the overhead irrigation system used for watering the turfgrass that was removed except micro sprays deliver water at a much lower volume, allowing deeper water infiltration, with minimal runoff. An advantage to micro sprays is supplying water to a large area with a minimal number of emission devices. The disadvantage of micro sprays in the landscape is their high visibility. They can be very prone to vandalism or equipment damage. Micro sprays are also affected by evaporation compared to drip or bubblers, and windy condition can skew their spray pattern.

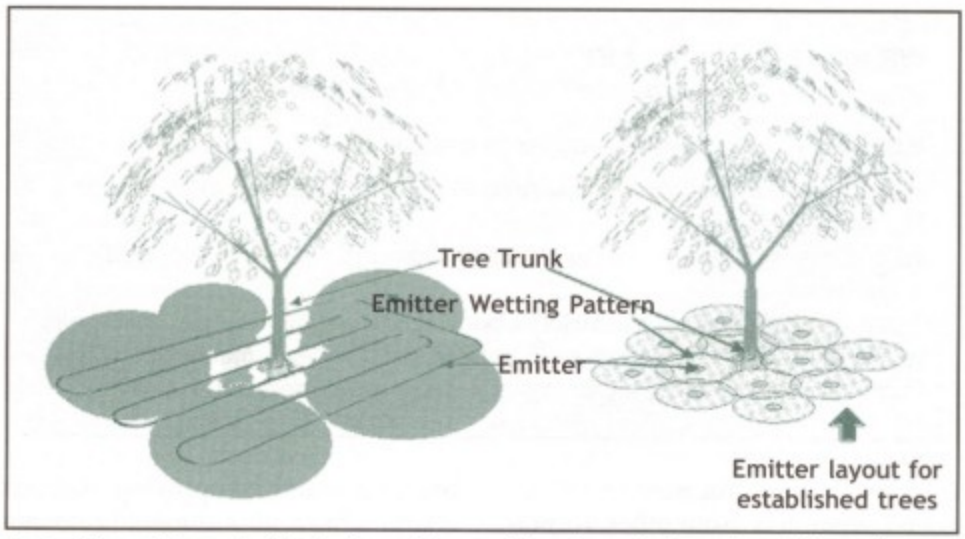
With bubbler irrigation, sometimes referred to as flood irrigation, the emission device tends to bubble water directly onto the ground or throw water a short distance, on the order of one foot, before water contacts the ground surface. Bubbler irrigation with a pressure compensating device works best in small planters in order to provide enough water to large trees. A disadvantage to bubblers with existing landscapes is the installation of the piping to the bubbler without damaging plant roots. In addition, only a limited number may be supplied by one valve, so it is not favorable for large projects.

Drip irrigation systems trickle water through emitters, generally delivering water at .05 to 2.0 gallons per hour (gph). Drip irrigation is perhaps the most efficient means of irrigating trees if it is designed and installed correctly. Emitters should not be installed too close to the tree trunk as it may cause damage to the trunk. The most common types of drip irrigation systems are conventional point source drip, and inline drip tubing irrigation. Inline drip tubing irrigation differs from conventional

$WR = 0.6234 \times A \times K_s \times ET_o$

WR	=	Water Use
0.6234	=	Conversion - inches to gallons
A	=	Potential Canopy Area at maturity (squarefeet)
K_s	=	Landscape Coefficient*
ET_o	=	Reference evapotranspiration (inches per time period)

* See the Irrigation Association's book, *Drip Irrigation in the Landscape*, or the California Cooperation Extension *A Guide to Estimating Irrigation Water Needs of Landscape Planting in California* for more information.



Two drip-options, Left: in-line drip emitter layout showing tubing placement. Right - conventional emitter layout showing emitter placement.

drip irrigation in that the emitters are pre-installed in the distribution tubing, simplifying installation. Inline drip tubing is probably the most cost-effective way of irrigating trees after turf removal.

The drip emitters need to be evenly spaced over the active root system in order to provide water for the tree to survive. In an effort to encourage a larger active root system for young trees, install the drip emitters beyond the pre-existing root system. For example, a tree in a sandy soil with a 20 foot canopy diameter will need an estimated minimum of 25 - two gph emitters to provide ample water to the active root zone. If we look at the previous example of the estimated water needs of a tree that requires 245 gallons of water per week and we irrigated the tree once a week with 25 – two gph emitters, we would need to run the irrigation system for 4.9 hours or 294 minutes. In order to reduce the irrigation run time, it would be recommended to double the number of emitters to reduce the irrigation run time.

Install the drip tubing by trenching the tubing in the soil about two inches deep (watch out for the root system) and use tubing stakes to hold the tubing in place. After the tubing is installed, then lay a mulch cover over the soil to reduce evapotranspiration. Often, the inline drip tubing system will be the most cost-effective way of providing water to the trees.

When designing and installing any irrigation system, the system needs to meet the needs of the mature tree. A challenge to any irrigation system for the trees is balancing the water needs of the various tree species. More emitters or higher output emitters will need to be added to meet the needs of trees that have higher water needs when different tree species are installed on the same irrigation zone.

After the installation of any irrigation system, train the trees to adjust to the new environment. At first, water the tree at the same frequency and depth of soil moisture that it was used to, along with supplying it with a little extra water to overcome the shock of the change. Then over time, increase the depth of water to the tree and decrease the frequency of irrigation to the tree to encourage a deeper active root system and healthier tree. Even in the hot dry southwest desert areas, a tree should not require irrigation more than once a week after establishment or re-establishment following turf removal.

How critical is it to water trees correctly after a turf removal? Just look in the face of any property owner that has lost a tree in a moderate wind storm due to the lack of proper water to the tree. Some trees simply expire slowly, succumbing to insects and disease. This can often take four to five years to perish without proper irrigation.

Also, how about the environmental, esthetic, emotional and economic value of the trees lost. With the vast turf removal, the heat gain in the urban environment increases tremendously. As previously discussed, proper irrigation to the active root zone of a tree where the turfgrass has been removed is critical to its health and survival. While planning for a turf removal project determine who will be liable if a tree dies and must be replaced or needs extensive follow-up treatment to survive? Recognize the fact that some trees are not likely to survive. Conserving water is important, but not at the expense of the trees within the landscape. Be conscientious. Be complete. Be quick in your action. Your trees deserve the best that you can provide.

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Forest pest website

Here is a useful website to learn about forest pests: **http://www.bugwood.org/**. It is at the University of Georgia, but includes quite a number of western U.S. pests.