WATER WISE

Residential Landscape and Irrigation Guide For Western Colorado

Best Management Practices for Water Conservation and Irrigation

This guide is a cooperative effort sponsored by the Gunnison Basin and Grand Valley Selenium Task Forces. Funding was provided by the Colorado Department of Public Health and Environment through a grant from the Environmental Protection Agency.

Table of Contents

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Introduction

"When moss is growing in a concrete gutter in the desert, we know there's a problem."

--Dick Bartholomay, Soil Scientist

Water Stewardship: Using Water Wisely

The western Colorado counties of Mesa, Delta, and Montrose are rich in geological diversity. Mountains in Montrose County climb to 14,000 feet in elevation, spawning tributaries that flow into the Colorado, Gunnison and Uncompahgre Rivers. Those rivers run through deep canyons and broad valleys carving out stunning desert vistas for hundreds of miles. This unique mix of beauty, and the quality of life it promises, is why many of us live here. It inspires us to be good stewards of the land and rivers so that our children and grandchildren can also enjoy these magnificent landscapes and invaluable lifestyle.

Being good stewards means that we must be wise about using our resources–especially water. Whether you own 40 acres of pasture, or rent a small house in town, using water wisely is essential to our future and to the delicate balance of our environment. Few people realize how precious and finite the water supply is, and how important it is to be deliberate about how and when we use it.

Colorado River (Photo: http://www.xcskiracer.com)

This booklet is a simple, easy-to-read guide for residents of the Tri River Area (consisting of the Colorado, Gunnison and Uncompahgre River Basins within Montrose, Delta and Mesa Counties) so you can:

- landscape new residential areas in the most water-efficient ways possible
- redesign existing landscapes to save water
- irrigate turf, trees, shrubs and gardens in a way that best uses, rather than loses, water
- understand and select beautiful, xeriscape™ and drought-resistant plants for your yard
- line a pond so you don't lose water to seepage
- connect with resources that can take you to the next step of a water-wise plan

The Benefits of Being a Good Water Steward

Taking responsibility for how much and when to use water is simple. With the correct tools, it is both cost-effective and convenient. Watering wisely will, in fact, save you money because you'll only pay for the water you use. Perhaps the biggest payoff is knowing that you are doing what you can to preserve the place you love, and the water that keeps it alive.

Photo: Gary Kramer, USDA-NRCS

Ultimately, conservation keeps water in the rivers to maintain wildlife habitat while also storing it upstream for use in times of shortage.

Wise-water use offers another important and emerging environmental benefit: Unabsorbed water that travels through the soils (called deep percolation) carries salts, selenium, pesticides, and other pollutants. Most of the polluted water finds its way into subsurface aquifers and eventually flows into the nearest river--along with the inorganic materials that are toxic to fish and wildlife. That affects the quality of drinking water and municipal use downstream. Some of the water re-surfaces, leaving unsightly, white salt deposits on the soil—a sight all-too familiar to residents of the Tri River area. For more information about selenium, go to: http://www.ext.colostate.edu/PUBS/natres/06109.html.

The less water that percolates, the less these pollutants taint the river. This is just one more reason that wise watering is the **right** thing to do.

Our Relationship with Water

Most of us take water for granted; but in the West, water is truly precious. Average annual precipitation in the Tri River Area ranges from about 40 inches in the high country, to as little as seven inches in the high deserts near Grand Junction. What's more, Colorado, like the entire desert southwest, has a long history of drought cycles. Without water conservation, dry years can adversely impact crops, wildlife, and the economy. The multi-year drought, which began in 2000, was so severe and lasting that even though the many high country reservoirs in Colorado have recovered, the reservoirs behind the mainstream dams (Lake Powell and Mead) were still only about half full in 2006. Some communities have had to turn to mandatory water restrictions to maintain service. For more information on drought in Colorado, go to: http://cwrri.colostate.edu/droughtpubs.html.

According to the 2005 Mesa County Water Audit, a typical household consumes approximately 150,000 gallons of water per year. Outdoor water use, primarily through irrigating lawns, is responsible for about 55% of that consumption. Much of the watering is unnecessary and wasteful. The report revealed that the Grand Valley residents who participated in the audit over water their lawns, on average, by 40%. This equates to approximately 28 inches or 2.3 acre feet per lawn based on audits of 68 properties covering 18.7 acres. If each of those residents corrected the over watering problems, we could save more than 14 million gallons! To read more about the Mesa County audit, go to:
http://www.coopext.colostate.edu/TRA/PLANTS/2005_irrigation_audit_final_report.pdf

The good news is that over watering is 100% preventable. Educating yourself and being mindful about water is a responsibility we can all accept, especially knowing that small changes in daily watering routines can add up to enormous benefits for our environment and for future generations.

Alluvial Landscape, Colorado (Photo: Damon Taylor)

Why So Important? Water, Salt and Selenium

Over watering isn't as devastating in other parts of the country as it is here. Many places may get ten times as much precipitation as we do, or their soils may not contain the salt and selenium that is common in our area.

According to Colorado State University (CSU) Cooperative Extension (http://www.ext.colostate.edu/) horticulturist, Dr. Curtis Swift, the Grand Valley was carved by the Colorado River (formerly called the Grand River) from soils laid down over eons by an inland sea called the Cretaceous Sea. This sea advanced and retreated 29 times laying down layers of salty soil forming materials that, over time, developed into Mancos Shale. By the time the Cretaceous Sea dried up, it left behind these deposits that contain significant salt and undesirable elements such as selenium. The majority of the irrigated soils in the Grand, Gunnison, and Uncompahgre Valleys are derived from this salt-rich Mancos shale.

Mount Garfield and Mancos Shale (Photo: Tim McCabe, USDA-Natural Resource Conservation Service)

Selenium and salts surface on local soil looking like snow. (Photo: Dr. Curtis Swift)

Section One:
Soils, Irrigation Systems, and Determining Plant Needs

If we didn't have the data on how much water is delivered, it would be hard to believe. But irrigation companies indicate that more water is delivered to residential homes than to farmers and ranchers. That means, for example, if 80 acres of alfalfa is converted to houses, lawns, streets, and sidewalks, it will likely take more water to feed the suburban community than it did to keep a crop alive. The reason for this is simple: Most people aren't aware of the types of soils they have and the watering needs of their plants and grasses. Typically, people think that constant watering is the best thing they can to do for plants and lawns, when in fact, plants usually thrive on far less water.

Since successfully growing crops is critical to the business of people in agriculture, most farmers and ranchers have learned to irrigate sparingly by using sophisticated methods to determine when and how much water to use. With agriculture lands being subdivided and turned into neighborhoods, it's more important now than ever to follow the models of farmers and ranchers, and ***use water wisely***.

Getting to Know What's Underground

To plan and install the most effective irrigation system and landscape, you'll first need to know:

- what type of soil you have
- the source of your water
- the best types of plants and turf for your soil and water

Soils: There are three basic types of soils in the Tri River Area along with various combinations of the three:

1. Fine textured (clay) soil with good water-holding capacities. Although the total moisture in clay soils can be high, the water itself may not be available to plants. In some cases, this clay may contain salts that inhibit plant growth. Also, if selenium is present in high enough concentrations, it can be harmful to animals or plant growth.

2. Coarser textured (sandy) soils, derived from sandstone, typically contain less salt, but this soil has lower water-holding capabilities. Since less water is present, less is available for the plant.

3. Silt soils have an intermediate texture that falls between the clay and sandy soils. Silt soils can contain greater moisture than sandy soil, but there is still less moisture available to the plants than in loamy clay soils. Loamy soils are defined as a combination of two or all three of the basic mineral soils (sand, silt, and clay) along with some organic matter.

It is possible to have clay and sandy soils in the same area, such as a field or plot. This requires different irrigation for the different types of soils. Each soil has its own characteristics, with both advantages and disadvantages. The more you know about your soil, the more you can work it so that it will produce a healthier lawn and landscape for you.

To learn more about what type of soil you have, go to: http://www.coopext.colostate.edu/TRA/PLANTS/index.html#http://www.coopext.colostate.edu/TRA/PLANTS/soil.html; or contact the Natural Resource Conservation Service (NRCS): http://www.nrcs.usda.gov, or your city government offices. Soil maps are also available to help define what type of soil you have.

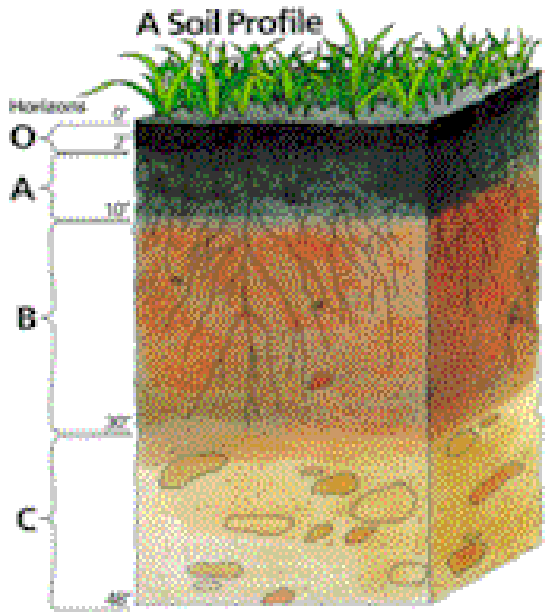
The other option is to determine for yourself what kind of soil you have. Obtain a soil auger from NRCS or Cooperative Extension. Then, walk the property and sample the soil with the auger to a four-foot depth recording what you find. Sampling to four feet is strenuous and time consuming, but you need to know about the soil to this depth for several reasons:

- Some trees have tap roots and need room to grow their roots
- Building foundations
- Irrigation main lines should have 30 inches of soil cover
- Shallow shale layers will reduce the soil water holding capacity

Take at least one sample per acre. Record color changes, soil texture, the presence of water, stones, rocks and other characteristics.

Color changes may indicate a change in soil texture or an area that has been consistently wet due to a shale layer that has prevented it from draining. Shale layers are normally high in salts with white or grayish salt deposits. The shale layer restricts root growth as the roots cannot penetrate it, and the shale holds the water back, making it less available to the plant. When the soil is saturated with water and drips from the auger, that suggests that you have located a water table. In this dry climate, you might assume that this is good news. On the contrary; water tables also restrict plant growth because the necessary oxygen has been expelled from the soil by the excess water.

Once you have your soil samples and a record of characteristics, bag a sample from each foot of depth, and take them to Cooperative Extension or NRCS. These experts can help determine what type of soil you have, and which plants are best suited for it.



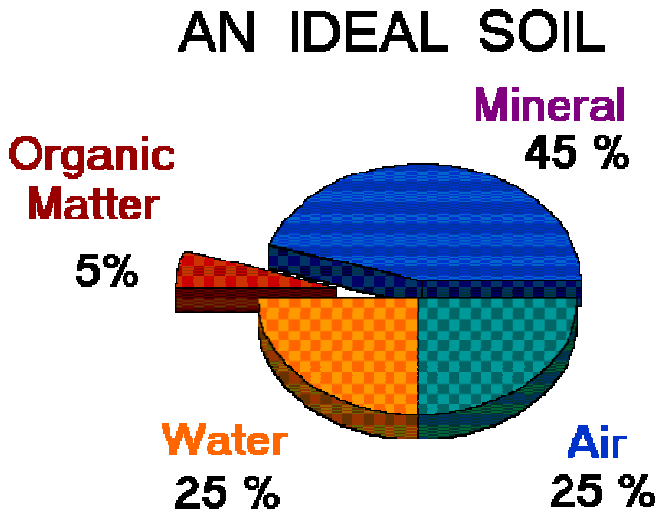
A typical soil profile showing a top layer of Organic matter (O); the topsoil layer (A); the subsoil layer (B); and the zone of parent material (C).

Soil Profile courtesy of USDA-NRCS.

Making the Match: Plants that Work with Your Soil

Regardless of your soil type, the good news about gardening in our region is that we have, on average, a nice, long growing season that lasts up to 188 days. Even so, there are a few plants that will not grow in our area. Extension horticulturist, Dr. Swift, advises against growing rhododendrons, azaleas, blueberry or other low pH plants due to our alkaline soils and the buffering affect of calcium carbonate found here. But, he advises, if properly enriched with organic matter, most plants will grow and flourish. Amending soils with organic material is essential. Bypassing that step likely spells disaster for many attractive and desirable plants.

As with most soils in semi-arid regions, the organic content of our native soils is typically less than 2%. An ideal soil should contain 5% organic matter by volume. Dr. Swift recommends adding and thoroughly working in 3 cubic yards of organic matter per 1,000 square feet each year for annual gardens. Six cubic yards of organic matter can be added per 1,000 square feet for perennial plants such as lawn areas, tree and shrub areas, and perennial flower and vegetable gardens.



Soils in the Grand Valley of Mesa County, and the valleys of Delta and Montrose are seldom deficient of any plant nutrient other than nitrogen. Due to the parent soil material, the other major soil nutrients, phosphorus and potassium, are typically high in concentration. Unless your soil test indicates that these components are low, do not add them Applying phosphorus or potassium to a soil that already contains excessive amounts can result in nutrient imbalances that adversely affect plant growth including iron deficiency in grasses. A coarse organic matter with particle sizes up to one-half inch is best. Avoid materials with the consistency of sawdust (or anything finer) as they block drainage and create root rot problems.

Clay soils, especially, need to be amended with organic matter. The more clay in the soil, the more amendment is needed. For information on soil amendments, go to: http://www.ext.colostate.edu/ptlk/ptlk1600.html.

Irrigation Systems and Watering Zones

Impact sprinklers *emit water from a single source using a rotating head so that the area around it is uniformly moistened. There is more pressure behind the impact system than a sprayer, so the water from this system travels further. These types of systems are often used on large or multi-acre lawns.*

The most common, and useful, irrigation systems on residential lawns are impact sprinklers (left) and sprayer sprinklers (below).

Sprayer sprinklers *utilize stationary heads that spray a uniform amount of water in a circle or semicircle that spurts from and around the head. They have less pressure and so, cover less ground. Therefore, more heads are required from these systems. (Photos: Dr. Curtis Swift)*

Both types of systems get the job done. But when watering your lawn near trees and shrubs, it's best to use the sprayer sprinkler because the leaves of many trees and bushes can't tolerate the salts in the water. Impact sprinklers tend to shoot water higher and the chance of hitting tree and shrub leaves is greater than using a sprayer sprinkler.

The best way to make sure your irrigation system is watering your lawn efficiently is to plan and implement specific watering zones within your yard. The shrub and tree zone should be separate from the lawn's watering system so that each zone receives the right amount of water for their needs. Special micro-sprayer or sprinkler emitters for shrubs and trees should be used so their leaves are unaffected. Weeper hoses (perforated to allow water to "weep") can be used above or below ground for placing a limited amount of water in a specific area. For more information on weeper or drip irrigation systems, go to: http://www.ext.colostate.edu/PUBS/Garden/04702.html.

Along with choosing the appropriate irrigation system for your landscape, you can also decide whether to operate it automatically or manually. Again, there are advantages and disadvantages to both.

- **Manual operation** is performed by physically turning your sprinkler system on and off. Because you have to be physically present to irrigate, you ultimately have more control over how much water you use. Once you see that the lawn is moist, for instance, you can turn it off. The downside of these systems, however, is that you might forget that the system is on, leaving your sprinkler to soak the lawn, inadvertently wasting water. Plus, if you leave town you′ ll need to ask someone else to do the watering for you. An automatic system is more convenient for most people.
- **Automatic operation** is generally built into new houses and can be installed in older homes. You program the system to water at specific optimal times (evenings) and for specific durations per watering zone. This is convenient because you don′ t have to think much about it and the systems are efficient. There is a minor the down side, however. For instance, if you program your system to water for hot summer months—every third day for 30 minutes—and neglect to change the setting when the cooler months arrive, then you′ ll be over watering in the fall. Another disadvantage is that the automatic system can break down without your knowledge. This doesn′ t pose an over watering problem; but it may cause problems for your lawn and plants.

Automatic Sprinkler Fixture (Photo: Dick Bartholomay)

Whichever system you choose will need your attention, especially during the change of seasons when the time and duration of watering needs to be adjusted. You'll also need to perform regular inspections. Either sprinkler system will work with both city and ditch water, but if you have ditch water, you may need to clean the screen and filter on a regular basis. Talk to your water provider about these issues. For more information, go to: http://www.ext.colostate.edu/pubs/Garden/07239.html

How Much Water is Enough?

Many factors determine the amount of water that your landscape needs. The most significant factor is the weather. Hot and dry equals high water needs, but how high? Tracking the weather is one component of understanding how much to water. But the following variables play into the mix:

- the landscape slope and aspect (south slopes get more sun)
- placement of trees, shrubs, sidewalks and drives
- soil types
- soil depth and preparation
- turf diseases common in the area
- types of sprinkler heads in your system
- changes in water pressure throughout the day
- weather, in particular, evapotranspiration

Photo: Dr. Curtis Swift

Using Evaportranspiration to Determine Watering

To determine how much water your plants need, it's useful to understand the relationship between plants and climate.

Imagine a wet sheet hanging on a clothesline. Sun and wind combine to remove the moisture from the sheet. The hotter the sun and the stronger the wind, the quicker the sheet will dry.

Plants go through the same process. The heat from the sun acts as a giant suction pump pulling water from plant leaves. The source water in the soil is pulled up through the roots into the plant body and then to the leaves where it can be used.

The water lost from the plant to the atmosphere is called *transpiration*. The sun's heat, aided by wind, also dries the soil, causing moisture in the soil to vaporize, or evaporate.

Scientists often combine the term *evaporation* from a soil surface with *transpiration* from plants into the concept of *evapotranspiration*, or commonly ET. It is generally measured in hundredths of inches of water per day. The ability to accurately estimate evapotranspiration rates is key to optimal watering. Optimal watering is defined as applying just the right amount of water to replace the water lost to evapotranspiration. For more information, go to: http://ccc.atmos.colostate.edu/~coagmet/extended_etr_about.php/.

Tips to Ensure Enough is Just Enough

Only you can determine the water needs of your landscape and how long you must irrigate each of the many different areas of your yard. Recommendations from your landscaping firm, nursery, or other professional should be considered, but in the final analysis, you must use personal observations. Each type of vegetation has different water needs. This section outlines some important concepts and provides some basic tips about how to make sure you're on track as you learn about your yard and its watering needs.

Know Your Soils

Table I

Soil Type	Water holding capacity (inches of water per foot of soil)	Water required to wet soil to a depth of 9 inch
Clay, silty clay	2.1 inches	1.2 to 1.9 inches
Silt loam, sandy clay loam	2.0 inches	1.0 to 1.8 inches
Fine sandy loam, sandy loam	1.0 to 1.6 inches	.8 to 1.2 inches

The Tri River Area Cooperative Extension website has the following suggestions for lawn care:

Water deeply, but only as needed. Avoid shallow, frequent watering. The frequency of irrigation of turf areas should be based on the condition of the grass. When turf grass requires water it will:

- turn darker than normal (it appears as if a shadow is cast on the lawn)
- turn blue-gray
- not spring back when walked on (depressions left by footprints do not bounce back)
- prevent the blade of a screwdriver or other such implement from penetrating into the soil any deeper than two inches.

These symptoms can appear in patches or over the complete turf area. When only small areas exhibit stress, water only those areas that need to be irrigated. If possible, adjust the sprinklers or sprayers to increase coverage on these dry areas. If that doesn't work, consider adding sprinkler or sprayer units and then adjust all units on the system using catch cans to insure all units are delivering near equal volumes of water.

Dry lawn in need of water (Photo: Dr. Curtis Swift)

Watering the complete lawn when only a small area requires water, or watering too frequently, results in shallow roots, increased susceptibility to drought (especially during July and August), and increased susceptibility to Melting-out Disease (Leaf-spot Disease).

Watering the lawn on a frequent, shallow basis results in death of the deep roots and increases the need to water. In some instances you may need to water daily or every other day. This is especially true if the soil is very sandy because it dries out quickly due to its limited water holding capacity.

Soils should always be amended with a good quality organic matter such as compost, composted horse manure, composted chopped straw, or hay prior to planting or sodding. This will help hold the soil moisture and reduce the need for frequent irrigation.

Water at night to reduce water loss from evaporation. Watering during the heat of the day results in excessive evaporation. Watering at night reduces problems with turf diseases and reduces the amount of water

loss from evaporation, making the irrigation more efficient. The most efficient and ideal time to irrigate turf grass is between 10 P.M. and 6 A.M. This timing may be difficult for those with manual sprinkler systems.

Water in calm weather rather than windy weather. Watering when it is windy results in loss of water through evaporation. Wind will also divert the water resulting in some areas getting much more water than others, and leaving dry spots. Areas of the turf that do not receive adequate moisture will require more water to stay alive.

Lawn in need of water. (Photo: http://www.denverwater.org/)

Aerate the lawn several times a year. Aeration should be done in the spring and again in the fall. Aerating the lawn is beneficial for many reasons, including:

- improving water penetration into compacted soils and through thatch and mat layers
- improving fertilizer movement to the turf roots
- allowing greater levels of oxygen to reach the soil in exchange for carbon dioxide and other gases
- enhancing turf grass shoot and root development
- reducing water runoff

Inspect irrigation systems, hoses and sprinkler. Problems with them wastes water. Spring is a great time to check for consistency, uneven water coverage, and leaks. Do this by placing straight-sided cans or glasses in the area where you will irrigate. Turn the sprinkler system on for a set length of time and measure the amount of water collected in the containers during that time. Using containers to measure the amount of water that's distributed will reveal variations and inconsistencies. By doing this, you can identify plugged heads, improper spacing of sprinkler heads, and more. Then correct the problem.

Check the amount of water applied and the depth of water penetration. This should be rechecked several times during the summer months to avoid problems that develop from clogged or twisted heads. Do this by the tin can method mentioned earlier in this booklet. Reset or clean heads as necessary. Use a ball probe (available from NRCS) after irrigating to determine depth and uniformity of the irrigation event. A ball probe is a four foot long, one-half inch diameter steel rod with a three-quarter inch smooth steel ball welded on one end, and a 12 inch steel handle welded on the other end. When the ball is forced into the wet soil, it easily penetrates until it hits a dry zone where it will stop. You will want the ball to stop just under the rooting depth of the plant.

Prepare the soil properly when establishing a new lawn. This will increase rooting depth and spread, and increase drought tolerance of the grass**.** Add organic matter to the soil and till it in as deeply as possible. Add 3.75 to 6 cubic yards of a decomposed organic matter per 1,000 square foot area of lawn. Use a coarse−not a fine−material. While root depth is controlled in part by genetics, the depth of soil preparation determines the ultimate rooting depth. Tall fescue grass will develop roots below 12 inches if the soil is properly prepared. Shallow soil preparation causes shallow roots. The deeper the roots, the more drought tolerant the grass.

Allow Kentucky bluegrass to go dormant if necessary. Kentucky bluegrass can be allowed to go "warm season dormant," which is defined as the ability of the plant to quit growing due to a moisture shortage, but remain alive until adequate moisture is available. This occurs without permanent and excessive injury to the lawn if otherwise healthy. This is a worst-case scenario option if drought conditions persist. Watering will allow Kentucky bluegrass to recover, even after as many as nine months without water.

If you don't have Kentucky bluegrass, your turf is probably either tall fescue or perennial ryegrass. The general rule of thumb for most grasses in our region is to water as deeply and infrequently as the grass will tolerate. For more details on how to care for Kentucky bluegrass, tall fescue, and perennial ryegrass, go to: http://www.coopext.colostate.edu/TRA/PLANTS/lawnwat.html

Delay watering in the spring. Base the first watering on soil moisture content. Spring is the time of maximum nutrient uptake. Watering too early in the spring cools the soil and reduces nutrient uptake. This stresses the grass and makes it more susceptible to insect and disease problems. Early spring watering can also saturate the soil, reducing the oxygen available to deeper roots, which results in the death of these deep roots. The loss of deep roots increases the grass's susceptibility to drought stress, and increases the need for more frequent watering. If the soil is dry, water. If the soil is moist, delay watering.

Prevent weeds from taking over drought-stressed turf area. Weeds always seem to thrive regardless of the conditions. Do not allow uncontrolled weeds to overtake the lawn or garden. Apply the proper methods necessary to prevent weed growth. Herbicides such as 2,4-D, Trimec, and Triamine are effective against broadleaf weeds that often invade weak turf. Scythe is a botanical herbicide used to spot-treat weeds.

Grass being invaded by Canada Curtail (Photo: Dr. Curtis Swift)

Avoid using manure as topdressing on lawns. Applying manure can increase the need to water. Some people think manure is the correct organic material to help lawns grow. But some manures are very low in nitrogen and typically high in salt. Adding salt to a lawn increases the need to apply more water.

Refer to a soil test to determine what nutrients are necessary. A properly fertilized lawn requires less water. Applying more fertilizer than is necessary can deplete other nutrients and cause deficiencies. The amount of nutrients needed is specific. Excessive nutrients are often as detrimental as deficiencies. For example, adding too much phosphorus may result in a deficiency of available iron both within the soil and within plants grown in the soil. Nutrient-stressed plants with deficiencies are more susceptible to insect and disease problems as well as to drought stress.

Using ET Rates to Optimize Water-Saving Irrigation Plans

Evapotranspiration can vary dramatically both seasonally and daily. The table below illustrates how ETs can vary in a single week of warm, windy weather. The cumulative ET, however, is the most important figure, and represents the amount of water that must be replaced by irrigation to ensure a healthy landscape (Table II):

Table II: Example of the Cumulative Effects of ET Over Seven Days

Day of week	ET	Cumulative ET
Wednesday	0.26	0.26
Thursday	0.27	0.53
Friday	0.28	0.81
Saturday	0.34	1.15
Sunday	0.32	1.47
Monday	0.28	1.75
Tuesday	0.25	2.00
Daily average	0.286	

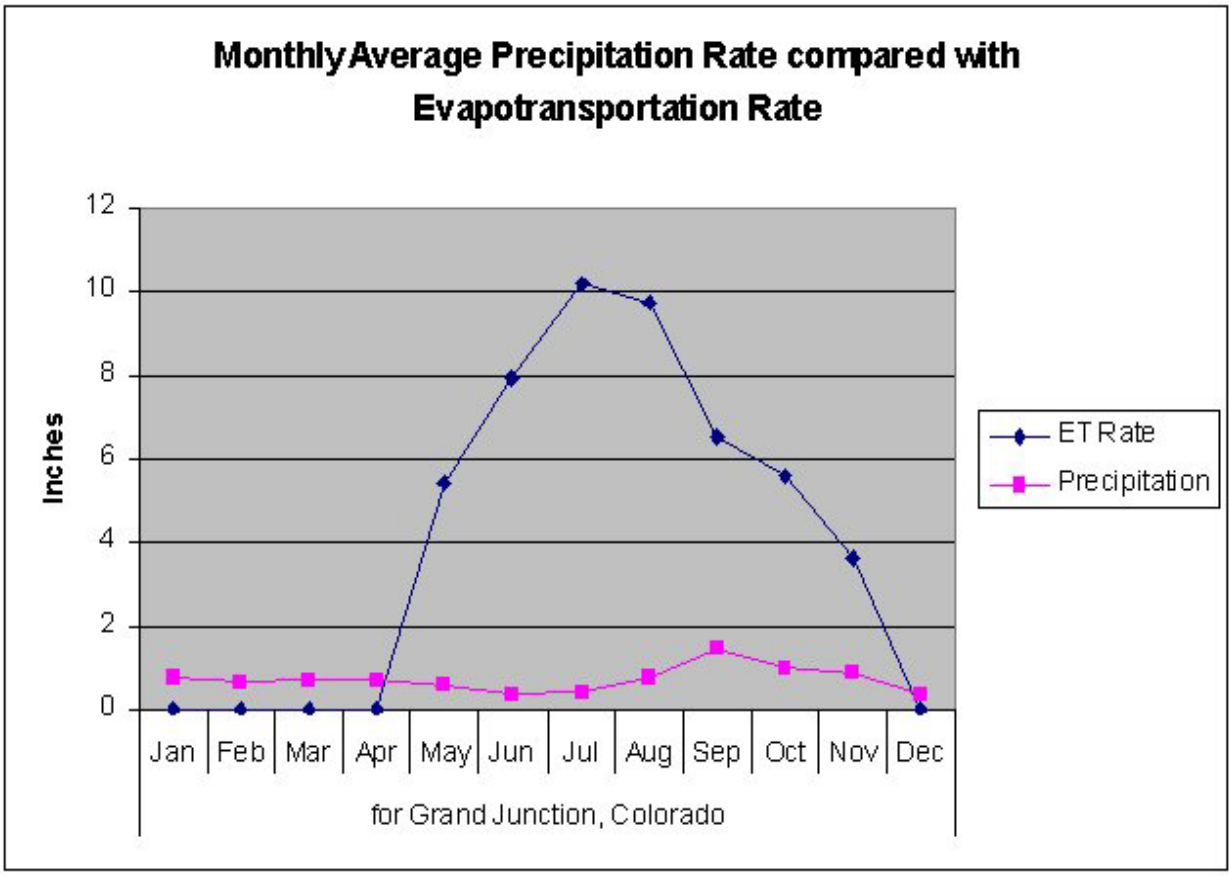
Optimally, you should irrigate when 50% of the available water-holding capacity of the soil has been depleted. Irrigate at that time to bring soil moisture that's in the root zone up to capacity. Table II refers to a loamy clay soil with 50% of the stored soil moisture at 1.20 inches. Assuming that on Wednesday, soil moisture in the root zone was at capacity (2.40 inches), by Saturday evening about 50% of the soil moisture was lost to ET (1.15 inches). At this point the lawn should be watered about 1.20 inches on Saturday evening or Sunday morning.

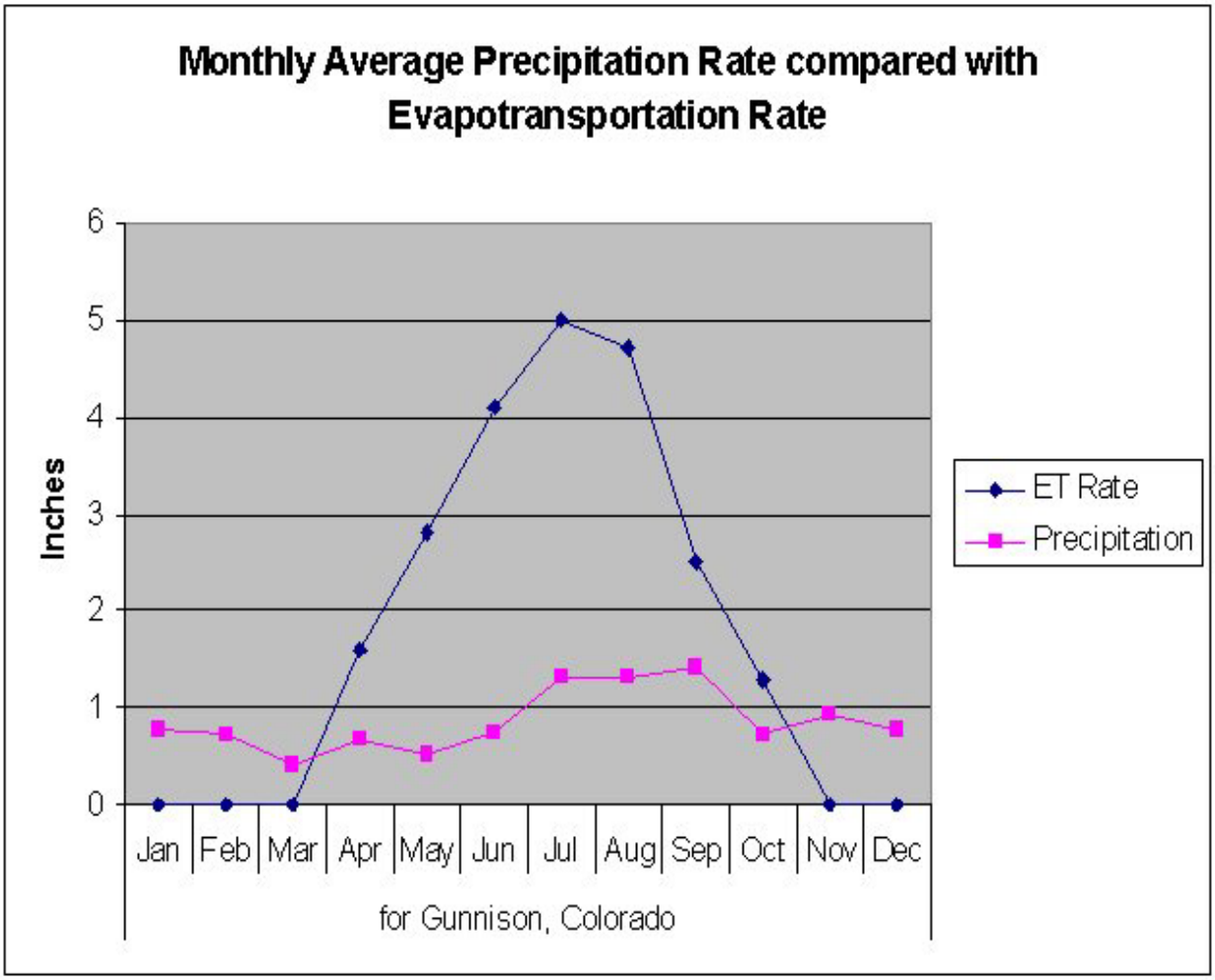
The easiest, least expensive way to determine the optimal time to quit irrigating is to use a ball probe. If irrigation has filled the soil to the root depth, it is time to stop irrigating. Too much irrigation causes the plants to drown since there's no oxygen in the root zone. Too little irrigation causes the plants to show distress. The trick is in knowing when to start and when to stop irrigating. Measuring, recording and using ET rates will help you to develop an optimal watering schedule.

Here's another example of how to use the ET information. Let's say you have a silty clay loam soil that has 2.1 inches of available water per foot of soil and we assume that a healthy lawn has a 15- inch root zone. Next we assume that the turf in this case has not been overly stressed and it has used 2.0 inches of the total 2.6 inches of water, held in the fully watered root zone. To replace this 2.0 inches of "water deficit," you need to know the rate of application of the lawn sprinklers. Place a few cans randomly around the lawn and turn on the water for a half hour and measure the amount of water in the cans. Average the total amount of water accumulated in the cans and multiply by two. Use this number as the application rate per hour. Assuming the rate is 1.5 inches per hour as measured by the cans, then 1.5 inches per hour is divided into the 2.0-inch water deficit, which equals an application time of 1.33 hours or one hour and twenty minutes to refill the soil profile.

If you have a sandy loam soil that has 0.75 inches of available water per foot of soil, it would need to be irrigated when 0.9 inches of water had been used, or approximately every third day when the average ET is 0.29 inch per day.

ET affects the amount of water used. Throughout the season, the ET rate guides you to use less water in the spring when the plants demand less water; to use more water during the hotter, longer days; and again, to use less water with shorter days and lower, autumn temperatures.





During the growing season, evaporation and transpiration are quantified on a daily basis for various geographical areas and is available at: http://ccc.atmos.colostate.edu. Then click on CoAgmetHomepage.

The ET Web Page at http://www.irrigationprovidersgv.org/soil.html provides ET data for the Grand Valley for Alfalfa, Corn, Dry Beans, Small Grains, Sugar Beets, Potatoes and Turf. The daily ET for each of these crops and the five-day total is provided along with how best to use this information.

Photo:
Gene Alexander,
USDA-NRCS

Section Two:
Planning Your Water-Wise Residential Landscape

Mesa, Montrose, and Delta counties are growing by leaps and bounds. In Mesa County alone, 1,600 new home permits are approved each year. But our precipitation isn't keeping up with that trend; Grand Junction still averages only about seven inches of precipitation each year.

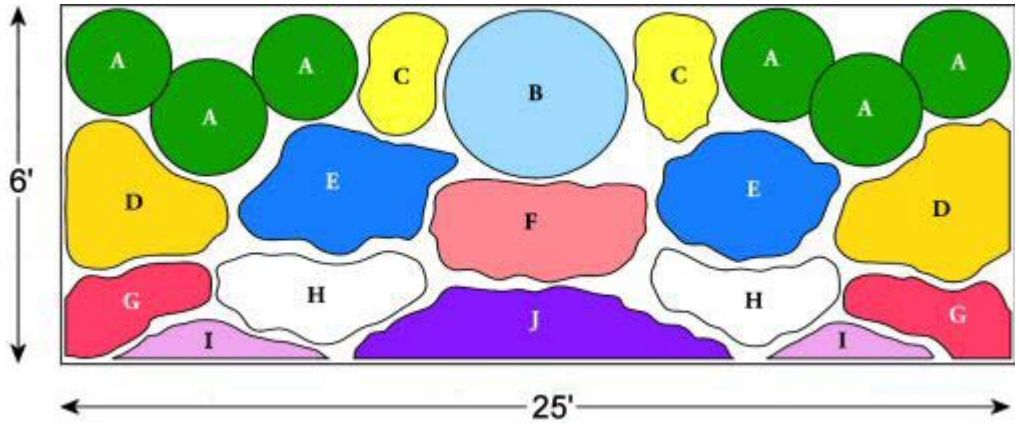
Whether you have a new house yet to be landscaped or an existing landscape that you'd like to rework for greater water efficiency, there are some basic steps that will ensure the best use of your time and money; keep your water bill down; and restrict deep percolation to a minimum.

Mapping Your Way to Water Wise Yards

Prior to making any planting decisions, you'll need to walk your property to assess:

- condition of existing plants
- soil variations
- degrees of sunlight
- watering zone placement
- recreation areas (i.e. patio, hot tub, playground, etc.)
- shade areas
- garden area
- rock/gravel areas instead of turf

When you have a good idea of what want and where you want it, draw a map of what you envision. Be particularly mindful of watering zones so that drought tolerant plants are planted in one area, while plants requiring medium amounts of water are in another, and high-water use plants are someplace else. The example below is a good reference for how to go about this.



Designed by Larry Horgan, RLA Garden Builders, Inc. (map courtesy of http://www.denverwater.org)

A. Ponderosa Pine x 3
B. Woolly Thyme– fill space between the flagstones
C. Kinnikinnick x 25
D. Russet Buffaloberry x 7
E. Common Juniper x 8
F. Mountain Snowberry x 2
G. Golden Currant x 4
H. Hancock Coralberry x 6
I. Lacy Self Heal x 18
J. Patio Area

This is the time to refer to your soil map. Use your knowledge of the soil to match the area with compatible plants. The surface soil determines how rapidly the soil will take in the irrigation water. This is the infiltration rate of a soil, and may vary from less than one half inch per hour, to more than four inches per hour. The infiltration rate determines the design application rate of a sprayer or sprinkler system, which in turn, determines how many minutes or hours are needed to replace the moisture used since the previous irrigation.

Design your irrigation system to water only the amounts necessary in any given space. Take note of areas of salty soils. Existing gardens will reveal salty soils by exhibiting stunted plant growth and/or whitish gray or brown surface salt deposits

The Beauty of Xeriscaping™

This is also a good time to consider xeriscape, or drought-tolerant plants. If you think they only come in brown, you're just not up to speed on the wide range of colorful and beautiful plants that are so well suited for our climate. You also don't need to xeriscape the entire yard; many people create hybrid yards where they plant their favorite, luscious green, thirsty plants in one area, and water-saving plants elsewhere. It's quite common now to see entire yards that are split between green grass and decorative rocks, wood chips or other non-water using materials. For a wonderful education on what types of xeriscaping plants, shrubs, flowers, and ornamental grasses are available that will save water and money, go to your local nursery or to: http://www.ext.colostate.edu/ptlk/1907.html.

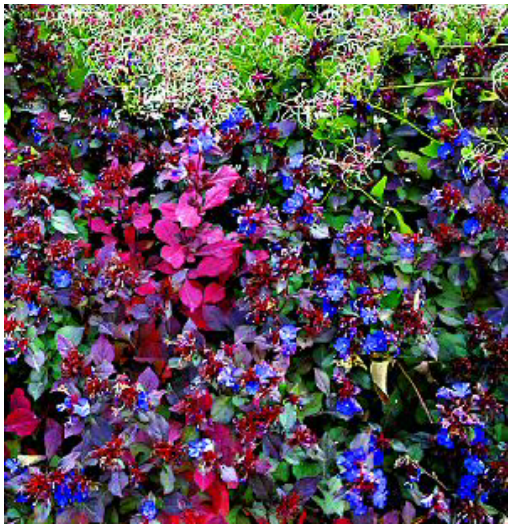
Fire Weed

Scotch Broom

(photos: http://www.denverwater.org)

Columbine
(photos courtesy of http://www.denverwater.org)

If you're not sure about the best places for specific plants, contact a Master Gardener at the CSU Cooperative Extension office, or work with a local greenhouse. If your garden is in an area where the topsoil is shallow and coarse, move it to an area with deeper and finer soil. That will reduce the frequency of irrigation. While some grasses and shrubs can tolerate shade, most garden crops need plenty of sunshine.



A bounty of color fills in a xeriscape garden.

The sun provides the energy for production and if sufficient water is available, there is more production in sunny areas than in shady areas for most garden plants.

Most trees and shrubs in a typical lawn are irrigated along with the grass. Remember: this can result in a situation where the tree or shrub receives more water than needed and may weaken the tree. Or, the tree may be getting over fertilized and grow leggy and unattractive. A separate buried line with small sprayer emitters for each tree and/or shrub will allow better water management and a healthier landscape.

Landscaping Multi-Acre, Vacant Land

The process of landscaping large acreage areas is similar to that of smaller yards. First, draw a map of vacant land with multiple acres. Here are some tips:

- Locate buildings on the high spot of the property. This will afford the best view and provide for water drainage. Be sure to include the building site, leach field, property lines (including fences), roads, driveways and other significant landmarks on your planning map.
- Place the septic system leach field in an area without vehicle or animal traffic. The county health department needs to approve the leach field design and test the leaching rate of the soils.
- Divert run-off from barn and stable roofs away from livestock yards.
- Determine the lawn, shrub, tree, and garden areas.

Attempt to scale each area on the map as accurately as possible, using charts that show the size and spread of mature trees and shrubs. Most of the local retail nurseries have someone on staff to assist with the design. While doing this design, select plant materials that are salt tolerant with low moisture requirements. Ask about the rooting depths and water requirements, including suggested watering frequencies of the plants you select. After locating the plant materials on your map, draw lines connecting the plant materials that have similar rooting depths and water requirements, using a colored pencil for each different requirement.

Plants perform best when the planting area is properly amended with organic material. (See page 8 for information on amending soils.) The depth and spread of a plant's roots depend, in part, on genetics. Soil preparation, however, ensures an adequate soil-oxygen:moisture ratio. This helps the plants realize their genetic potential and create healthy root systems.

Different plants will respond well in different types of amended soils. Plants that tolerate clay soil, as long as they're not over watered include:

Catalpa (*Catalpa speciosa)*
Hackberry (*Celtis occidentalis)*
Hawthorn (*Crataegus* species)
Green Ash (*Fraxinus pennsylvanica)*
Golden Raintree (*Koelreuteria paniculata)*
Cottonwood (*Populus* species)
Willow (*Salix* species)
Blue Spruce (*Picea pungens*)
Eastern Red Cedar (*Juniperus virginiana)*
Dogwood (*Cornus* species)
Alkali Sacaton (*Sporobolus airoides)*
Western Wheatgrass (*Agropyron smithii)*
Bluebunch Wheatgrass (*Agropyron spicatum)*
Ephraim Crested Wheatgrass (*Agropyron cristatum)*
(Ephraim also works well in sandy soil)

Plants more adapted to well-drained sandy soils:

Austrian Pine (*Pinus sylvestris)*
Pinyon Pine (*Pinus edulis)*
Ponderosa Pine (*Quercus gambelii)*
Rocky Mountain Juniper (*Juniperus scopulorus)*
Serviceberry (*Amelanchier* species)
Woods Rose (*Rosa woodsii)*
Mountain Mahogony (*Cercocarpus* species)
Shrubby cinquefoil (*Potentilla fruiticosa)*
Blue grama (*Bouteloua gracilis)*
Galleta grass (*Hilaria jamesii)*
Indian Ricegrass (*Oryzopsis hymenoides)*
Sand Dropseed (*Sporobolus cryptandrus)*
Ephraim Crested Wheatgrass (*Agropyron cristatum)*

Ask for help at your local nursery to choose plants with similar water requirements so you can plant them according to watering zones.

Conclusion

Our region is growing quickly, placing ever-higher demands on our water supply. Those of us who want the best for our children and their children, and who want to preserve the beauty and well being of the environment that surrounds us can meet these challenges by using water wisely. The information age has equipped us with both knowledge and sophisticated technology so that we can manage our water supplies better now than ever before. It's your choice as a resident of Western Colorado, and our choice as growing and thriving communities, to be stewards to our land and water. Let's work together and choose to make it happen.

Resources for More Information

With the basic knowledge that this booklet has provided, you can now make decisions about how to most effectively landscape and irrigate your property. But there is much, much more to know. Here is a list of resources that can help you as you navigate your way through the wise world of water use. To download more copies of this booklet or manuals about water-wise construction of ponds, golf courses or other large-acreage properties, go to: www.thedripwebsite.com, or www.seleniumtaskforce.org.

Colorado State University Cooperative Extension offices:

http://www.coopext.colostate.edu/TRA/PLANTS/index.html#main.html

http://www.coopext.colostate.edu/WR/

Delta County 970-874-2195 Montrose County 970-249-3935

Mesa County (Grand Junction) 970-244-1834

Gunnison County 970-641-1260 http://www.coopext.colostate.edu/gunnison/

USDA-NRCS:

Delta	970-874-5735
Montrose	970-249-8407
Grand Junction	970-242-4511

To learn more about the following topics, go to the related web link:

Colorado Division of Water Resource:

http://water.state.co.us/

Colorado Department of Wildlife:

http://wildlife.state.co.us/

Colorado/Gunnison Basin Army Corp of Engineers:

http://wildlife.state.co.us/LandWater/WetlandsProgram/IsItAWetland/

Drought:

http://cwrri.colostate.edu/droughtpubs.html

http://ccc.atmos.colostate.edu/drought.php

http://www.thedripwebsite.com

Evapotranspiration:

http://ccc.atmos.colostate.edu/~coagmet/extended_etr_about.php/

http://www.irrigationprovidersgv.org/soil.html

Irrigation systems and guidance:

http://www.ext.colostate.edu/pubs/Garden/07239.html

http://www.irrigationtutorials.com

http://www.ext.colostate.edu/PUBS/Garden/04702.html

Mesa County Water Audit:

http://www.coopext.colostate.edu/TRA/PLANTS/2005_irrigation_audit_final_report.pdf

Mosquito Control:

http://www.ext.colostate.edu/PUBS/INSECT/05526.html

http://wsprod.colostate.edu/cwis79/mosq/entire.cfm

Pond construction and maintenance:

http://www.aces.edu/pubs/docs/A/ANR-1114/

Selenium:

http://www.ext.colostate.edu/PUBS/natres/06109.html

Soil amendments:

http://www.ext.colostate.edu/ptlk/ptlk1600.html

Soils in Western Colorado:

http://www.coopext.colostate.edu/TRA/PLANTS/index.html#

http:// www.coopext.colostate.edu/TRA/PLANTS/soil.html

http://www.co.nrcs.usda.gov/technical/soil/soil-index.htm

Turf care:

http://www.coopext.colostate.edu/TRA/PLANTS/lawnwat.html

West Nile Virus:

http://www.ext.colostate.edu/westnile/reslist.html

Xeriscape or drought-tolerant plants:

http://www.ext.colostate.edu/ptlk/1907.html.

http://www.xeriscape.org

www.ext.colostate.edu/pubs/garden/07230.html

http://www.ext.colostate.edu/pubs/garden/07231.html

Books:

Irrigation of Agriculture Lands Agronomy No. 11, Edited by Hagan, Haise, and Edminster

American Society of Agricultural Engineering Papers.

The Nature and Property of Soils, Buckman and Brady

Matson, Tim. 1997. *Earth Ponds Sourcebook: The pond owner's manual and resource guide*. The Countryman Press, Woodstock, VT.

Matson, Tim. 1991. *Earth Ponds: The country pond maker's guide to building, maintenance and restoration*. Second Edition. Countryman Press, Woodstock, VT.

Porter, Valerie. 1988. *The Pond Book*. Christopher Helm Publishers, London, England.

"Ponds - Planning, Design, Construction." The USDA Natural Resources Conservation Service (NRCS)- Agriculture Handbook 590. Contains detailed information on design surveys, site selection, drainage area, pond layouts, soil analysis and spillway construction. Contact your county NRCS office or download a copy from the UDSA NRCS website to obtain this publication.

Water: Colorado's Most Precious Resource

Photo: Gene Alexander, USDA-NRCS

Colorado's average annual precipitation is 17 inches—including all of the mountainous areas of the state. Certain parts of the state, such as the high desert of Grand Junction, average only between seven and 10 inches per year.

A family of four needs 0.5 acre feet, or approximately 150,000 gallons of water, per year to satisfy the typical demands of home and landscape.

There is so much Coloradoans can do to use water wisely. This booklet provides simple, easy steps for homeowners to understand:

- why water is Colorado's most precious resource
- how over-watering landscapes contributes to toxic materials in our rivers
- the nature of soils in Western Colorado, and why amending them before planting is necessary
- evapotranspiration, or ET, and why it determines watering needs
- the best way to design a water-wise landscape
- that drought-tolerant plants are beautiful, too
- how to safely construct a pond so it doesn't seep into surrounding areas