UCCE
El Dorado County
Master Gardeners
Present

Water-resilient Landscapes
Part 1
Water-resilient Landscapes

**Agenda:**
- Overview
- California Water Story
- It Starts with the Soil
- Hydrozoning & Plant Selection
- Irrigation
- Capturing & Utilizing Rainwater
- Q & A Class Wrap-Up
Resources

- **CNPS – What Grows Here?** [https://www.calflora.org/entry/wgh.html](https://www.calflora.org/entry/wgh.html)
- **Eco-Friendly Landscape Design Plans for the New California Landscape** [www.ecolandscape.org/new-ca/](http://www.ecolandscape.org/new-ca/)
- **River Friendly Inspiration Garden** [http://www.ecolandscape.org/riverfriendly/topics/inspiration-garden.html](http://www.ecolandscape.org/riverfriendly/topics/inspiration-garden.html)
- **The Regional Water Authority's Water-Wise Gardening software** [http://www.rwa.watersavingplants.com/](http://www.rwa.watersavingplants.com/)
- **The UC Davis Arboretum All-Stars** [http://arboretum.ucdavis.edu/arboretum_all_stars.aspx](http://arboretum.ucdavis.edu/arboretum_all_stars.aspx)
- **The Bay Area Bringing Back the Natives website** includes useful information on using California natives in the landscape.
- **California plant database search tool** — [www.waterwonk.us](http://www.waterwonk.us)
California Water Story
Why Conserve Water?

- Climate Change - Effect on the Sierra Nevada
- Depletion of Our Aquifers & Reservoirs
- Contamination of Aquifers
April 2015 – 25% Mandatory Cutback

88% of state experiencing some level of drought
15-year Drought Snapshot
Where does Californian's Water Come From?

- 75 percent of the fresh water that flows into the Sacramento-San Joaquin Delta (Delta) comes from the Sierra Nevada
- 60% of treated water comes from the Sierra Nevada
- 30 percent from groundwater in normal years (up to 60 percent in drought years)
Climate Change Effects on Sierra Nevada

- Glacial retreat
- Snowpack decreasing
- Rise in snow level
- Decline in runoff
- Peak runoff timing
- Off–storage capacity
Glaciers in California

- **Definition:** A body of perennial ice or snow that moves. Movement of ice can be observed as cracks in the ice known as crevasses.

- Estimated number of "true glaciers": 118

- Based on analysis of photographs, glaciers lost an average of 55 % of their surface area between 1900 and 2004
http://www.glaciers.pdx.edu/Thesis/Basagic/snglac.html
How is water stored?

• Surface
  • Lakes
  • Reservoirs
• Sub-surface
  • Fissures and cracks in the rock
  • Aquifers
Changing Water

Snowpack decreasing

- Normally provides 1/3 of the state’s total water supply
- Since 1915, average snowpack in western states has declined by between 15 and 30 percent; equivalent to Lake Mead
- Declining trends largest in the spring, in Pacific states, and in locations with mild winter climates

Rise in snow level

Decline in runoff
Changing Water

- **Peak runoff timing**
  - 50–80% is spring and summer runoff
  - Earlier-occurring snowmelt runoff threatens storage efficiencies
    - Flood control vs. maximum storage

Early runoff ➡️ Early release ➡️ Less water stored ➡️ Longer summer droughts

- consequences for water supply, ecosystem, and wildfire management
Reservoirs

- New storage capacity has a low and decreasing incremental value for water users and other beneficiaries

"Completing all Proposition 1-funded storage projects ($2.7B) would increase total surface water storage capacity in California by less than 8 percent, and increase water deliveries by perhaps 1-2 percent, because most of the expanded capacity would refill infrequently."
Aquifers
Depletion of Aquifers

• Groundwater
  • does not exist in underground lakes
  • fills pores (spaces) between sand, gravel, silt and clay in water-bearing formations known as aquifers.
Water Conservation

- A holistic approach of
  - Creating drought-resistant soils with compost and mulch
  - Use efficient irrigation systems that include self-adjusting, weather-based controllers
  - Install systems to capture and reuse water
    - stormwater, greywater and recycled water in the landscape as much as possible
Water Conservation

- **Selecting plants** naturally adapted to summer-dry climates
- **Group plants by water needs** (hydrozoning)
- **Minimize/eliminate lawn**
  - Lawn requires much more water to keep healthy than other landscape plants.
  - Reducing or eliminating the lawn area conserves water and energy and reduces need for fertilizers and pesticides
It Starts with the Soil
The Role of Soil

- Topsoil formation occurs when living material descends into Mother Earth followed by the movement of waste material from living things into plants. And the cycle continues...
What is Soil?

- Average garden soil is a complex mixture of
  - 45% minerals (weathered rock)
  - <50% air and water (approximately half and half)
  - 5% organic matter
    - decaying remains of plants, animals and microorganisms
Air and Water

- Fills the voids between the mineral and organic particles
- Water moves through the soil 2 ways
  - Gravitational water moves freely and down
  - Capillary water moves by the molecular attraction of water molecules for each other and can move up and down
- Water movement pushes stale air out and sucks in air from the surface and displaces carbon dioxide
• Water movement pushes stale air out and sucks in air from the surface and displacing carbon dioxide

• Soil compaction reduces pore space so that water and air can’t move through it and is prone to anaerobic activity
  • In the absence of air, organisms produce alcohols that kill plant roots

• Hydroscopic water
  • A few molecules thick on the surface of particles and hard to break the bond
  • Cannot be used by roots
  • Critical to the ability of microbes to travel and live
• Texture
  • Sand – 0.0625 to 2 mm
  • Silt - 0.004 – 0.0625 mm
  • Clay - < 0.004 mm
Soil Structure

- The arrangement of the solid parts of the soil and of the pore space located between them
  - Affects drainage and water movement
  - Affects air circulation
  - Space for soil organisms to live
Soils Analysis

- Nutrient content
  - Macro-nutrients (NPK)
  - Micro-nutrients
- pH
- Organic matter
- Salts
- Soil Structure

What is soil analysis?

- Soil analysis is a set of various chemical processes that determine the amount of available plant nutrients in the soil, but also the chemical, physical and biological soil properties important for plant nutrition, or "soil health".
Mechanical Analysis of Soils

“The Jar Test”

• **Materials:**
  - Various soil samples (remove pebbles, rocks and OM)
  - Mesh sieve or old colander
  - 1 one-quart canning jar (with lid and ring) for each sample
  - Calgon water softener, Dawn detergent or powder dishwasher soap
  - Ruler (metric)
  - ½ cup measuring cup
  - Tablespoon
  - Masking tape and pen (or similar materials for labeling jars)
Getting Soil Samples

• Create a soil slice about ½” thick by 6-10” deep
• Take a 1-inch-wide core strip from the center down the entire length
• Remove grass blades, stems, stones, thatch and other organic matter & place in a bag or bucket
• Return remaining soil to the opening pressing firmly back in place
• Repeat to collect 6 to 10 random soil cores from the area
• Mix the cores thoroughly to make one uniform sample of ½ to 1 cup
Mechanical Analysis of Soils “The Jar Test”

**Procedure:**

1. Place about ½ cup of loose soil in a quart jar.
2. Add 1 heaping tablespoon of Calgon and 3-½ cups of water. Cap and shake for 5 minutes (alternately inverting the jar will suffice).
3. Allow the jar to sit, undisturbed, for at least 24 hours.
4. At the end of 24 hours, measure the depth of settled soil. This represents the total depth of soil.
5. Shake again thoroughly for 5 minutes.
6. Let the jar sit, undisturbed, for 40 seconds. Measure the depth of the settled soil with a ruler. This is the sand layer.
7. At the end of 30 minutes, measure the depth of the settled soil again. From this depth, subtract the thickness of the sand layer to obtain the depth of the silt layer above it.
8. The remaining unsettled particles in suspension represent the clay fraction and can be obtained by subtracting the depths of the sand and silt layers from the total depth determined in step 2.
Mechanical Analysis of Soils “The Jar Test”

- The more thoroughly your sample is dispersed by mixing, the more accurate your measurements will be.
- Optional method: mix sample initially (step 1) in a blender for 10 minutes rather than shaking by hand.
  - more thoroughly disperses floccules of clay which may otherwise settle with the sand and/or silt fractions due to their size
Mechanical Analysis of Soils “The Jar Test”

- The measurements may be converted into percentage figures according to the following example:
  - Total depth of soil: 23 mm
  - Depth of Sand Layer 9 mm
  - Depth of Silt Layer 10 mm

  \[
  \begin{align*}
  \% \text{ sand} &= \frac{9 \text{ mm}}{23 \text{ mm}} \times 100\% = 39\% \\
  \% \text{ silt} &= \frac{10 \text{ mm}}{23 \text{ mm}} \times 100\% = 43.5\% \\
  \% \text{ clay} &= 100\% - 39\% - 43.5\% = 17.5\%
  \end{align*}
  \]
Mechanical Analysis of Soils “The Jar Test”

• Plot your percentages on the soil texture triangle.
  • Begin by putting a mark on the bottom leg of the triangle at the percent of SAND you calculated in your soil sample.
  • From this point, draw a line upward to the left, parallel to the other slanted lines that start on the sand scale (bottom) of the triangle.
  • On the left side of the triangle, mark the percent of SILT in your sample.
  • From this point, draw a horizontal line across the triangle to the right.
  • On the right side of the triangle, mark the percent of CLAY in your sample.
  • From this point, draw a line down to the left, parallel to the other lines that start on the clay scale.
  • The 3 lines you have drawn should intersect in a point. That point will fall into one of the soil descriptions on the graph.
Mechanical Analysis of Soils "The Jar Test"

- Refer to the soil triangle and determine the textural class of your soil.
  - \( \% \text{ sand} = \frac{9 \text{ mm}}{23 \text{ mm}} \times 100\% = 39\% \)
  - \( \% \text{ silt} = \frac{10 \text{ mm}}{23 \text{ mm}} \times 100\% = 43.5\% \)
  - \( \% \text{ clay} = 100\% - 39\% - 43.5\% = 17.5\% \)
SoilWeb app

- Accesses USDA-NCSS detailed soil survey data (SSURGO)
- SSURGO database contains information about soil as collected by the National Cooperative Soil Survey over the course of a century
BOOMER SERIES

The Boomer series consists of deep and very deep, well-drained soils that formed in material weathered from metavolcanic and basic igneous rocks. These soils are on foothills and mountains and are typically at the transition between these landscapes. Slopes range from 2 to 75 percent. The mean annual precipitation is about 45 inches and the mean annual temperature is about 55 degrees F.

TAXONOMIC CLASS: Fine-loamy, mixed, superactive, smectitic Hapludolls

TYPICAL PEDON: Boomer gravelly loam - on a northeast facing slope of 23 percent under black oak, ponderosa pine, and manzanita at 1,400 feet elevation. (Colors are for dry soil unless otherwise noted. When redescribed February 1977, the soil was moist throughout.)

DESCRIPTION

<table>
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<th>Backslope, n slopes</th>
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AUBURN SERIES

The Auburn series consists of shallow to moderately deep, well-drained soils formed in material weathered from amphibolite schist. Auburn soils are on foothills and have slopes of 2 to 75 percent. The mean annual precipitation is about 619 mm and the mean annual air temperature is about 16 degrees C.

TAXONOMIC CLASS: Luquous, mixed, superactive, thermic Lithic Hapludolls

TYPICAL PEDON: Auburn silt loam - on an easterly facing slope of 10 percent under annual grasses, blue oak, interior live oak and California foxtail pine at 190 meters elevation. (Colors are for dry soil unless otherwise noted. When described on March 27, 1959, the soil was dry throughout.)

DESCRIPTION

<table>
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The Sobranse series consists of moderately deep, well-drained soils that formed in material weathered from basic igneous and metamorphic rocks. These soils are on foothills and have slopes of 2 to 75 percent. The mean annual precipitation is about 32 inches and the mean annual temperature is about 60 degrees F.

TAXONOMIC CLASS: Fine-loamy, mixed, active, thermic Mullia Hapludolls

TYPICAL PEDON: Sobranse silt loam, rangeland. (Colors are for dry soil unless otherwise noted.)

A-1 to 5 inches; reddish brown (5YR 5/4) silt loam, dark reddish brown (5YR 5/4) matrix; massive, slightly hard and hard, friable, slightly sticky and slightly plastic; many very fine roots; common very fine and medium tubular and intertubular pores; moderately acid (pH 6.9); clear smooth boundary (4 to 9 inches thick)

Bt1-5 to 10 inches; yellowish red (5YR 4/8) silt loam, yellowish red (5YR 3/6) matrix; weak medium subangular blocky structure; hard, friable, sticky and slightly plastic; common very fine roots; many very fine and fine tubular pores; few thin clay films in pores; slightly acid (pH 6.3); clear smooth boundary (5 to 10 inches thick).

Bt2-11 to 24 inches; yellowish red (5YR 5/6) light clay loam, dark red (2.5YR 3/6) matrix; moderate medium subangular blocky structure; hard, friable, sticky and slightly plastic; common very fine roots; common very fine, many fine and medium tubular pores; some thin clay films in pores; slightly acid (pH 6.5); clear smooth boundary (10 to 24 inches thick).
My Soil Jar Test
Fine silty loam
Drainage Test

- Dig a hole 12” deep by 6” wide
- Fill with water and allow to drain completely
- Fill again and see how long it takes to drain
- If more than 8 hours, address drainage problems
Soil Nutrient Testing

- Traditional soil tests (NPK Test) only determine elemental deficiencies, pH, and CEC (must be done by a lab)
  - Do not measure plant-available nutrients
  - Chemical reagents used in the lab don’t interact with the soil like plants do
  - Soil chemistry changes throughout the year
  - Procedures vary greatly from lab to lab
Soil Structure

- The arrangement of the solid parts of the soil and of the pore space located between them
  - Affects drainage and water movement
  - Affects air circulation
  - Space for soil organisms to live
Soil Structure

• **Good soil structure**
  • Granular, crumbly like cookie crumbs
  • Resists erosion
  • Resists drying
  • Nutrient retention is high

• **Poor Soil Structure**
  • Won’t hold water
  • Little air for roots or organisms
  • Nutrients are locked up because inaccessible to organisms
  • Often leads to over-watering and fertilizing
Soil on the right has better tilth. Higher organic matter results in better and more stable aggregation that results in a more favorable root environment.
Soil pH

- **Acidity**
  - pH 3 (Very Strong)
  - pH 4 (Strong)
  - pH 5 (Moderate)
  - pH 6 (Slight)

- **Neutrality**
  - pH 7 (Slight)
  - pH 8 (Moderate)
  - pH 9 (Strong)

- **Alkalinity**
  - pH 10 (Very Strong)

- pH range of acidic peats
- pH range of mineral soils in humid regions
- pH range of mineral soils in arid regions
- Highly alkaline soils
The Soil Food Web

- Plants are in control
  - Photosynthesis
    - process used by plants to convert light energy into chemical energy, stored in the form carbohydrates (liquid carbon)
Exudates aka Sugars

- Exudates: carbohydrate secretions (like humans perspire) in the rhizosphere are traded for nutrients the plant needs for growth.
- In healthy soil, plants get 85-90% of nutrients they need through this carbon exchange.
Soil Food Web

• Microorganisms comprise the major part of the Soil Food Web
Soil Food Web

• Per teaspoon of healthy soil:
  • 1M to 1B bacteria
  • Miles of fungal hyphae
  • 10,000 to 100,000 protozoa
  • 15 to 500 beneficial nematodes
  • Thousands of microarthropods
  • More organisms than people who have ever lived
THE POOP LOOP

Based on information from Dr. Elaine Ingham and Soil Foodweb, Inc.
by Alane O’Rielly Weber, Botanical Art
(c) 2004

Decomposers:
saprophytic fungi,
aerobic bacteria
(Nitrogen accumulation)

Microscopic Soil Predators:
protozoa, amoebae, flagellates, ciliates

D.O.M.
(dead organic matter)

Predators:
nematodes, arthropods, mites

Higher level predators

Living Plants

release of Nitrogen...the "Poop Loop" begins

more Nitrogen released

and more "Poop Looping"

and more...

Vertebrates

Sun
**Fungi**

- Yeasts – little presence in soil
- Molds – important in humus formation
- Fusarium & Aspergillus
- Penicillium
- Mycorrhizae (hyphae & mushrooms)
- Endophytes - live inside plants
Fungi

• The primary decay agents in the SFW
• Break down a wide range of organic matter
  • Lignin and cellulose
  • Chitin shells of insects
  • Bones of animals
• Scout for and find nutrients, bind them up
Mycorrhizae

- Fungi that grow in a symbiotic association with plant roots or mildly pathogenic relationship
  - Hyphae grow end-to-end creating strands
  - Masses create mycelia
- Able to grow significant distances to locate food sources
- Transports nutrients through the hyphae, cell to cell
- Hyphae tubes provide paths for air, water and bacteria
- 90-95% of plants have associations with mycorrhizae
Mycorrhizae

- Symbiotic relationship with plant roots
- Convert insoluble nutrients into plant-available forms
- Exchange nutrients for exudates
  - Phosphorus
- Waste provides nitrogen
Mycorrhizae

• Unlock, retrieve and transport minerals
  • Phosphorus
  • Calcium
  • Magnesium
  • Zinc
  • Iron
  • Copper
Earthworms

• Healthy soil contains 10-50 per sf
• Master shredders
• Aerate soil, increase porosity
• Help with soil aggregation
• Increase water-holding capacity
• Move OM and microorganisms
• Increase microbial population
• Aid plant root growth
• Increase fertility
Soil Organisms

- Decompose organic compounds
  - manure, plant residues

- Sequester nitrogen and other nutrients

- Fix nitrogen from the atmosphere, making it available to plants

- Enhance soil aggregation and porosity
  - increase infiltration and reduce runoff

- Prey on pests

- Food for each other and above-ground animals
Soil fertility is the capacity to nurture healthy plants

“Through the activities of soil microbes...the basic raw materials needed by plants are made available at the right time, and in the right form and amount.” – The Soul of the Soil

Microorganisms serve as “nutrient facilitators”

Microorganisms are responsible for the formation of humus.
Organic Matter (OM)

OM is vital to soil health

• Improves the physical and chemical properties
• Improves biological health

What is it?

• Bacteria and fungi produce slime so they don’t get washed away; this stuff binds mineral particles together
• Fungal hyphae physically bind particles and clods together
Benefits of the Soil Food Web

• A healthy soil food web controls disease
  • Not all soil organisms are beneficial
  • A large, diverse community controls problem organisms
  • Competition keeps pathogens in check
• Eliminate or reduce the need for:
  • Fertilizers
  • Pesticides
  • Herbicides
  • Fungicides
• Improved water- and air-holding capacity
• Healthier, more productive plants
Bacteria + fungi =
Protozoa + nematodes =
Effects of Chemical Fertilizers

**Synthetic NPK fertilizer:**
- Decline of populations of bacteria and fungi affect all the other organisms down the food line, including worms
- Reduces soil production of plant-available nitrogen
- Slows production of exudates
- Slows down or even halts humus formation (i.e., carbon storage)
- Worms are irritated by chemical fertilizers
- Chemical fertilizers are a one-shot wonder
  - plant uses what is immediately available - the rest leaches out into the soil beyond the plants reach.
Effects of Chemical Fertilizers

- Chemical fertilizers
  - Deteriorate soil structure
  - Decrease water-holding capacity
  - Increase salts in the soil
  - Increase the presence of pathogens and pests
  - Are the number one polluter of our waterways
Rototilling

- Breaks up fungal hyphae
- Destroys worms
- Pulverizes arthropods
- Destroys soil structure
- Reduces air- and water-holding capacity
Building the Soil

• First priority: Restore/build a diverse soil food web
  • 3 primary strategies:
    • Building and Maintaining OM
    • Compost
    • Mulching

“The proper care and feeding of soil organisms demands close attention to managing soil organisms.” – Soul of the Soil
Building the Soil

• No matter what your soil or climate, improving the soil food web will improve your soil
  • Improve soil structure
  • Improve nutrient availability and retention
  • Improve water-holding capacity and drainage
  • Minimize pests and diseases
  • Provide the right pH at the root zone
Amendments for Building and Maintaining the Soil Food Web

- Compost
- Manures
- Cover Crops
- Mulch
- Compost Tea
- Worm Castings
- Mycorrhizal Fungi
- Other Amendments
  - Bio-char
  - Rock dust
Compost

- Art/science of mixing various OM in a pile and allowing it to decay into stable humus
  - High in microbial life & microarthropods
  - Use to inoculate your soil
  - NO tainted or toxic materials
    - No herbicides
    - No pesticides
    - No fungicides
- Initial soil prep: 12 cubic yards per 1,000 square feet (4"")
- Annually: Place ¼” to 1” around your plants
Animal Manures

• Contributes significantly to SOM
• Stimulates humification of other OM
• Aged at least 6 months
• Best added to compost
Green Manures

- Any crop that is chopped & dropped before maturity to improve the soil
  - Compost in place
  - Biomass – perennial grasses & legume sod crops
    - Nitrogen - legumes
- Especially effective for heavy and compacted soils with little OM
- Spring-planting and fall-planting mixes
Cover Crops

- Planted along side and under plants
- Suppress growth of weeds
- Attract and feed beneficials
- Can add biomass and fix nitrogen
- Shade the soil
- Supress weeds
Mulch

- Anything placed on the soil to
  - Reduce evaporation
  - Prevent weed growth
  - Insulate roots
- Provides a home for beneficial organisms
- Place on top of compost 2-3” thick
- Taper away from plant stems and trunks
Organic mulches

- Wood chips
- Leaves and pine needles
- Grass clippings
- Straw
Building the Soil

- All landscape areas:
  - Add at least 12 cubic yards per 1,000 square feet (4") of compost to the soil and rototill in the greatest depth possible
  - Do this in two 2" lifts, not all at once
  - This is a one-time use of a rototiller
- Use potting soil mix with compost in raised beds
Sheet Mulching
(No-till method)

- As simple as a layer of newspapers and/or cardboard topped by 8 to 12” of nearly any mulch material

Toby Hemenway’s Bomb-proof Sheet Mulch
Compost Tea

- Actively Aerated Compost Tea (AACT)
- Helps put microbiology in the soil or on plants
- Stretches the use of compost a lot farther
- It is not compost leachate, extract or manure tea (anaerobic mixtures)
Worm Castings

- Water-soluble allowing plants to quickly and easily absorb essential nutrients and trace minerals
- Coating around the grain allows for the nutrients to "time release" into the soil
  - Nutrients are readily available to plant material over a greater length of time and will not burn even the most delicate plants
- Rich in iron, sulfur, calcium, nitrogen, phosphorus and potassium (NPK rating: 5-5-3)
  - much richer in nutrients than bulk compost, requiring lower application rates
- Fruit and vegetable tests have resulted in yield improvements from 57% to over 200% as well as improvement in taste and appearance

https://ucanr.edu/sites/mgfresno/files/262372.pdf
Worm Tea

• Soak 1 part worm castings in 3 parts of water for 24 hours or more, stirring several times over the 24-hour period

• Direct application: Apply one 8-ounce cup of tea per plant every 30 days, or

• Foliar spray: Add 4 ounces of tea to 1 gallon of water

• Apply every 30-60 days

https://ucanr.edu/sites/mgfresno/files/262372.pdf
Water Useage
How We Can Influence Water Use

- Plant selection and grouping
- Compost
- Mulch
- Efficient irrigation components
- Proper irrigation scheduling
Water Use

1. Remove & replace lawn
   - Lawn substitutes

2. Establish Hydrozones

3. Utilize drought-tolerant plants

4. Install dripline irrigation system
Hydrozoning

The practice of clustering together plants with similar water requirements in an effort to conserve water

- Sun, partial shade, shade
- Water needs (high, medium, low)
- Plants in the ground
- Plants in pots
- Veggie beds

It is a proven effective water management solution
This planting design was based on irrigation. Plants were grouped together according to water use, making it easy to create the hydrozones and valve zones.
Landscape Design based on Water-use
Logical Separations of Hydrozones
Troubleshoot Water-use Differences
Is this water-efficient?
Not so much
Hydrozoning an Existing Landscape

- Draw a plan of your property indicating your trees, shrubs, annuals, lawn, a vegetable garden and other plants
- Circle and group plants with similar water needs in hydrozones
- Separate hydrozones would include:
  - Lawn
  - Mass plantings of perennials and groundcovers
  - Vegetable garden and or mass plantings of annuals bedding plants
  - Sun vs. Shade
  - Flat vs. Slopes
- Not sure of your plants' watering needs? Find out the water requirements of specific plants, by clicking on the link: [http://ucanr.edu/sites/WUCOLS/](http://ucanr.edu/sites/WUCOLS/)
WUCOLS IV

Water Use Classification of Landscape Species

Plant Search Database

If you know exactly which plant you are interested in, you may search for it by name (partial names are OK, too). Otherwise, consider searching by plant type and/or water use.

City
Search for a city: Citrus Heights

Plant Name
Nandina

Water Use
- Very Low
- Low
- Moderate/Medium
- High
- Unknown
- Not Appropriate for this Region

Plant Type
- Gc (Ground Cover)
- P (Perennial)
- S (Shrub)
- T (Tree)
- V (Vine)
- Ba (Bamboo)
- Bu (Bulb)
- G (Ornamental Grass)
- Pm (Palm and Cycad)
- Su (Succulent)
- N (California Native)
- A (Arboretum All-star)

Search Plants
WUCOLS IV

Water Use Classification of Landscape Species

Plant Search Database

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<th>City</th>
<th>Citrus Heights</th>
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<tr>
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Legend: Plant Types

Legend: Categories of Water Needs

Search Results: 2

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<td>heavenly bamboo (Nana)</td>
<td>Moderate/Medium</td>
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• The Water Use Classification of Landscape Species
  • An online system maintained by the UC Division of Agriculture and Natural Resources
  • Developed by and based on the field experience of landscape horticulturalists & professionals
  • User-friendly enough for home gardeners
WUCOLS IV

• Provides information on water needs of more than 3500 plants
• Different plant species require different amounts of water for optimal health
• Plant Factor (PF) - Expressed as a percentage of ETo

Water Budget = Weather x Plant Factor x Area
Evapotranspiration (ETo)

The loss of water to the atmosphere by the combined process of:

- Evaporation from the top 1" of the soil and plant surfaces
- Transpiration through plant tissues
Factors Affecting ETo

- Solar Radiation
- Air Temperature
- Relative Humidity
- Wind Speed
- Soil Exposure
- Planting Density
"Lawns, by acreage, are the nation’s largest irrigated crop, surpassing corn."

<table>
<thead>
<tr>
<th>Icon</th>
<th>Text</th>
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</thead>
<tbody>
<tr>
<td>🌿</td>
<td>Lawns are a vestige that started with English gardens and spread by those living in water-rich environments in the East and mid-West.</td>
</tr>
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<td>🌳</td>
<td>The future profits of the lawn care and horticulture industries rely on the endurance of the myth that we need lawns and persistent sprawl.</td>
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<td>🌪️</td>
<td>Lawn rebate program in L. A. will save approximately 47 million gallons of water each year</td>
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<tr>
<td>🚰️</td>
<td>9.2 billion gallons of water have been saved through turf removal in Las Vegas</td>
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<tr>
<td>💰</td>
<td>Time and money consuming</td>
</tr>
</tbody>
</table>
Lawns

Ecological deserts
- Monocrop
- Ecological deserts for pollinators

Fertilizers and pesticides
- Contaminate groundwater
- Pollute waterways
- Toxic to children and pets
- Fourteen of the 30 most commonly used lawn pesticides are neurotoxins are known or suspected carcinogens, and two-thirds of them may cause reproductive harm in humans

Fossil fuels
- Costly
- Air pollution

Contribute to carbon dioxide load
Resources

• Soils
  • Worm Castings: https://ucanr.edu/sites/mgfresno/files/262372.pdf
UCCE
El Dorado County
Master Gardeners

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