Estimating Landscape Irrigation Requirements
Four Factors Determining Landscape Water Use

Climate
Plants
Landscape Size
Irrigation System Efficiency
EVAPOTRANSPIRATION or ET:

The amount of water used by the plants (transpiration) and evaporated from the adjacent soil (evaporation)

- Sunlight
- Wind
- Temperature
- Humidity all together determine ET

Sunlight (solar radiation) is the most important factor in determining ET
Evapotranspiration is made up of:

- Transpiration from leaf surfaces
- Evaporation from soil surface

Water
REFERENCE EVAPOTRANSPIRATION, ETo:

ETo is a standard measurement which estimates the evapotranspiration of:

- Large field of 4” - 7” tall, cool-season grass that is well watered
- ETo is measured by the CIMIS system as well as other methods
- Is expressed in inches of water loss
EFFECTIVE PRECIPITATION

Rainfall replaces some of the moisture lost to ET

A small portion, usually 25% or less, of annual rainfall is useful
Sacramento Average ETo
Calif. Climate Information

Available through CIMIS

California Irrigation Management Information System

120 automatic weather stations - via telephone to central computer database in Sacramento

Provides both historical and current data
Different Plants use water at different rates. This water use rate expressed in relation to ETo is the Plant Factor, or Crop Coefficient (Kc)

- **Low Water Using Plants**
  - (Such As Oaks, Manzanita, Rosemary) 0 - 0.3

- **Medium Water Using Plants**
  - (Such As Roses, Citrus Trees, Camellia) 0.4 - 0.6

- **High Water Using Plants**
  - (Such As Redwoods, Birch, Azaleas) 0.7 - 1.0

- **Cool Season Grass (Blue Grass, Fescue, Rye)** 0.8
- **Warm Season Grass (Bermuda, Zoysia, St. Augustine)** 0.6
A refinement of the plant factor that factors in:

- Species factor
- Density factor and
- Microclimate factor

A Guide to Estimating Water Needs of Landscape Plantings in CA (WUCOLS)
http://www.owue.water.ca.gov/docs/wucols00.pdf
The Size Factor - Area (LA):

A length-times-width measurement of the ‘Landscaped Area’
This area is expressed in square feet (sq/ft) or acres
Irrigation Efficiency (IE)

IE = Amount of water used benef. by plant
    Total water applied

Actual efficiency is hard to measure
Distribution Uniformity is typically used
Expressed as a percentage
Hardware efficiency times management efficiency
Irrigation System Components

Figure L-1
(San Diego Xeriscape Council)
Distribution Uniformity is an expression of how evenly water is applied to landscaping.

Wet areas VS. dry spots

Dry spots drive system scheduling

Measured most accurately by a catch can test
Catch can test

- Lay out low catch cans (tune cans) in rectangular or triangular pattern
  - “At a head and in between heads”
  - 16 – 20 cans per zone tested
- Run sprinklers 3 - 10 minutes for sprays and 10 - 30 minutes for rotors
- Measure water in each can
- DU = Average catch in the lowest quartile x 100/Average catch overall
These things reduce uniformity:

- Unequal spacing
- Stretched spacing
- Mismatched sprinklers/nozzles
- Blocked or broken heads
- Sunken heads
- High/Low pressure
- Tilted heads
UNIFORMITY

POOR D.U.

GOOD D.U. Never Perfect

ITRC
Cal Poly
Setting controller
Estimated Water Use

- EWU = (ETo-EP) (PF) (LA) (0.62) / (IE)
- EWU = Estimated Water Use (gal/yr)
- ETo = Ref. Evapotranspiration (in/yr)
- EP = Effective Precipitation (in/yr)
- PF = Plant Factor (fraction of ETo)
- LA = Landscaped Area (sq ft)
- .62 = Conversion Factor (" of rain to gallons)
- IE = Irrigation Efficiency (%)
- DU = Distribution Uniformity
What is EWU for a 100 ft\(^2\) cool season lawn in Sacramento? (ETo=52\”, EP=4\”, PF=0.8, IE=0.5)

EWU = (52-4) (0.8) (100) (0.623)/(0.5)

EWU = 4,785 gal/year

What is EWU for 100 ft\(^2\) manzanita in San Diego? (ETo=40\”, EP=0, PF= 0.3, IE=0.8)

EWU = ???
Resources

- See “Evaluating irrigation sprinkler uniformity” to calculate Distribution Uniformity (DU)

http://cati.csufresno.edu/cit/rese/97/970703/
Questions?
Exercise

- Landscape size = 1500 ft²
- Irrigation flow rate = 25 gpm
- Weekly ET requirement = 1.75 inches
- Irrigation efficiency = 80%

How many minutes/week must the timer be set for?
Exercise

- ETo for the month = 9 inches
- Effective Precipitation = 1.5 inches
- Irrigation flow rate = 100 gallons/hour
- Irrigation efficiency = 100%
- Landscape size = 250 ft²
- Plant Factor = 0.2 (African Daisies)

How many minutes/week must the timer be set for?