RCAC

Estimating Landscape Irrigation Requirements

Four Factors Determining Landscape Water Use

Climate

Plants

Landscape Size

Irrigation System Efficiency

RCAC

The Climate Factor

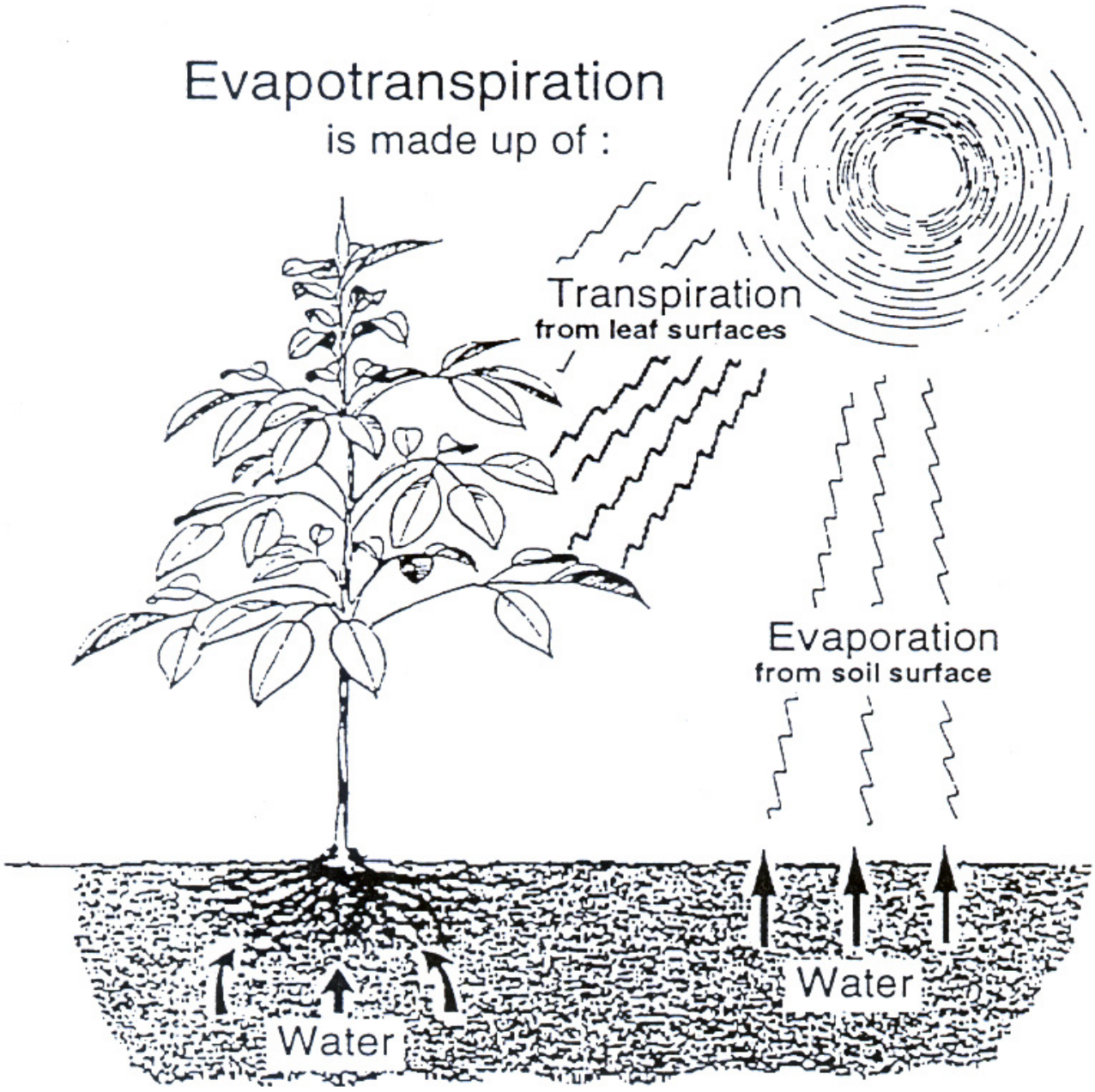
EVAPOTRANSPIRATION or ET:

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

RCAC


Evapotranspiration
is made up of :
Transpiration
from leaf surfaces
Evaporation
from soil surface
Water
Water

The Climate Factor, cont'd

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**

RCAC

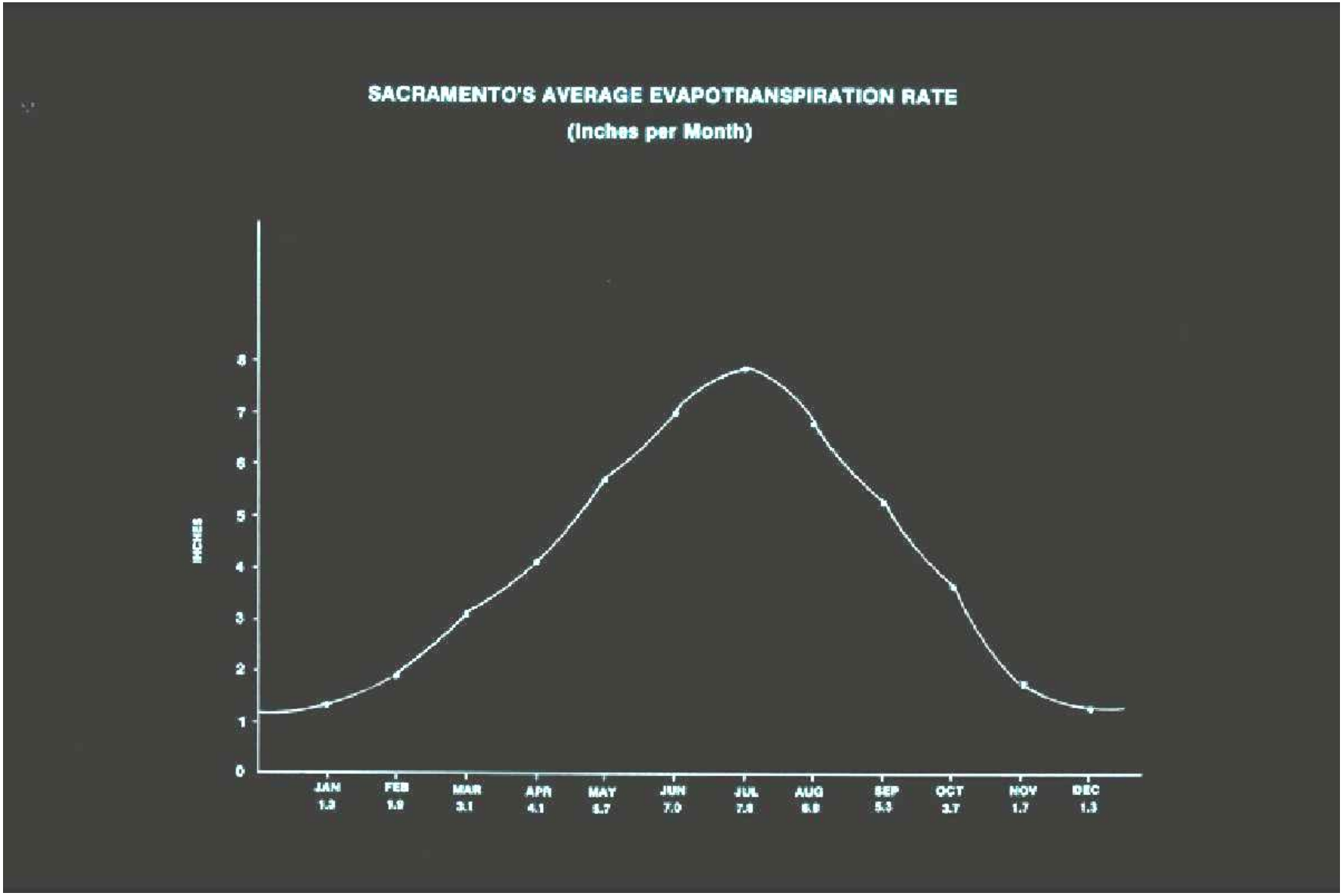
The Climate Factor, cont'd

EFFECTIVE PRECIPITATION

Rainfall replaces some of the moisture lost to ET

A small portion, usually 25% or less, of annual rainfall is useful

RCAC



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

RCAC

CA Irrigation Management Information System - CIMIS

The Plant Factor (PF)

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**

RCAC

Landscape Coefficient

- **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**

RCAC

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

RCAC

Irrigation Efficiency (IE)

$$IE = \frac{\text{Amount of water used benef. by plant}}{\text{Total water applied}}$$

Actual efficiency is hard to measure

Distribution Uniformity is typically used

Expressed as a percentage

Hardware efficiency times management efficiency

RCAC

Irrigation System Components

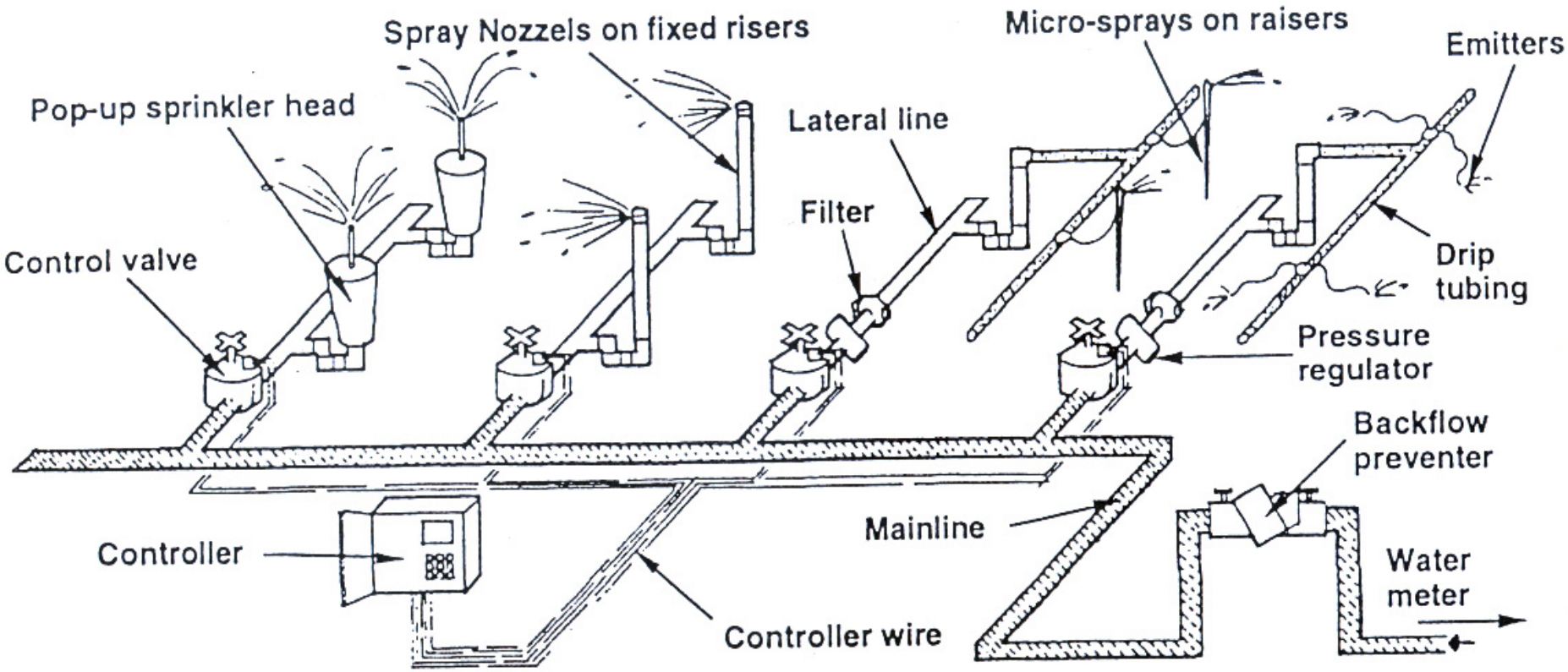


Figure L-1
(San Diego Xeriscape Council)

Distribution Uniformity

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

RCAC

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

RCAC

Uniformity Destroyers

- **These things reduce uniformity:**
  - **Unequal spacing**
  - **Stretched spacing**
  - **Mismatched sprinklers/nozzles**
  - **Blocked or broken heads**
  - **Sunken heads**
  - **High/Low pressure**
  - **Tilted heads**

RCAC

UNIFORMITY

POOR D.U.

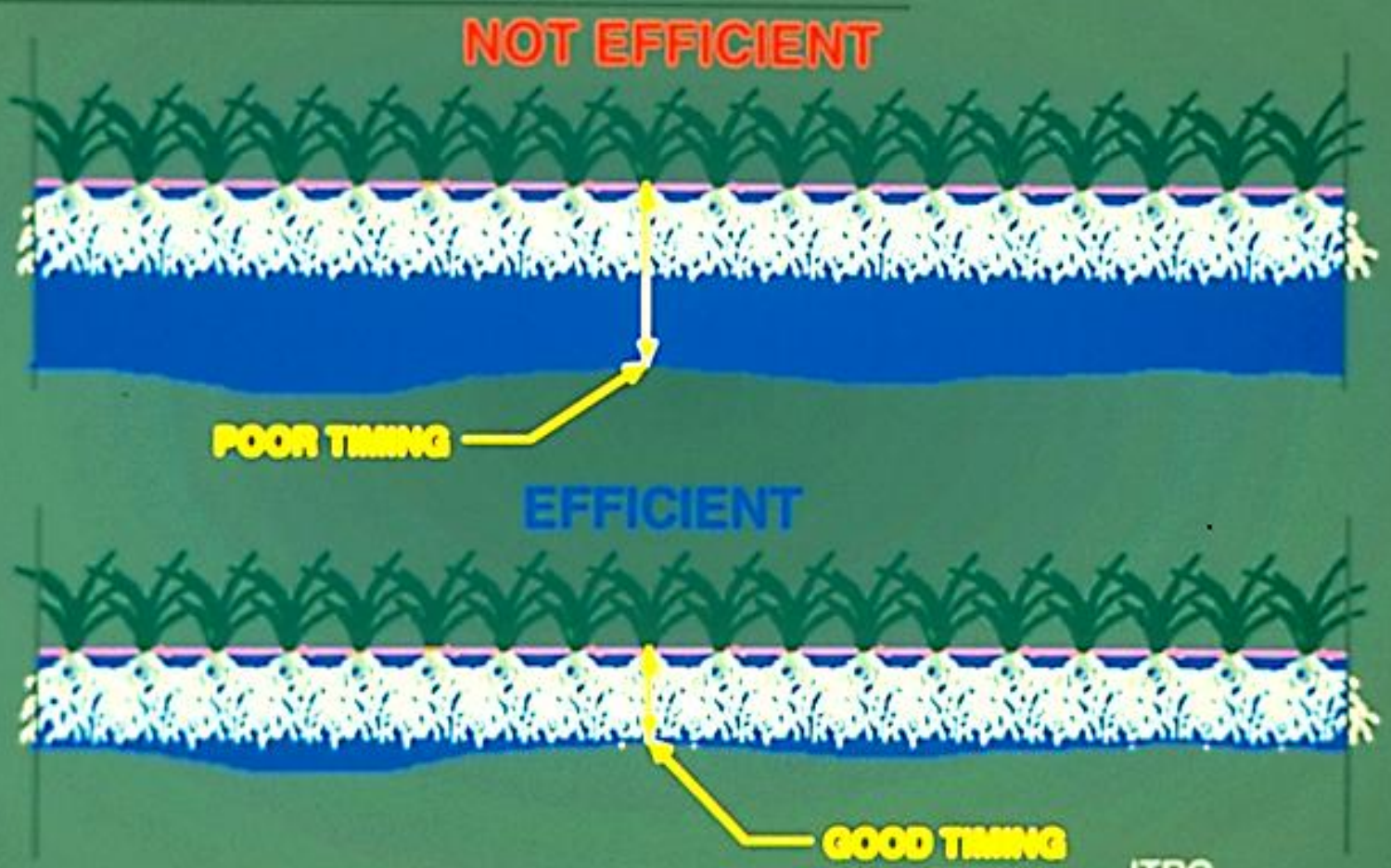
GOOD D.U. Never Perfect

ITRC

Cal Poly

Setting controller

EFFICIENCY



ITRC

Cal Poly

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**

RCAC

EWU Example

- 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= ???

RCAC

Resources

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

http://cati.csufresno.edu/cit/rese/97/970703/

RCAC

Questions?

RCAC

Exercise

- Landscape size = 1500 ft^2
- Irrigation flow rate = 25 gpm
- Weekly ET requirement = 1.75 inches
- Irrigation efficiency = 80%

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

RCAC

Exercise

- ETo for the month = 9 inches
- Effective Precipitation = 1.5 inches
- Irrigation flow rate = 100 gallons/hour
- Irrigation efficiency = 100%
- Landscape size = 250 ft^2
- Plant Factor = 0.2 (African Daisies)

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

RCAC