THE 2016 - LONG BEACH LANDSCAPE
DESIGN • BUILD • MAINTAIN • SUPPLY
OCTOBER 19TH & 20TH EXPO

Applying the New ANSI/ASABE S623 Standard *to estimate landscape water demands*

Dennis Pittenger, M.S.
Area Environmental Horticulturist

University of California Cooperative Extension
Los Angeles County/UC Riverside

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THE 2016 - NORTHERN CALIFORNIA LANDSCAPE EXPO
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AT THE CAL EXPO IN SACRAMENTO

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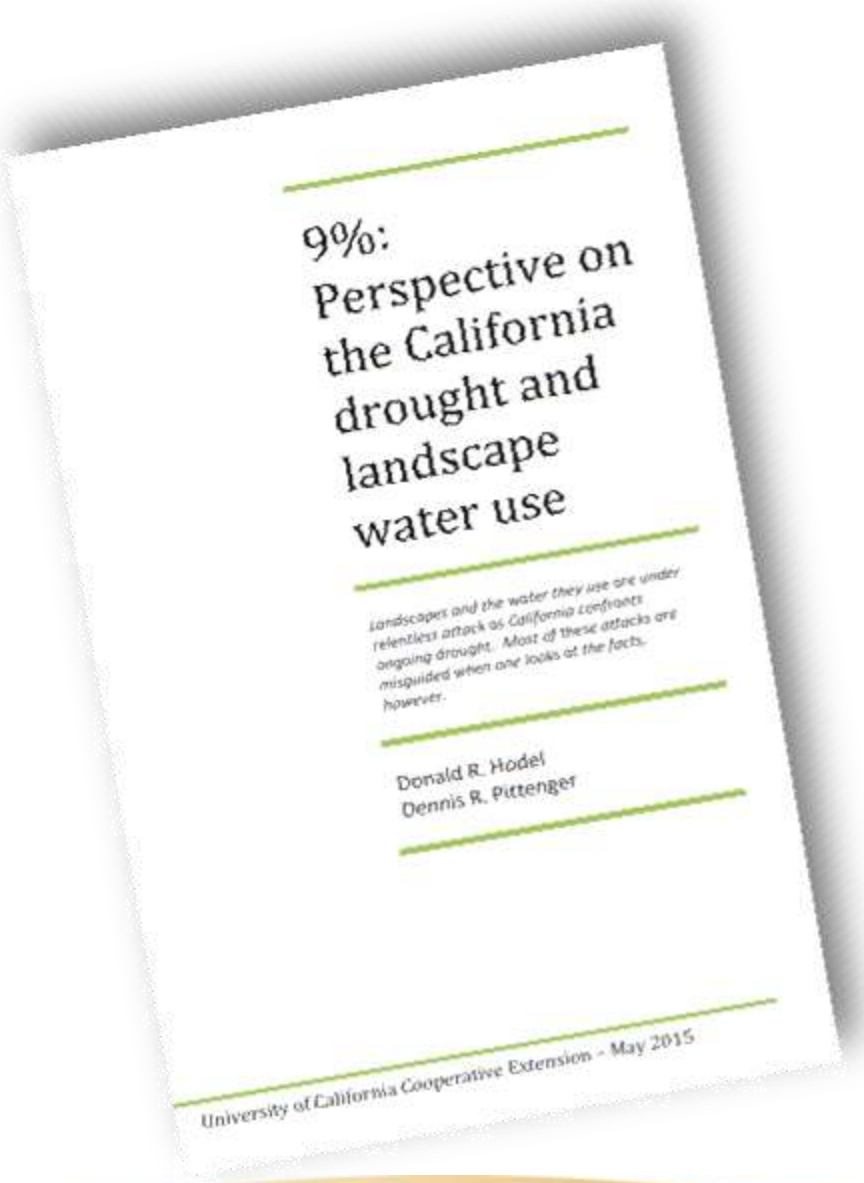

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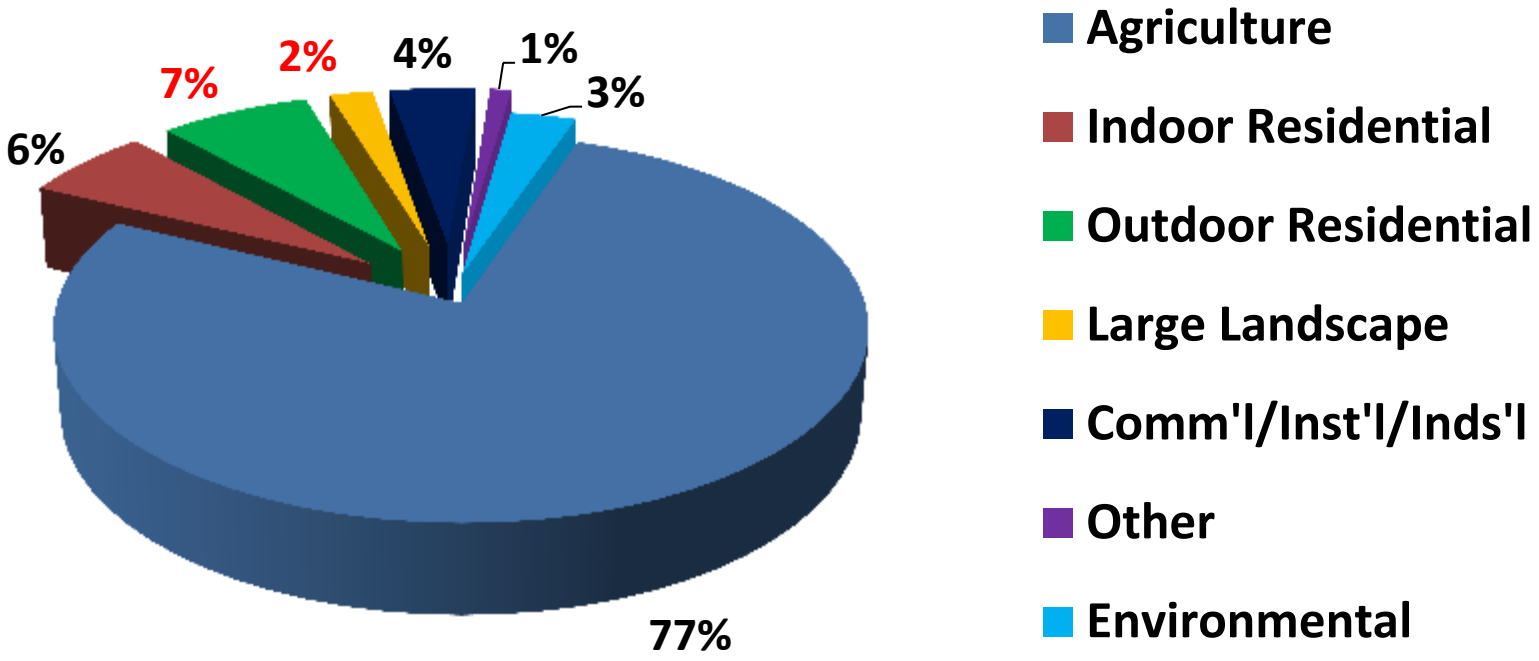
Average California Water Use

Statewide Developed Water

20% Urban & 9% Landscape



Sources: Calif. Dept. Water Resources, 2013 Calif. Water Plan Update Chp. 3.
UCLA Inst. of the Env't. and Sustainability, So. Calif. Environ'l. Report Card, Fall 2009.

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- **Landscape Water Conservation & Irrigation Management**
  - Easy Calculators for Estimating Landscape Water Requirements
  - Drought and Landscape Water Use - Some Perspective
  - Tree Water Requirements
  - Estimating Landscape Water Needs
  - Plant Factors and Crop Coefficients

Questions & Answers About Drought & Water Conservation

Q. How much water do landscapes use in California?

A. Landscape irrigation accounts for only about 9% of total statewide developed water use, but the percentage varies widely among communities. Water applied to landscapes is estimated to account for about 50% of residential water consumption statewide, but the amount varies from about 30% in some coastal communities to 60% or more in many inland suburban communities.

Q. What are some easy things I can do to save water in a landscape?

A. Check the irrigation system regularly for leaks as well as physical and operational problems that reduce the efficiency and function of sprinklers, drip emitters, and other water delivery devices. Correcting these problems can reduce water use by 10% or more, improve the uniformity of water application, and likely improve the health of plantings. Check that automatic valves are functioning and repair any leaks at valves, spray heads, and other connections. Walk through an area while the irrigation system is running and repair or replace sprinklers or other types of emitters that

Landscape Water Conservation Programs & Approaches

Water Efficient Landscape Ordinances

Simplified **L**andscape **I**rrigation **D**emand **E**stimation

S L I D E Rules

…..for estimating water requirements

of established landscapes

ANSI/ASABE S623

Determining Landscape Plant Water Demands

ASNSI/ASABE S623 Features

- Simple to use and understand
- Planners, regulators, designers, managers
- Scientifically & conceptually sound
- Provides reliable PFs to for calculations
- Accommodates new plants
- Wide geographic & climatic application
- ANSI/ASABE S623: *Determining Landscape Water Demands*

ANSI/ASABE S623 Equation
Accurate and Simple Equation

Inches = ETo × PF

Gallons = ETo × PF × LA × 0.623

- ETo = inches of reference evapotranspiration for a given period
- PF = ETo adjustment factor for plant type
- LA = sq. ft. of landscape area or canopy area
- 0.623 = converts depth to volume [gal. ÷ (in. x sq. ft.)]

SLIDE Rule #1:

Reference evapotranspiration (ETo) marginally represents water demand of urban landscapes

Evapotranspiration (ET)

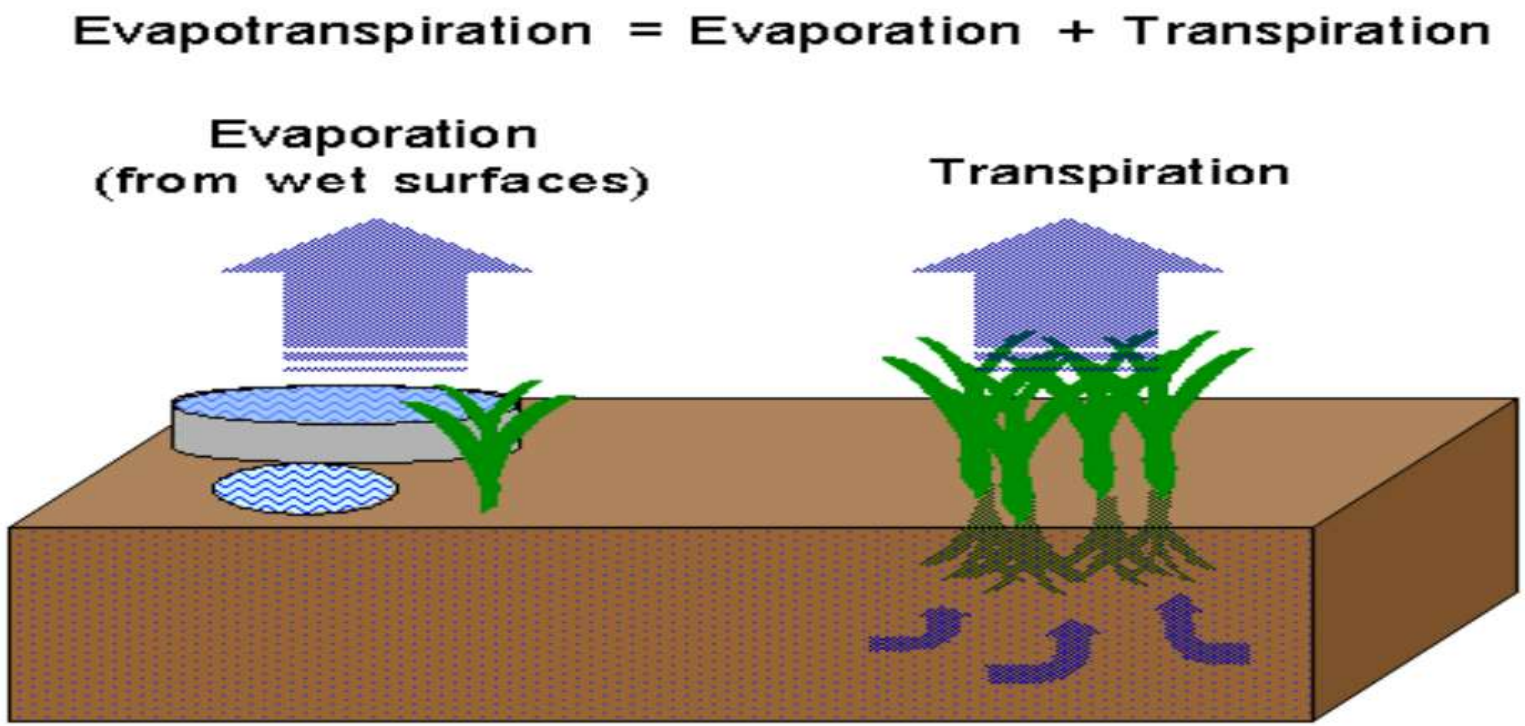


Figure 1. Evapotranspiration

ETo = Reference Evapotranspiration

Estimated environmental demand for evaporation & transpiration from a planted area

- Climate-based reference
- Inches/day
- Estimated water use of well-watered cool-season turf
- Calculated from weather data
  - Sunlight, temperature, RH, wind
  - ASCE Penman-Monteith equation
- Based on field research with agricultural crop production

ET (plant water use) is driven mostly by the energy from the _____.

SUN

Factors Affecting Plant Water Use & ET

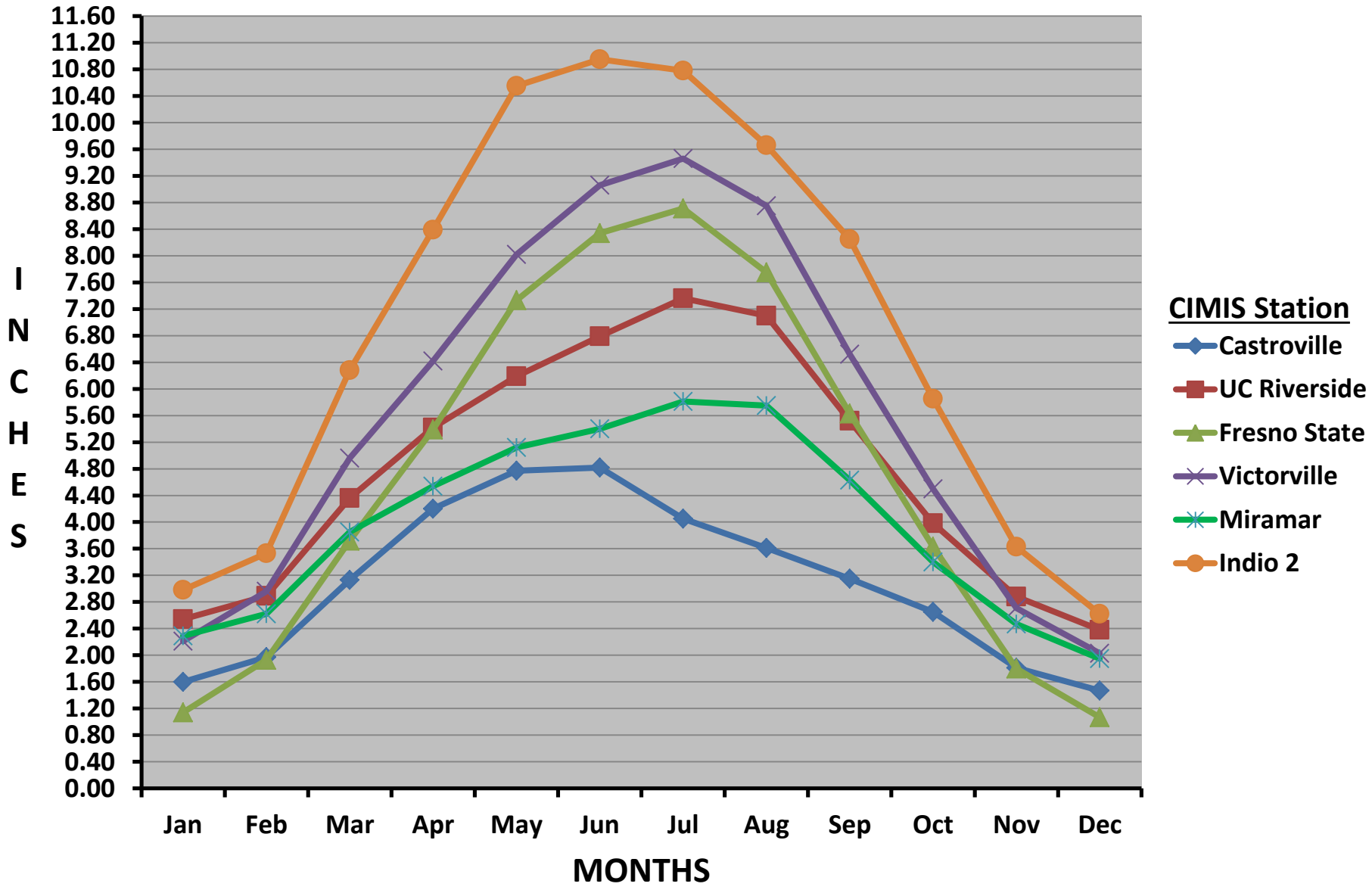
- **Sunlight**
- Temperature
- Humidity
- Wind
- Plant species
- Plant size
- Site characteristics

Reference ET (ETo) values are derived from the water use of cool-season turf under the local climate when water is unlimited.

TRUE or FALSE?

TRUE

MONTHLY AVERAGE ETo



www.cimis.water.ca.gov

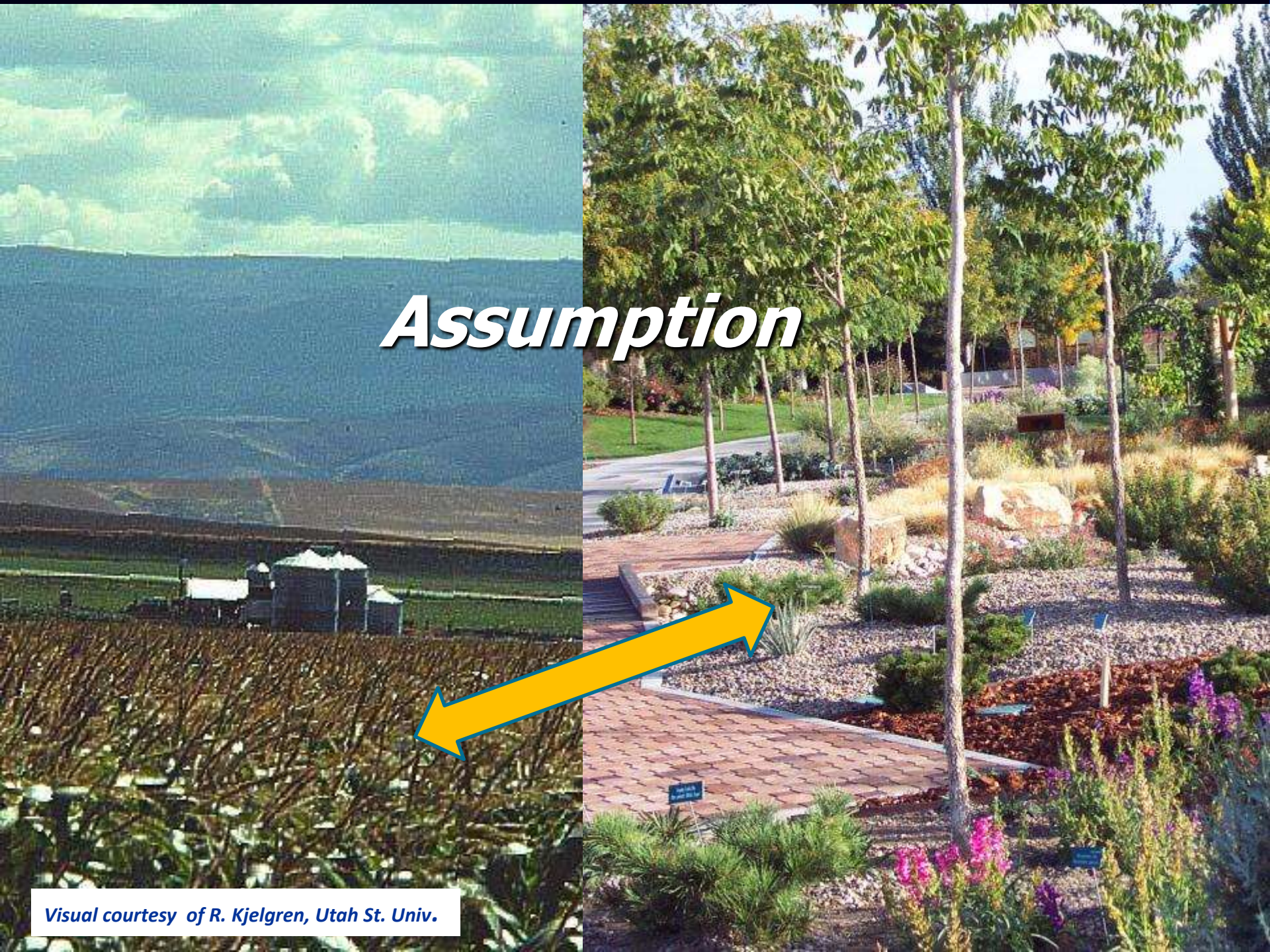
ETo = Reference Evapotranspiration

Estimated environmental demand for evaporation & transpiration from a planted area

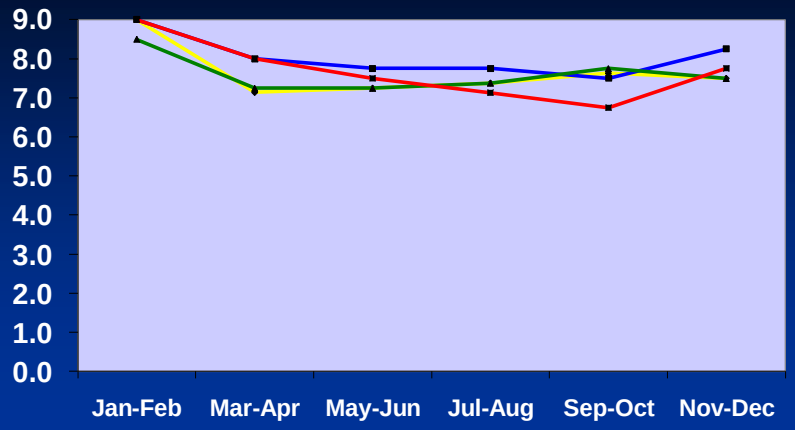
- Tells nothing about what plants are actually doing
- Complexities of landscapes not accounted for

ETo Accurate With Turf

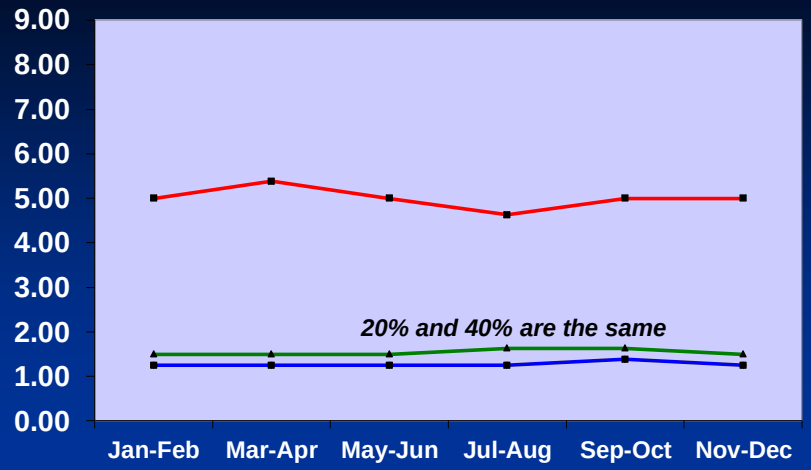
Visual courtesy of R. Kjelgren, Utah St. Univ.


Assumption
Visual courtesy of R. Kjelgren, Utah St. Univ.

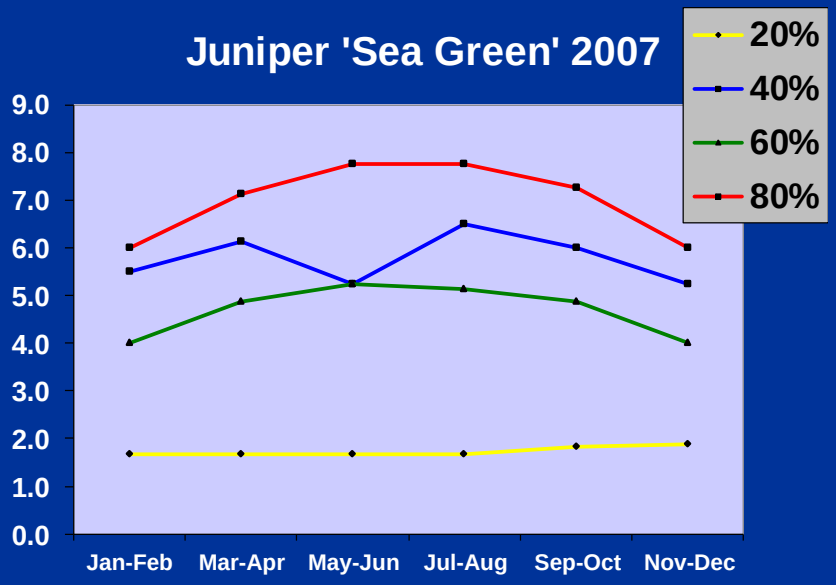
Cassia (Senna) 2007



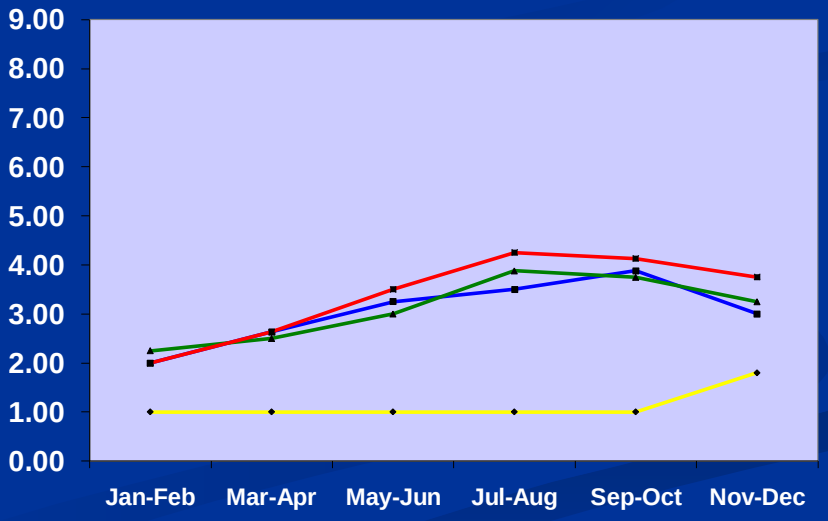
Star Jasmine 2007



Juniper 'Sea Green' 2007



Lantana 2007



SLIDE Rule #2:

Plant Factors (PFs) alone accurately adjust ETo, and are assigned by general plant type, not by individual species

SLIDE Rules

Landscape Coefficient (K_L)

$$K_L = K_{PLANTS} \times K_{VEG.\ DENSITY} \times K_{MICROCLIMATE}$$

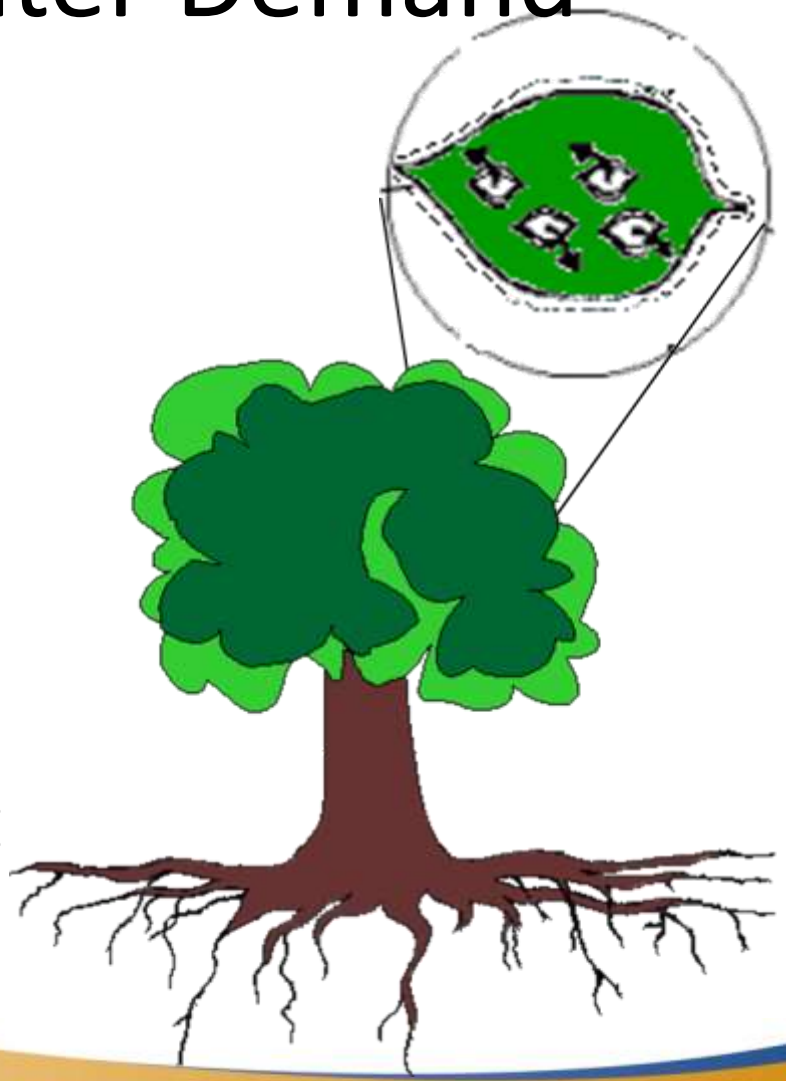
WUCOLS

Water Use Classification of Landscape Species

Estimating Plant Water Needs Through Science

Woody Plant Water Demand

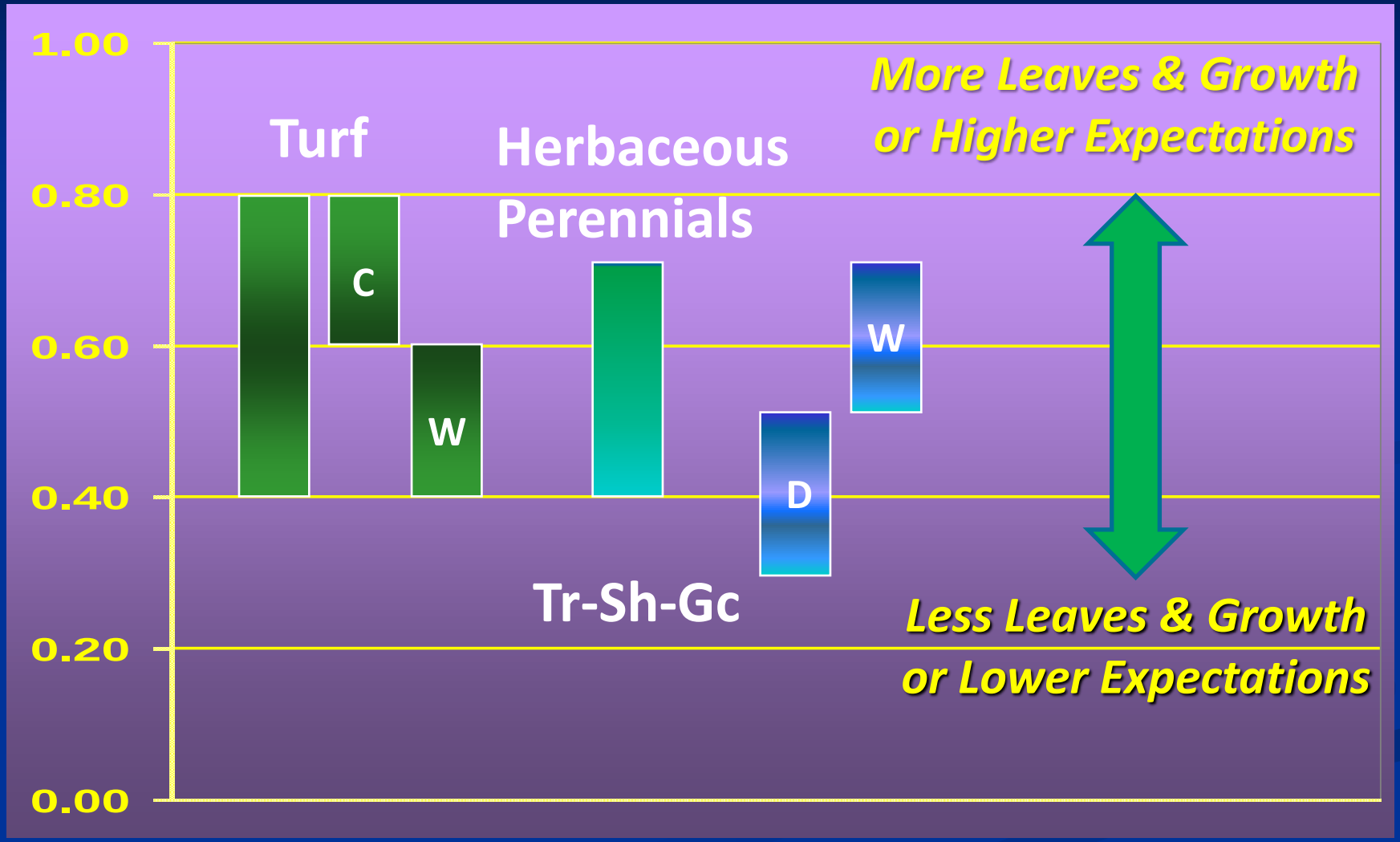
- Woody plants have considerable drought resistance
- Trees more responsive to humidity/aridity, less to wind
- Sunlit leaves conduct most transpiration



Groundcovers, Trees, Shrubs

- Use more water than need
- Traditional plants perform acceptably with low to mod. water
  - Most are acceptable at ≤50% of ETo
  - Less water limits growth, not quality
- Discrepancies with WUCOLS

Percent of ETo Required



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ANSI/ASABE Standard S623

SLIDE Rule #2

Plant Factors (Fraction of ET_o) for estimating water required to maintain acceptable appearance of established landscape plants	
Plant Type	**Plant Factor**
Turf-Cool Season	0.8
Turf-Warm Season	0.6
Woody/Herb. Peren'ls.- Humid	0.7
Woody /Herb. Peren'ls.- Arid	0.5
Desert plants	0.3

100th Meridian Longitude

< 20 in. precip. **>20 in. precip.**

SLIDE Rule #3:

A) ***Hydrozones are smallest water management units***

B) ***When plant types are mixed in a zone, water demand is governed by plant type with highest PF***

Not Hydrozoned

- Trees irrigated with turf
- All 80% ETo

Hydrozoned

- Turf irrigated separately
- Part 50%, part 80% ETo
- Lower water demand

SLIDE Rule #4:

A) ***Water demand of dense plant cover is that of single 'big leaf' governed by plant type with highest PF***

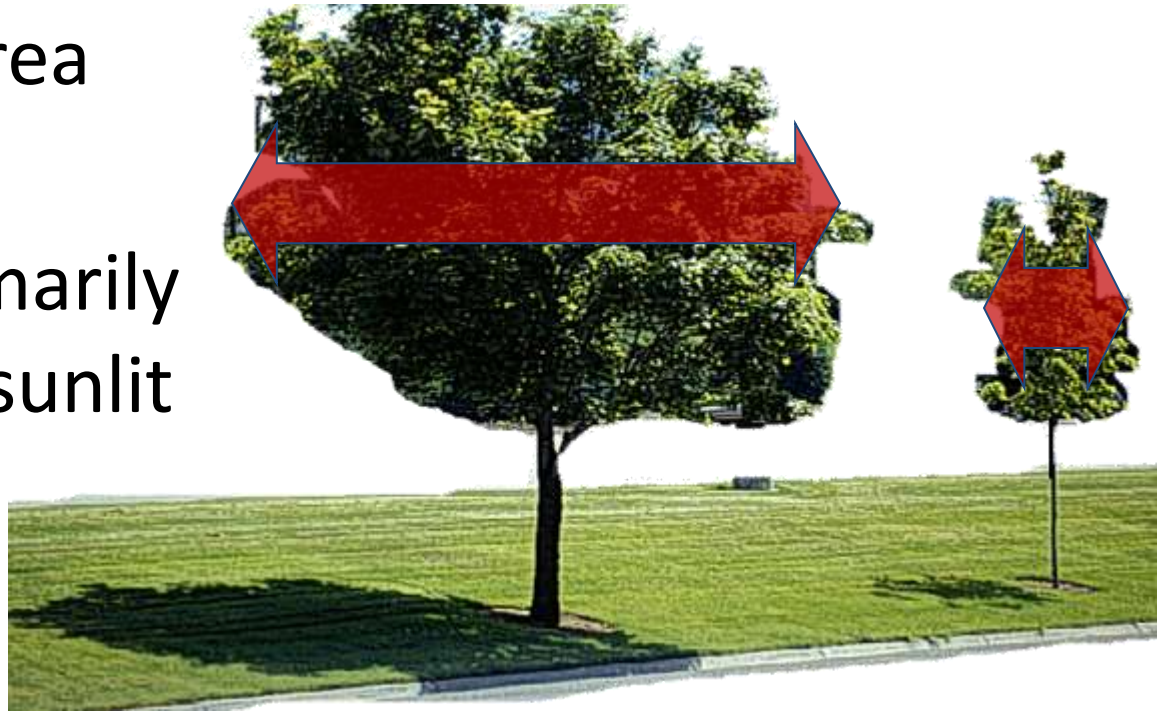
B) ***Water demand of sparse plant cover is that of individual plant PFs governed by their canopy areas***

Dense ‘Big Leaf’ Landscape

- ≥80% canopy cover
- Water demand governed by highest PF in hydrozone
- ETo x PF x Landscape Area
- Irrigate whole area

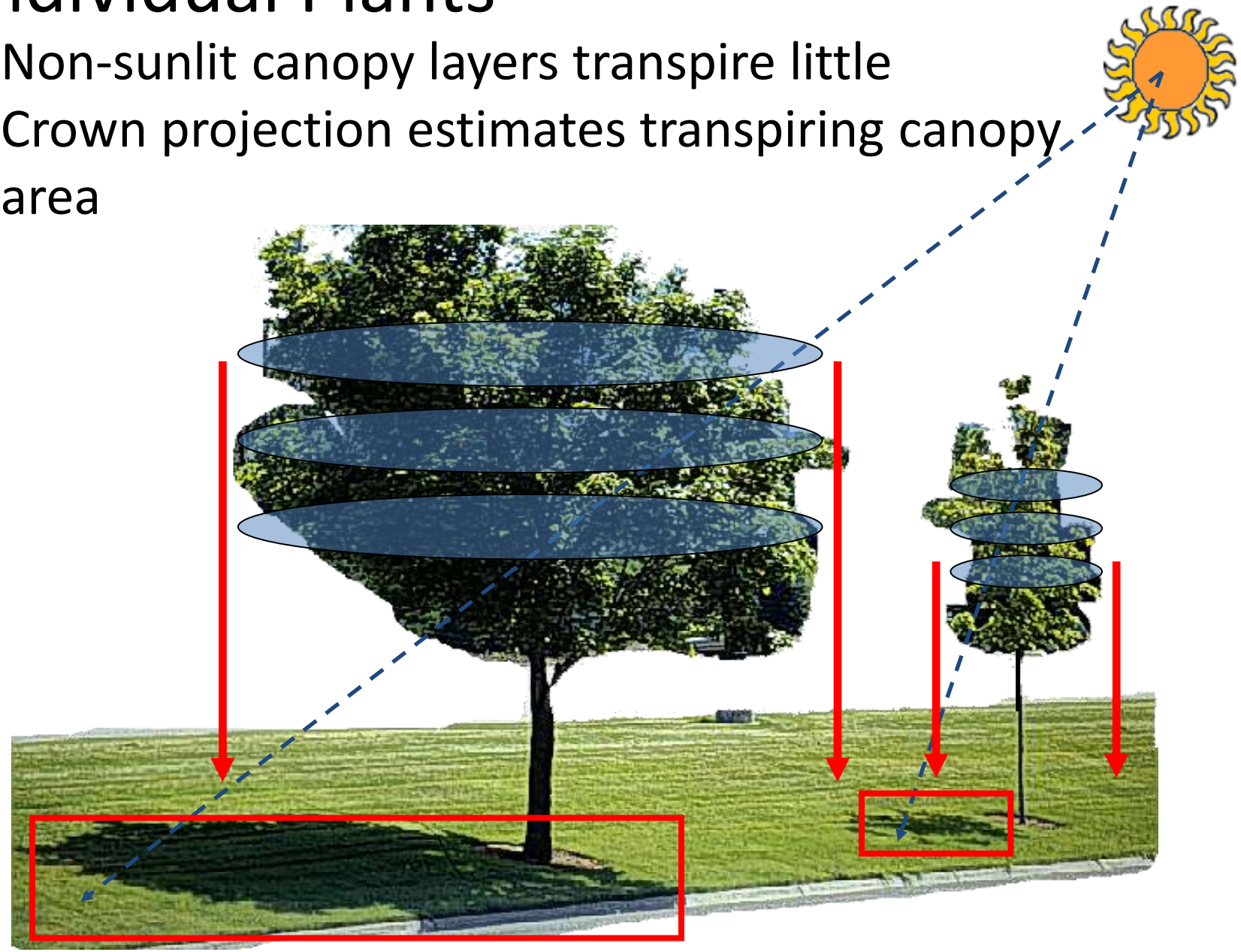
Non-Turf Water Demand

- Canopy size affects transpiring leaf area (water use rate)
- Transpiration primarily in outer canopy (sunlit leaves)



Individual Plants

- Non-sunlit canopy layers transpire little
- Crown projection estimates transpiring canopy area



Applying ANSI/ASABE S623

Established Landscapes

Landscape Water Requirement

$$\textbf{Gallons} = \textbf{ETo} \times \sum(\textbf{PF} \times \textbf{LA})_{\textbf{zone 1-x}} \times \textbf{0.623}$$

$$= \sum(PF \times LA)_1 + (PF \times LA)_2 + (PF \times LA)_3 \ldots..$$

- ETo = reference evapotranspiration, CIMIS, etc.; climate impact
- PF = plant material factor (turf, shrub-tree-vine-gc, flowers, etc.)
- LA = sq. ft. landscape area
- 0.623 = converts depth to volume [gal. ÷ (in. x sq. ft.)]

Plants Closely Spaced & Plants in Mixed Plantings

- ≥80% canopy cover – treat as 100% plant cover
- Planting functions as big leaf
- Water requirement set by plant type with highest PF
- Use: ETo x PF x LA
- Hydrozone plantings
- Irrig. uniformity not critical

Estimated Annual Water Demand

Gal. = ETo × PF × Sq. Ft. × 0.623

Annual ETo = 50 inches

Plant Type	Sq. Ft.	PF	Water Demand (gal.)
Turf (bermuda)	10,000	0.6	186,900
Woody Plants,	15,000	0.5	233,625
Groundcvr, mixed per.	2,000	0.5	31,150
Annual Flowers	500	0.8	12,460
Total	**27,500**		**464,135 gal.**

Sparse Landscape/Isolated Trees

- <80% canopy cover
- Water demand governed by PF & individual plant canopy areas
- ETo x PF x Canopy Area
- Sum canopy areas
- Irrigate within drip line

Isolated Plants

- <80% canopy cover
- Estimate transpiring canopy area of single plants & sum
- Transpiration can be lower in paved areas
- Apply water over root zone
- Irrig. uniformity not critical

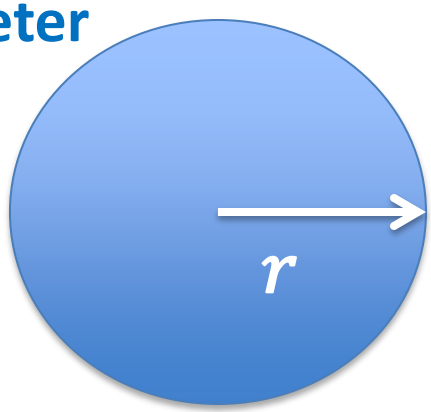
Isolated Plants

Use Canopy Area for Landscape Area

Gallons = ETo (in) × PF × Canopy Area (sq ft) × 0.623

Canopy Area (sq. ft.) = 3.14 × (radius × radius)

Canopy Diameter



$$A = \pi r^2$$

www.ucanr.edu/cluh → Easy Calculators

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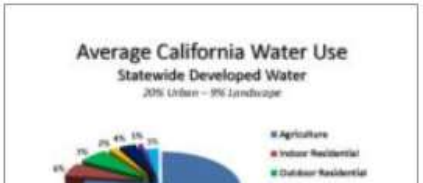
- landscape water management and conservation.
- urban tree management and selection.
- assistance for consumers of horticultural products and services.

UPCOMING EVENTS

Event Name	Date
WORKSHOP: Dealing with Drought & Landscape Watering Restrictions - 2015 Landscape EXPO	9/2/2015



Trees in Healthy Turfgrass

- Turf dictates irrigation
- Tree water requirement met with turf's
- Use: ETo x PF x LA
- No adjustment needed for canopy layers
- Irrigation uniformity critical

Trees in Under-Irrigated Turf

- Meet tree water requirements
- Estimate water requirement based on % canopy cover
  - ≥80% use sq. ft. of Landscape Area
  - <80% add individual plant canopy areas
- Consider retrofitting irrigation to drip

Trees in Turf Replacement & Landscape Retrofits

- Meet tree water requirements during transition and beyond
- Irrigation distribution to match tree root zone
- Water requirement set by plant type with highest PF

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