People Waste Water….. Not *Plants!!!*

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Water Management 4

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Learning Objectives

Become familiar with the basic concepts of evapotranspiration (ET) and plant water needs.

Develop an understanding of basic concepts of water movement in soil and plant water availability in different soil types.

Learn how to place plants with similar water needs together and irrigate them effectively.

Understand and apply basic principles of irrigation and water management to maintain optimal plant health, reduce water waste, and protect groundwater and surface water quality.

Learn how to manage drought in California landscapes and gardens.

California Master Gardener Handbook 2nd edition

Table 4.2.

AVERAGE SEASONAL EVAPOTRANSPIRATION (ET) RATES BY LOCATION IN CALIFORNIA (INCHES)

Location (see fig. 4.2)	Nov–Mar	Apr–Oct	Annual
Zone 1. North Coast	5.3	20.8	26.1
Zone 2. North Coast Interior Valleys	6.3	34.9	41.2
Zone 3. Northeastern Mountain Valleys	5.1	37.1	42.2
Zone 4. Sacramento Valley	8.5	40.7	49.2
Zone 5. San Joaquin Valley	7.9	40.7	49.0
Zone 6. Central Coast Interior Valleys	10.8	37.5	48.3
Zone 7. Sierra (Tahoe Basin)	—	30.0	—
Zone 8. Central Coast	10.7	30.6	41.3
Zone 9. Southern Coast	12.1	32.3	44.4
Zone 10. Southern Inland Valleys	11.5	37.9	49.4
Zone 11. Southern Deserts	17.7	65.1	82.2

Source: Harris and Coppock 1977, p. 2.
Note: Each of the 11 locations listed is considered a climate zone within the state, as shown in fig. 4.2.

Figure 4.2

Map of California's 11 lawn watering (climate) zones. Zone 1: North Coast; Zone 2: North Coast Interior Valleys; Zone 3: Northeastern Mountain Valleys; Zone 4: Sacramento Valley; Zone 5: San Joaquin Valley; Zone 6: Central Coast Interior Valleys; Zone 7: Sierra; Zone 8: Central Coast; Zone 9: Southern Coast; Zone 10: Southern Inland Valleys; Zone 11: Southern Deserts. Source: After Hartin 1991, pp. 2–3.

erence ET rates, which are used by scientists and growers to estimate and compare water use among plant species. Reference ET closely matches the amount of water that many extensive single-species crop plantings use when soil moisture is not limited and the soil surface is at least 80% covered or shaded by plant foliage. It is not the amount of water needed by plants; many plants perform quite well when irrigated below their respective evapotranspiration rate. This is particularly true for most nonturfgrass urban landscape plantings, since reference ET only roughly approximates their water needs.

You can use the map in figure 4.2 and the corresponding ET rates listed in tables 4.1 and 4.2 to estimate the daily, weekly, monthly, and seasonal amounts of soil moisture needed by your plants. In estimating the ET rates for landscape and garden plantings, consider the following:

- The data in tables 4.1 and 4.2 are historical averages. The actual water loss varies somewhat, possibly 10 to 25%, during unusually hot or windy days or unusually cool, cloudy days.
- Plants typically require nearly 100% of ET on a frequent basis after planting until they are established.
- Once they are established, most established landscape plants and turf species can be maintained on considerably less water than the ET rates listed.
- Although certain drought-resistant plants can maintain acceptable performance with reduced amounts of water, many plants considered drought-resistant are "water-spenders" and have daily average ET rates similar to those listed in table 4.1 when water is continuously available.

More detailed information on water needs of specific plant materials and crops is found in this chapter in the section "Water Management Strategies for Specific Plants" and in chapters on specific crops in this book.

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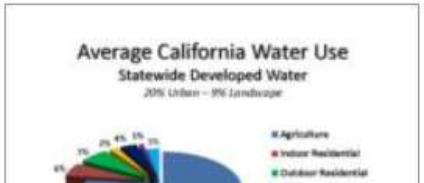
Welcome to the *Center for Landscape and Urban Horticulture (CLUH)*, an information resource of the University of California Cooperative Extension (UC Cooperative Extension). CLUH supports UC Cooperative Extension educational and applied research programs serving California's environmental horticulture industry.

- 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



Useful Equations

Inches = Gallons ÷ (Sq. Ft. × 0.623)

Gallons = Inches × Sq. Ft. × 0.623

1 gal. covers 1 sq. ft. with 1.6 in. of water

1 Billing Unit = HCF = CCF = 748 gallons

Zero-scape

(*Not* Xeriscape)

Prioritizing Irrigation

- Focus water on most valuable & difficult to replace plants
- **Trees/Shrubs/Vines/Grdcvr > Perennials > Lawn/Annuals**

Evapotranspiration (ET)

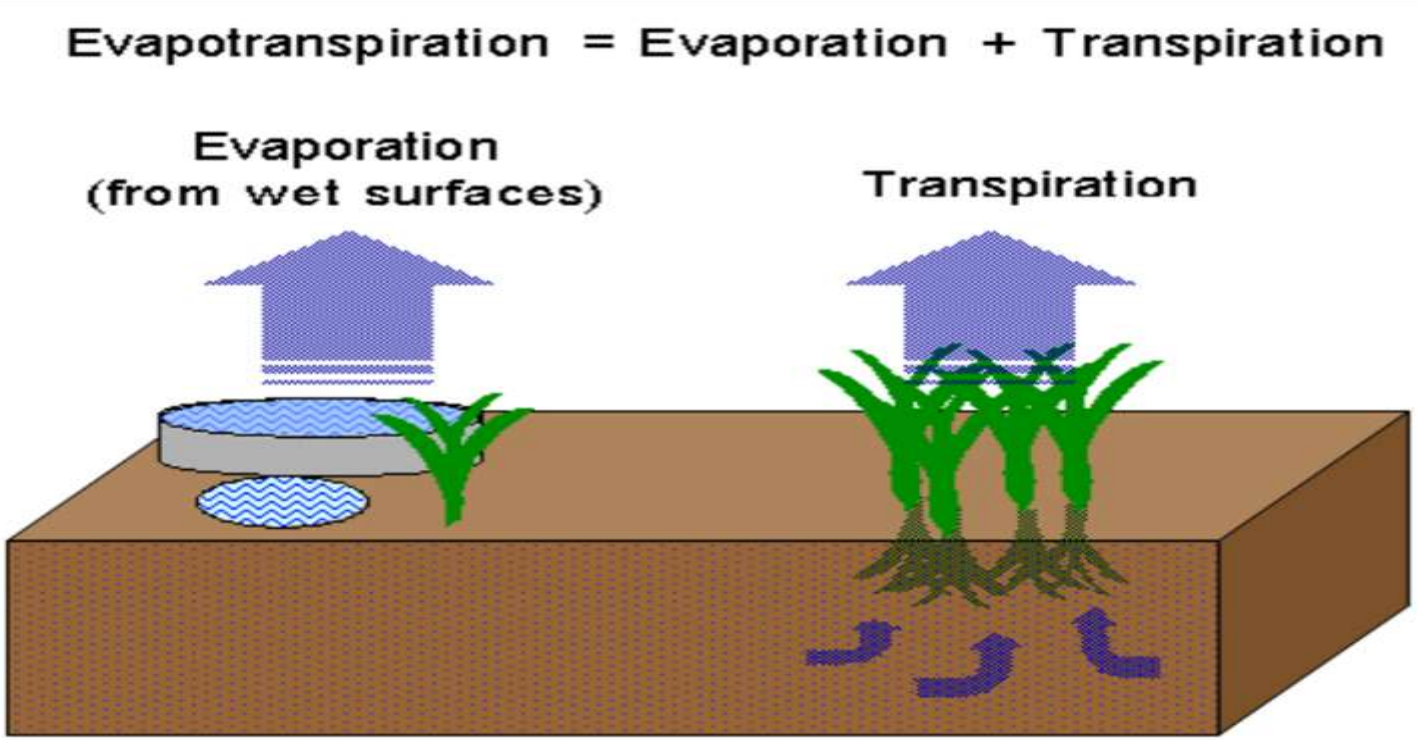
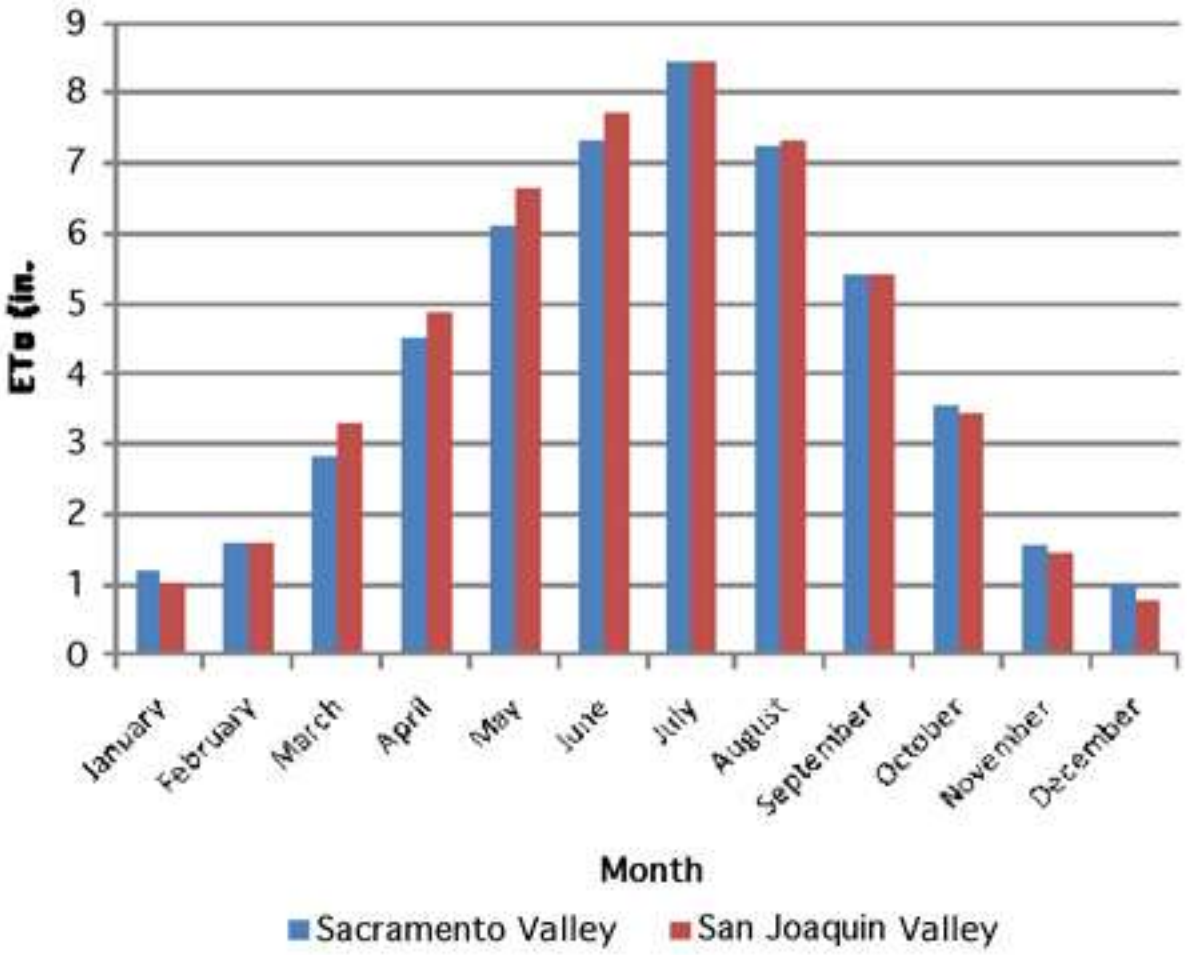


Figure 1. Evapotranspiration

Reference Evapotranspiration (ETo)

Estimated water demand of a planted area

- Climate-based reference
- Inches per day
- Calculated from weather data
- Sunlight, temperature, wind, humidity
- Hypothetical water use of tall fescue given unlimited water



(G.S. Sibbett and L. Ferguson. 2005. Olive production manual. Oakland: UC Div. of Agriculture & Natural Resources Pub. 3353.)

Evapotranspiration

Pomona, CA Average ETo (in.)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
Mo.	1.95	2.35	3.67	4.62	5.27	5.93	6.52	6.38	4.87	3.39	2.26	1.64	**48.9**
Wk.	0.4	0.6	0.8	1.1	1.2	1.4	1.5	1.5	1.1	0.8	0.6	0.4	
Day	0.06	0.08	0.12	0.15	0.17	0.20	0.21	0.21	0.16	0.11	0.08	0.05	

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Hierarchy for Reducing Garden & Landscape Water Demand

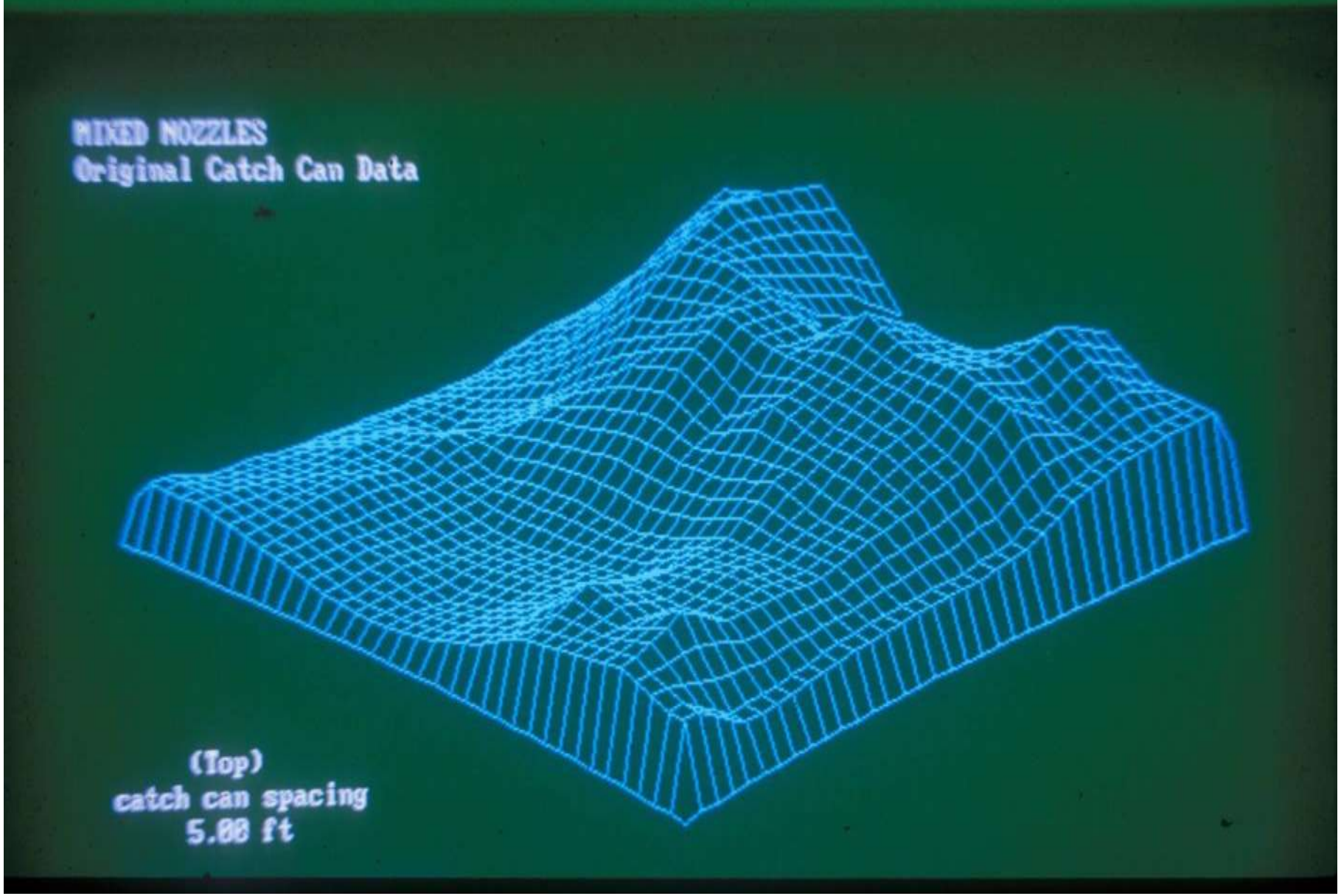
- Improve Irrigation System Performance
- Improve Irrigation Schedules & Management
- Adjust Cultural Practices
- Reduce Turf Area/Alter Plant Palette
- Reduce Total Planted Area

Improve Irrigation System Performance

The irrigation system should distribute water as uniformly and efficiently as possible

Improve Irrigation System Performance

When applied water closely matches the needs of plants, the uniformity of the irrigation system is critical


MIXED NOZZLES
Original Catch Can Data
(Top)
catch can spacing
5.00 ft

Distribution Uniformity (DU)

DU	Irrigation Multiplier
0.5	2.00
0.6	1.67
0.7	1.43
0.8	1.25
0.9	1.11

Improve Irrigation System Performance
Fix Obvious Problems

Improve Irrigation System Performance

- Catch can test
- Evaluate Each Station's
  - *Distribution Uniformity*
  - *Precipitation Rate*
- DU Goals:
  - Overhead (turf) = 70%
  - Drip = 90%

Avoid Runoff & Overspray

- Cycle and soak
- Run irrig. lines across slope
- Reduced precipitation rate heads

Improve Irrigation System Performance

Effective Irrigation Controllers

- Minimum 3 programs
- Minimum 4 start times
- Interval or day of week option
- Station for each zone
- Rain shutoff
- Global % adjustment

Improve Irrigation Schedules & Management

The schedule should apply water at the time and in the amount needed by the plants

….. plus extra water for

non-uniform distribution & salt management

Improve Irrigation Schedules & Management

- How much? How often?
- Irrigate 11 PM – 6 AM
- Set July runtime & cycles
- Adjust schedules monthly
- Use global % adjust

Factors Affecting Scheduling

- Root system depth
- Soil type (general texture)
- Plant type
- ETo (weather)
- Plant performance expectations
- Irrigation system type – drip vs. spray
- Uniformity and efficiency of irrigation system

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Approx. Irrigation Intervals

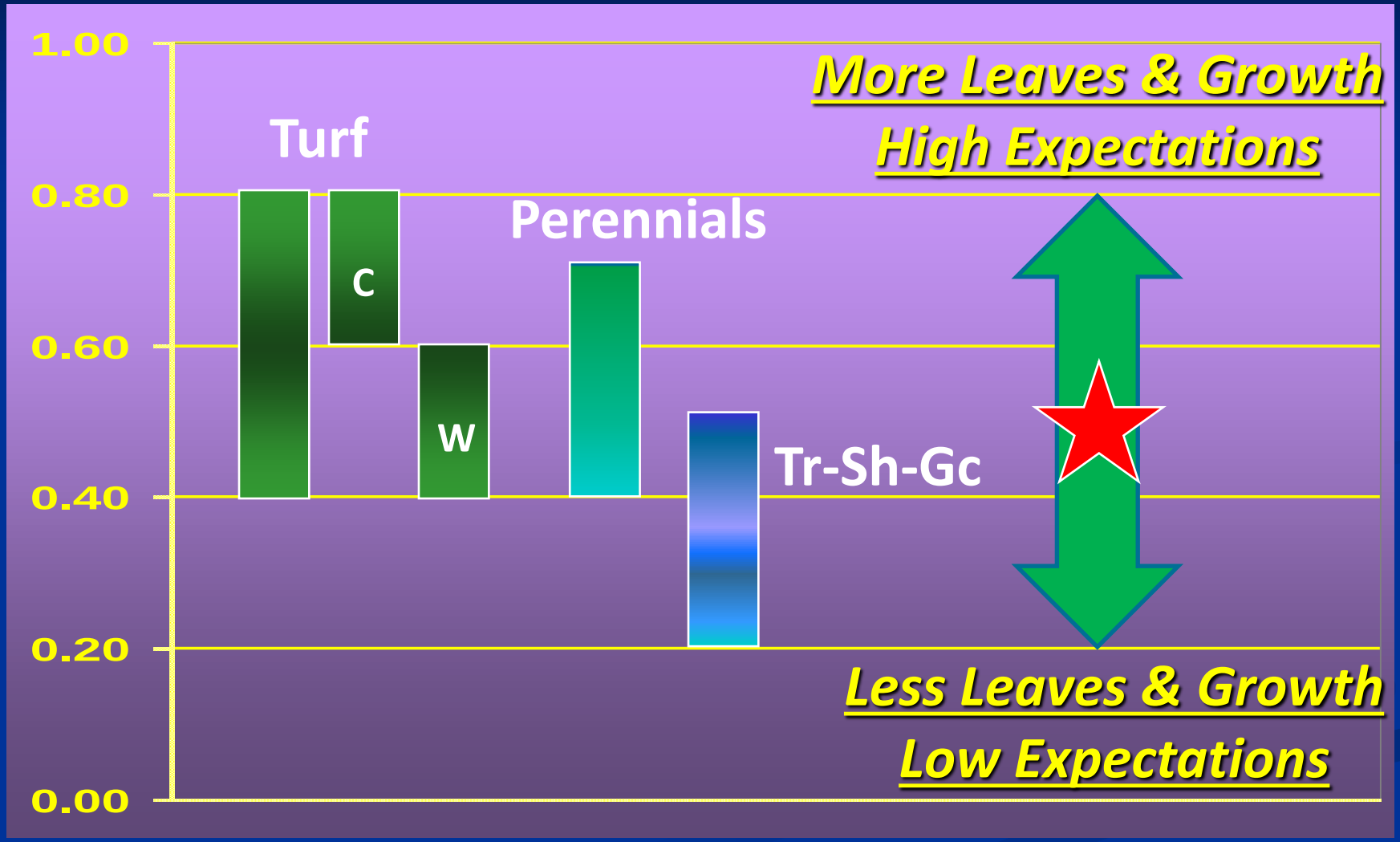
June-July -August

- Overhead Irrigation
  - Turfgrass: 2-3/wk.
  - Tree-Shr-Grdcvr: 1 ev. 10-14 days
  - Perennials: 1 ev. 3-5 days
- Drip Irrigation – non grid
  - Irrigate every 2-4 days
- Drip Irrigation – grid
  - Same as overhead

ETo x PF = inches

Adjust runtimes to account for irrigation system inefficiency

Percent of ET Required



Estimated Irrigation Req’ts.

Irrigation Calculators: www.ucanr.edu/cluh

- Increase amounts and runtimes to account for system inefficiency

Food Gardens & Edible Landscapes

.....*Same as cool-season grass*

Improve Irrigation Schedules & Management

Deficit Irrigate by up to 30%

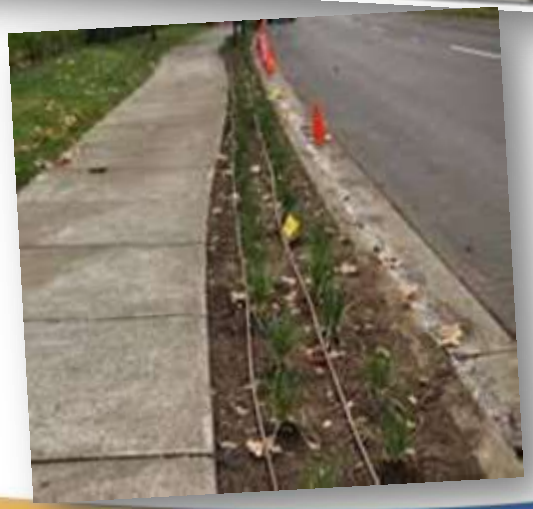
- Extend time between irrigations
- Wet entire root zone
- Trees, shrubs, groundcovers tolerate well
- Cool-season grass less tolerant

Adjust Cultural Practices

- Limit fertilizer
- Limit pruning/renovation
- Mulch bare soil
- Aerate turf
- Raise mowing height
  - 3+ inches for tall fescue
  - 1.5+ inches for bermuda

Reduce Turf/Alter Plant Palette

- Functional turf only
  - Play & walk-on surfaces
  - Erosion, mud, dust control
  - Cooling
- Separate irrigation zone



Not Hydrozoned

- Trees irrigated with turf
- All 80% ETo

Hydrozoned

- Turf irrigated separately
- Part 50%, part 80% ETo

Reduce Planted Area

Photo Credit: Larsen Landscape

Considerations When Reducing Planted Area

- Potential Pros
  - Less water demand
  - Less maintenance
  - Similar cooling
- Potential Cons
  - Similar maintenance
  - Increased heat
  - Increased erosion
  - Altered habitat
  - Expensive to install