People Waste Water...... Not Plants!!!
Water Management
Janet Hartin and Ben Faber

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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)

<table>
<thead>
<tr>
<th>Location (see fig. 4.2)</th>
<th>Nov-Mar</th>
<th>Apr-Oct</th>
<th>Annual</th>
</tr>
</thead>
<tbody>
<tr>
<td>Zone 1: North Coast</td>
<td>5.1</td>
<td>20.8</td>
<td>25.1</td>
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<tr>
<td>Zone 2: North Coast Interior Valleys</td>
<td>6.3</td>
<td>34.9</td>
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<tr>
<td>Zone 3: Northeastern Mountain Valleys</td>
<td>5.1</td>
<td>37.1</td>
<td>42.2</td>
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<td>Zone 4: Sacramento Valley</td>
<td>8.5</td>
<td>40.7</td>
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<tr>
<td>Zone 5: San Joaquin Valley</td>
<td>7.9</td>
<td>40.1</td>
<td>45.0</td>
</tr>
<tr>
<td>Zone 6: Central Coast Interior Valleys</td>
<td>10.8</td>
<td>37.5</td>
<td>48.3</td>
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<tr>
<td>Zone 7: Sierra (Yuba Basin)</td>
<td>--</td>
<td>30.0</td>
<td>--</td>
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<td>Zone 8: Central Coast</td>
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<td>35.3</td>
<td>43.2</td>
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<td>Zone 9: Southern Coast</td>
<td>12.1</td>
<td>32.3</td>
<td>44.0</td>
</tr>
<tr>
<td>Zone 10: Southern Island Valleys</td>
<td>11.5</td>
<td>37.9</td>
<td>49.0</td>
</tr>
<tr>
<td>Zone 11: Southern Deserts</td>
<td>17.7</td>
<td>65.1</td>
<td>82.0</td>
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</table>

Notes: 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 Island Valleys; Zone 11: Southern Deserts. Source: After Bartz 1991, pp. 2-3.

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 ornamental 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 averaged. The actual water loss varies somewhat, possibly 10 to 25%, during unusually hot or windy days or unusually cool, cloudy days.
- Plants typically require no more than 100% of ET on a frequent basis after planting until these are established.
- Once these are established, most established landscape plant and turf species can be maintained on considerably less water than the ET rates listed.
- Although some 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 plants and turf species is found in this chapter in the sections “Water Management Strategies for Specific Plants” and in chapters on specific crops in this book.
Welcome!

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

<table>
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<th>Date</th>
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<tr>
<td>WORKSHOP: Dealing with Drought &amp; Landscape Watering Restrictions - 2015</td>
<td>9/2/2015</td>
</tr>
<tr>
<td>Landscape EXPO</td>
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</tr>
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</table>
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)

Evapotranspiration = Evaporation + Transpiration

Evaporation
(from wet surfaces)

Transpiration

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
Evapotranspiration

Pomona, CA  Average ETo (in.)

<table>
<thead>
<tr>
<th></th>
<th>Jan</th>
<th>Feb</th>
<th>Mar</th>
<th>Apr</th>
<th>May</th>
<th>Jun</th>
<th>Jul</th>
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<th>Nov</th>
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<td>3.67</td>
<td>4.62</td>
<td>5.27</td>
<td>5.93</td>
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<td>4.87</td>
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www.cimis.water.ca.gov
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.
## Distribution Uniformity (DU)

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<th>Irrigation Multiplier</th>
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<tbody>
<tr>
<td>0.5</td>
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<tr>
<td>0.6</td>
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<td>0.7</td>
<td>1.43</td>
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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
## Reference Evapotranspiration

Pomona, CA  Average ETo (in.)

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Approx. Irrigation Intervals

June-July - August

• Overhead Irrigation
  – 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

\[ ETo \times PF = \text{inches} \]

Adjust runtimes to account for irrigation system inefficiency
Percent of ET Required

- **Turf**
  - More Leaves & Growth (High Expectations)
  - Less Leaves & Growth (Low Expectations)

- **Perennials**
- **Tr-Sh-Gc**

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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