Watering Your Landscape

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Landscape Irrigation:

What Determines Water Use in a Landscape?

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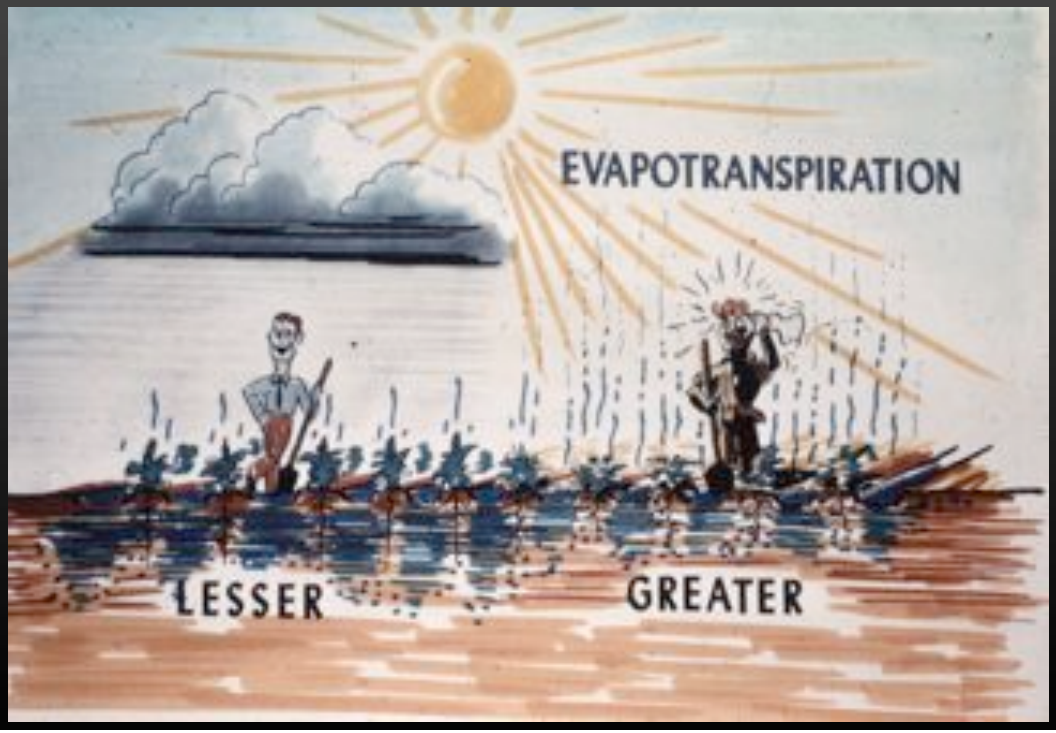
1. Growing environment
   - Climate - hot, cool, dry, humid, cloudy, windy



Landscape Irrigation:

What Determines Water Use in a Landscape?

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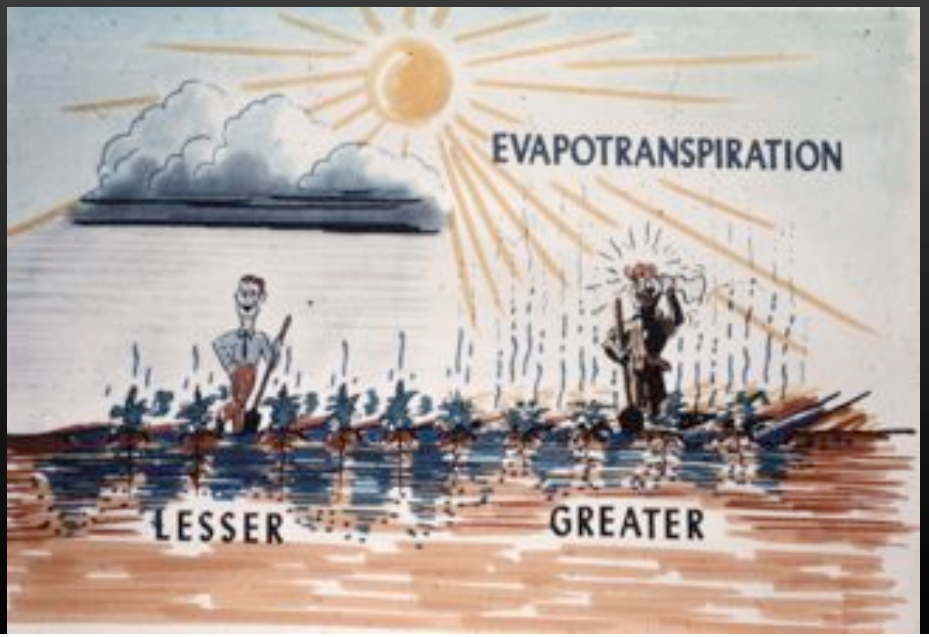
   - Plant exposure - sun, shade



Landscape Irrigation:

What Determines Water Use in a Landscape?

1. Growing environment
   - Climate - hot, cool, dry, humid, cloudy, windy
   - Plant exposure - sun, shade
   - Surroundings - other plants, hardscape

Landscape Irrigation:

What Determines Water Use in a Landscape?

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2. Types of plants
   - Trees

Landscape Irrigation:

What Determines Water Use in a Landscape?

1. Growing environment
2. Types of plants
   - Trees - on a canopy area basis, they *can* use significantly more than turfgrass.

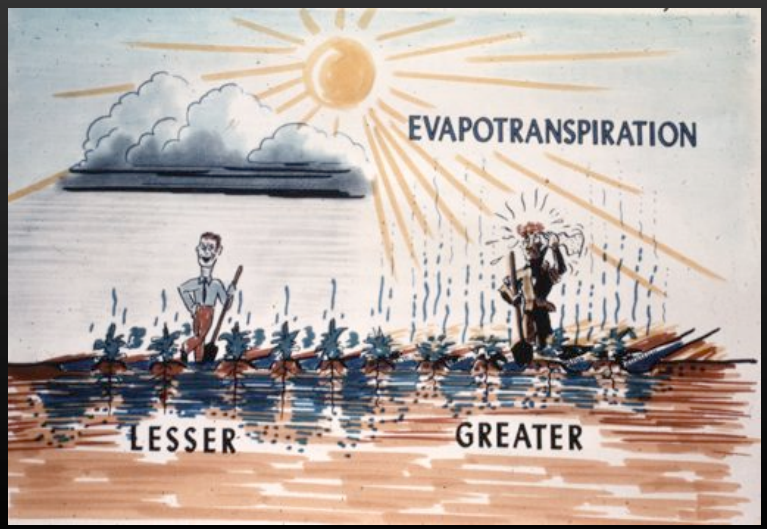
Plant Water Use:

- Measure evapotranspiration (ET).

Evaporation from the soil

+

Transpiration from the plant



Where do you get ET estimates?

Historical ET estimates:

Olive historical ET - inches during period

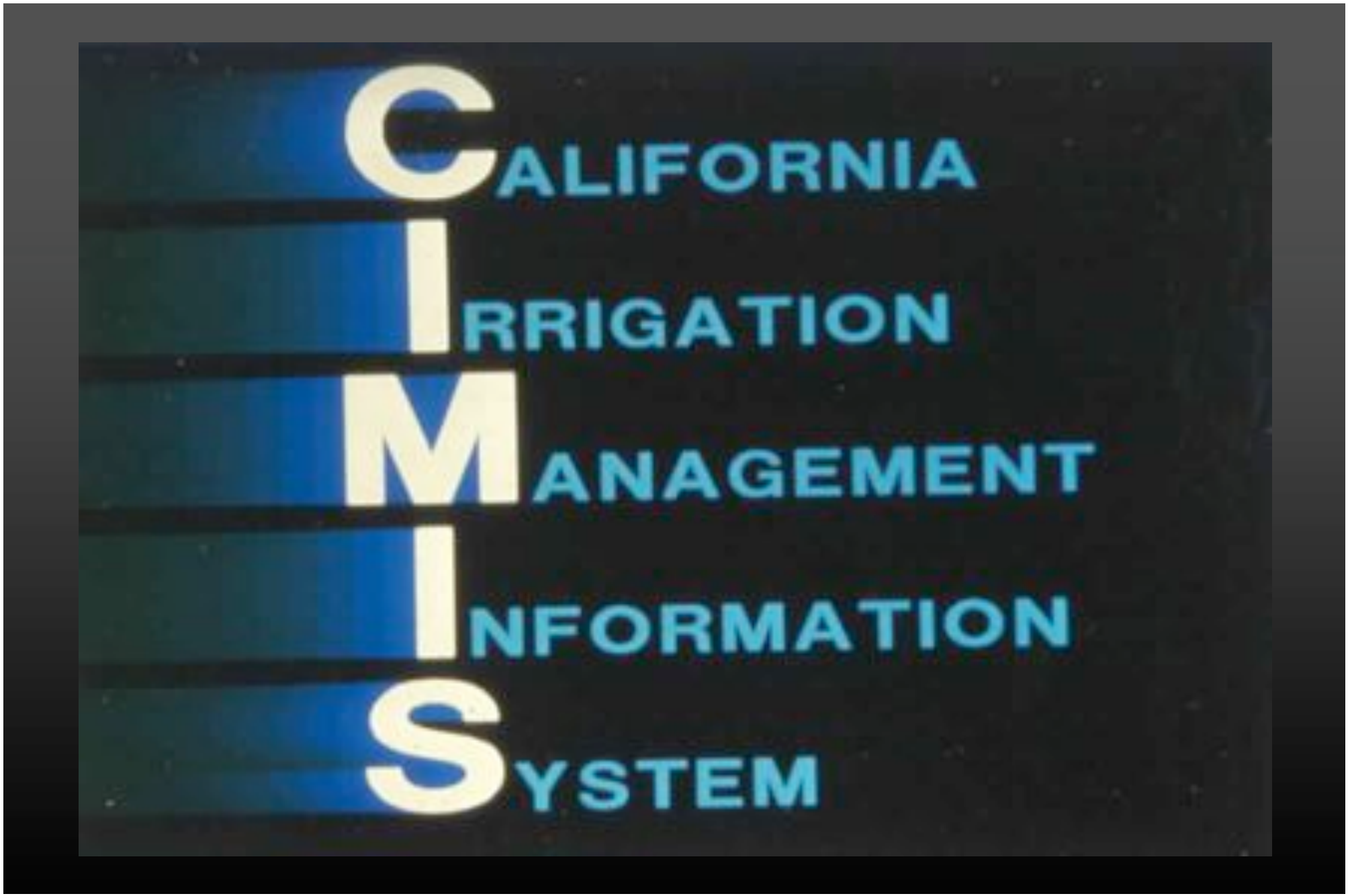
Table 6. Olive historical evapotranspiration estimates (inches during period)

Date	Lakeport	Ukiah	Orland	Parlier	Santa Rosa	Atascadero
Mar 16–31		0.36	0.98	1.66	1.56	1.92
Apr 1–15	1.32	1.26	1.40	2.04	1.80	2.12
Apr 16–30	1.58	1.50	1.63	2.28	2.00	2.24
May 1–15	1.90	1.83	1.97	2.64	2.16	2.32
May 16–31	2.14	2.08	2.23	3.07	2.40	2.44
June 1–15	2.32	2.24	2.66	3.12	2.52	2.52
June 16–30	2.54	2.41	2.74	3.24	2.56	2.60
July 1–15	2.80	2.68	3.05	3.24	2.52	2.60
July 16–31	2.89	2.64	3.32	3.20	2.36	2.48
Aug 1–15	2.57	2.43	3.53	2.88	2.16	2.32
Aug 16–31	2.32	2.21	3.02	2.82	1.88	2.04
Sept 1–15	2.02	1.94	2.82	2.28	1.56	1.88
Sept 16–30	1.71	1.63	2.30	1.80	1.32	1.68
Oct 1–15	1.36	1.30	1.94	1.56	1.04	1.52
Oct 16–31	1.01	0.98	1.53	1.15	0.68	1.24

Available at http://anrcatalog.ucdavis.edu/SoilWaterIrrigation/8212.aspx

Real-Time Weather Monitoring:

- Measure evapotranspirtation (ET).
- CIMIS weather stations predict the ET of pasture grass (Reference ET = ET_o).


CALIFORNIA
IRRIGATION
MANAGEMENT
INFORMATION
SYSTEM

Accessing CIMIS data:

- Go through the Department of Water Resources

  www.cimis.water.ca.gov

- Univ. of CA IPM website:

  www.ipm.ucdavis.edu


CALIFORNIA THE GOLDEN STATE
CALIFORNIA HOMEPAGE
GOVERNOR'S HOMEPAGE
CIMIS
CALIFORNIA IRRIGATION MANAGEMENT INFORMATION SYSTEM
DEPARTMENT OF WATER RESOURCES
OFFICE OF WATER USE EFFICIENCY
WELCOME
INFO CENTER
DATA
RESOURCE CENTER
MY CIMIS
General
Events
System News
FAQs
CIMIS Staff
Upcoming Events
Non-ideal site study update
New CIMIS Web Site
My CIMIS
Current System News
Station #176 (La Quinta) Disconnected
Station #27 (Zamora) disconnected
#177 Watsonville West
New Station #198
Welcome
CIMIS Overview
The California Irrigation Management Information System (CIMIS) is a program in the Office of Water Use Efficiency (OWUE), California Department of Water Resources (DWR) that manages a network of over 120 automated weather stations in the state of California. CIMIS was developed in 1982 by the California Department of Water Resource and the University of California at Davis to assist California's irrigators manage their water resources efficiently. Efficient use of water resources benefits Californians by saving water, energy, and money. (more...)
CIMIS Data Uses
Since the beginning of the CIMIS weather station network in 1982, the primary purpose of CIMIS was to make available to the public, free of charge, information useful in estimating crop water use for irrigation scheduling. Although irrigation scheduling continues to be the main use of CIMIS, the uses have been constantly expanding over the years. At present, there are approximately 6,000 registered CIMIS users from diverse backgrounds accessing the CIMIS computer directly. It is estimated requests for CIMIS information on the WWW average about 70,000 per year. There are also many secondary suppliers of CIMIS weather data, such as other web sites, radio, newspapers, consultants, and local water agencies. (more...)
Irrigate like a Pro
CIMIS System Status:
The normal Maintenance window is:
Tuesday 04:00 - 06:00 PM
REGISTER
for email weather data access

March 4-5 Conference on IPM for Public Agencies | UC SAREP-UC IPM Grants Available for Educational Events

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Including 2001 Annual report NEW

HOW TO MANAGE PESTS

- Management and identification of plant diseases, insects, mites, nematodes, weeds
  - **Pests of agricultural crops, floriculture and ornamental nurseries, and commercial turfgrass** - *Pest Management Guidelines*
  - **Pests of home and landscape** - *Pest Notes*
  - **Weed photo gallery** - photos and descriptions of weeds
- **Weather data**
- **Degree-days** - run models and calculate degree-days
- **Model descriptions**
  - **Plants, pests, and beneficials** - **crop diseases** - **more**
- **Special projects on the Web**
  - **Citrus thrips damage estimator** NEW - **ant ID key** NEW - **more**

Weather monitoring:

- Measure evapotranspirtation (ET).
- Weather stations predict the ET of pasture grass (Reference ET = ET_o).
- Convert the reference ET (ET_o) to your plant's ET (ET_{crop}) using a crop coefficient (k_c).

Determining Crop ET:

Crop ET = Reference ET x Crop Coefficient

$$ET_{crop} = ET_o \times k_c$$

Crop Coefficient for Olives (k_c) = 0.8

Irrigation scheduling example:

Date	Almonds	Walnuts	Pistachios	Stone fruit	Prunes	Olives	Citrus
Jan 1–15	—	—	—	—	—	0.8	0.65
Jan 16–31	—	—	—	—	—	0.8	0.65
Feb 1–15	—	—	—	—	—	0.8	0.65
Feb 16–28	—	—	—	—	—	0.8	0.65
Mar 1–15	—	—	—	0.55	—	0.8	0.65
Mar 16–31	0.54	0.12	—	0.62	—	0.8	0.65
Apr 1–15	0.60	0.53	0.07	0.67	0.62	0.8	0.65
Apr 16–30	0.66	0.68	0.43	0.73	0.84	0.8	0.65
May 1–15	0.73	0.79	0.68	0.78	0.96	0.8	0.65
May 16 –31	0.79	0.86	0.93	0.85	0.96	0.8	0.65
June 1–15	0.84	0.93	1.09	0.87	0.96	0.8	0.65
June 16–30	0.86	1.00	1.17	0.87	0.96	0.8	0.65
July 1–15	0.93	1.14	1.19	0.87	0.96	0.8	0.65
July 16–31	0.94	1.14	1.19	0.87	0.96	0.8	0.65
Aug 1–15	0.94	1.14	1.19	0.87	0.95	0.8	0.65
Aug 16–31	0.94	1.14	1.12	0.87	0.92	0.8	0.65
Sept 1–15	0.94	1.08	0.99	0.87	0.84	0.8	0.65
Sept 16–30	0.91	0.97	0.87	0.82	0.78	0.8	0.65

Available at http://anrcatalog.ucdavis.edu/SoilWaterIrrigation/8212.aspx

Irrigation scheduling example:

Santa Rosa - North Coast Valleys - Station 83

Date	CIMIS ETo (in)	Precip (in)	Sol Rad (Ly/day)	Avg Vap (mBars)	Max Air Temp (°F)	Min Air Temp (°F)	Avg Air Temp (°F)	Max Rel Hum (%)	Min Rel Hum (%)	Avg Rel Hum (%)	Dew Pt (°F)	Avg wSpd (MPH)	Wnd Run (miles)	Avg Soil Temp (°F)
07/01/2009	0.19	0.00	607	13.8	69.4	50.2	59.4	95	64	80	53.1	4.5	107.6	71.8
07/02/2009	0.19	0.00	589	13.6	70.5	49.5	59.1	94	63	79	52.7	4.4	106.7	71.4
07/03/2009	0.18	0.00	566	13.7	70.4	51.6	58.3	96	61	83	53.0	4.0	96.3	70.8
07/04/2009	0.12 *	0.00	424	13.3	67.4	51.4	56.4	96	67	86	52.2	4.7	113.3	70.0
07/05/2009	0.13	0.00	460	12.6	64.4	44.9	54.7	96	71	86	50.7	4.8	116.3	68.9
07/06/2009	0.22	0.00	661	11.3	77.5	38.9 Y	57.5	97	40	70	47.8	3.5	83.9	67.6
07/07/2009	0.19	0.00	608	11.8	69.8	37.5 Y	55.0	96	60	80	48.8	3.8	92.1	67.9
07/08/2009	0.25 R	0.00	657	10.7	84.3	38.5 Y	62.8	97	27	55	46.3	3.6	86.5	68.1
07/09/2009	0.23	0.00	647	11.9	78.1	41.5	59.6	96	42	69	49.2	4.4	105.3	68.8
07/10/2009	0.21	0.00	585	12.1	83.1	39.6 Y	60.0	96	34	69	49.6	3.9	94.6	69.1
07/11/2009	0.20	0.00	568	13.0	78.3	48.9	61.5	96	45	70	51.5	4.7	112.3	70.1
07/12/2009	0.24	0.00	626	11.5	85.2	43.4	63.1	96	22	58	48.2	4.5	109.5	70.5
07/13/2009	0.28	0.00	658	10.5	93.5	41.9	67.6	95	16	46	45.9	4.1	100.1	71.3
07/14/2009	0.27	0.00	640	12.4	94.3	47.4	67.9	92	23	53	50.3	4.1	98.6	72.6
07/15/2009	0.23	0.00	641	12.4	82.3	44.6	60.7	95	40	69	50.3	3.9	95.1	72.4
Tots/Avgs	3.13	0.00	596	12.3	77.9	44.7	60.2	96	45	70	50.0	4.2	101.2	70.1

Olive water use example:

Date	ET_o (in.)	k_c	ET_{olives} (in.)
7/14/09	0.27	0.80	0.22

$$ET_{crop} = ET_o \times k_c$$

Landscape Irrigation:

Tree water use example (walnuts):

- 20-foot diameter (10’ radius) tree, midsummer

  Tree area = 3.14 x $(\text{radius})^2$ = 3.14 x $(10)^2$ = 314 ft^2

  ET_o = 0.25 in/day k_c = 1.0 (e.g. walnuts)

$$ET_{tree} = 0.25 \text{ in/day} \times 1.0 = 0.25 \text{ in/day}$$

$$0.25 \frac{\text{in}}{\text{day}} \times \frac{\text{ft}}{12 \text{ in}} \times \left(314 \text{ ft}^2\right) \times \frac{7.48 \text{ gal}}{\text{ft}^3} = 49 \frac{\text{gal}}{\text{day}}$$

Landscape Irrigation:

What Determines Water Use in a Landscape?

1. Growing environment
2. Types of plants
   - Trees - on a canopy area basis, they *can* use significantly more than turfgrass.
   - Turfgrass - cool season (k_c=0.8), warm season (k_c=0.6)

Landscape Irrigation:

Turfgrass water use example:

- Warm season grass

  Area = 314 ft^2

  ET_o = 0.25 in/day k_c = 0.6 (warm season grass)

$$ET_{tree} = 0.25 \text{ in/day} \times 0.6 = 0.15 \text{ in/day}$$

$$0.15 \frac{\text{in}}{\text{day}} \times \frac{\text{ft}}{12 \text{ in}} \times \left(314 \text{ ft}^2\right) \times \frac{7.48 \text{ gal}}{\text{ft}^3} = 29 \frac{\text{gal}}{\text{day}}$$

(Walnut water use was 49 gal/day)

Landscape Irrigation:

What Determines Water Use in a Landscape?

1. Growing environment
2. Types of plants
   - Trees - on a canopy area basis, they *can* use significantly more than turfgrass.
   - Turfgrass - cool season, warm season
   - Stand-alone, smaller plants (shrubs, etc)
     - Wide range of water use, but water use is a function of their canopy size
     - Can save water if only water the plants, not the bare ground.

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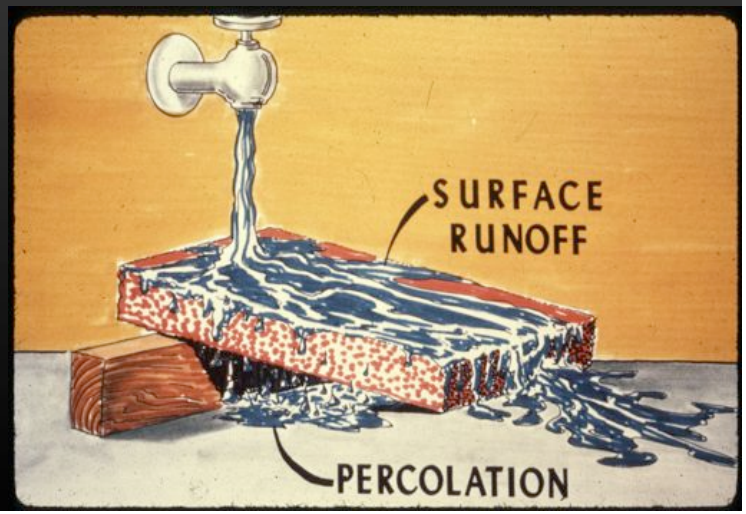
   - Can the irrigation system provide *just the right amount* of water to all the plants in the landscape? Without wasting any?



Landscape Irrigation:

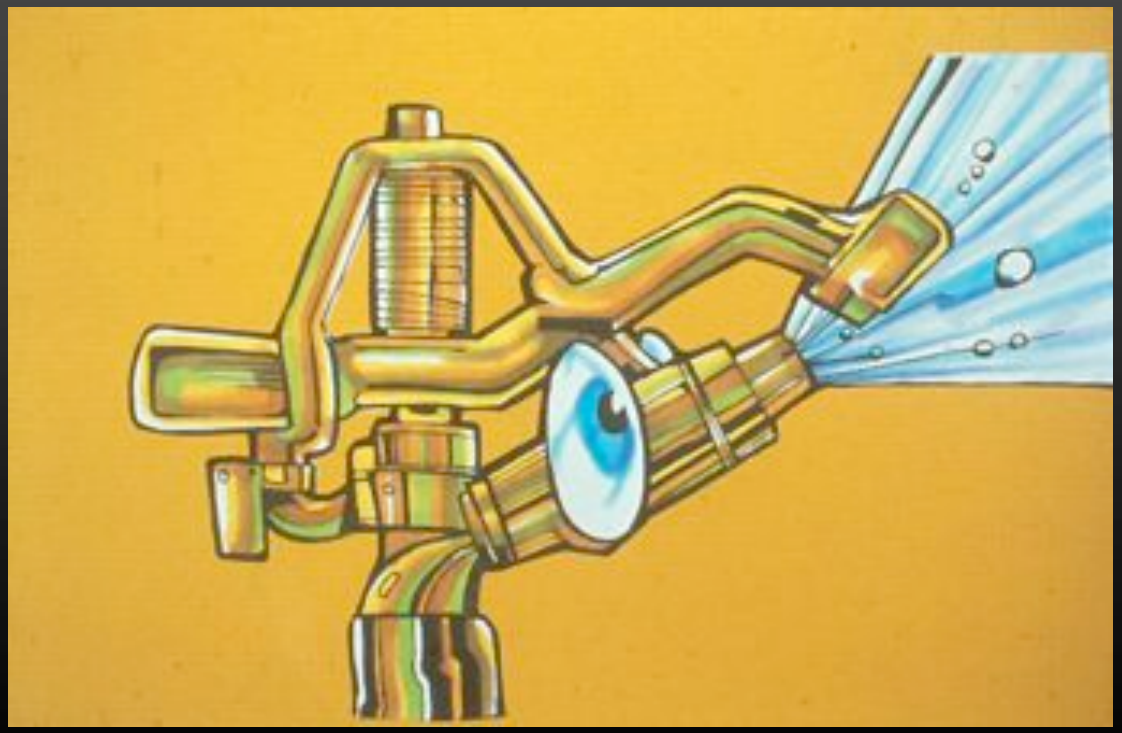
What Determines Water Use in a Landscape?

1. **Growing environment**
2. **Types of plants**
3. **Irrigation system**
   - **Can the irrigation system provide *just the right amount* of water to all the plants in the landscape? Without wasting any?**
   - **Want to apply water only to those areas where plants can take it up.**

Efficiency

Turfgrass Irrigation:

- Design
- Operation



Turf Design from an Irrigation Standpoint:

- Curves are hard to irrigate - rectangular shapes are easier.

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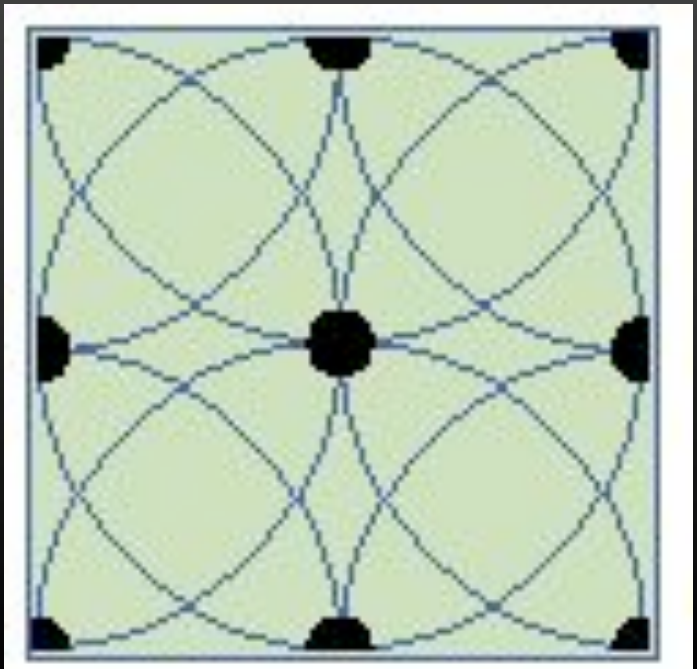
- Small / narrow shapes are hard to irrigate.

Turf Design from an Irrigation Standpoint:

- Curves are hard to irrigate - rectangular shapes are easier.
- Small / narrow shapes are hard to irrigate.
- Slopes are harder to irrigate.

Sprinkler Design:

- Standard sprinkler spacing is “head-to-head” coverage.
  - Closer spacing = higher application rate = runoff?



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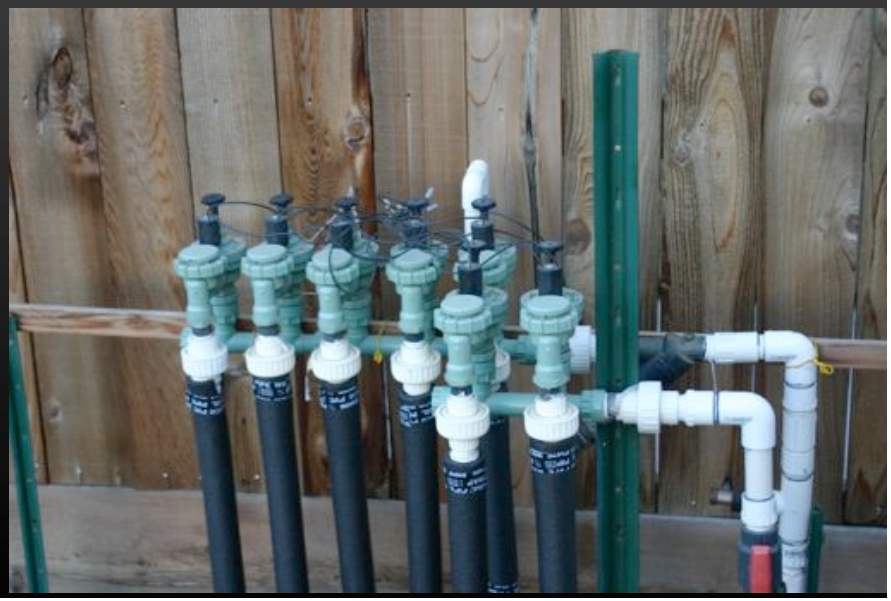
- Too many sprinklers on a line means poor pressure = poor coverage.
- Keep track of where the pipelines are.
- Error on the side of more valves / stations.



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- Keep track of where the pipelines are.
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- Error on the side of using larger pipe.
  - Smaller pipe does not increase pressure

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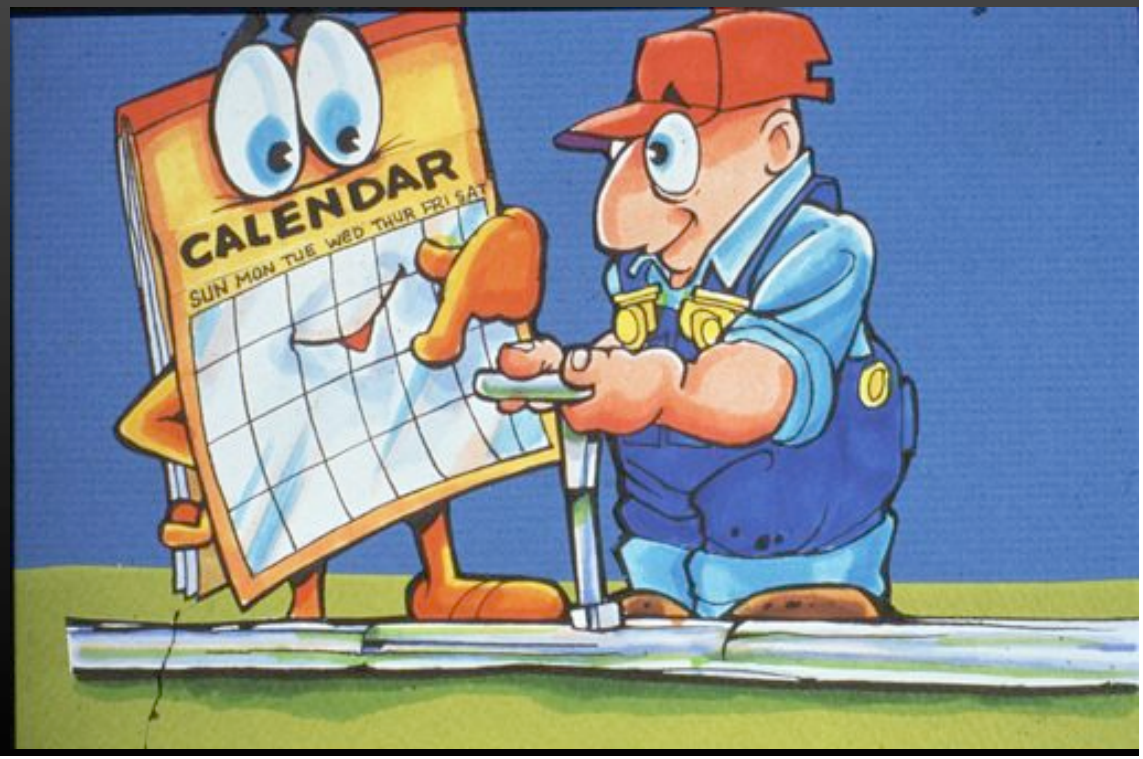
- Standard sprinkler spacing is “head-to-head” coverage.
- Too many sprinklers on a line means poor pressure = poor coverage.
- Keep track of where the pipelines are.
- Error on the side of more valves / stations.
- Error on the side of using larger pipe.
- Make sure the sprinkler “pops-up” above the grass.

Turfgrass Irrigation Management:

- Try to avoid daily irrigations.
  - Odd/even watering requirements.



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- Try to avoid daily irrigations.
- Irrigate in the early mornings.
- If there are brown spots, don't just increase the run time.
- Adjust your controller for changing water needs.
  - Smart controllers?

Summary: How do you get by on less water?

- Change your landscape plant selection
  - Go from high water users (lush trees & turfgrass) to lower water users.

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- Become a more efficient irrigator
  - Easier to be efficient with drip irrigation.

Summary: How do you get by on less water?

- Change your landscape plant selection
  - Go from high water users (lush trees & turfgrass) to lower water users.
- Become a more efficient irrigator
  - Easier to be efficient with drip irrigation.
- Combination of the two is often the best
  - Low water use landscape irrigated with drip irrigation.

Questions?

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www.anrcatalog.ucdavis.edu
Lawn Watering Guide for CA: Pub. 8044
Drip Irrig. In the Home Landscape: Pub. 21579

Powerpoint presentation at http://schwankl.uckac.edu