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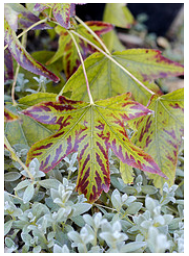

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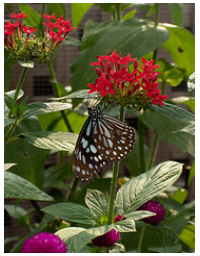

Make Every Drop of Water Count:

Efficient Irrigation, Smart Controllers and Climate Appropriate Shade Trees

Clovis Community College Center

Clovis, CA

June 28, 2017

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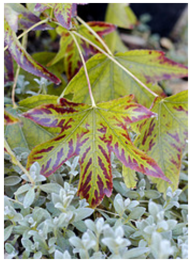

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Evapotranspiration Adjustment Factor Study

Department of Water Resources Grant #4600008156

April 1, 2009 – December 31, 2016

Principal Investigators:

Loren Oki, Landscape Horticulture Specialist, UCCE, UC Davis Depts. of Plant Science and Landscape Design and Architecture

Janet Hartin, Environmental Horticulture Advisor, UCCE San Bernardino, Los Angeles, & Riverside Counties

Dave Fujino, Executive Director, CA Center for Urban Horticulture, UC Davis

Cooperators:

Darren Haver, Water Resources/Water Quality Advisor and Director of South Coast REC and UCCE Orange

Karrie Reid, Environmental Horticulture Advisor, UCCE San Joaquin County

Chuck Ingels, Farm Advisor, UCCE Sacramento County

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WUCOLS IV

Water Use Classification of Landscape Species

- **Home Page**
- User Manual
- Plant Search Instructions
- Plant Search Database
- Download WUCOLS IV Plant List
- Download WUCOLS IV User Manual
- Water Requirements for Turfgrasses
- Partners
- Acknowledgements

Water conservation is an essential consideration in the design and management of California landscapes. Effective strategies that increase water use efficiency must be identified and implemented. One key strategy to increase efficiency is matching water supply to plant needs. By supplying only the amount of water needed to maintain landscape health and appearance, unnecessary applications that exceed plant needs can be avoided. Doing so, however, requires some knowledge of plant water needs.

WUCOLS IV provides evaluations of the irrigation water needs for over 3,500 taxa (taxonomic plant groups) used in California landscapes. It is based on the observations and extensive field experience of thirty-six landscape horticulturists (see the section "Regional Committees") and provides guidance in the selection and care of landscape plants relative to their water needs.

WUCOLS IV provides an assessment of irrigation water needs for over 3,500 taxa. Photo by Ellen Zagory.

http://ucanr.edu/sites/WUCOLS/

Dave Fujino, Ph.D.
Executive Director, California Center for Urban Horticulture
Co-Director, UC Nursery and Floriculture Alliance
dwfujino@ucdavis.edu

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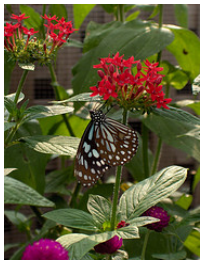
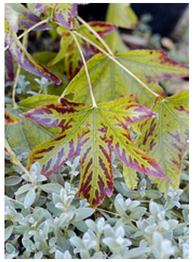


Regulation Background

As a result of State Assembly Bill 1881 resulted in California enacted:

- Model Water Efficient Landscape (MWELO) January 1, 2010
- Evapotranspiration Adjustment Factor (ETAF) from .8 to .7 for new landscapes over 2,500 square feet
- Lower ETAF = less allowable water for water-budgeted urban landscapes.







Current ETAF Guideline

1. Before January 2010, ETAF = 0.80

2. January 2010 to December 2015, ETAF = 0.70

3. After December 2015: ETAF = 0.55 Residential

   ETAF = 0.45 Commercial

   Option Appendix D, no water budget

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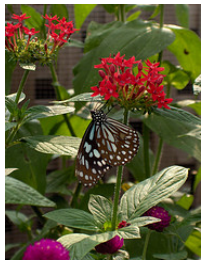


"Simplified" Water Budget Equation for MWELO

Maximum Applied Water Allowance = (ETo) (0.7) (LA) (0.62)

ETo = Reference Evapotranspiration (inches per year)

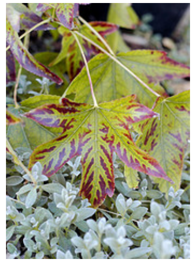
0.7 = ET Adjustment Factor

LA = Landscaped Area (square feet)

0.62 = Conversion factor (to gallons)

MAWA = _____ gallons/year





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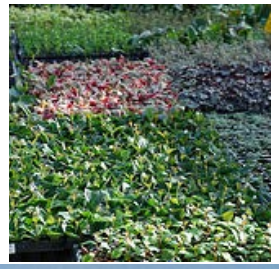
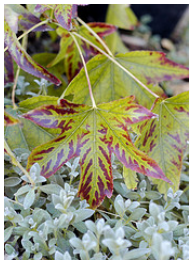
Landscape Demonstration Overview

Optimize irrigation system and then measure water use at 31 large urban landscapes that include a variety of ornamental plants with varying water use rates growing under a wide mixture of plant densities and microclimates.

1. South Coast
2. Central Coast
3. Los Angeles Basin
4. Inland Empire
5. Desert
6. Central Valley

Question

Can each landscape perform at or below mandated 0.7, while maintaining health and acceptable aesthetic appearance?

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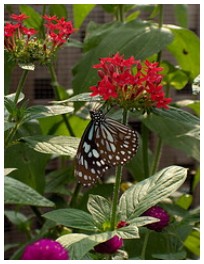



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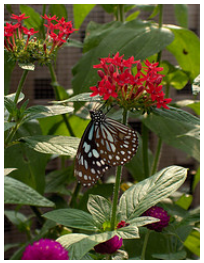

Calculated "ETAF" for Study

Calculated ETAF = Landscape Water Used
(Eto)(LA)(.62)

Eto = Reference Evapotranspiration (inches per year)
LA = Landscaped Area (square feet)
0.62 = Conversion factor (to gallons)

How did we measure water used?



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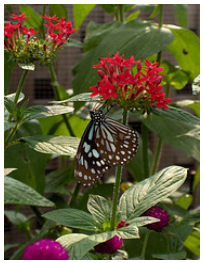

Central Valley
Sacramento County




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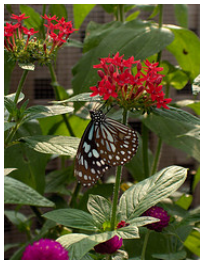

Central Valley Sacramento County Plant List

Botanical Name	Common Name
Diospyros kaki 'Fuyu'	fuyu persimmon
Agastache 'Summer Breeze'	hummingbird mint
Bulbine frutescens	cape balsam
Erigeron karvinskianus	Santa Barbara daisy
Gazania x hybridus	trailing gazania
Helianthemum nummularium 'Wisley Primrose'	sunrose
Lavandula 'Goodwin Creek'	Goodwin Creek lavender
Lonicera hispidula	California honeysuckle
Oenothera missouriensis	prostrate evening primrose
Pelargonium sidoides	garnet geranium
Penstemon 'Dark Towers'	dark towers beard tongue
Penstemon hybrid 'Blackbird'	border penstemon
Penstemon hybrid 'Garnet'	border penstemon
Penstemon hybrid 'Midnight'	border penstemon
Penstemon pinifolius	pinleaf penstemon
Penstemon schmidel 'Red Riding Hood'	beard tongue
Rosmarinus officinalis 'Mozart'	Ed Carman's rosemary
Rosmarinus officinalis 'Tuscan Blue'	Tuscan blue rosemary
Ruellia elegans	elegant ruellia
Salvia chamaedryoides	germander sage
Salvia greggii 'Hot Lips'	autumn sage
Salvia greggii 'Lipstick'	autumn sage
Salvia greggii 'Red Lady'	red lady
Santolina chamaecyparissus 'Lemon Queen'	lemon lavender cotton
Solidago hybrid 'Golden Baby'	dwarf goldenrod
Tagetes lemmonii	copper canyon daisy
Tagetes lemmonii 'Compactum'	dwarf copper canyon daisy
Teucrium chamaedrys	germander
Carex testacea	orange bronze sedge
Leymus condensatus 'Canyon Prince'	canyon prince blue rye grass
Miscanthus sinensis 'Little Kitten'	little kitten maiden grass
Zinnia hybrida Profusion series	annual profusion zinnia
Narcissus canaliculatus	miniature narcissus
Triteleia (Brodiaea) spp.	brodiaea
Triteleia hyacinthina 'Starlight'	brodiaea
Tulipa saxatilis	species tulip



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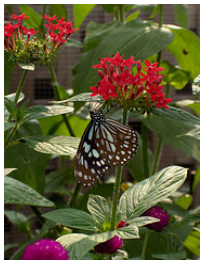
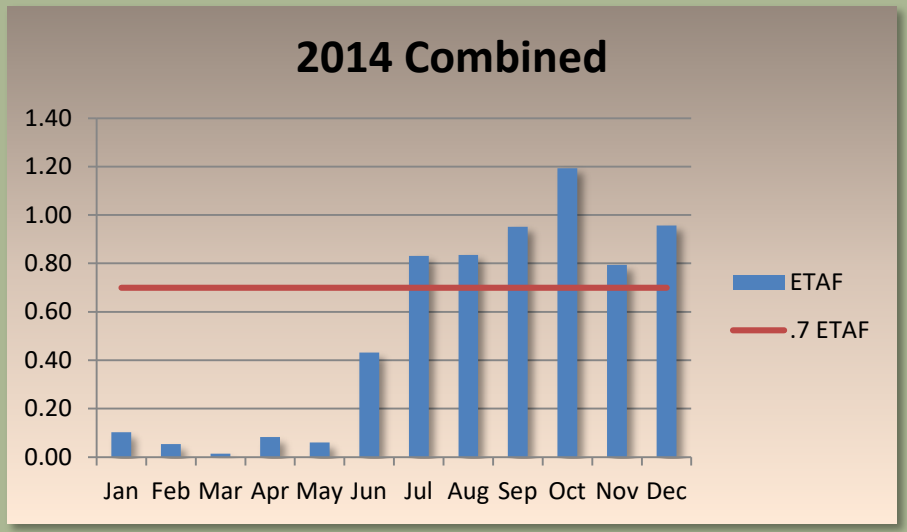
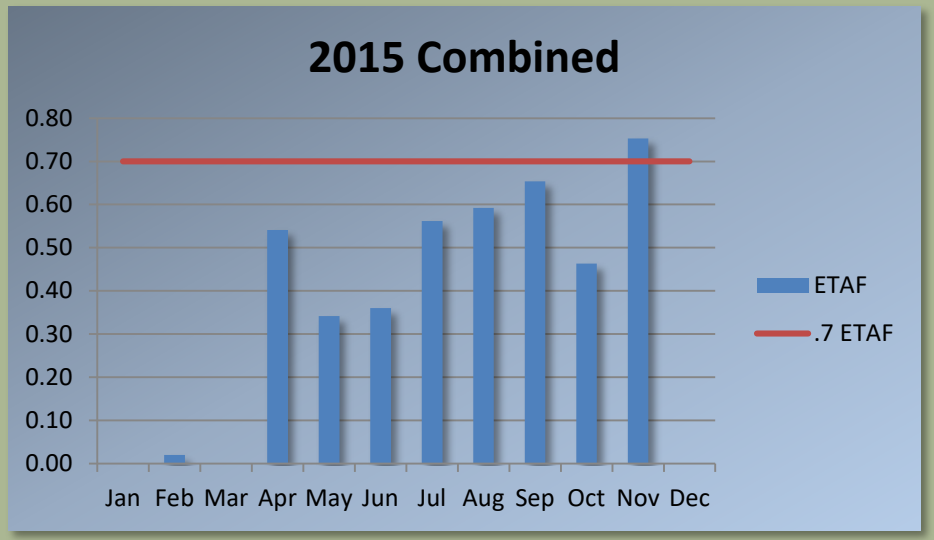


Central Valley
Sacramento County







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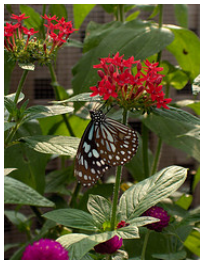

Central Coast
San Luis Obispo County

PLANT SPECIES LIST				
Site Location	**Plant Name**	**Common Name**	**WUCOLS Region**	**Water Need**
Atascadero	*Rosmarinum officinalis*	rosemary	1	Low 0.2 - 0.3
	Lavandula stoechus	Spanish lavender	1	Low 0.2 - 0.3
	Cistus spp.	rockrose	1	Low 0.2 - 0.3
	Archtostaphylos spp.	manzanita	1	Low 0.2 - 0.3
	Euryops pectinatus	yellow daisy bush	1	Low 0.2 - 0.3
	Prunus cerasifera	flowering plum	1	Low 0.2 - 0.3
	Tulbaghia violacea	society garlic	1	Low 0.2 - 0.3




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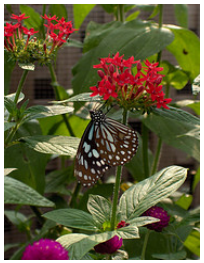
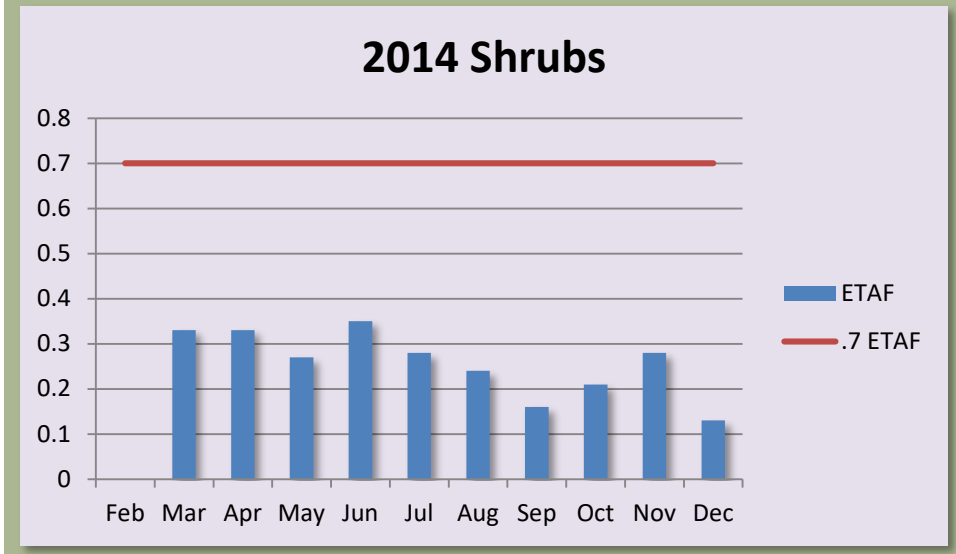
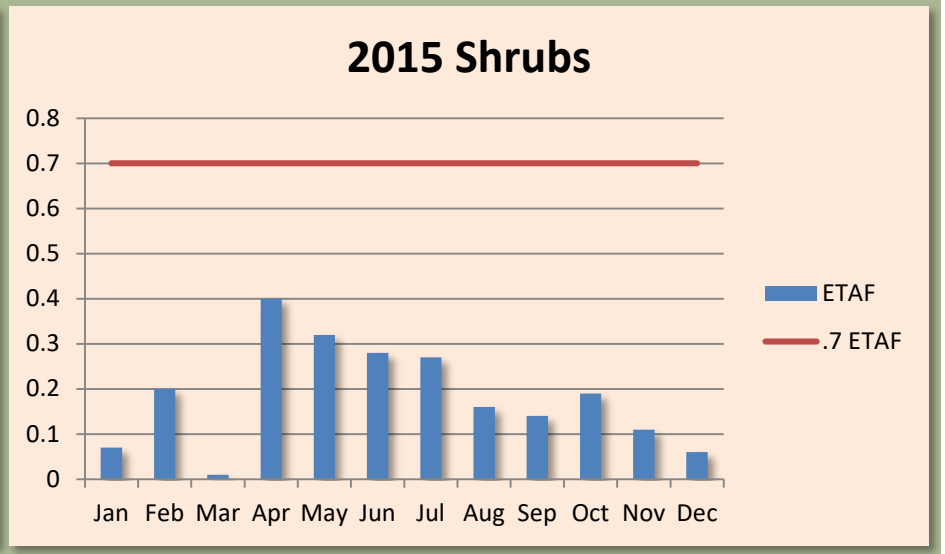


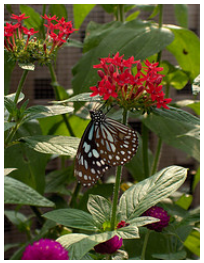
Central Coast
San Luis Obispo County











Shrub Site Results

- Shrub landscape sites used less water compared to turfgrass (13 gallons per sq. ft. versus 20 gallons per sq. ft.).
- Shrub sites total amount of water used was below 0.7 ETAF water budget for both study years (ETAF of 0.58 year 1, increasing to 0.61 in year 2).
- Fourteen out of the twenty-four shrub locations actually reduced water consumption in 2015/2016.
- Shrub sites can be irrigated below 0.7 ETAF without any adverse effects to the plant material.
- Nine of the sites with drip irrigation were able to be irrigated to 0.27 ETAF in 2015/2016.

COOL SEASON TURF

CENTRAL VALLEY

MISSION OAKS – FIRST YEAR PERIOD

ETAF – 0.41

COOL SEASON TURF

CENTRAL VALLEY

MISSION OAKS – SECOND YEAR PERIOD

ETAF – 0.33

WARM SEASON TURF

LOS ANGELES BASIN
CITY OF PASADENA – FIRST YEAR PERIOD
ETAF – 0.76

WARM SEASON TURF

LOS ANGELES BASIN

CITY OF PASADENA – SECOND YEAR PERIOD

ETAF – 0.38

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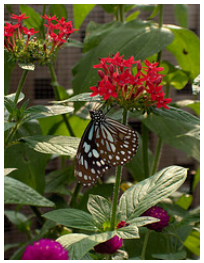

Turfgrass Results

1. Fourteen turfgrass sites had an average 13% increase in distribution uniformity
2. All fourteen turfgrass sites lowered their individual water consumptions at each location.
3. Turfgrass sites in 2014 had a combined actual ETAF of 1.28, and the actual ETAF lowered to 0.89 during 2015/2016.
4. Turfgrass sites in both years were not able to meet the evapotranspiration adjustment factor of 0.7.




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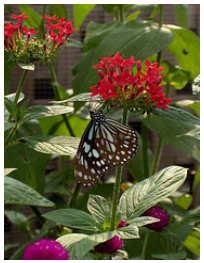

Key Learnings for Meeting the 0.7 ETAF Regulation

- Turfgrass area will need to be reduced and re-landscaped with low water use plants.
- Increasing the distribution uniformity can result in lower amounts of water being applied.
- Distribution uniformity in turf and landscape sites can be improved without major redesign and installation efforts by switching from spray to rotary sprinkler heads.
- Professionally designed landscapes hydrozoned using low water use plants along with high efficient and uniform irrigation systems will result in lower water use.
- Irrigation maintenance inspections and water audits recommended at 4 times per year.
- New landscape designs should utilize the efficiency and uniformity of drip irrigation systems.




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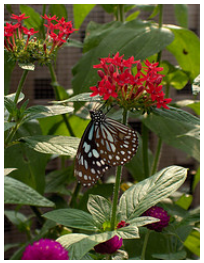
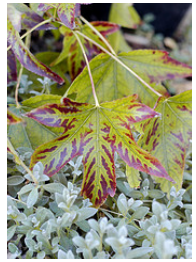


Checklist for Distribution Uniformity Improvement

1. Retrofit spray nozzles to rotating stream nozzles
2. Replace defective rotary stream nozzles (rotating to manufacturer's specification)
3. Match the rotary nozzles to the pressure and spacing as per manufacturer's specifications
4. All sprinklers have matching nozzles
5. Level all sprinkler heads with the ground (upright and flat)
6. Check arc alignments and adjust as manufacturer's specifications
7. Check all nozzles for obstruction
8. Sprinkler bodies were adjusted to prevent any spray deflection
9. Check valves to ensure proper operation (open and close)
10. Measure static, dynamic, and sprinkler head pressure and adjust to correct operating pressure of the sprinkler
11. Sprinkler system equipment was evaluated during each audit, and repaired or brought to the irrigation manager's attention





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ETAF Summary

1. Retrofitting existing mature landscapes can meet an ETAF = 0.7
2. Use “certified” irrigation professionals or obtain irrigation certification (CLCA, IA, EPA WaterSense).
3. Baseline irrigation system audit and optimization; and, ongoing measurement and maintenance are “must haves”
4. Landscape water savings achieved through irrigation management and maintenance and not by re-landscaping with low water use plants

Dave Fujino, Ph.D.

Executive Director

California Center for Urban Horticulture

UC Davis

(530) 754-7739

dwfujino@ucdavis.edu

http://ccuh.ucdavis.edu