

Turfgrass in Arizona: Water Requirements & Economic Impact

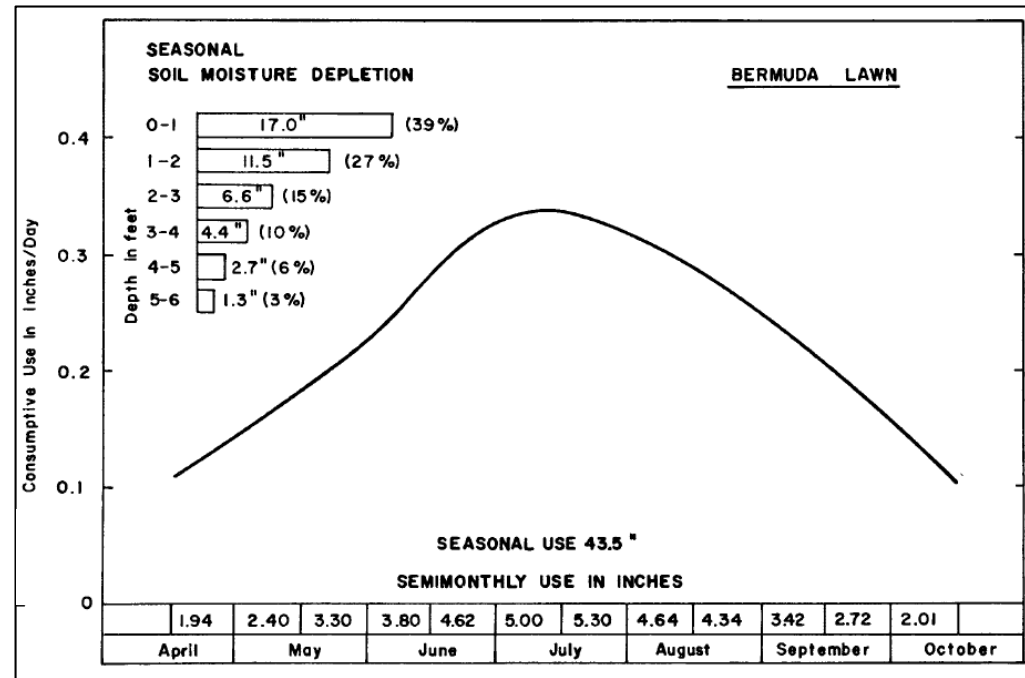
**Paul Brown & George Frisvold
Arizona Cooperative Extension
College of Agriculture & Life Sciences
University of Arizona**



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Water Use of Turfgrass in Arizona Circa 1980

- **Consumptive Use Curve**
 - Common Bermudagrass
 - Low Maintenance
 - Flood Irrigated
 - Every 2 Weeks
 - Mowed to 1.5"
 - Every 4 Weeks
 - Summer Only (No Overseed)
 - Consumptive Use: 43.5"



Source: USDA Conservation Research Report #29

Groundwater Management Act of 1980

- **Active Management Areas**
 - Assured Water Supply
 - Safe Yield by 2025
- **Water Management Plans**
 - Water Use Reporting
 - Conservation Targets
 - Irrigation Water Duties
 - Including Turfgrass



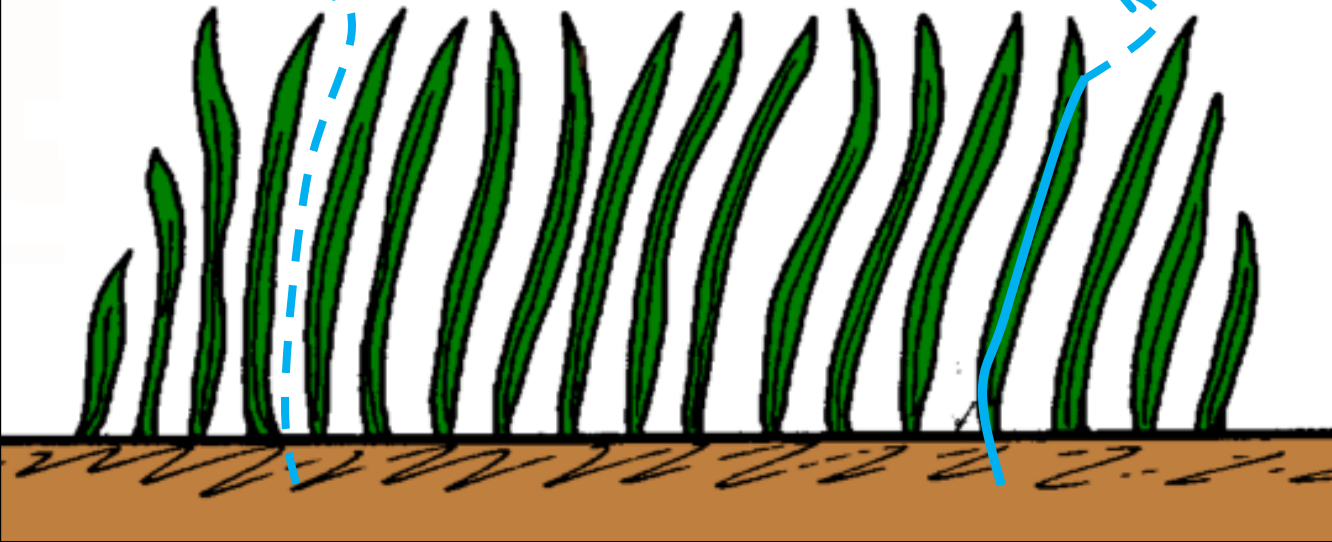
<http://www.azwater.gov/AzDWR/WaterManagement/AMAs/>

Limited Knowledge on Turf Water Use

Evapotranspiration (ET)

Evaporation

Transpiration



Factors Impacting ET

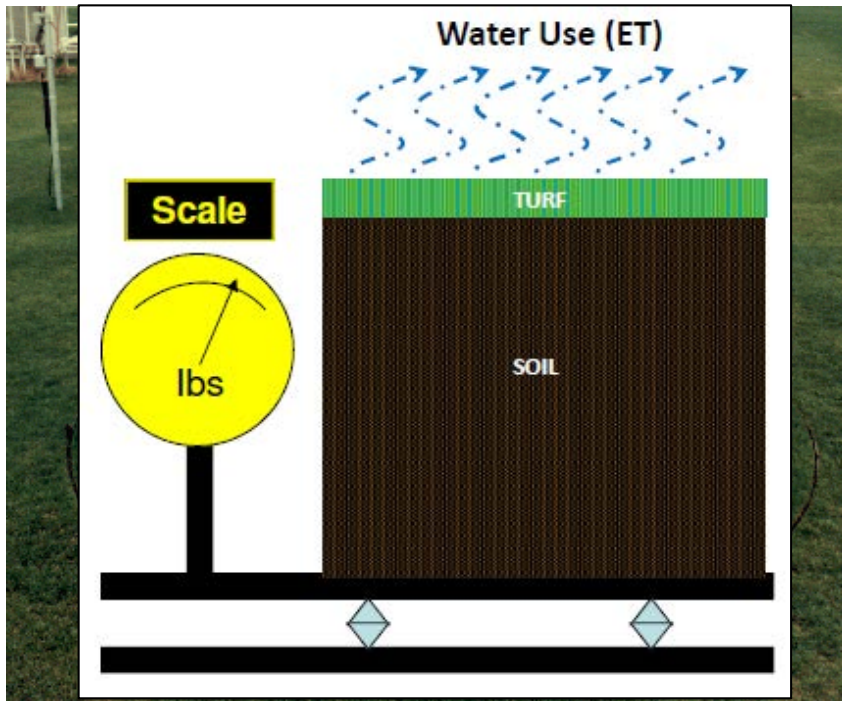
- Turf Type
 - >Warm vs Cool
- Soil Moisture
- Turf Condition
 - >Height/Density
 - >Growth Status
- Weather
 - >Sun
 - >Wind
 - >Humidity
 - >Temperature

ET: Evaporation from Vegetation

Water Use of Fairway Quality Desert Turfgrass

Funding: USGA, Cactus & Pine GCSAA, ADWR, Karsten Mfg, Phoenix & Univ. of Arizona

Lysimeters



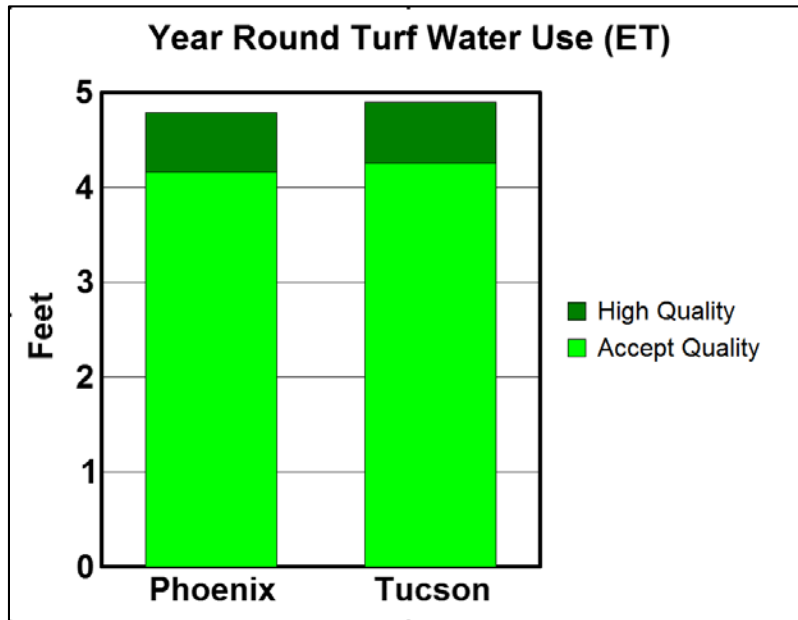
Measuring Water Use



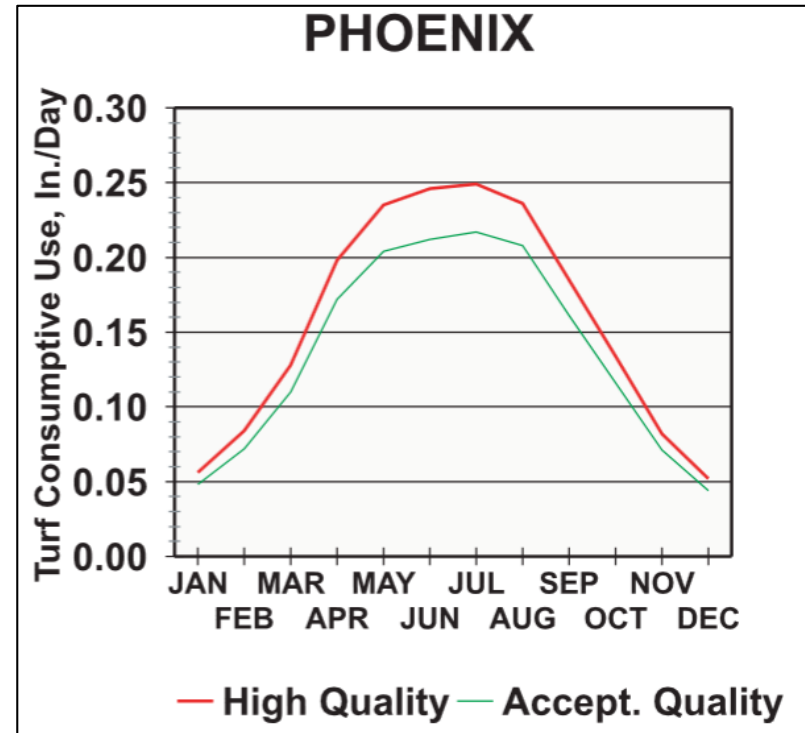
Estimating Water Use (Using Reference ET)

Turf Water Use

Total & Seasonal Dynamics Quantified



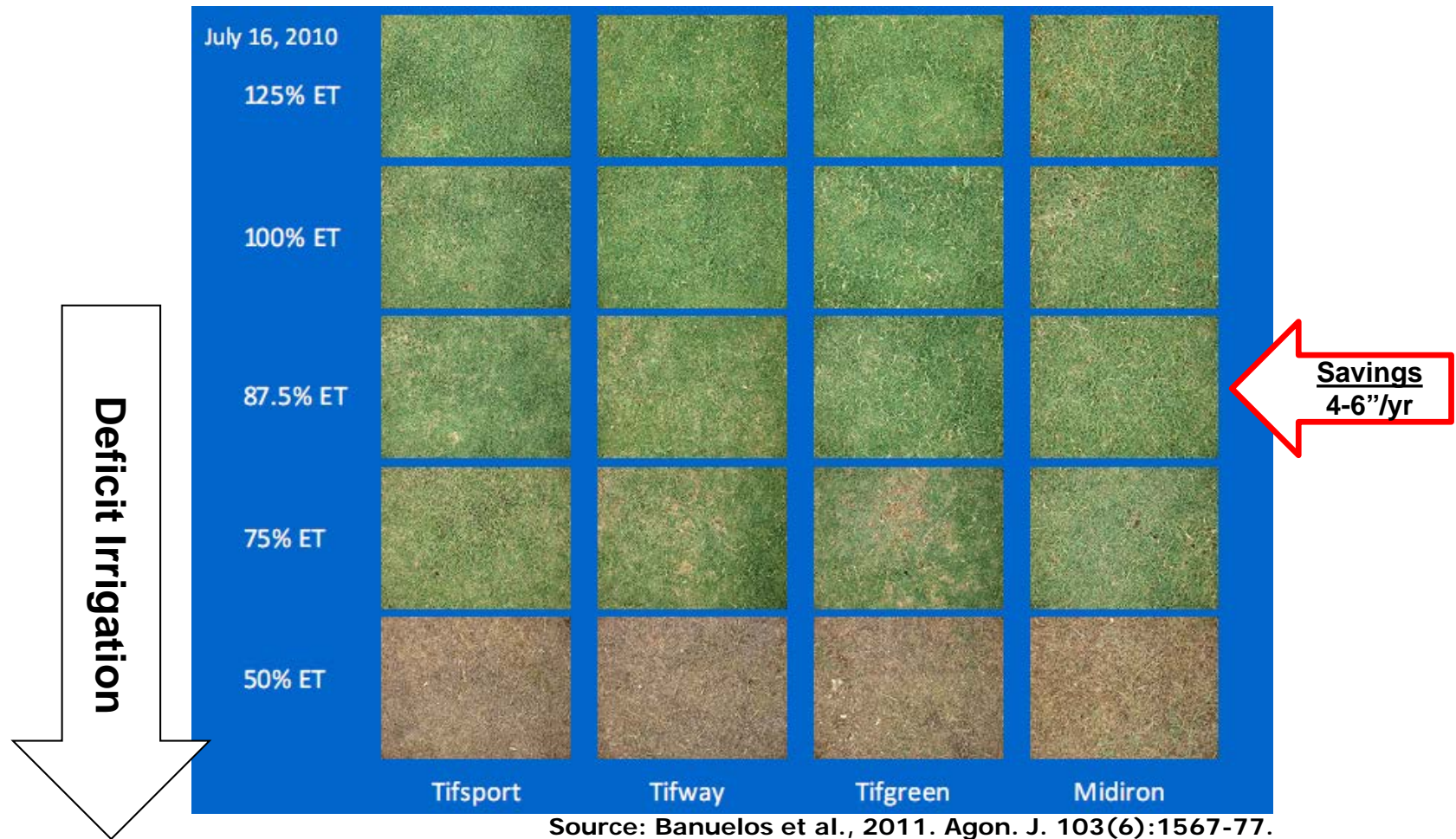
-- 4.2-4.9 Acre-Feet/Acre
 -- Dependent on Quality



-- Peak Demand: 0.25"/Day
 -- Varies 4-5X Over Year



Can We Use Less Than Optimal ET?



A qualified yes, provided facility can:

- Tolerate slower growth (slower recovery from use)
- Address the potential buildup of soil sodium & salinity levels

ESTIMATING TURF ET



Crop Coefficients (Kc): Convert ETos To Turf ET

Reference ET (ETos)

Cool Season Grass

4.7" (12 cm) Tall

Turf ET

0.75" Bermudagrass

$$ET_t = Kc * ETos$$


CROP COEFFICIENTS

For Desert Turf

Turf	Turf Quality			
	Maximum	Good	Acceptable	Minimum
Overseeded	0.83	0.75	0.68	0.60
Bermudagrass	0.80	0.70	0.60	0.50

Source: Brown et al., 2001. Crop Sci. 41:1197-1206.


Maximum: highest quality golf & sports turf, irrigated daily
Good: high quality golf & sports turf, irrigated every 2-3 days
Acceptable: parks & schools
Minimum: marginal to acceptable quality turf



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AZ1195

Revised 02/14

CONVERTING REFERENCE EVAPOTRANSPIRATION INTO TURF WATER USE

Paul Brown and Dave Kopec



Weather-Based Irrigation Scheduling

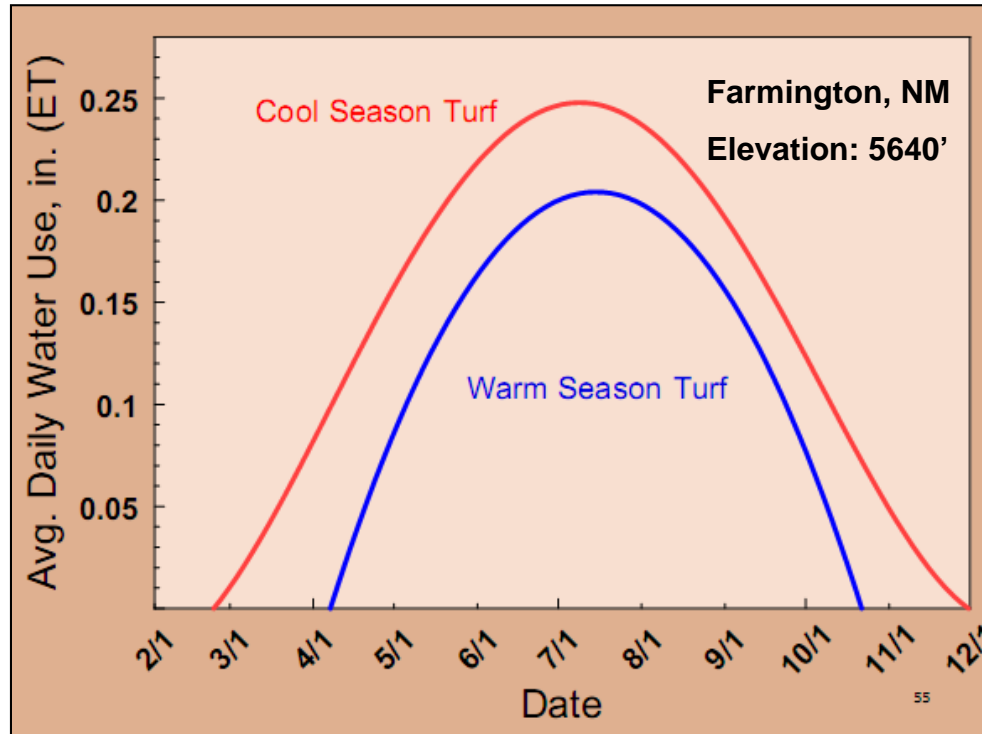


Most golf courses & many large parks now have weather stations to assist with irrigation management



Turf Water Use: Higher Elevations

Derived From Arizona, New Mexico & Colorado Research

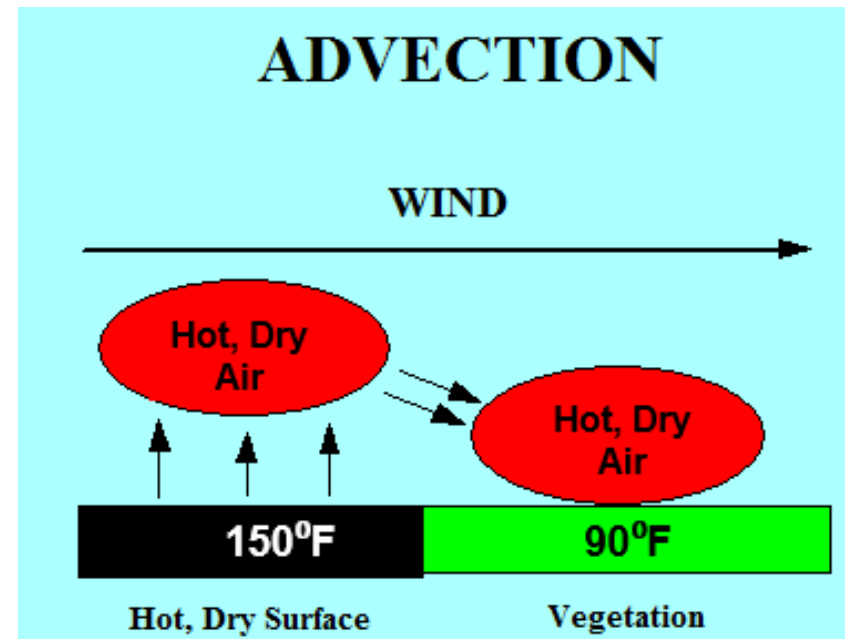


Source:
Dam Smeal
NM. State Univ.

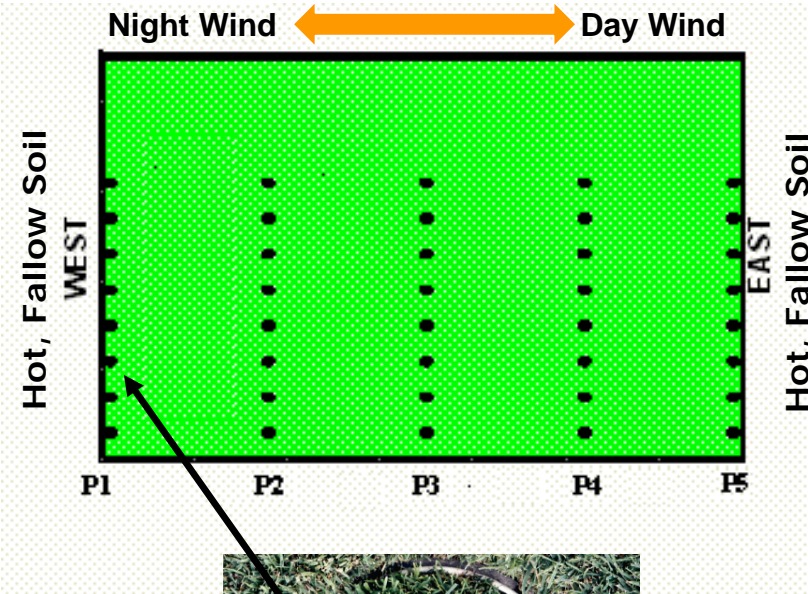
Results used to develop crop coefficients for cool season turfs.

Note: cool season turfs use 15-20% more water than warm season turfs when grown under similar conditions.

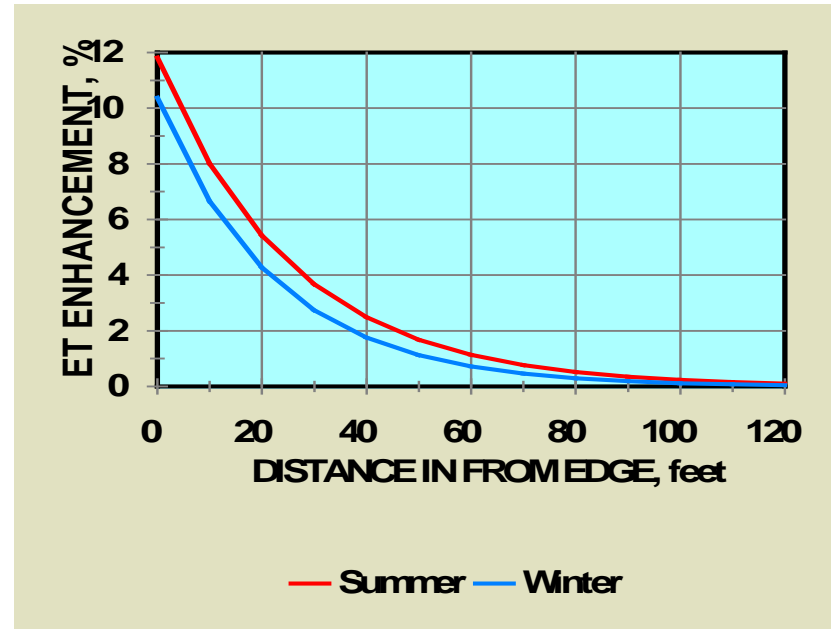
Water Use of Small Turf Areas/Edges Adjacent to Hot, Dry Surfaces



Small Turf Areas/Edges Use More Water



Micro-lysimeters in rows at various distances from hot, fallow ground



Normal ET Enhancement: 5-10%
Extreme Days: 20-25%

Local Turf Consumptive Use

 THE UNIVERSITY OF ARIZONA,
Cooperative Extension Turf Irrigation Management Series

 No. 5

**Turfgrass Consumptive Use Values
for the Phoenix Area**

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College of Agriculture and Life Sciences

AZ1353 Revised 11/11

**Turfgrass Consumptive Use:
Flagstaff, Arizona**

Paul W. Brown

 No. 6

 THE UNIVERSITY OF ARIZONA,
Cooperative Extension Turf Irrigation Management Series

 No. 4


**Turfgrass Consumptive Use Values
for the Tucson Area**

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AZ1447 Turf Irrigation Management Series 02/08

**Water Use of Turfgrass
Mohave County, Arizona**

 No. 9

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AZ1354 Revised 01/12

**Turfgrass Consumptive Use:
Prescott, Arizona**

Paul W. Brown and Jeff Schalaus

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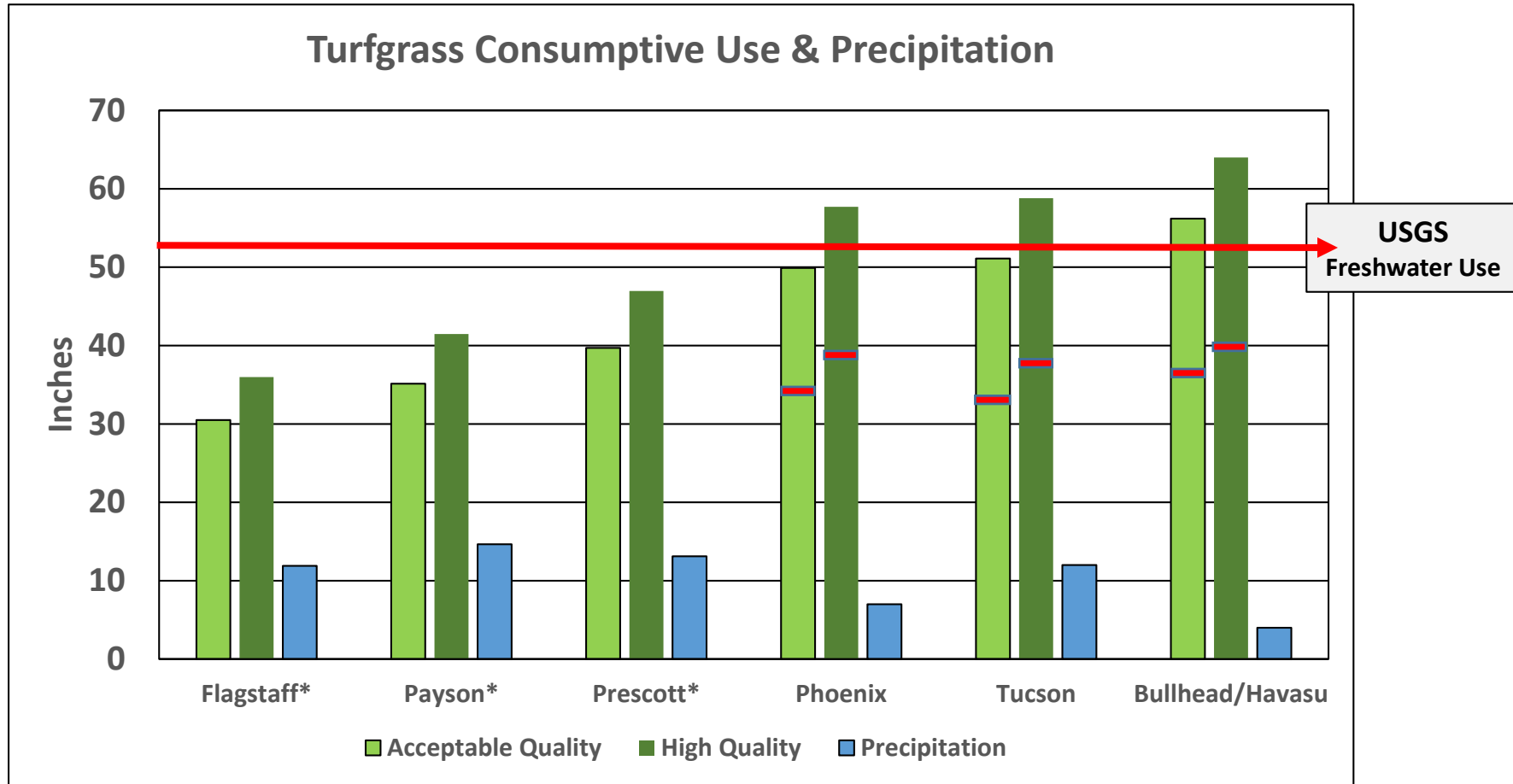
AZ1355 Revised 11/12

TURFGRASS CONSUMPTIVE USE: PAYSON, ARIZONA

Paul W. Brown and Chris Jones

 No. 8

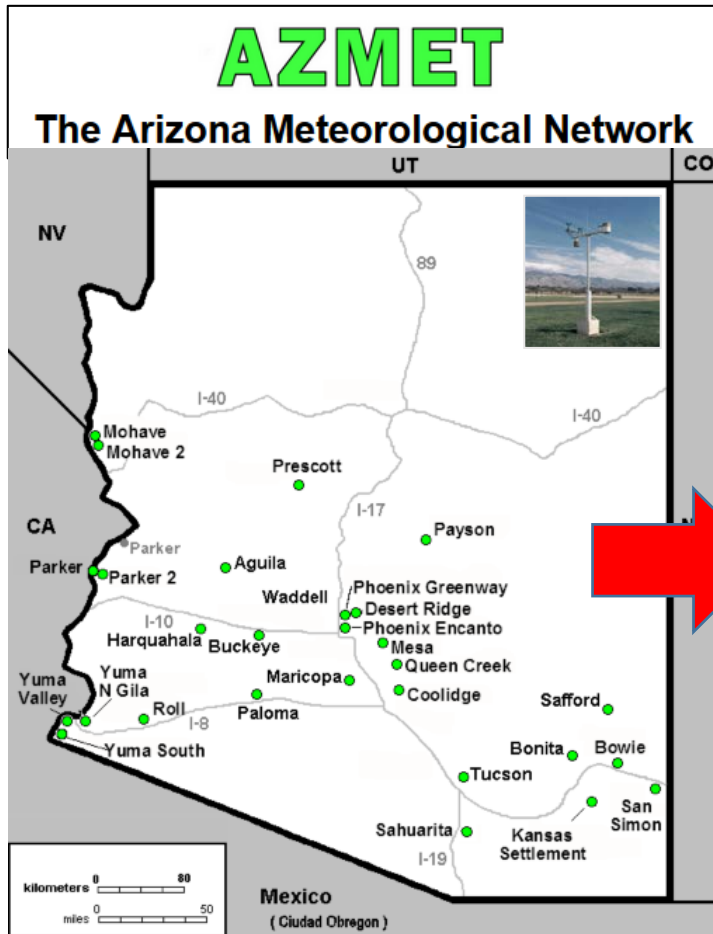
Turfgrass Consumptive Use: Arizona



* Values for Growing Season

— Not Overseeded

Distribution of Turf Water Use Information



Phoenix Area Turf Water Use Report

JUN, 20 2016

Turf: Bermuda

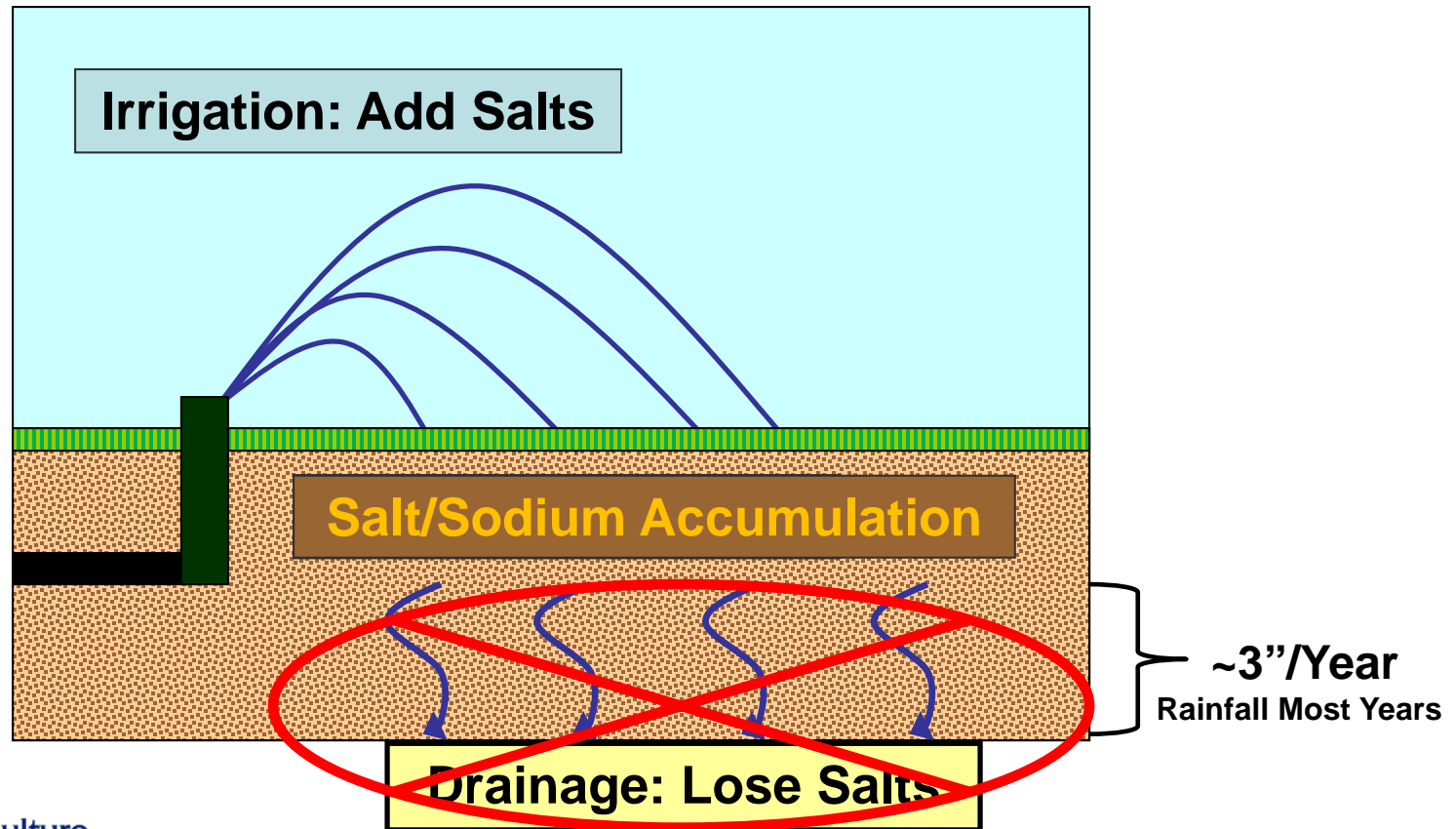
LOCATION	----- Water Use In Inches For Previous -----					
	Day		3 Days		7 Days	
	AC	HQ	AC	HQ	AC	HQ
Phoenix Greenway	.28	.31	.71	.81	1.50	1.71
Phoenix Encanto	.26	.29	.66	.75	1.42	1.62
Desert Ridge	.26	.29	.73	.83	1.55	1.76
Mesa	.26	.30	.73	.83	1.56	1.77
Buckeye	.29	.33	.79	.90	1.62	1.84
Queen Creek	.28	.31	.71	.81	1.62	1.84
Maricopa	.30	.34	.76	.87	1.75	1.99
AREA AVERAGE	.28	.31	.73	.83	1.57	1.79

AC: Acceptable Quality Turf
HQ: High Quality Turf

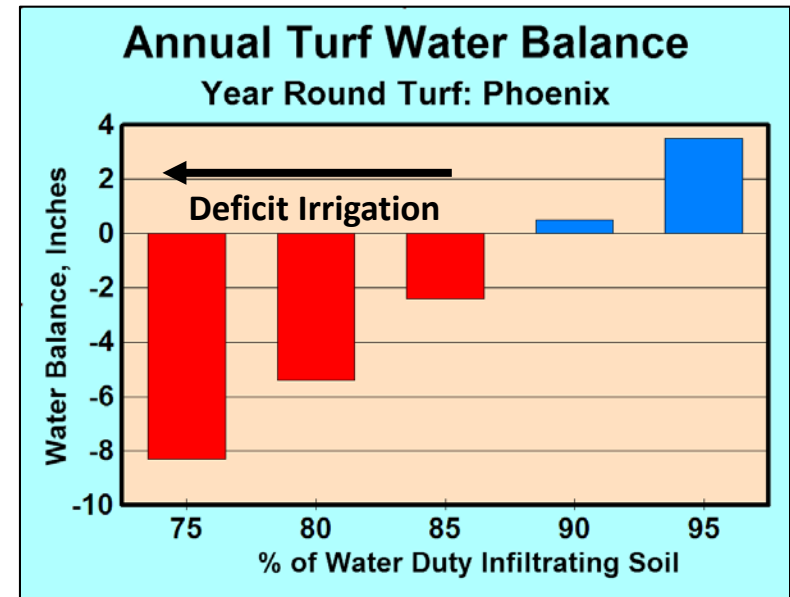
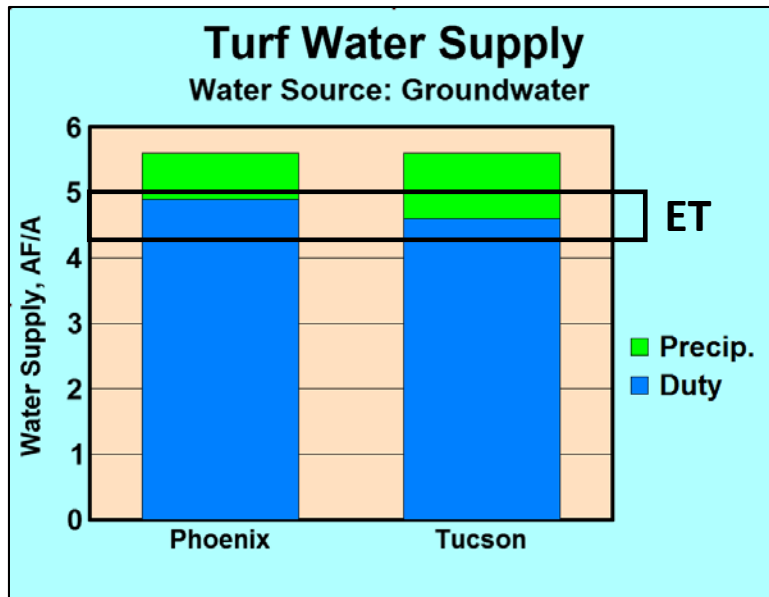
Updated daily & free of charge
Available by internet or delivery via email listserv

The Danger of Deficit Irrigation

- Deficit irrigation reduces amount of salt that is leached (leaching)
- Leaching/drainage is required to remove this salt!



EVALUATION OF ADWR WATER DUTIES FOR LARGE TURF FACILITIES

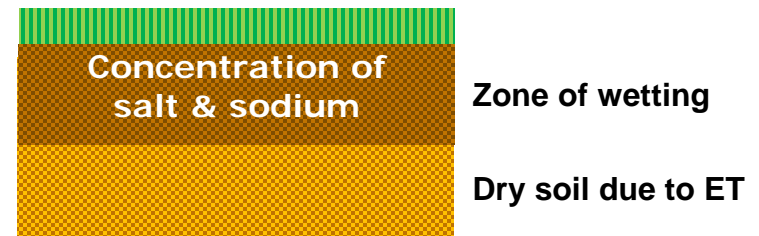
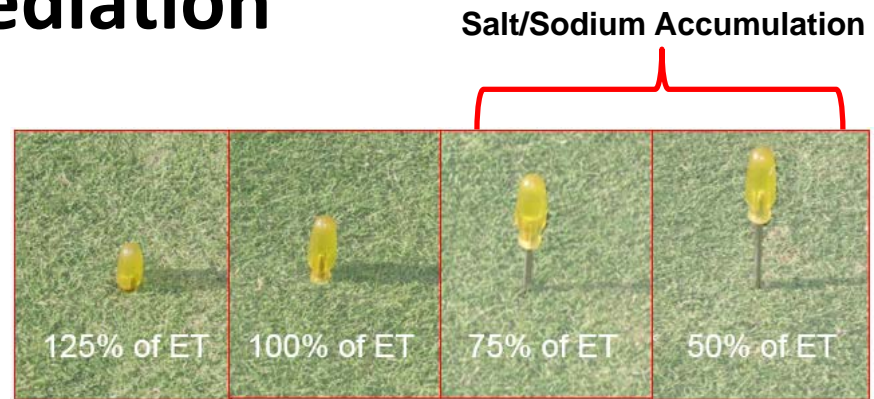



- Tight water supplies for turf
- Precipitation is important!
- Drought can create shortages

- Deficits possible when adjusted for efficiency!



Salt/Sodium Affected Soils Identification & Remediation





The University of Arizona 

Soil Structure: The Roles of Sodium and Salts

Dr. Jim Walworth
Department of Soil, Water and Environmental Science
University of Arizona


AZ 1414
July 2006
The University of Arizona Cooperative Extension

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FACTORS CONTRIBUTING TO DEVELOPMENT OF SALINITY PROBLEMS IN TURF

Paul Brown, Jim Walworth

AZ1527 August 2010

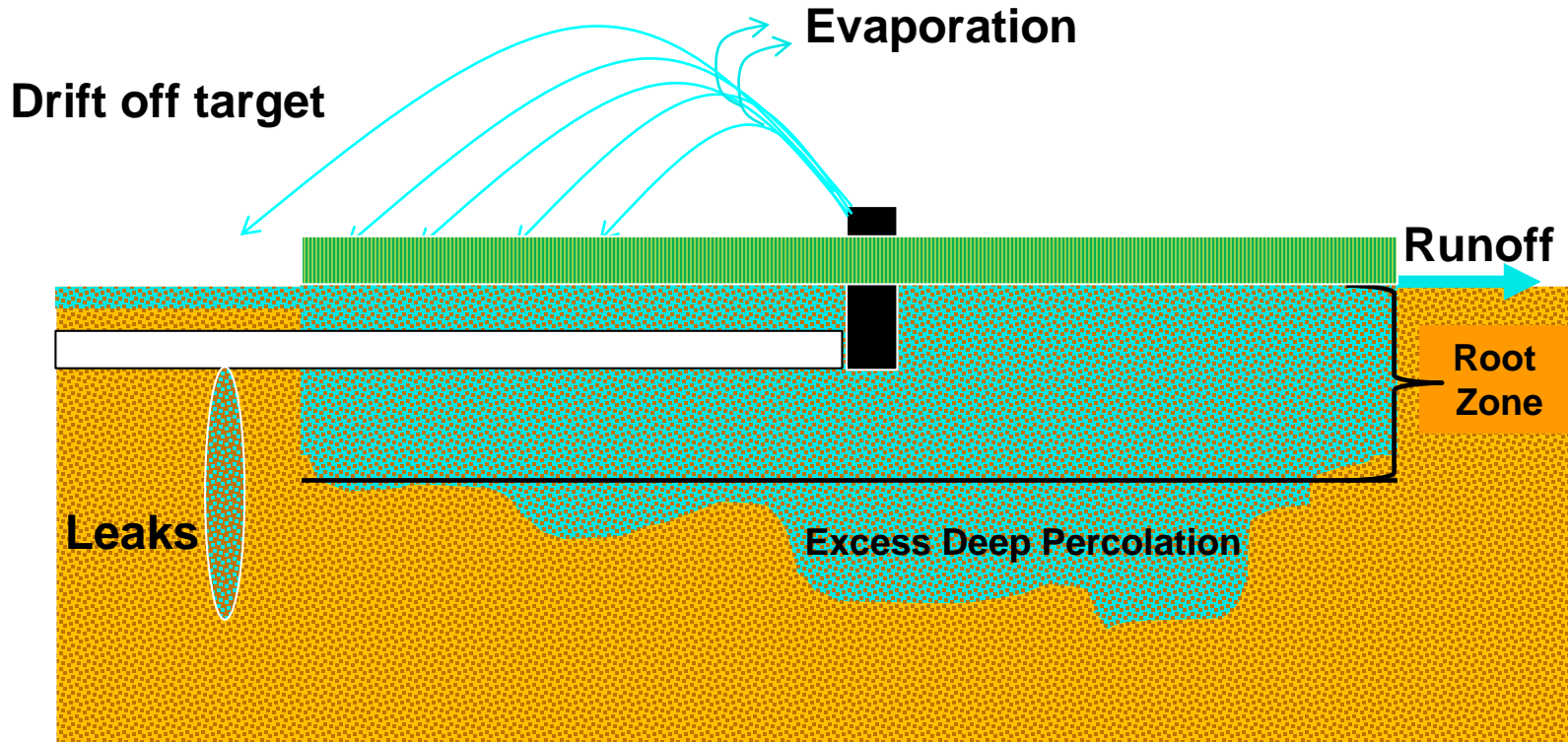
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AZ1413 Revised 08/12

USING GYPSUM AND OTHER CALCIUM AMENDMENTS IN SOUTHWESTERN SOILS

Dr. James Walworth

Irrigation Efficiency



Tight water supplies focused attention on irrigation efficiency



Irrigation Efficiency Improvements

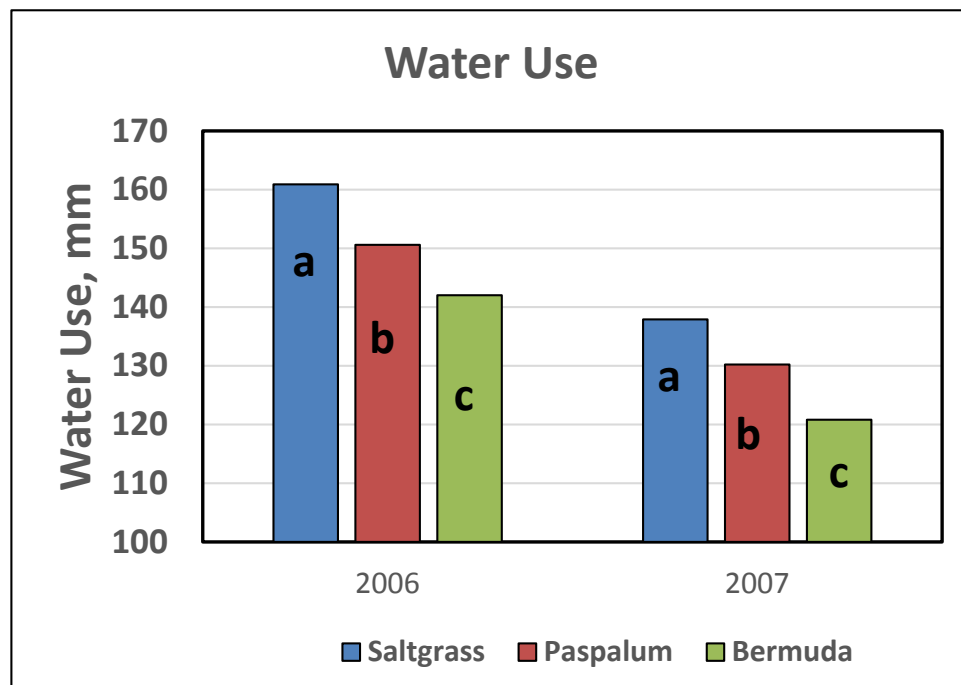
Irrigation Industry Driving New Tools to Market

- **System Maintenance/Mgmt**
 - Pressure Regulation
 - Nozzles
 - Level Heads
- **Weather Stations & ET**
- **Advanced Central Control**
- **Improved Sprinkler Design**
 - Higher Uniformity
- **Soil Moisture Monitoring**
- **Irrigation/Course Design**
- **GPS Technologies/Drones**



Alternative Grasses

Inland Saltgrass & Seashore Paspalum



-Salt tolerant grasses used more water!

-But can thrive on poor quality water

-Avoid drought (better water extraction)



AMA Turf Water Regulations

Large Turf Facilities (> 10 Acres)



Active Management Areas

AMAs
85% of Population
85% of Golf Turf

	Phoenix	Pinal	Tucson Santa Cruz	Prescott
Turf*	4.9 AF/A	4.8 AF/A	4.6 AF/A	4.9 AF/A
Water**	6.2 AF/A	6.2 AF/A	5.8 AF/A	5.5 AF/A
Low Water Landscape*	1.5 AF/A	1.5 AF/A	1.5 AF/A	1.5 AF/A
Effluent Incentive	0.6 AF/AF	0.7 AF/AF	0.7 AF/AF	0.6 AF/A
Flex Acct	+/-20%	+/-20%	+/-20%	+/-20%
Salinity Adj	≥1000 ppm	≥1000 ppm	≥1000 ppm	≥1000 ppm

* Golf course allocation for turf & low water use landscape computed as turf value multiplied by 5 acres.

** Golf course allocation limited to 0.14 acres of water surface per hole.

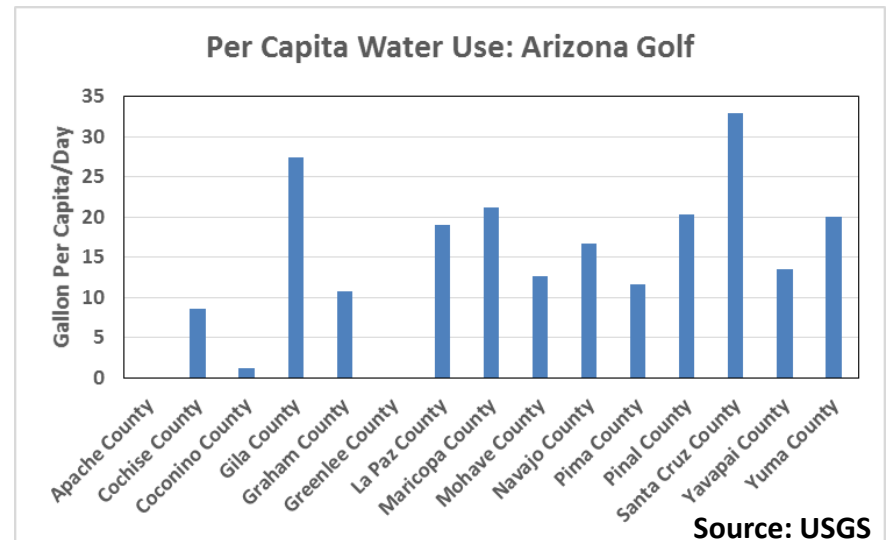
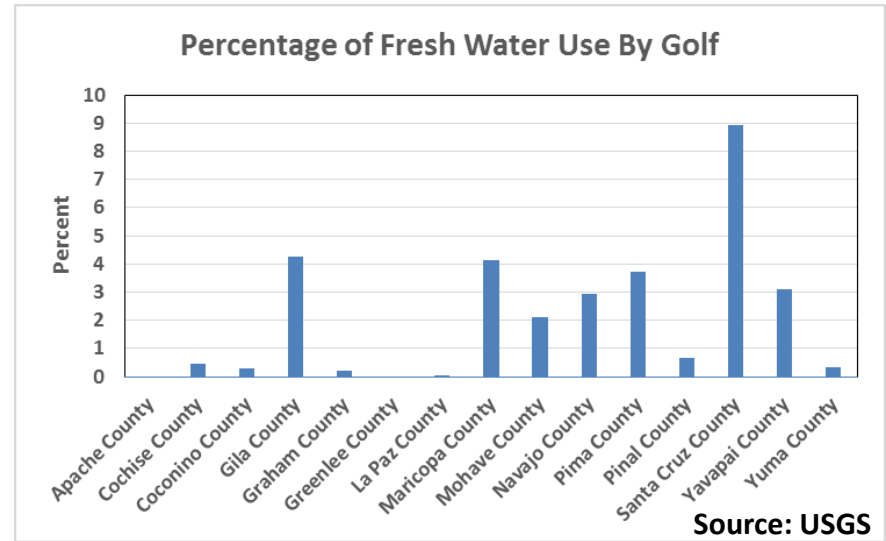
Turf Water Use in Arizona

- **USGS (Golf Only)**

- 29,680 Acres
- 1.9% of Freshwater
- 4.38 AF/A/Yr (52.5")
 - 18.8 gal/person/day

- **ADWR (> 10 acres)**

- Phoenix (591 Facilities)
 - All: 6.1% (GW:3%)
 - Golf: ~4%
 - Reclaimed: 22%
- Tucson (122 Facilities)
 - All: 7.3% (GW ~3%)
 - Golf: ~5.8%
 - Reclaimed: 57%



Additional Water-Related Information

Turfgrass Education, Research, and Extension

11th Annual

Desert Turf School

A one-week course
January 9-13, 2017
Phoenix, Arizona

Objective:

To provide a unique learning experience about desert turfgrass management for professional turfgrass managers. The distinctive arid climatic conditions of southern Arizona afford an opportunity for instruction on warm- and cool-season turfgrass management, saline and desert soils, and specialized irrigation practices. Participants will receive a certificate of completion for the desert turf school and may apply for GCSAA and other professional continuing education credits.

Audience:

Golf course superintendents
Sports turf managers
School, municipal, and recreational facilities managers
Professional landscapers

Topics:

Desert Turfgrass Species (warm and cool season)
Overseeding and Transition
Cultural Management Practices
Desert Soils, Fertility, and Nutrition
Salinity Principles and Management
Irrigation Audits and Analyses
Irrigation "Smart" Controllers
Heat and Drought Stress on Turfgrasses
Disease, Insect, Nematode and Weed Management

Features:

- Both lecture and field demonstrations;
- Interactions and dialogue between instructors and students;
- Class materials included in registration fee;
- Lunches and refreshments provided daily.

Time and Location:

Start with lunch on Monday afternoon and continue through lunch on Friday.
Remainder of daily classes are 8 AM to 5 PM.
The University of Arizona Maricopa County Cooperative Extension office is located at 4341 E. Broadway Rd, Phoenix, AZ 85040 which is easy access from I-10 and minutes south of the airport.

Accommodations:

Several hotels are within walking distance or a short drive to class. Hotel rooms are not included in the registration fee.



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AZ1194
BASICS OF EVALUATING TURFGRASS

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Cooperative Extension
STANDARDIZATION OF TURFGRASS EVALUATION
A NEW PROCEDURE FOR

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COOPERATIVE EXTENSION
AZ1195
CONVERTING TURFGRASS FROM

THE UNIVERSITY OF ARIZONA
06/06
TURFGRASS DUTIES AND RESPONSIBILITIES

THE UNIVERSITY OF ARIZONA
College of Agriculture and Life Sciences
August 2010
DEVELOPMENT OF TURFGRASS

Revised 08/12
TURFGRASS AMENDMENTS AND

