Turfgrass in Arizona: Water Requirements & Economic Impact

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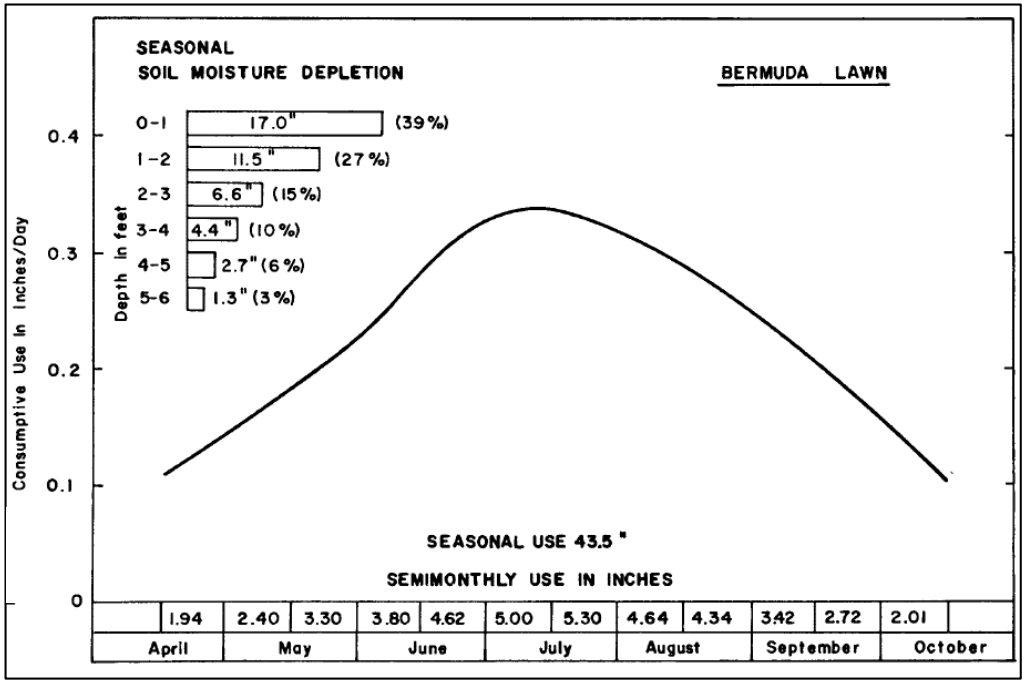
Water Use of Turfgrass in Arizona
Circa 1980

- **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”



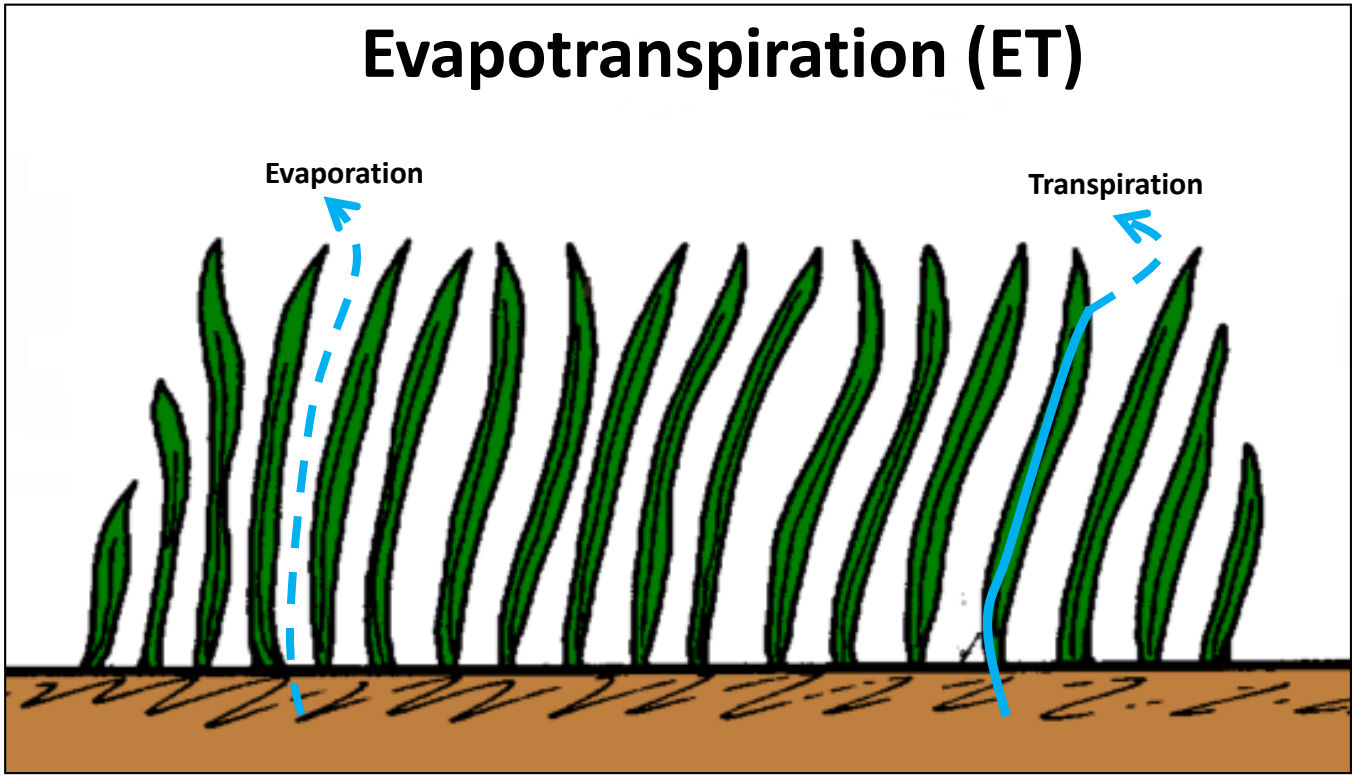
Source: USDA Conservation Research Report #29

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



ET: Evaporation from Vegetation

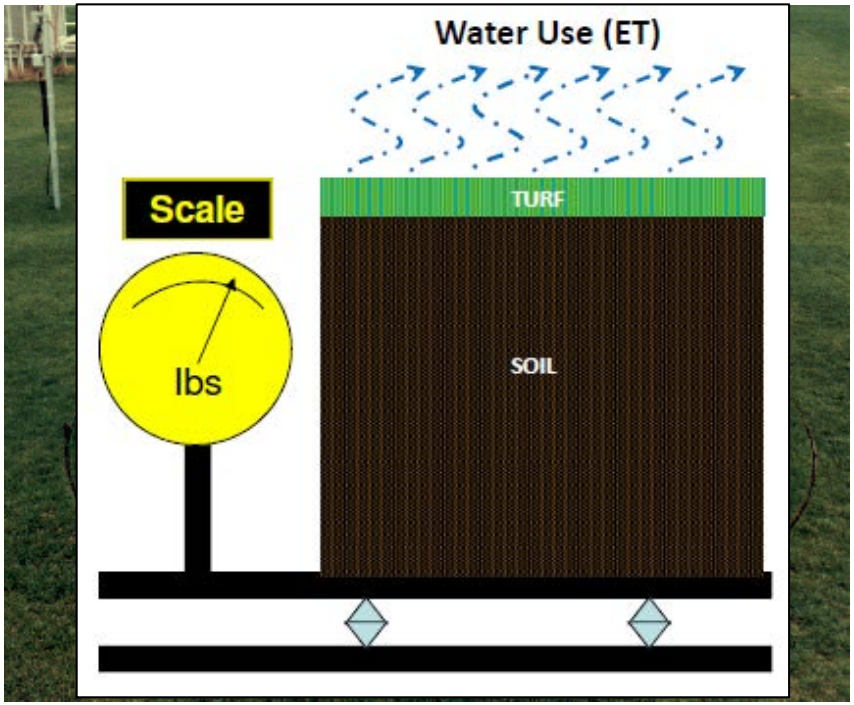
Factors Impacting ET

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

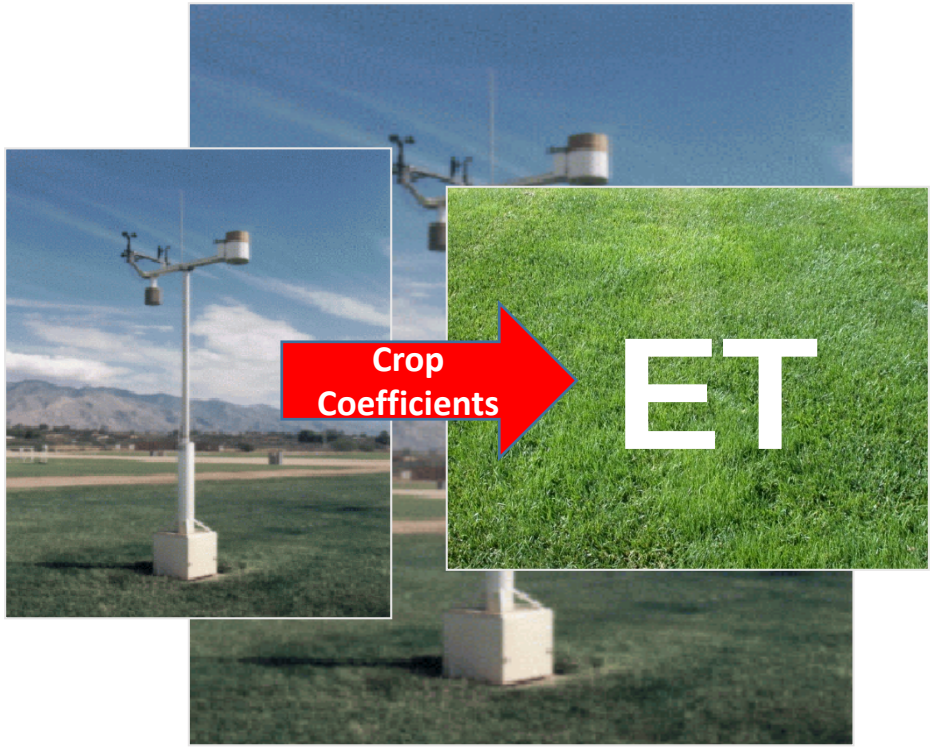
Water Use of Fairway Quality Desert Turfgrass

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

Lysimeters



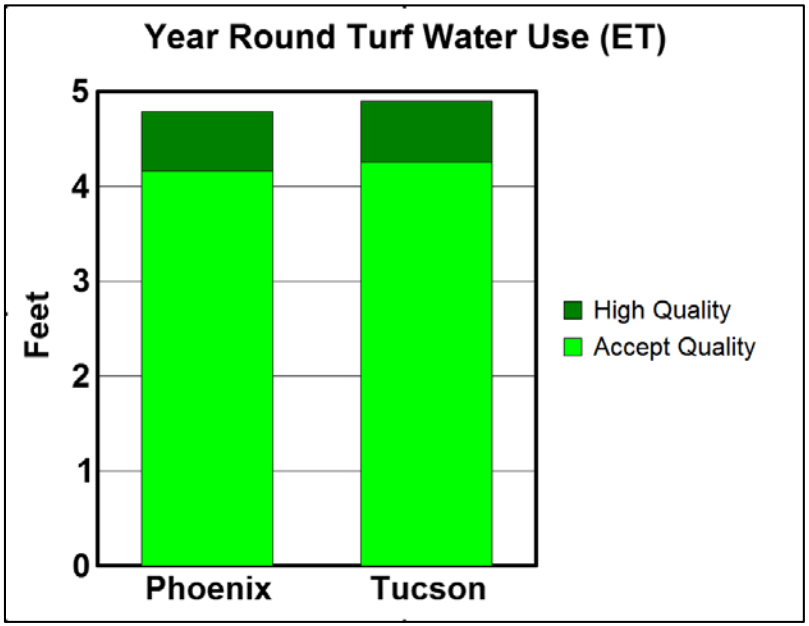
Measuring Water Use

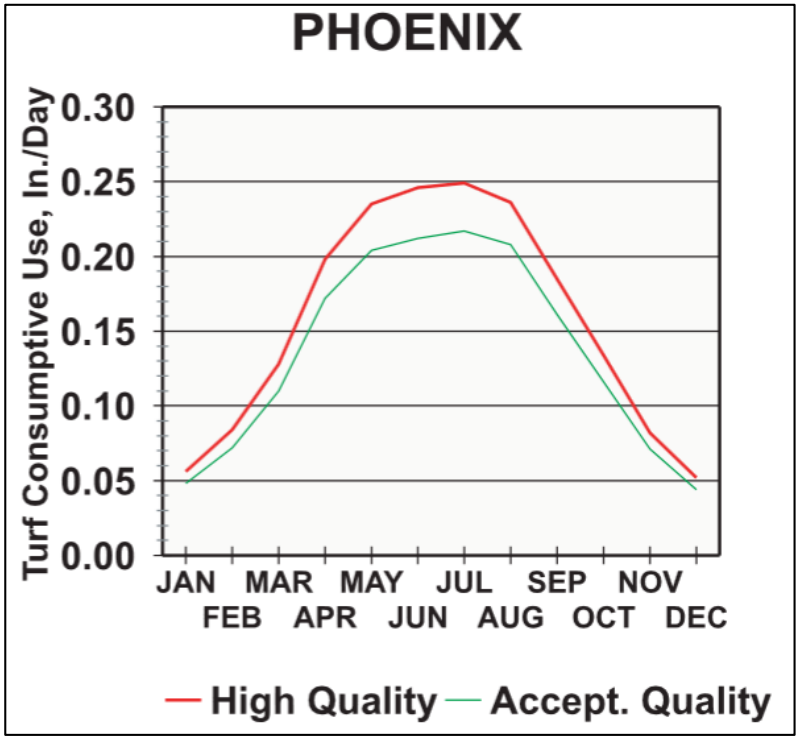


Estimating Water Use (Using Reference ET)

Turf Water Use

Total & Seasonal Dynamics Quantified

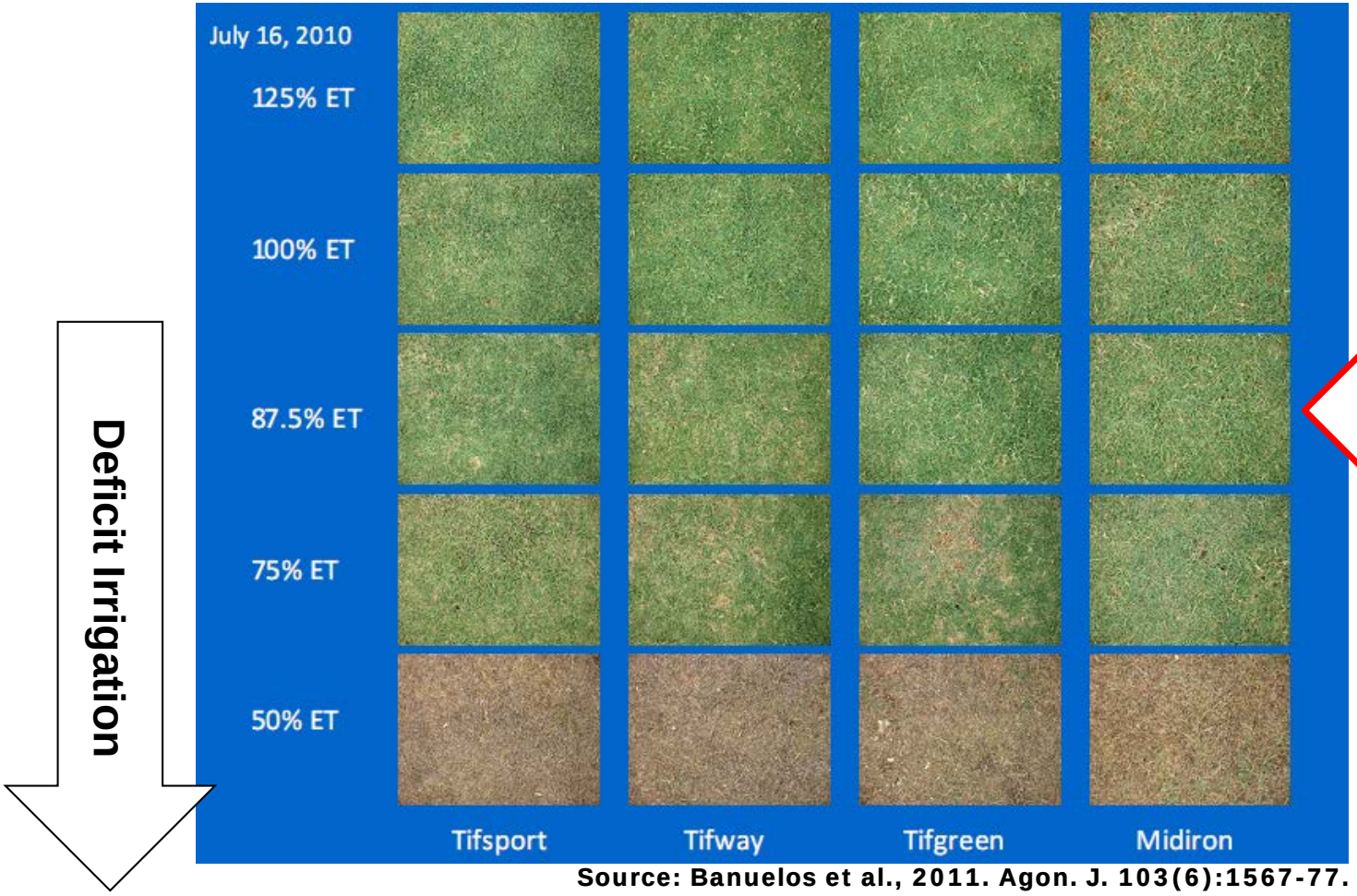




-- 4.2-4.9 Acre-Feet/Acre
-- Dependent on Quality

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

Can We Use Less Than Optimal ET?



Source: Banuelos et al., 2011. Agon. J. 103(6):1567-77.

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

$$ET_t = Kc * ETos$$

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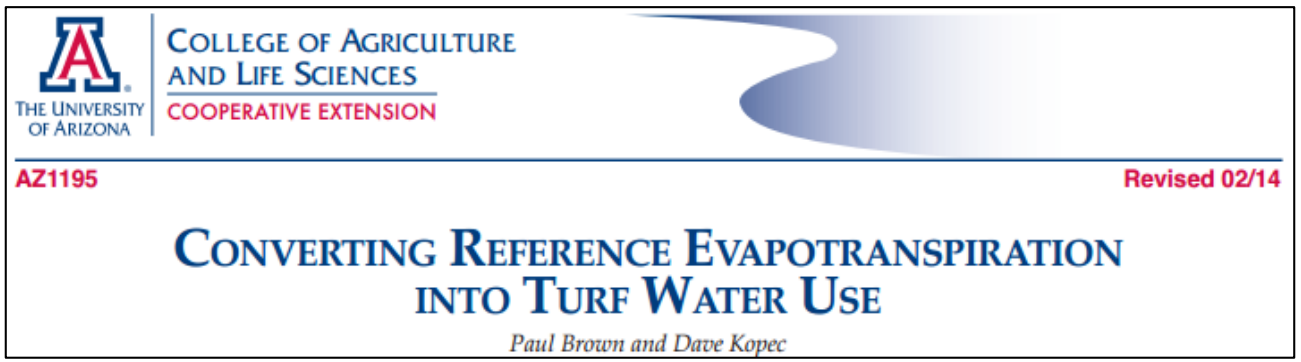
CROP COEFFICIENTS

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

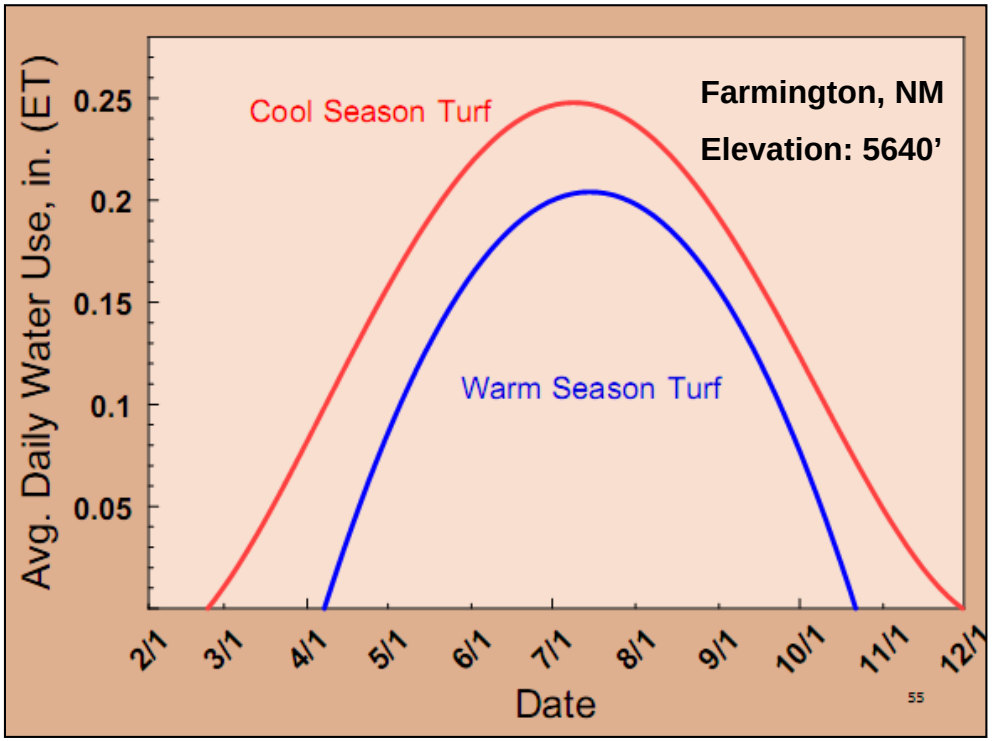


Weather-Based Irrigation Scheduling

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



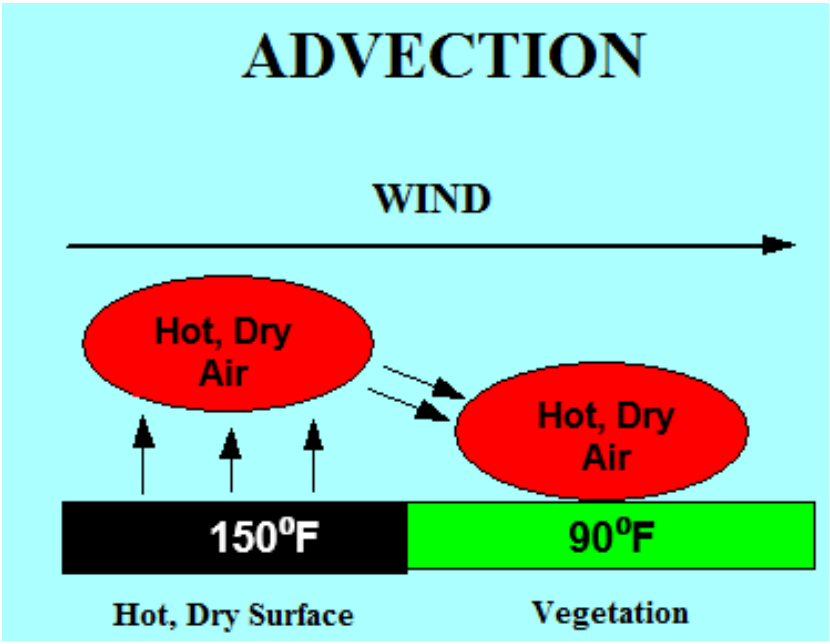
Source:
Dam Smeal
NM. State Univ.

Results used to develop crop coefficients for cool season turfs.

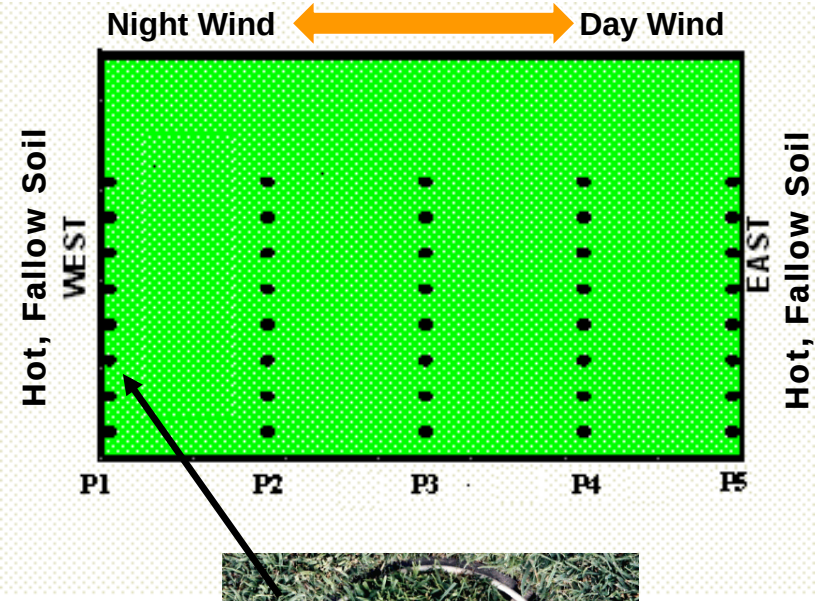
Note: cool season turfs use 15-20% more water than warm season turfs when grown under similar conditions.

Water Use of Small Turf Areas/Edges

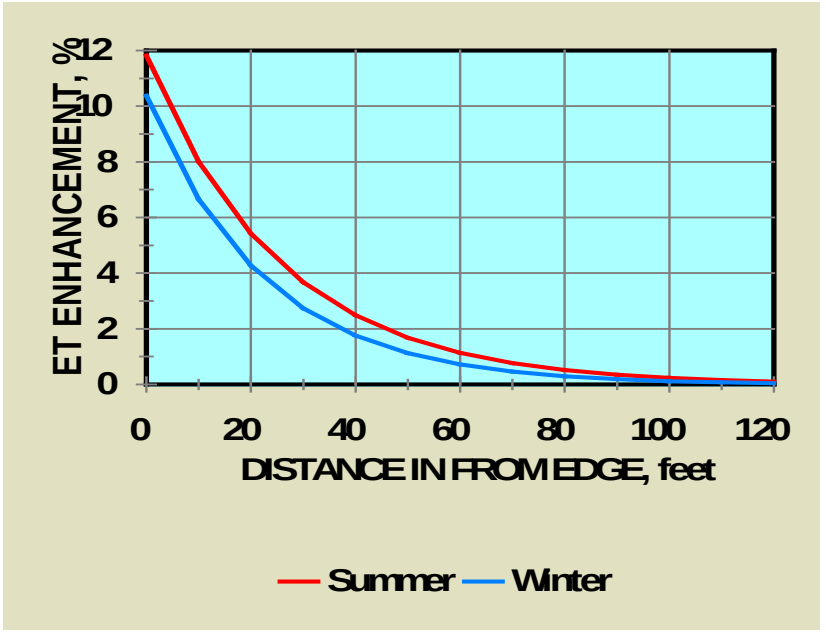
Adjacent to Hot, Dry Surfaces



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%

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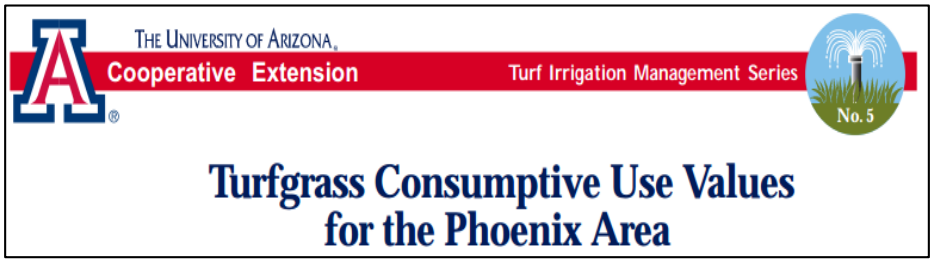
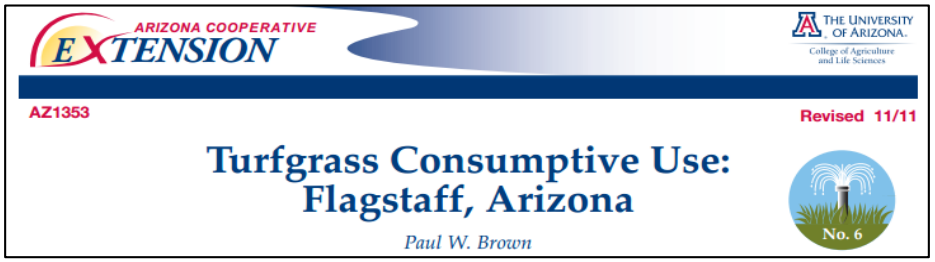
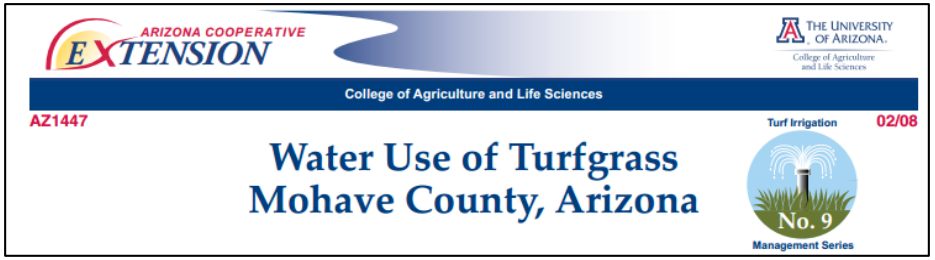
Local Turf Consumptive Use







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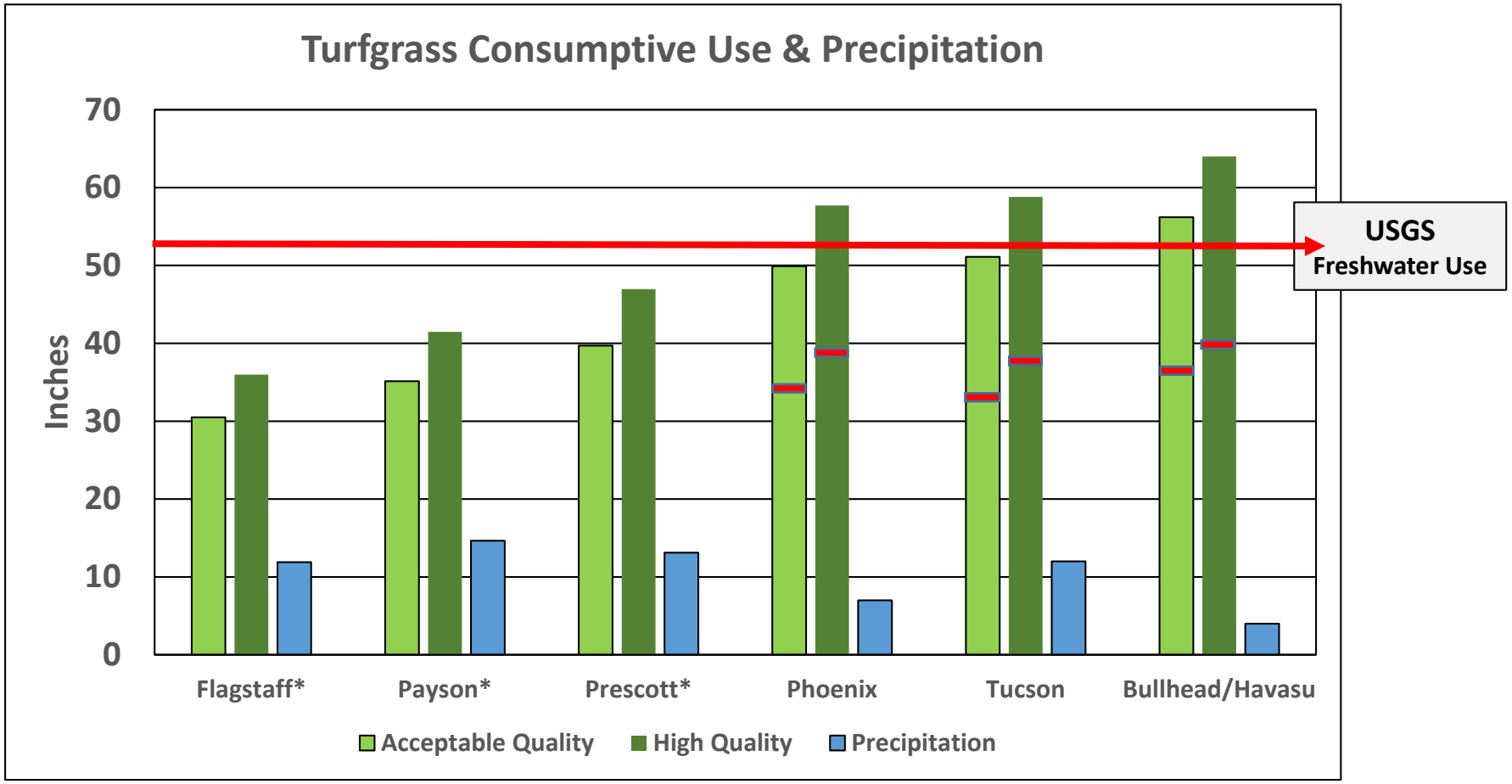
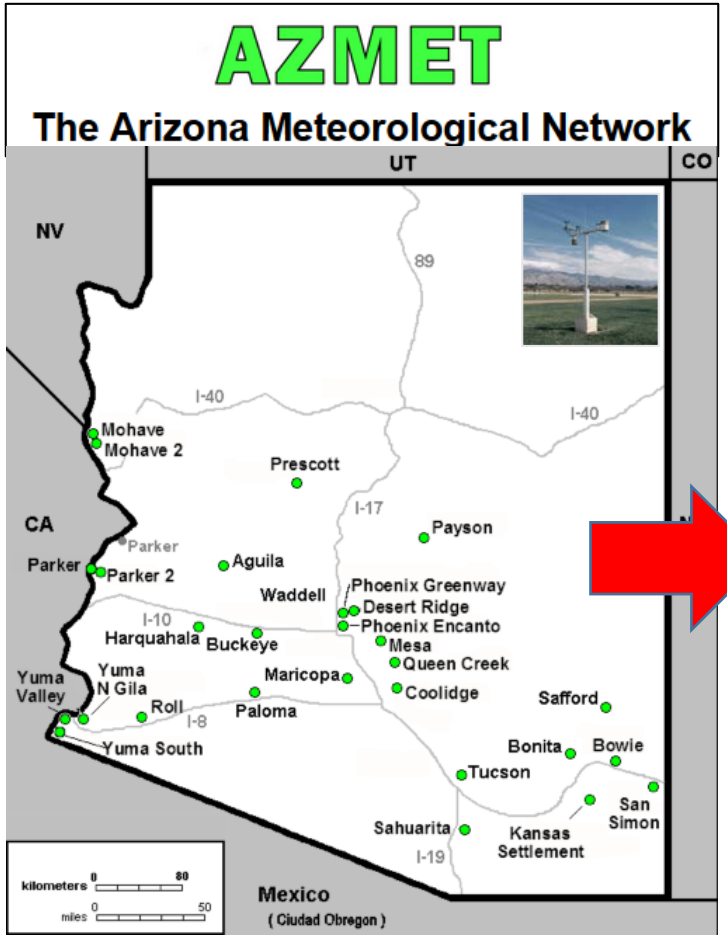
Turfgrass Consumptive Use: Arizona



* 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 AC	Day HQ	3 Days AC	3 Days HQ	7 Days AC	7 Days 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

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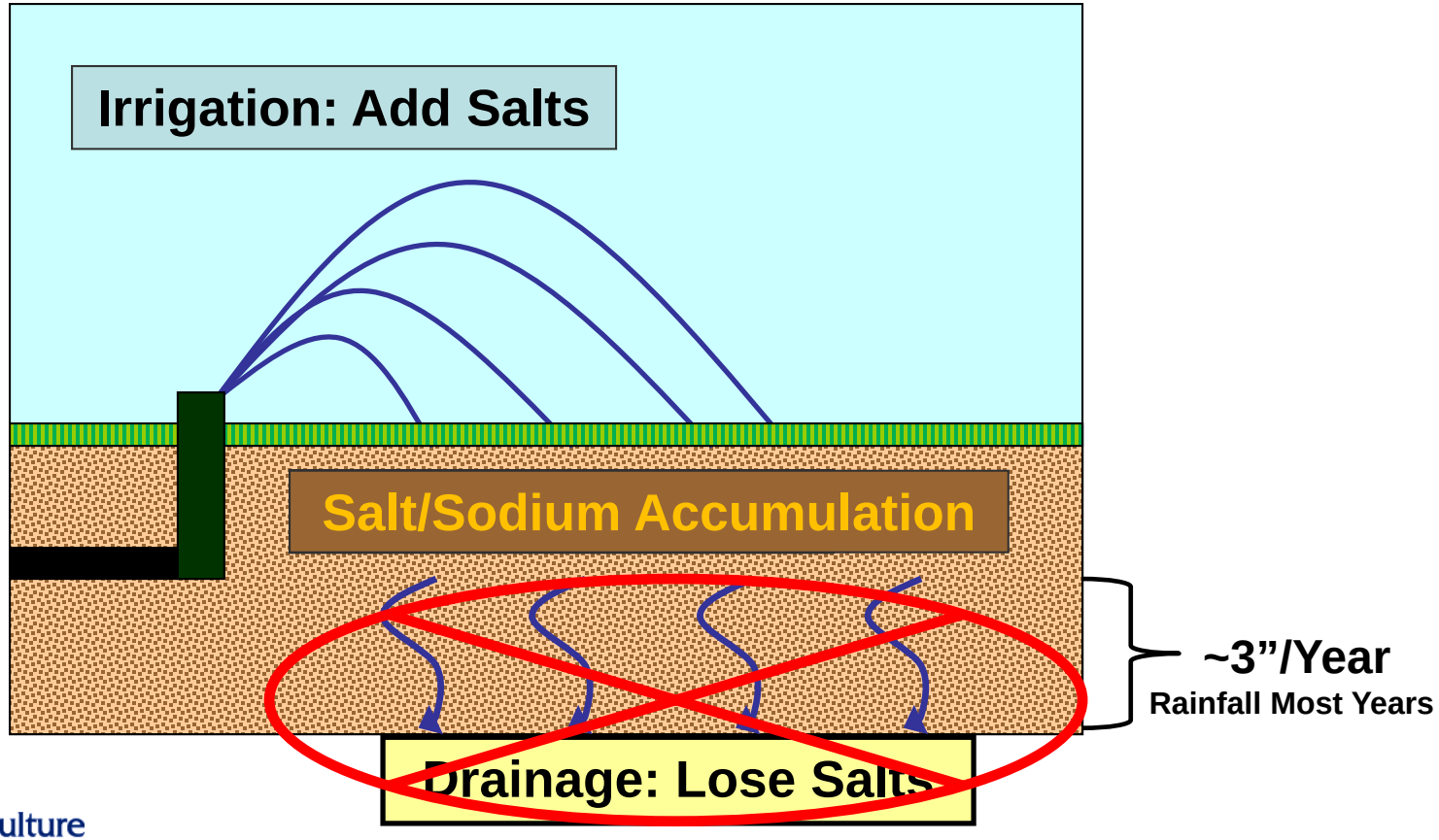
The Danger of Deficit Irrigation

- Deficit irrigation adds 5-7 tons of salt/acre each year!
- Leaching/drainage is required to remove this salt!



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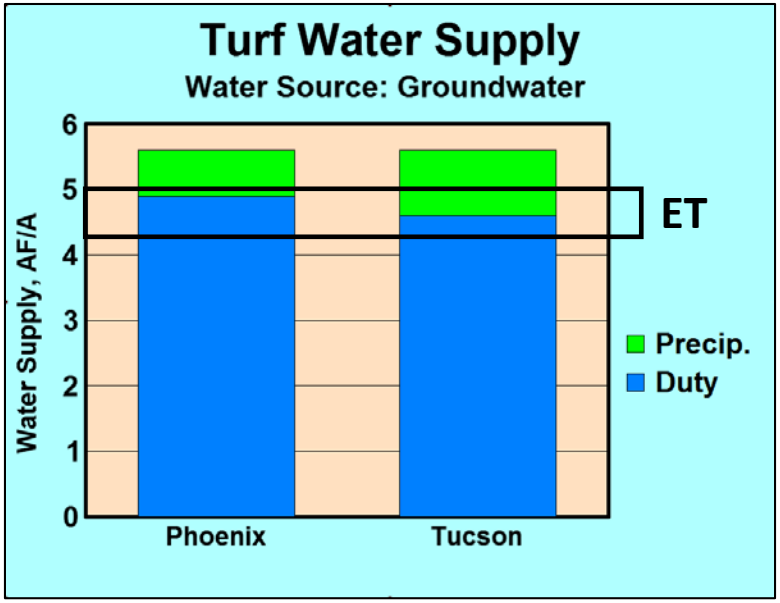
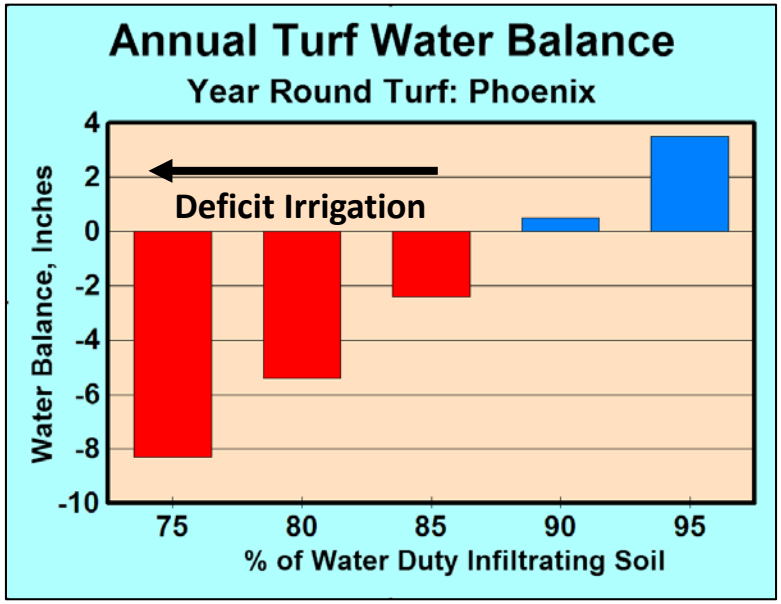
AZ1381 06/06

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

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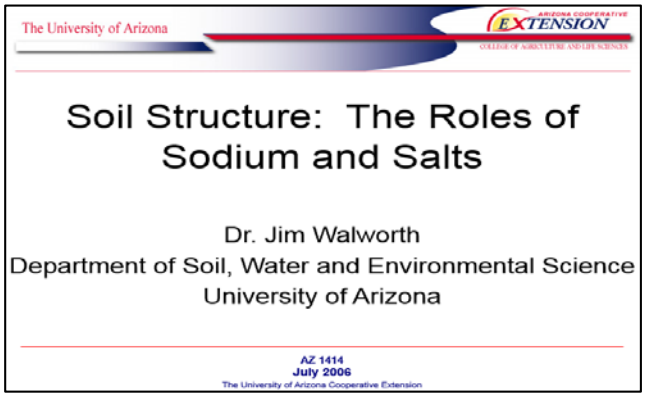
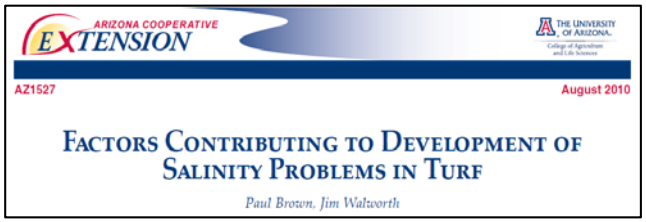
Poor surface soil structure caused by sodium accumulation & compaction inhibits infiltration

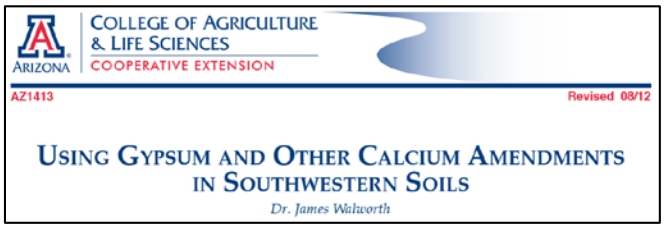
Salt/Sodium Accumulation

Zone of wetting

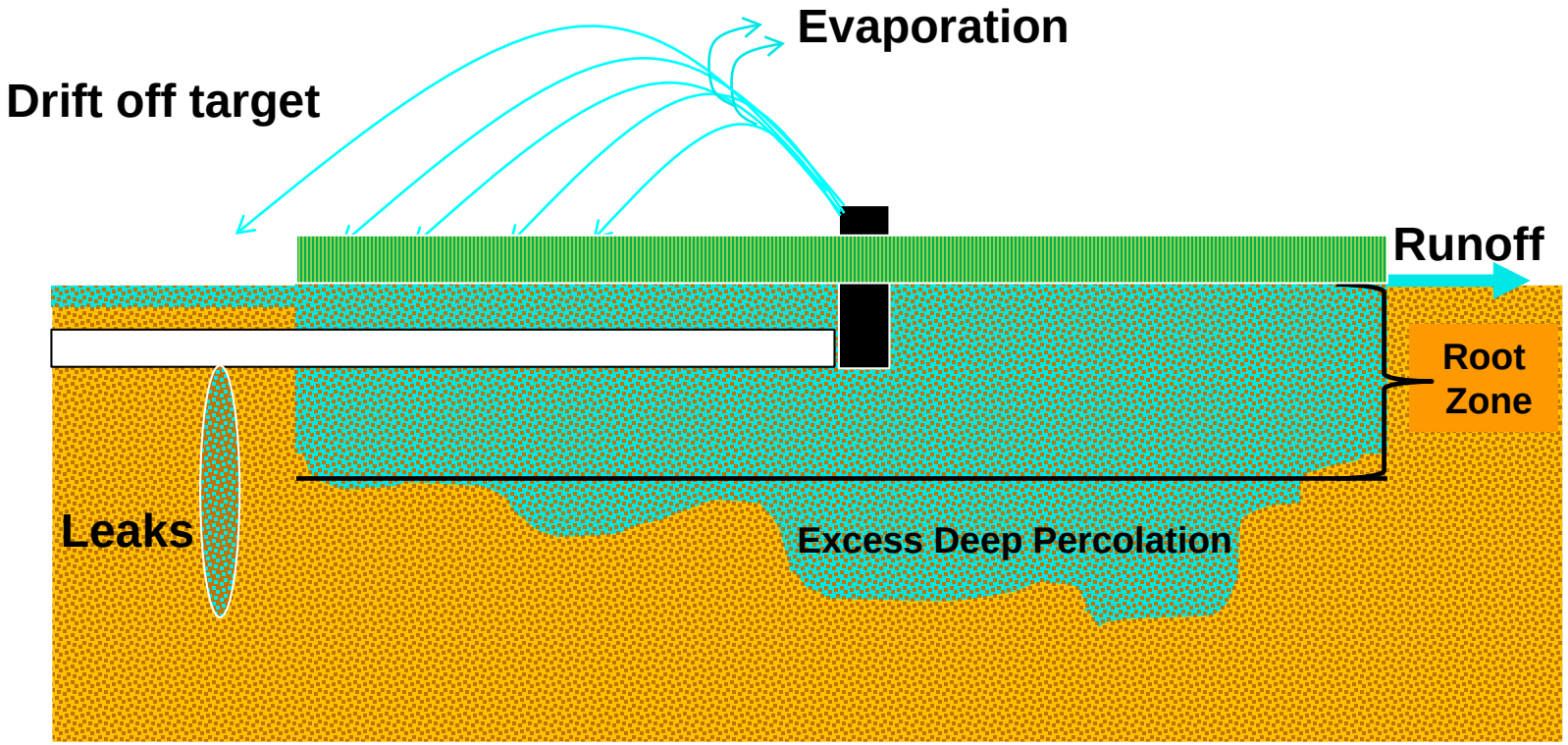
Dry soil due to ET







Irrigation Efficiency



Tight water supplies focused attention on irrigation efficiency

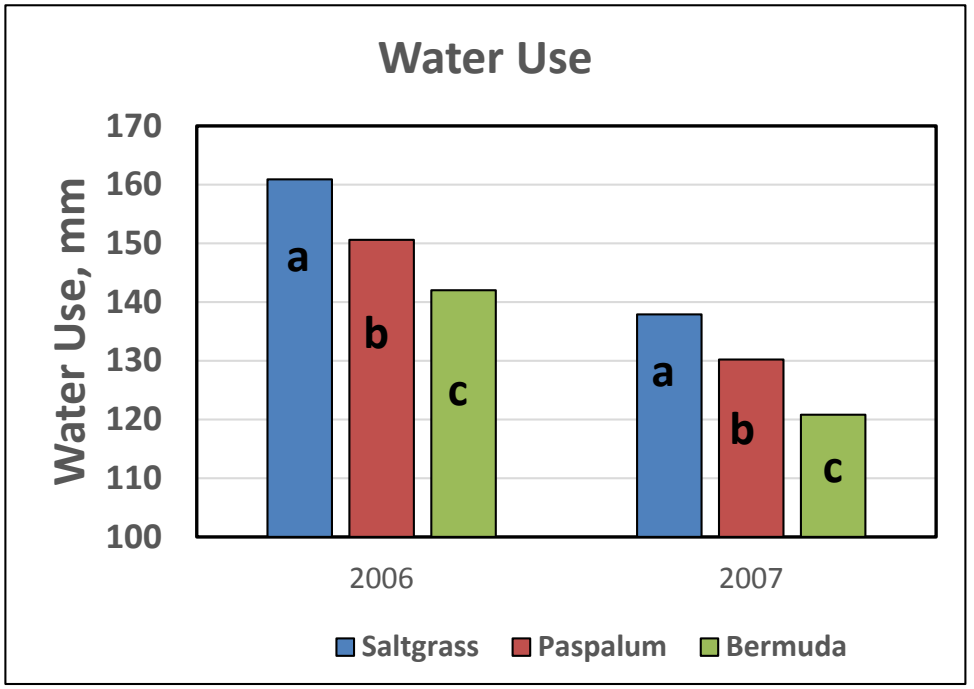
Irrigation Efficiency Improvements

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)

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AMA Turf Water Regulations
Large Turf Facilities (>10 Acres)

Active Management Areas

	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

AMAs
85% of Population
85% of Golf Turf

* 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.

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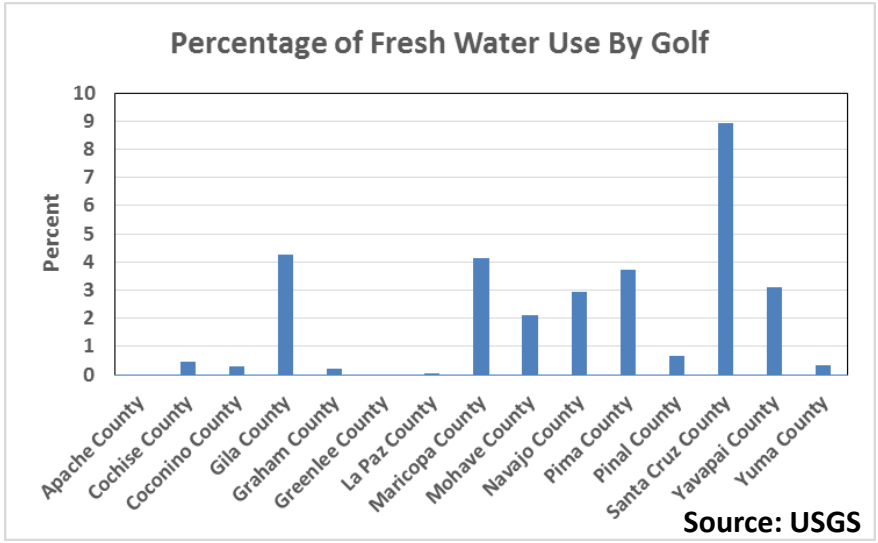
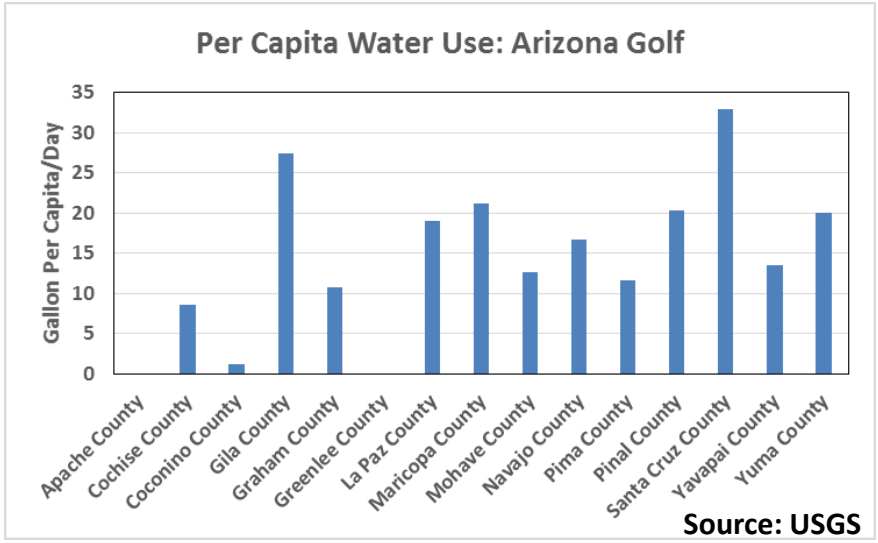
Turf Water Use in Arizona

- **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%



Source: USGS



Source: USGS

Additional Water-Related Information