



Smart Irrigation – Making Every Drop Count

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UF/IFAS Center for Landscape Conservation and Ecology

- Mission
 - To protect and conserve Florida's natural resources through research-based sustainable urban landscape practices.
- Vision
 - To be the leading source of science-based information on horticulture and the urban environment in Florida.

Why Worry About Water?

- 17.5% population growth 2000→2010
- Florida will be 3rd most populous state by 2030

Water – How Much and Where?

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 - 3,200 gal/mon
 - 38,400 gal/yr

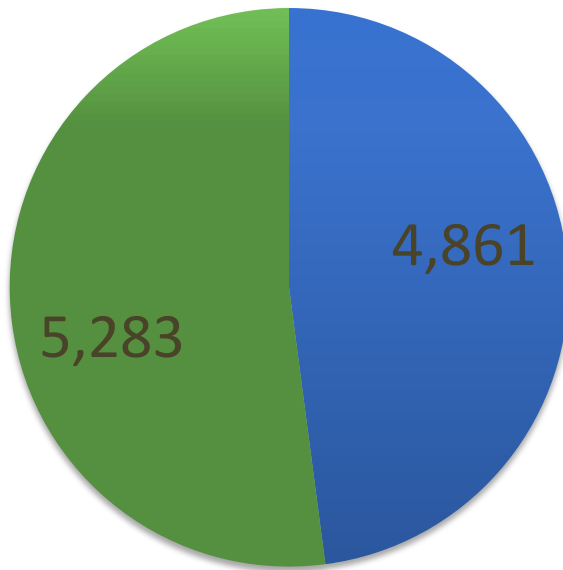
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- How much water is used in FL landscapes?

Mean Water Use Distribution

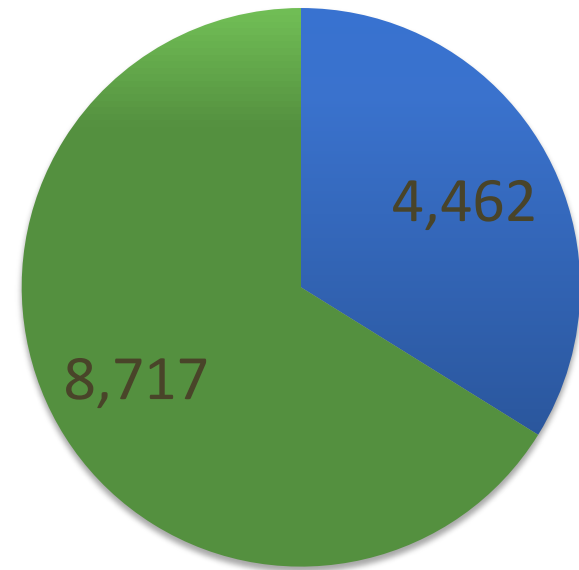
(gal/mon)

Tampa Water Dept.
121,728 gal/yr



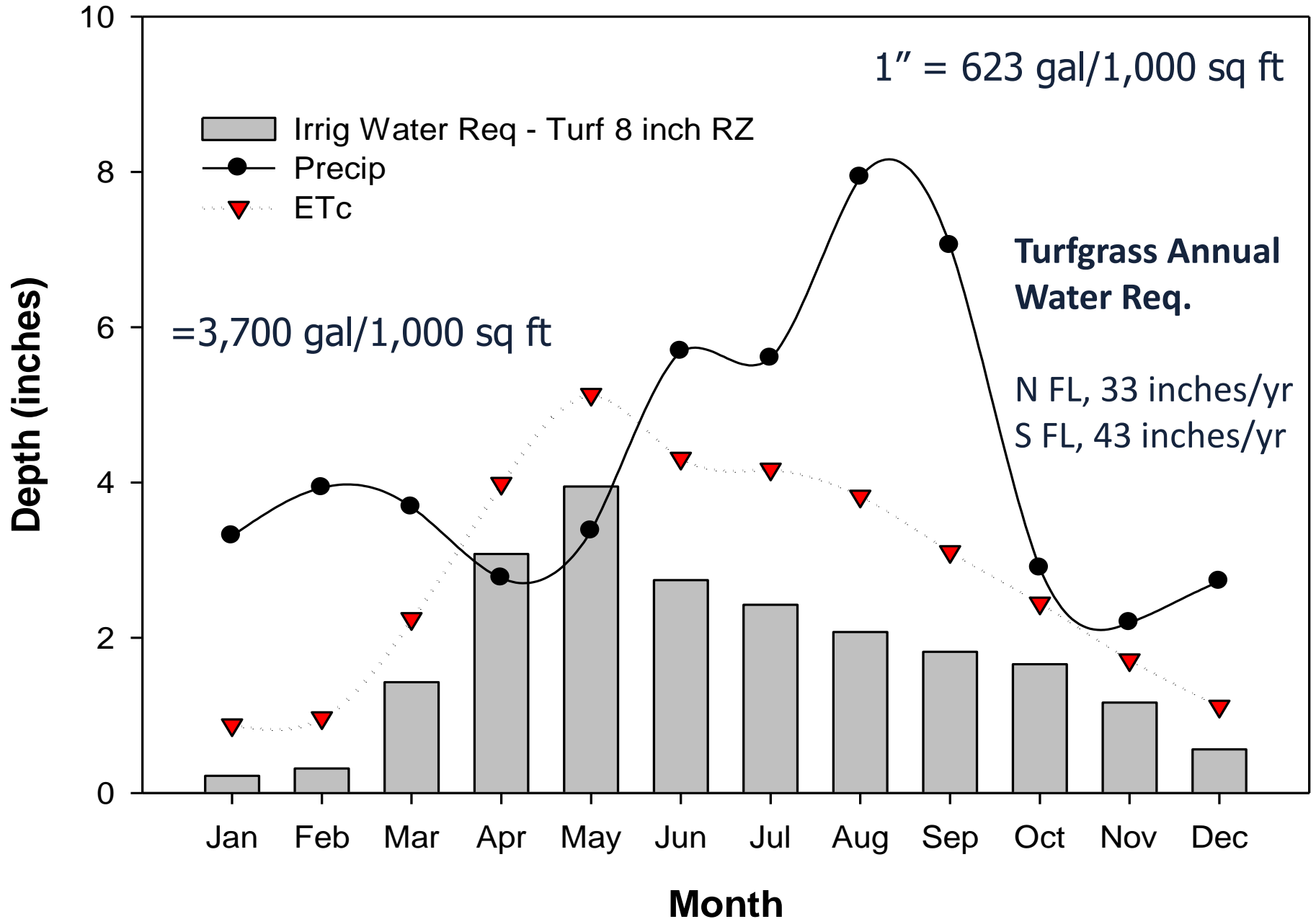
■ Indoor ■ Irrigation

Orange Co. Utilities
158,148 gal/yr



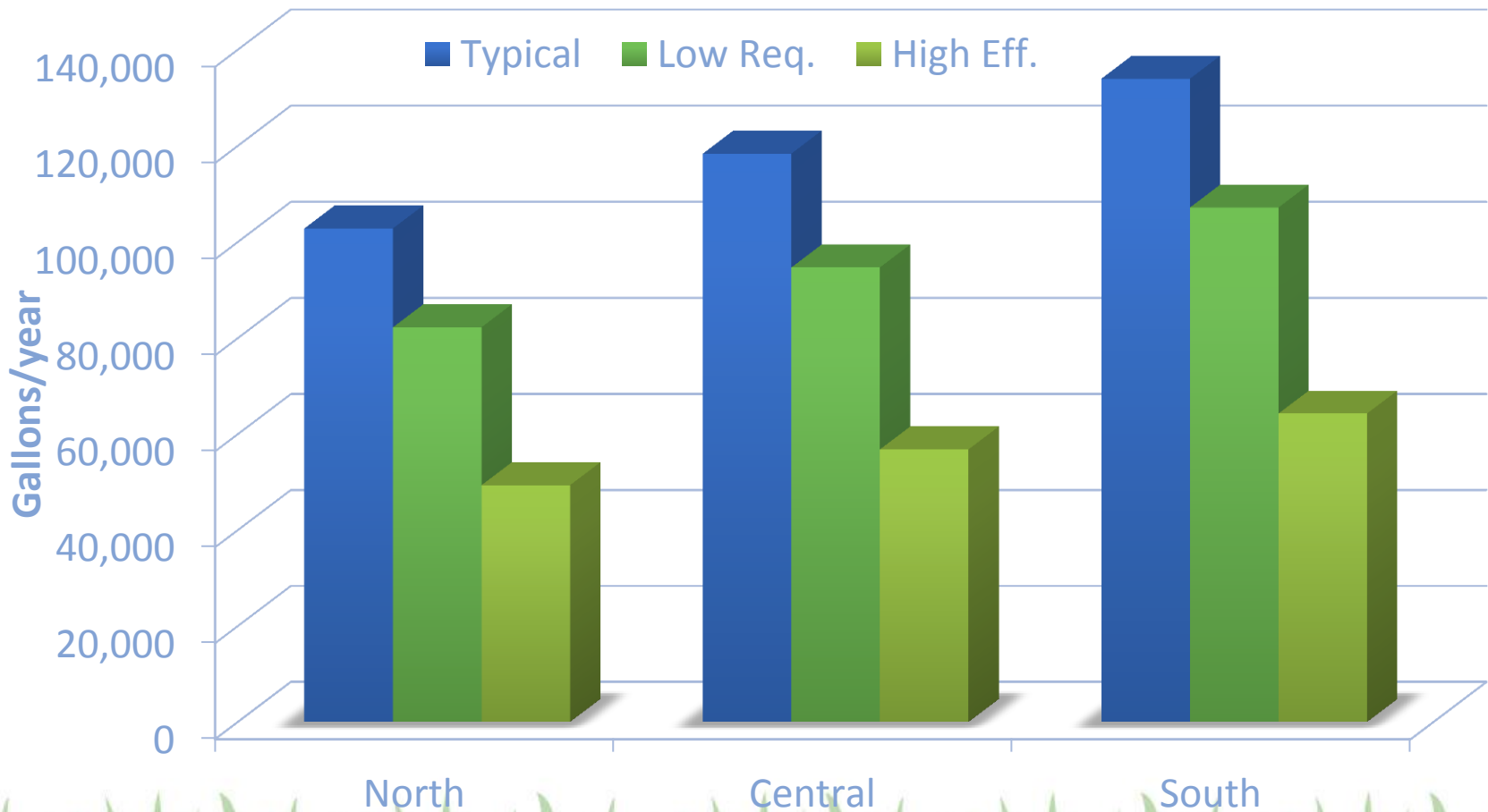
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Irrigation Requirements Estimation



Annual Irrig. Requirement

Volume over 4,000 sq ft



How Much Water Can Be Saved?

- *Toilets: 2,484 gal/yr
- *Dishwasher: 288 gal/yr
- *Washing Machine: 5,220 gal/yr

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- Irrigation Scheduling (25%): 18,837 gal/yr
– 240% of all indoor

Smart Water Application Technologies (SWAT)



Evapotranspiration (ET) based controllers

Soil moisture controllers (SMS)

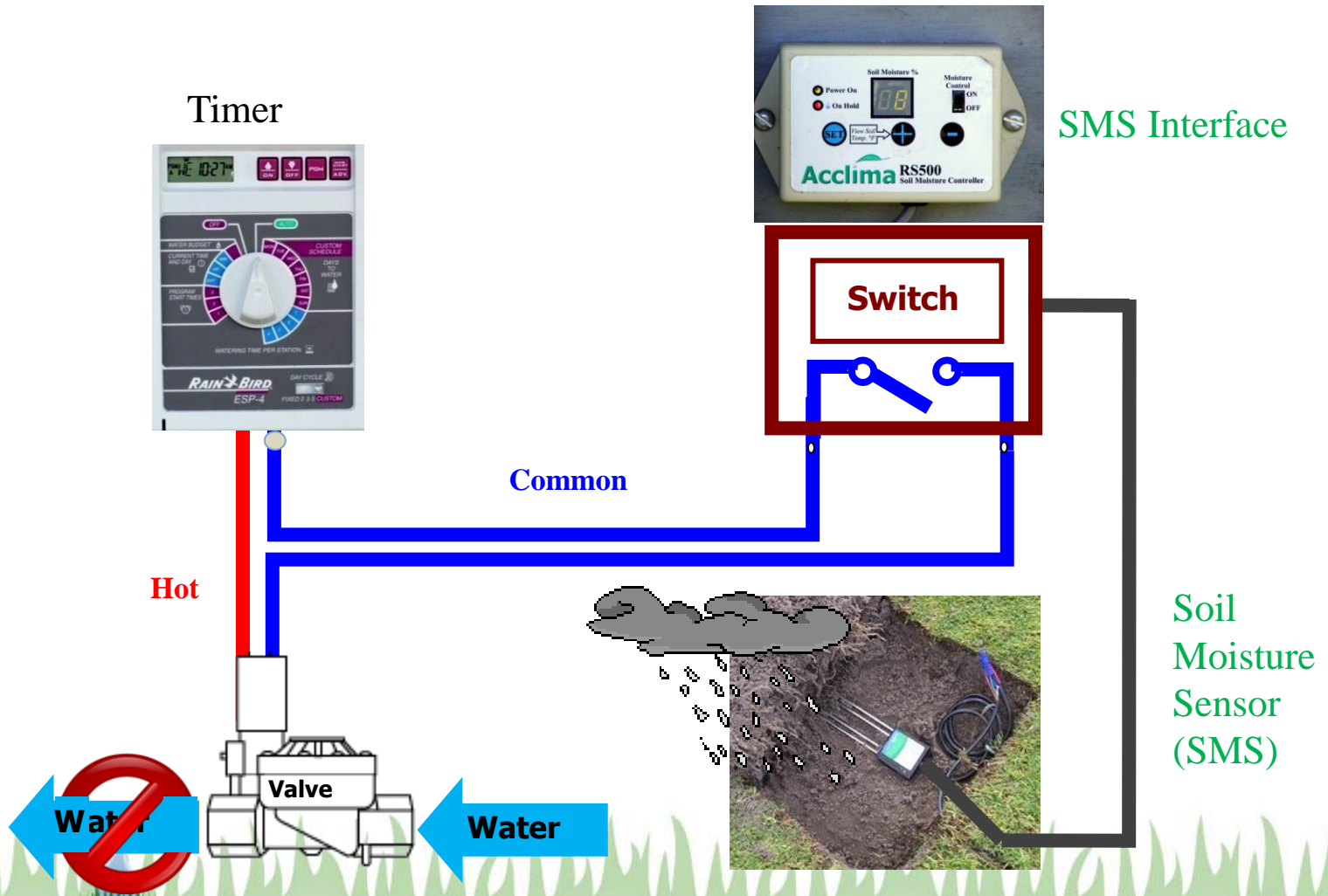


Irrigation controllers that respond to conditions in the irrigated system to automatically adjust to plant needs

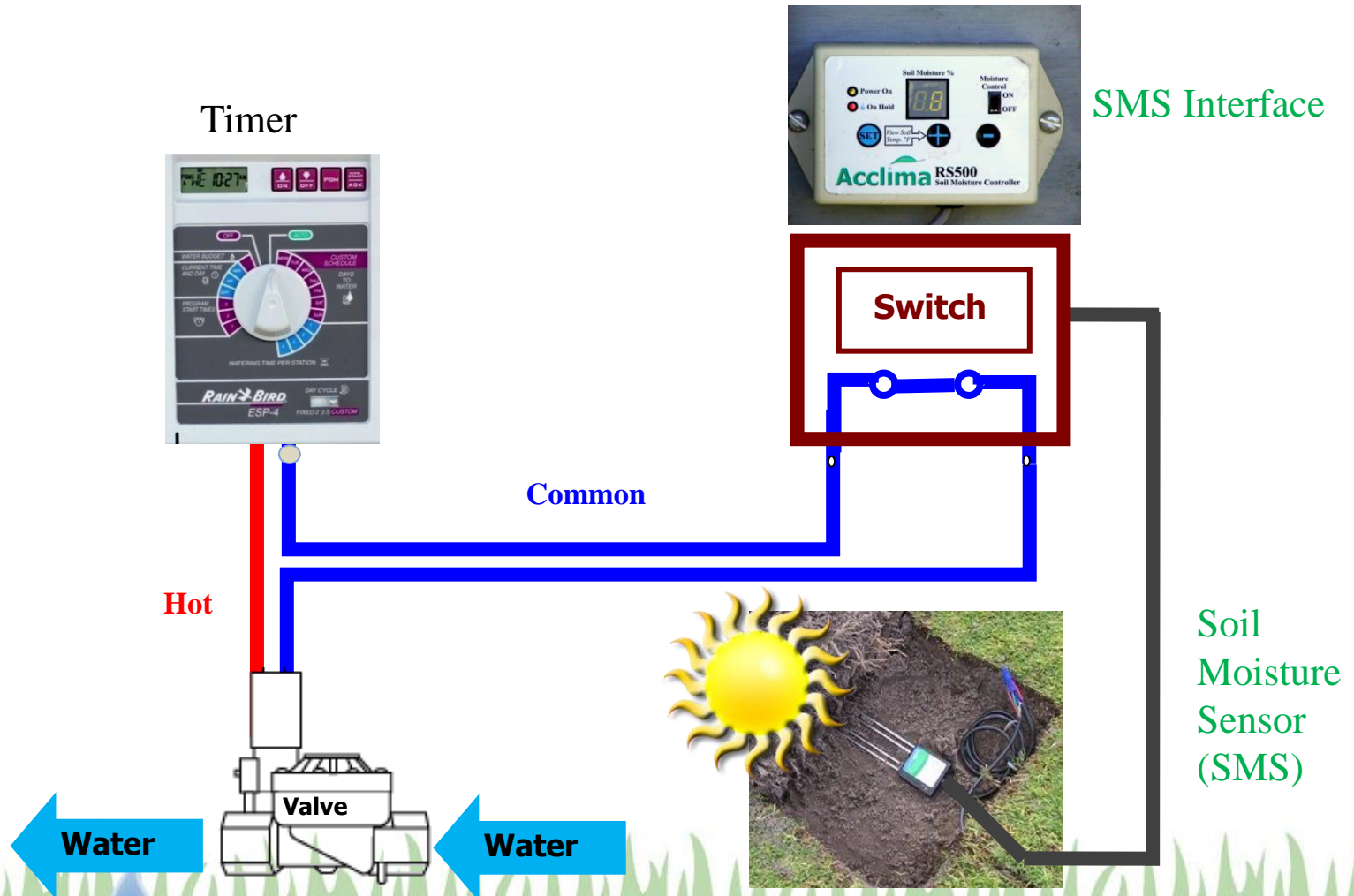
Soil Moisture Sensor Controller



Bypass Control: How Does It Work?



Bypass Control: How Does It Work?



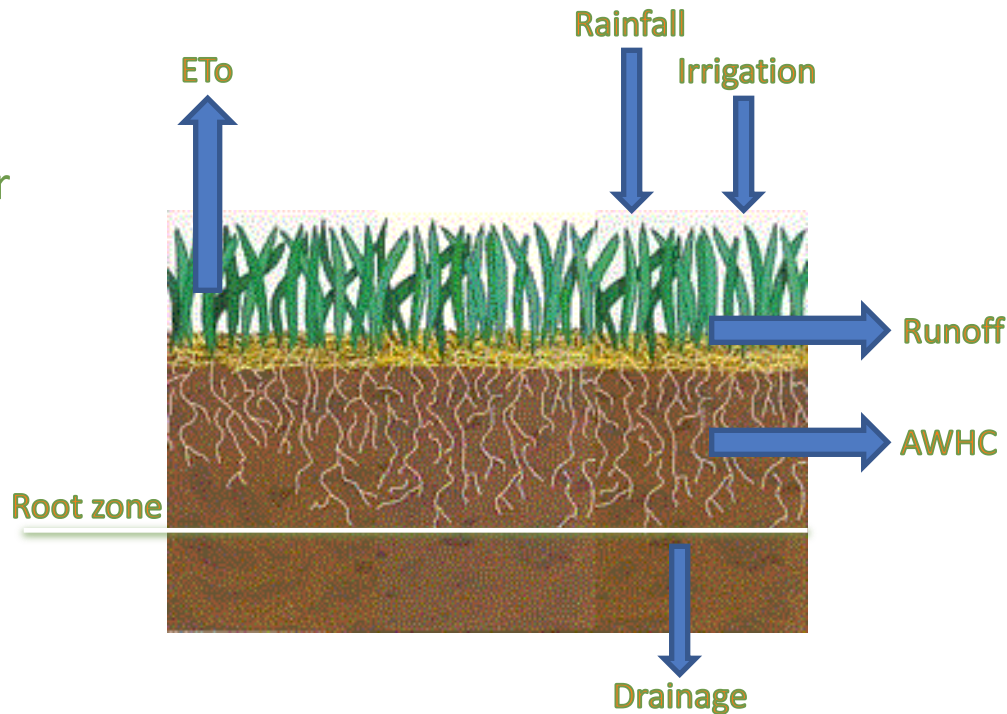
ET Controllers

- Can determine runtimes and days
- Programming is key!
 - Soil type
 - Plant type
 - Microclimate
 - Application rates
 - Slope



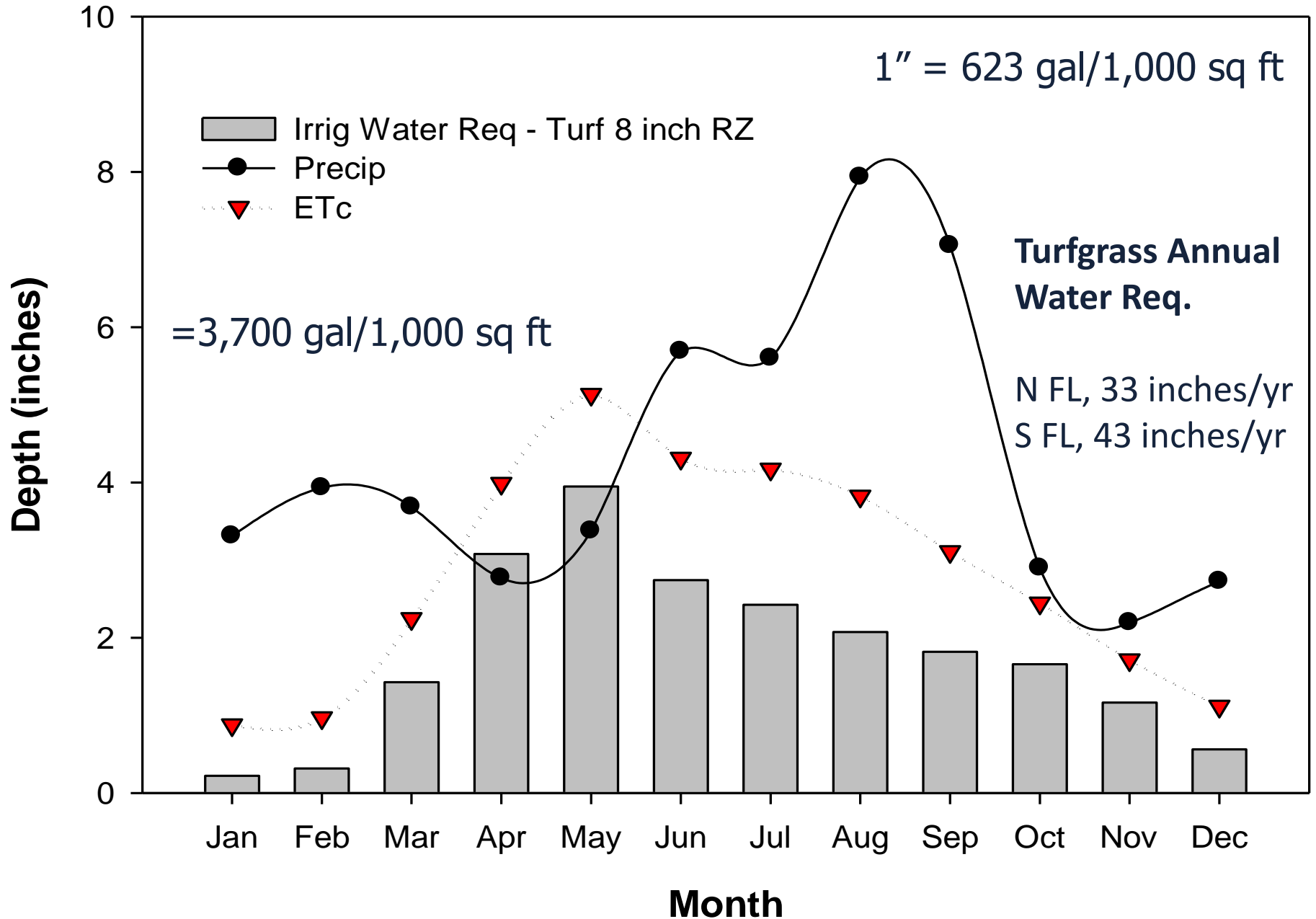
ET Controllers Calculate Plant Water Use

- Runoff and drainage assumed negligible for irrigation calculation

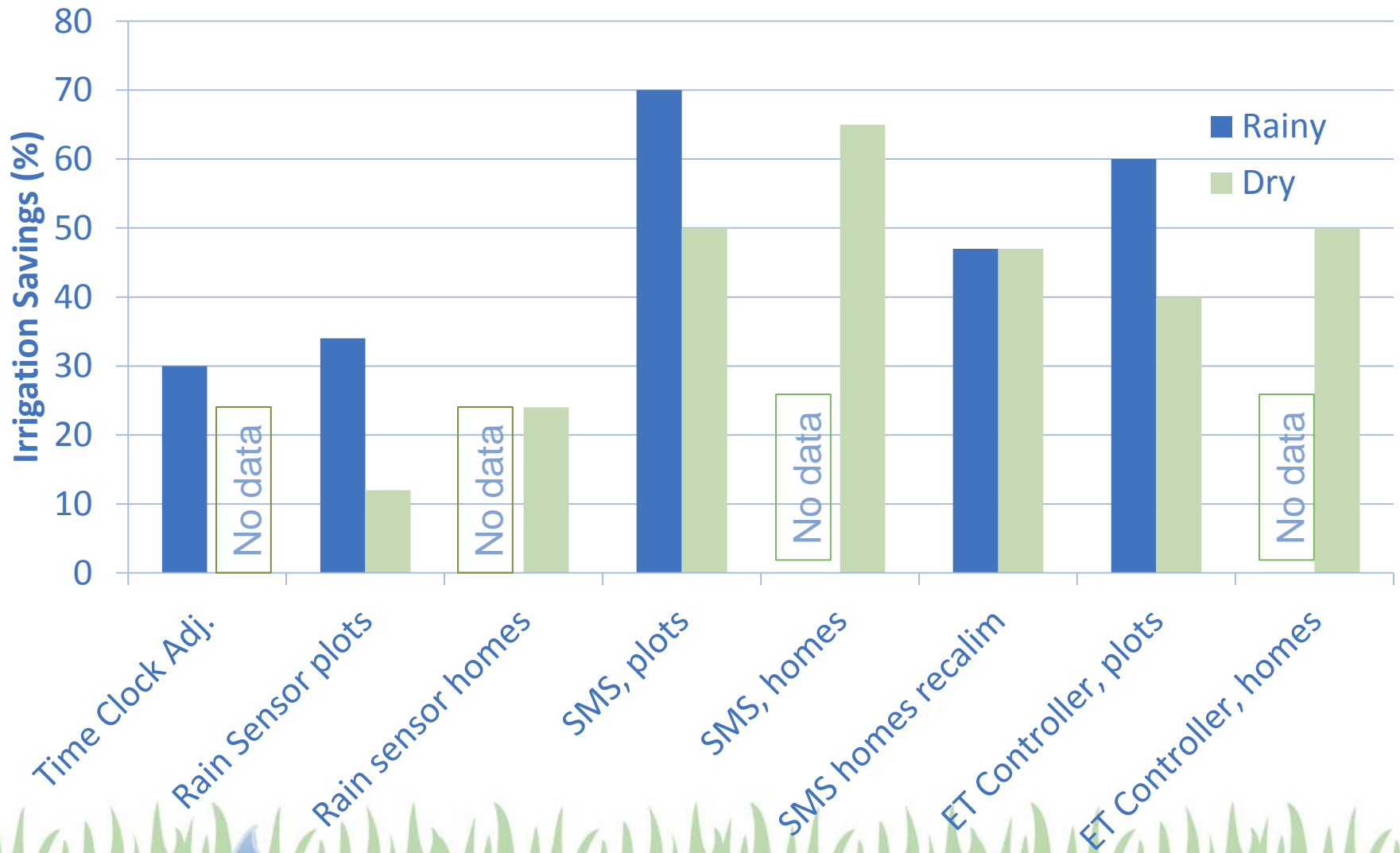


- $\text{Irrig} = \text{ET} - \text{Rain}$

Irrigation Requirements Estimation



Research Based Irrigation Savings Potential



Current

- Smart Controllers just a fraction of total controller sales
- Utilities resistant to “count on” smart controllers
- Everyone hesitant to change....

OCU Smart Controller Demonstration Objectives

- Will smart controllers reduce irrigation on moderate to high use single family homes?
- What is effectiveness of ET vs. SMS controllers?
- Impact on landscape quality?
- Customers feelings about technology?

Smart Technologies

- ET Controller (ET)
 - Rain Bird ESP-SMT

- Soil Moisture Sensor (SMS)
 - Baseline WaterTec S100

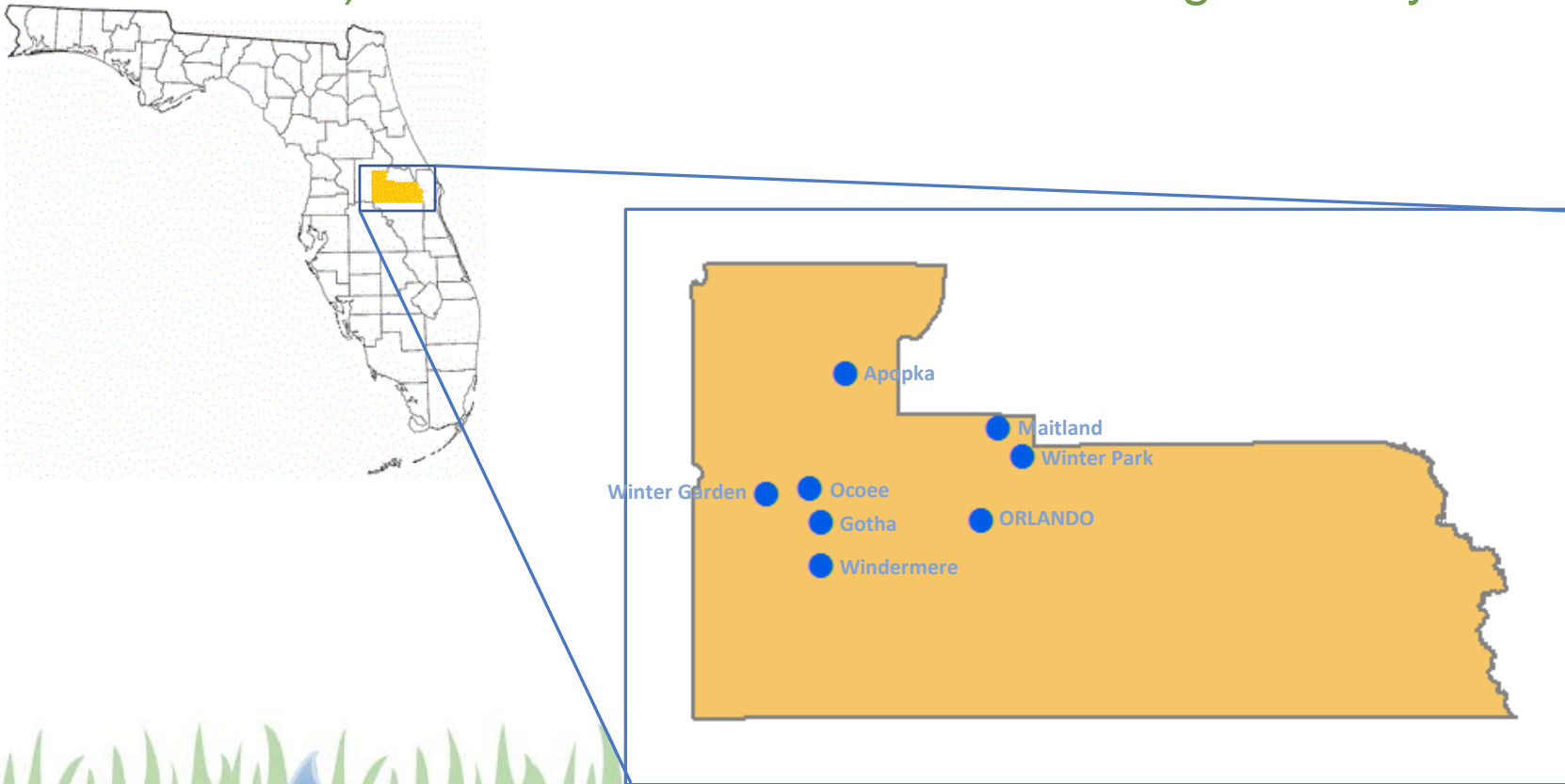


Determine Potential Cooperators



Water Use Data

- Gather monthly water billing records for 7 years (2003-2009) from OCU for 8 locations in Orange County



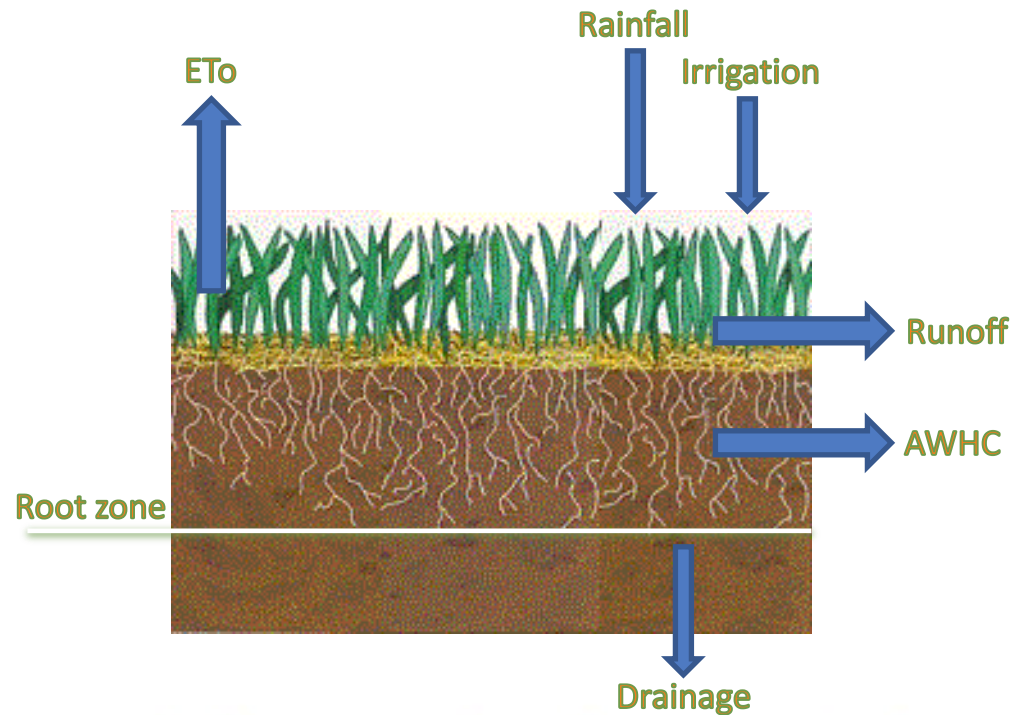
Irrigation Estimation

$$= \frac{\text{monthly metered water use} - \text{per capita indoor water use}}{\text{irrigable area}}$$

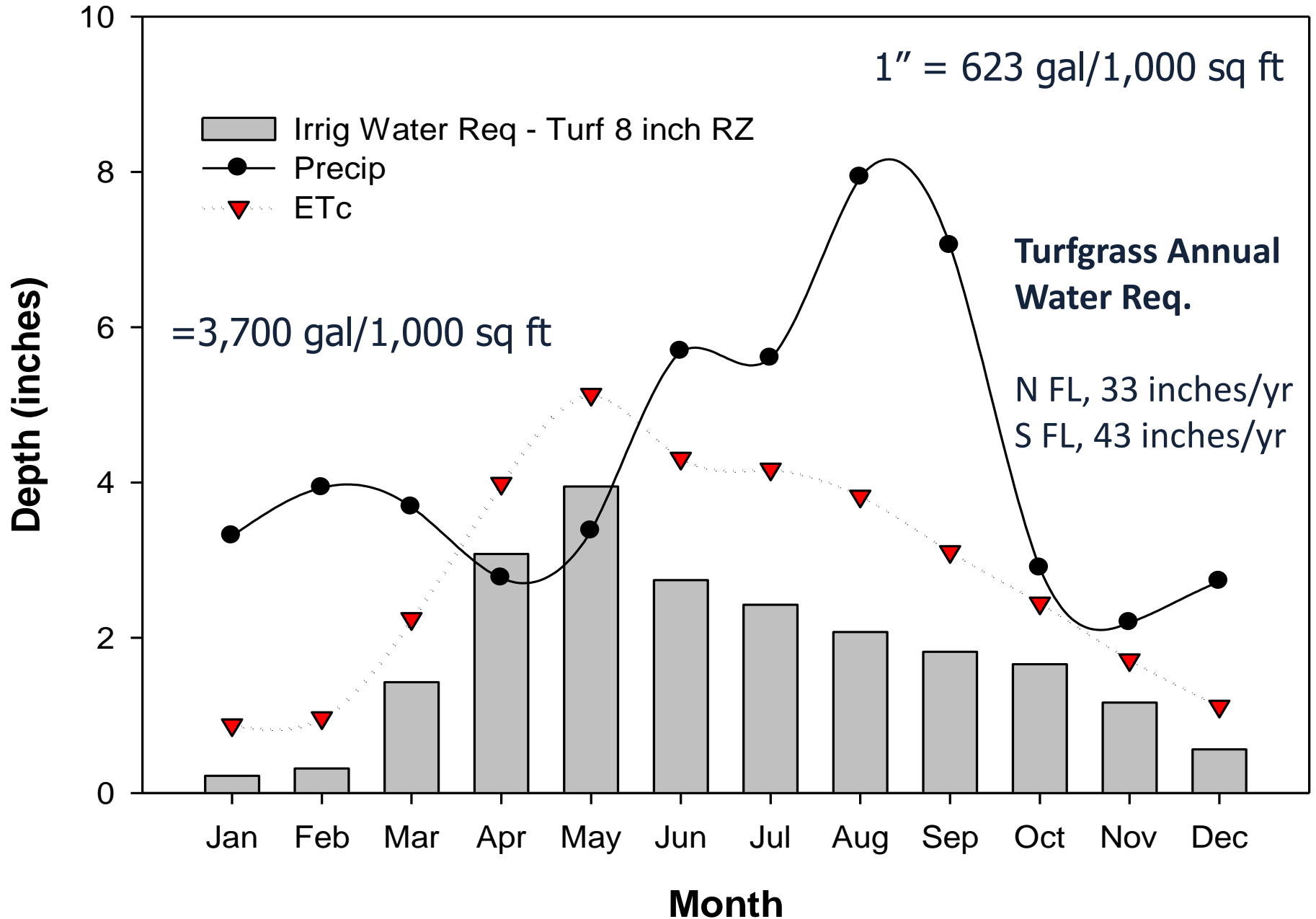
- Per capita indoor use = 70 gal/person/d ~ 5,000 gal/month
- irrigable area = total lot area – built area
- Estimated irrigation expressed as depth (mm or inches) per month

Theoretical Irrigation Requirements Calculation

- A **soil water balance** (Dukes, 2007) was used to calculate the irrigation requirements from 2003-2009.
- Every city had its own inputs based on weather and soil variability.
- $\text{Irrig} = \text{ET} - \text{Rain}$



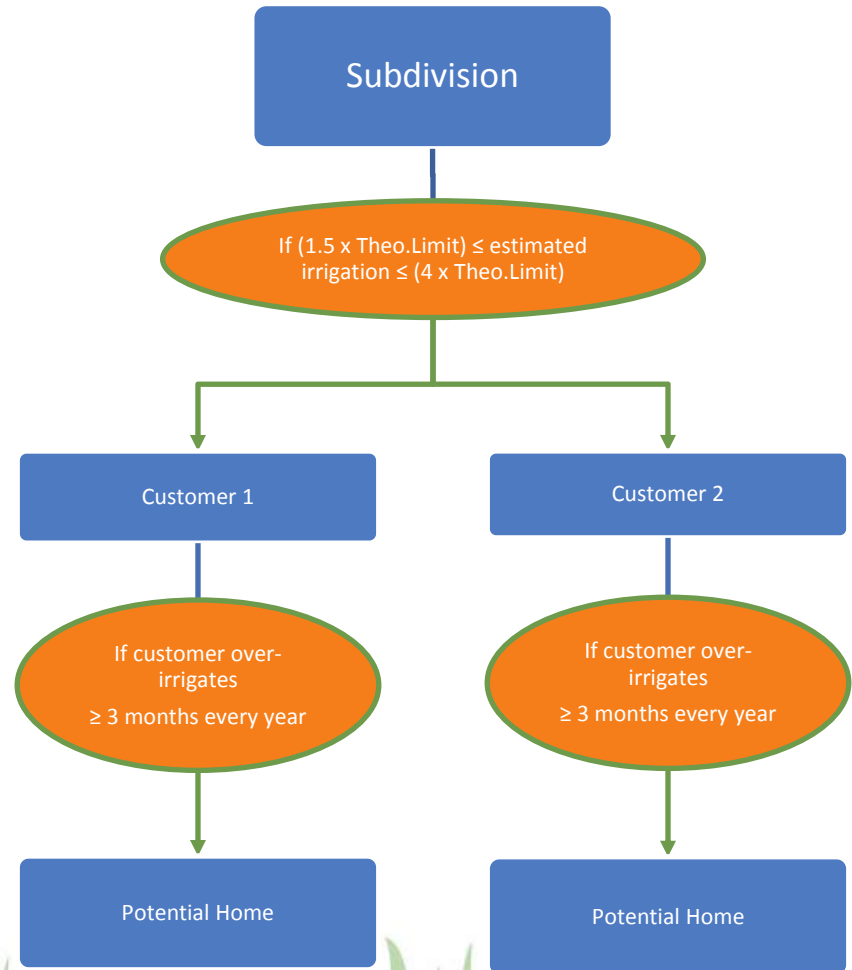
Irrigation Requirements Estimation



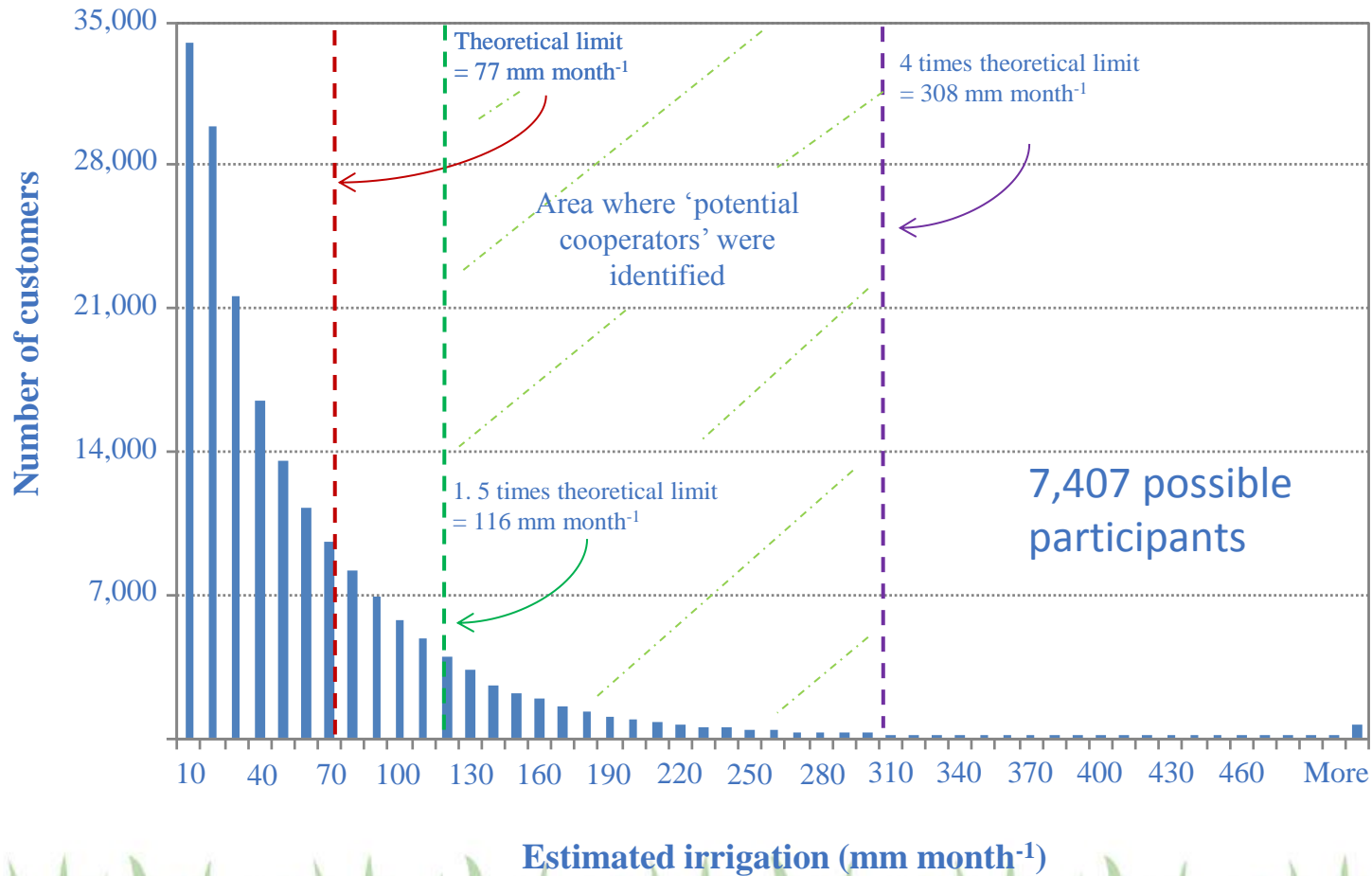
Selecting Potential Homes

- **Within each subdivision, select customers that:**

- 1) Exceed average monthly theoretical limit by 1.5-4 times,
and
- 2) Over-irrigate at least 3 months out of every year from 2006-2008



Selection of High Irrigators

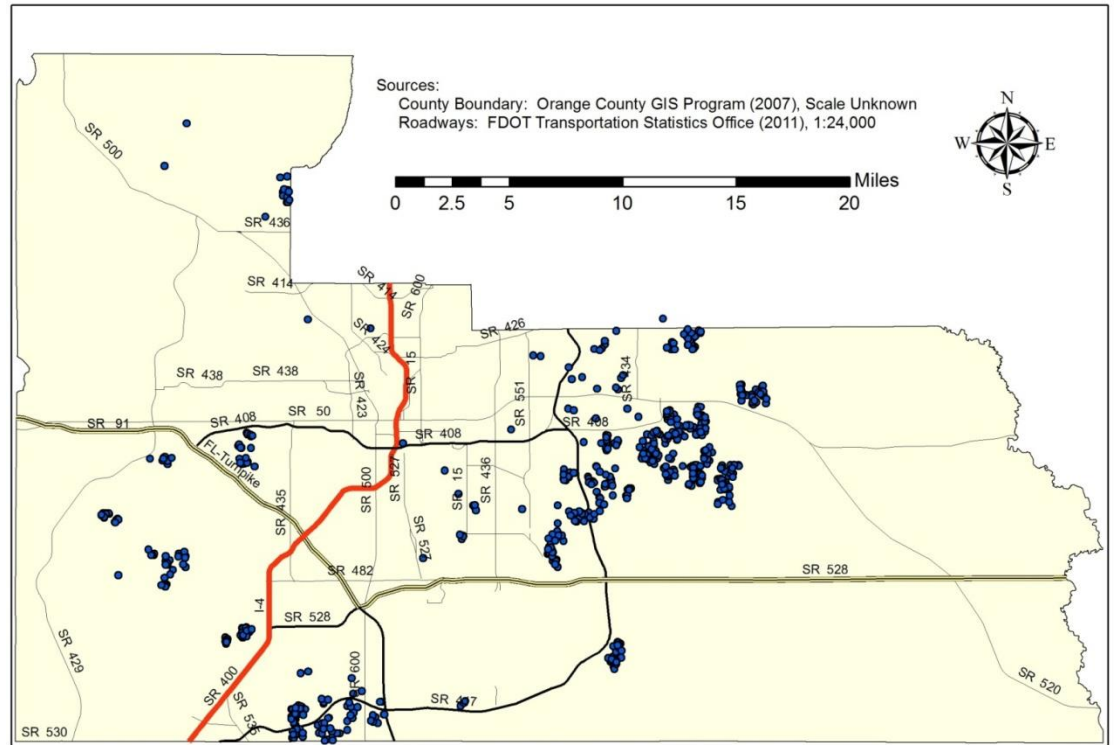


Recruit Potential Cooperators



Initial Questionnaire Respondents

- Of the OCU service area,
 - 7,407 met the initial study requirements
 - 843 responded to the questionnaire



Criteria for Study Removal

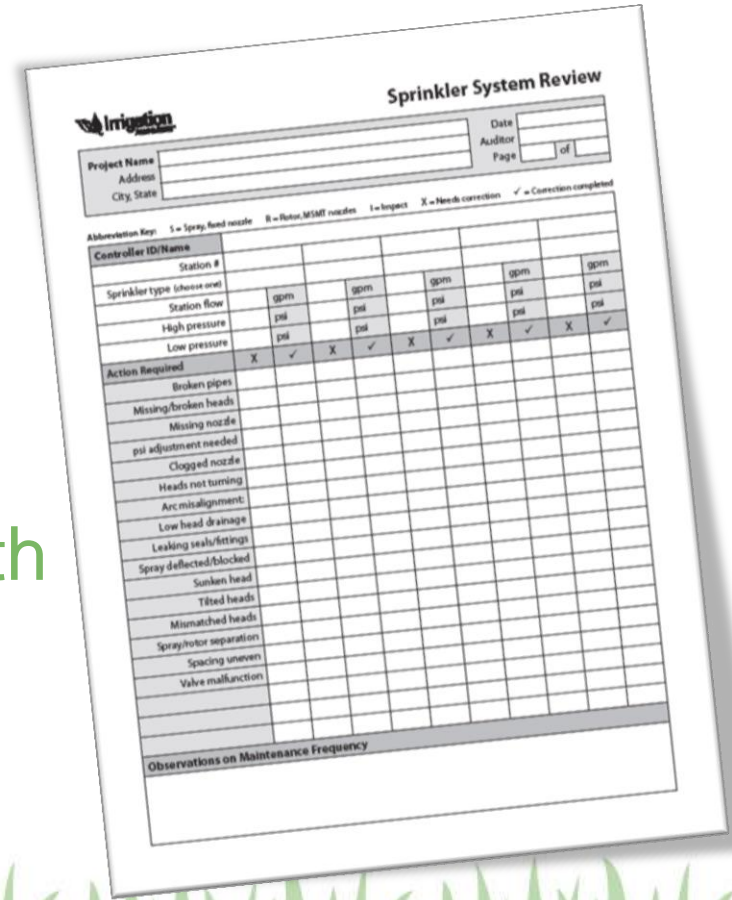
- Of the 843 respondents, participants were removed from consideration unless they met the following requirements:
 - Utilized automatic time clock for irrigation
 - Irrigation connected to potable water supply (not reclaimed)
 - Lived in home for more than 2 years (2008 - 2009)
 - Year round resident
 - Owned home (does not rent)
 - Indicated automatic or manual irrigation habits

Criteria for Study Removal

- Some respondents chose to remove themselves from the study due to:
 - Lack of trust in that there were no fees or products being sold
 - Did not understand that there were future commitments after the questionnaire
 - Decided that future commitments to the study were too much to handle

Irrigation Inspection: The System Review

- Activate all zones
- Observe and document which components are not operating correctly
 - The Sprinkler System Review form can help with recording and reporting



The image shows a 'Sprinkler System Review' form. At the top left is the 'Irrigation' logo. The form includes fields for 'Project Name', 'Address', 'City, State', 'Date', 'Auditor', and 'Page' (with 'of' next to it). Below these is an 'Abbreviation Key' with the following definitions: S = Spray, fixed nozzle; B = Backflow, MIMF nozzle; I = Impact; X = Needs correction; ✓ = Correction completed. The main table has columns for 'Controller ID/Name', 'Station #', and six columns for flow and pressure measurements: 'Station flow' (gpm, psi), 'High pressure' (psi), and 'Low pressure' (psi). The 'Action Required' section lists various issues with checkboxes for each: Broken pipes, Missing/broken heads, Missing nozzle, psi adjustment needed, Clogged nozzle, Heads not turning, Arc misalignment, Low head drainage, Leaking seals/fittings, Spray deflected/blocked, Sunken head, Tilted heads, Mismatched heads, Spray/tutor separation, Spacing uneven, and Valve malfunction. At the bottom, there is a section for 'Observations on Maintenance Frequency'.



Low Pressure





Broken Sprinklers

Bad Seals



FIRE LANE

NO PARKING





Mismatched Sprinklers

AUG 3 2004

Statistics from On-site Evaluations

Location	Number Evaluated	Average Number of Zones	Avg. Zone Area (ft ²)	Irrigating on Non-watering Days (%)
Hunters Creek Area	54	4.3	967	9
Keenes Pointe Area	37	6.0	1267	3
N. Tanner Rd Area	29	4.0	896	10
Turtle Creek Area	28	4.7	1102	0
Waterford Lakes Area	96	3.7	1060	10
Not grouped	40	4.6	879	10
Total	284	4.3	1033	8

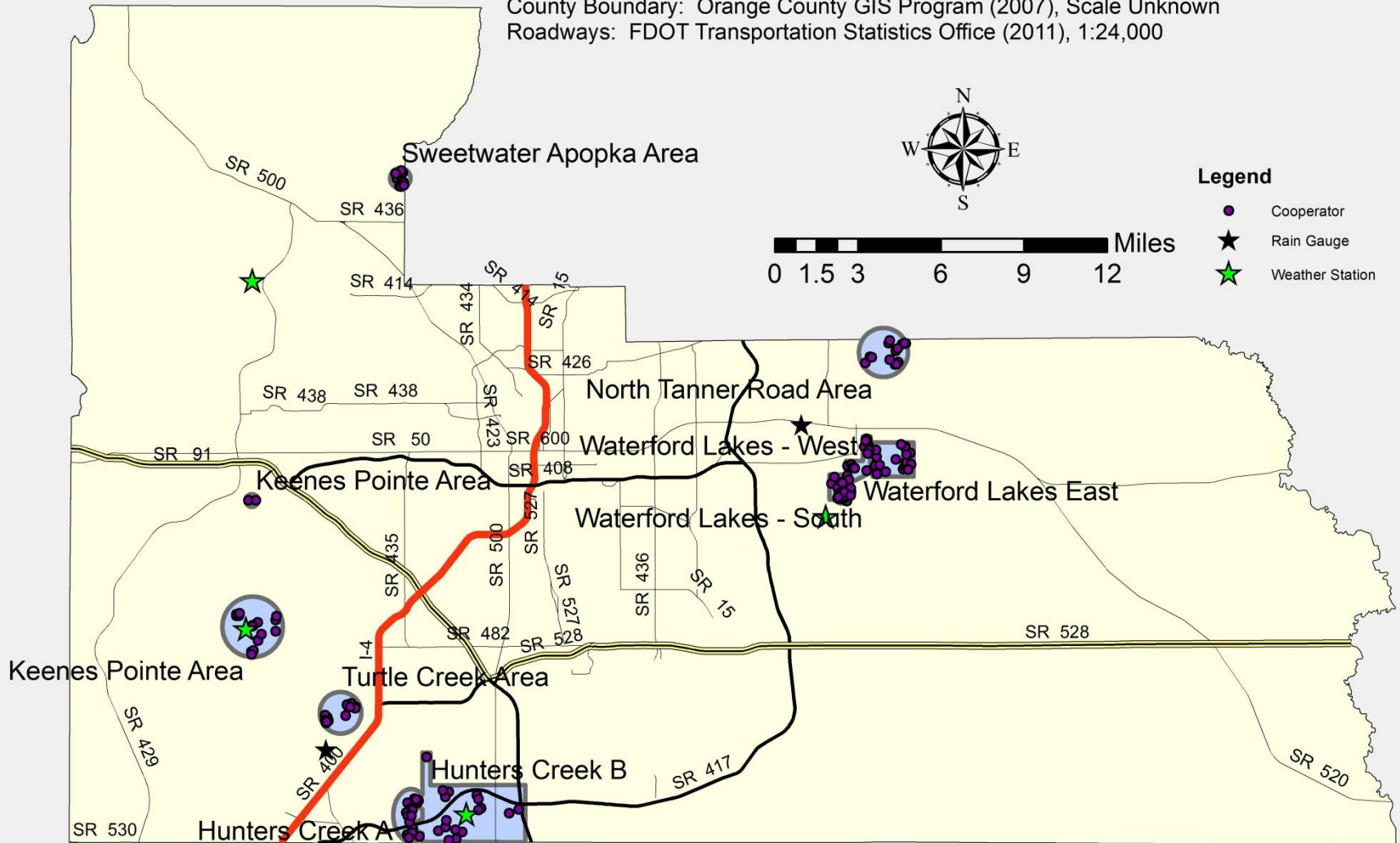
Statistics from On-site Evaluations

- Minor problems
 - 415 total
 - Average of 1.5 per home
 - 65% had at least 1 minor problem
- Major problems
 - 59 total
 - Average of 0.21 per home
 - 15% had at least 1 major problem

Map of Final Participants

Sources:

County Boundary: Orange County GIS Program (2007), Scale Unknown
Roadways: FDOT Transportation Statistics Office (2011), 1:24,000



Select Treatments and Install Equipment



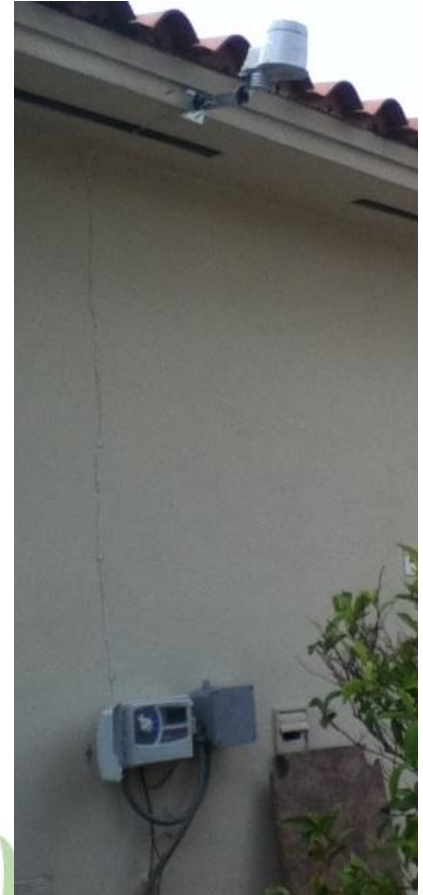
Summary of Treatments

– ET

- Rain Bird ESP-SMT installed by contractor
- Received educational pamphlet in mail

– ET + Edu

- Rain Bird ESP-SMT installed by contractor
- Follow-up visit from UF
- Physically handed educational pamphlet



Summary of Treatments

– SMS

- Baseline Watertec S100 installed by contractor
- Received educational pamphlet in mail

– SMS + Edu

- Baseline Watertec S100 installed by contractor
- Follow-up visit from UF
- Physically handed educational pamphlet

– Comparison (MO)

- No changes



Summary of Final Participants

Group Name	Soil type	ET ^a	ET + Edu ^b	SMS ^c	SMS + Edu	MO ^d	Total
Hunters Creek A	Flatwoods	4	4	4	4	4	20
Hunters Creek B	Flatwoods	4	4	4	4	4	20
Keenes Pointe Area	Sand	4	4	4	4	3	19
North Tanner Road Area	Sand	0	5	0	5	5	15
Turtle Creek Area	Sand	4	4	4	4	4	20
Waterford Lakes – East	Flatwoods	4	4	4	4	4	20
Waterford Lakes – South	Flatwoods	4	4	4	4	4	20
Waterford Lakes –West	Flatwoods	4	4	4	4	4	20
Sweetwater Apopka Area	Sand	0	5	0	5	3	13
Total		28	38	28	38	35	167

^aET designates cooperators that received a Rain Bird ESP-SMT ET controller

^bEdu designates cooperators that received an on-site educational training

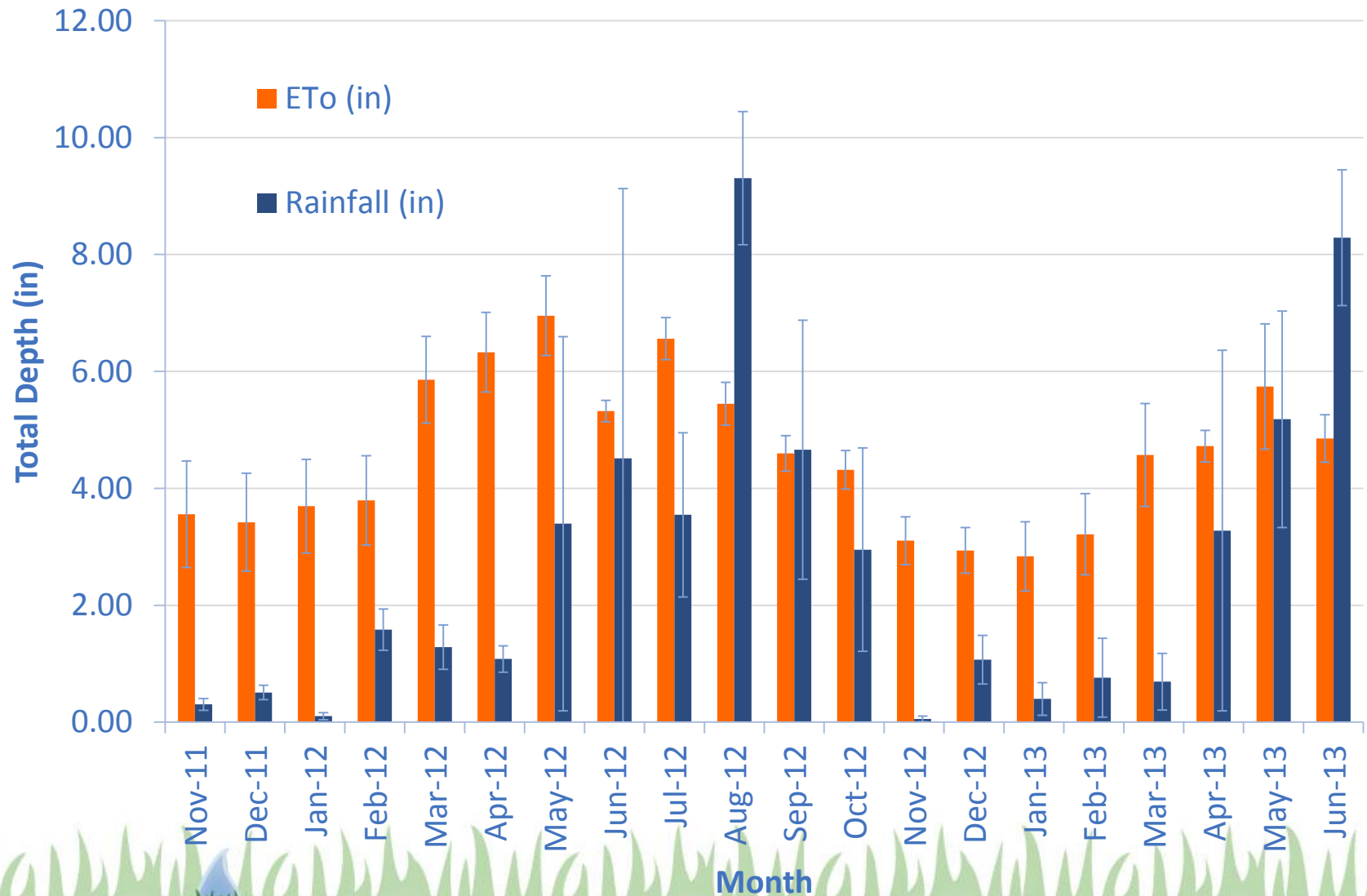
^cSMS designates cooperators that received a Baseline WaterTec S100 soil moisture sensor

^dMO designates cooperators that did not receive a technology

Begin Monitoring

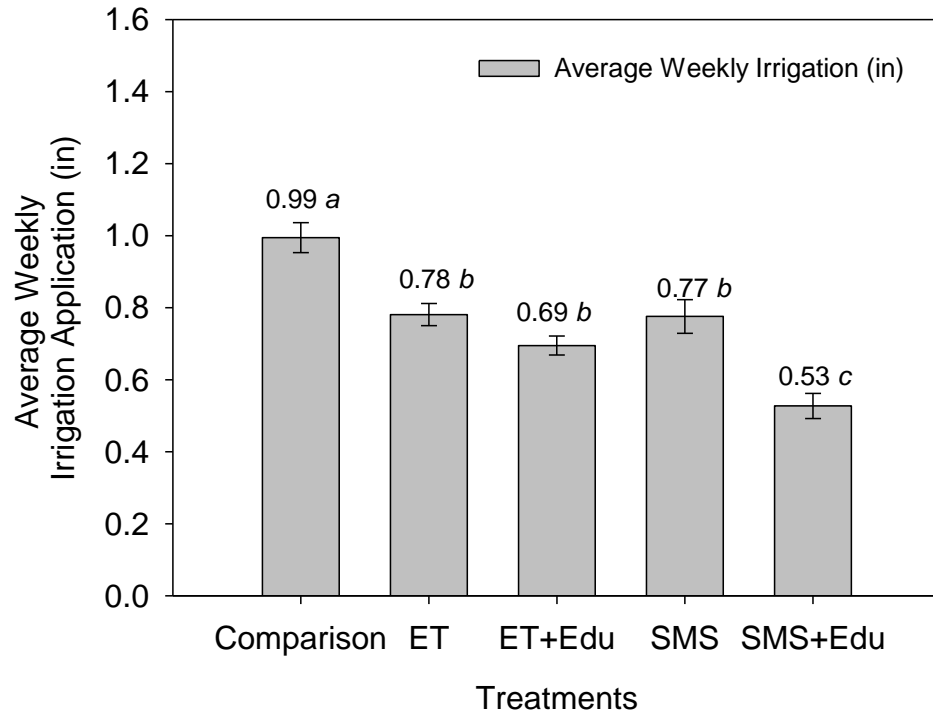


Reference ET (ETo) & Rainfall

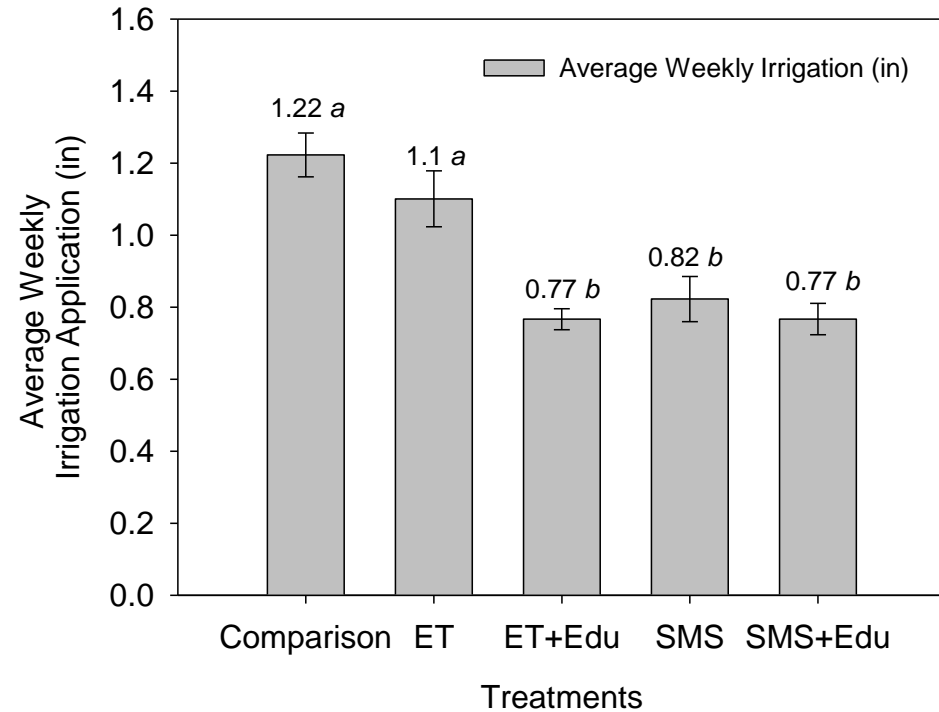


Residential Avg. Irrigation

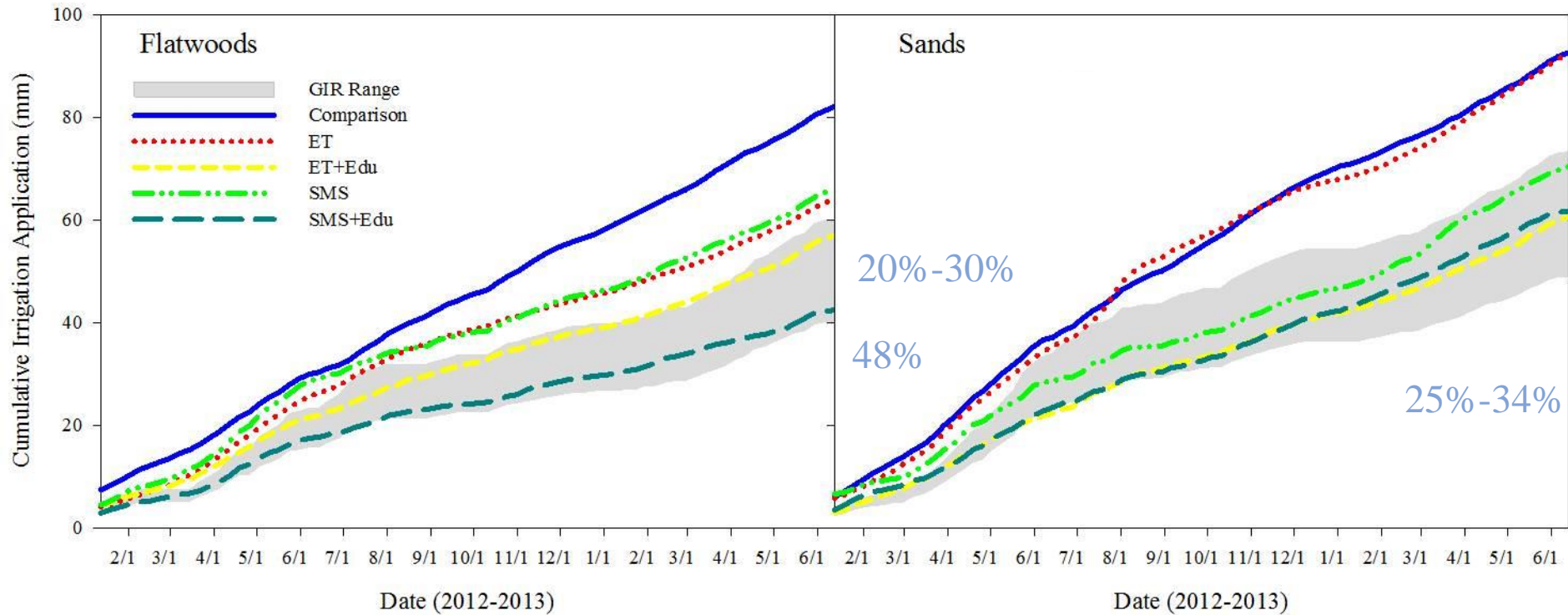
Flatwoods



Sand



Cumulative Irrigation



Turfgrass Quality

- What is the turfgrass quality rating?

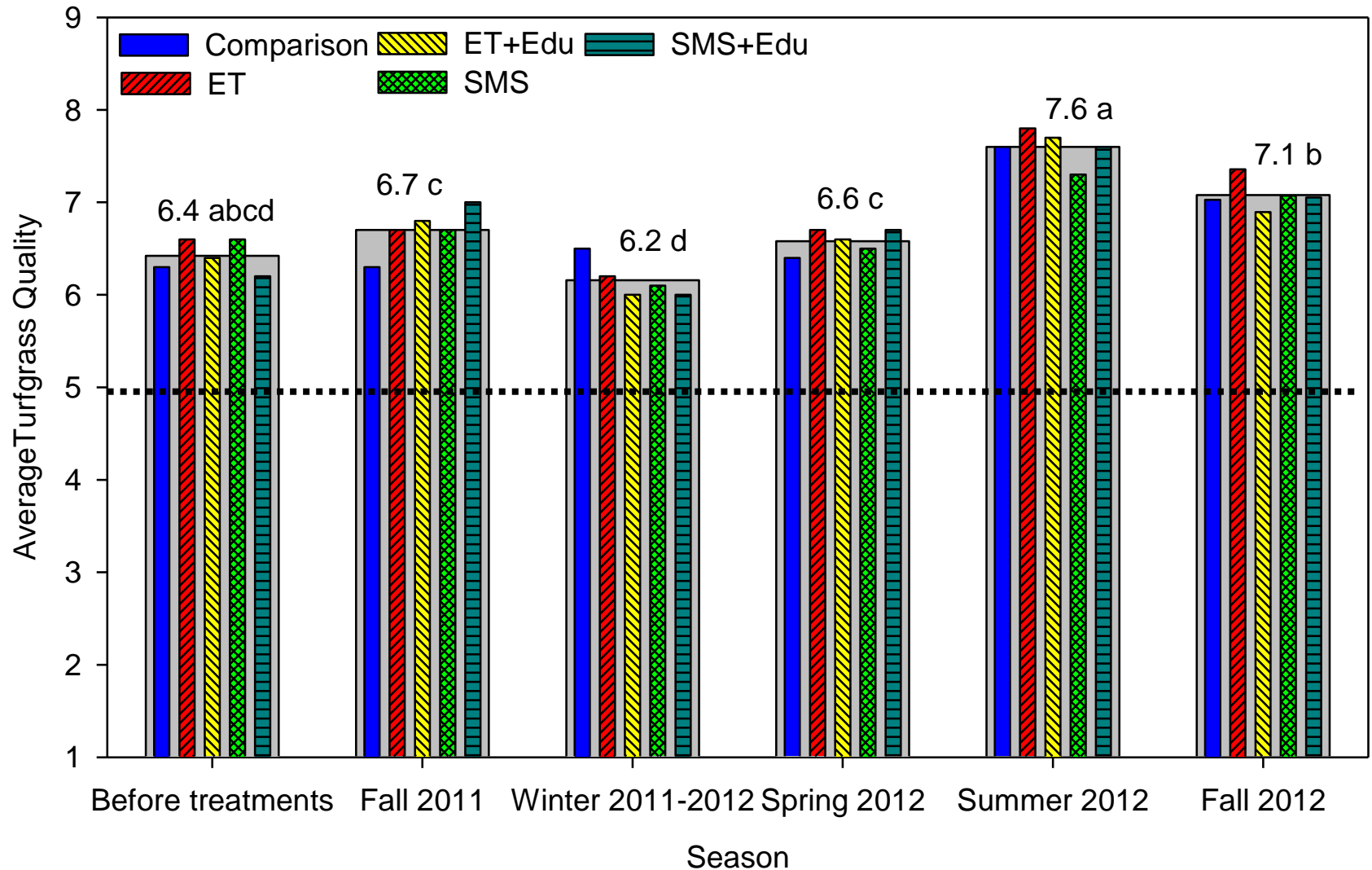


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Turfgrass Quality



Customer Concerns

- Too much irrigation/high water bill
- Too little irrigation
- Watering too soon after rainfall
- Non-functioning controller/sensor

Customer Concerns

Treatment	Count
ET	17
ET+Edu	25
SMS	8
SMS+Edu	21
Grand Total	71

Year	Months Per Year	Count
2011	8	29
2012	12	34
2013	6	8
Grand Total		71

Questions?

