



# Long-term Performance of Smart Irrigation Controllers

Irrigation Association Show

Nov., 6-10

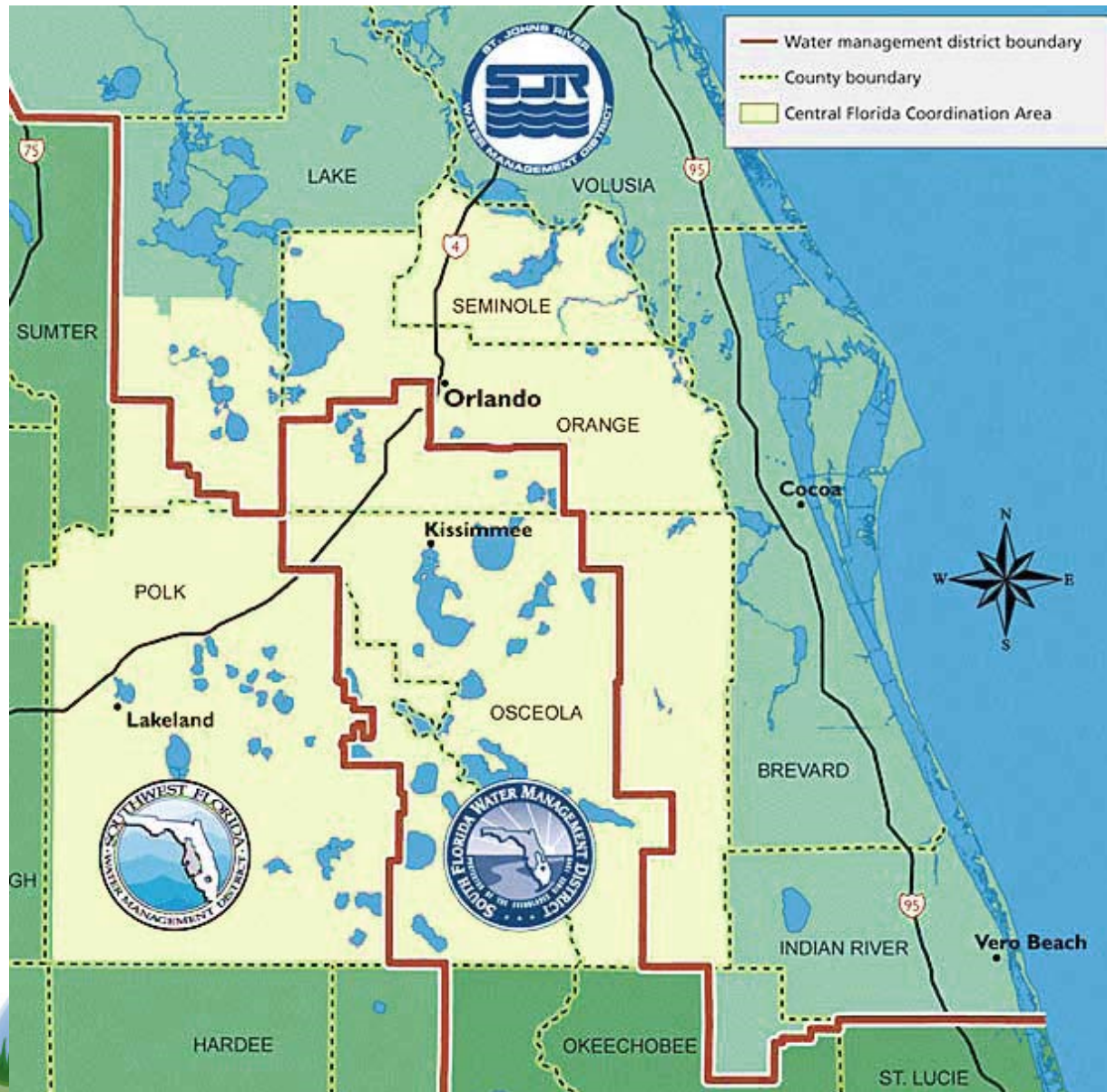
Orlando, FL

Michael D. Dukes, PhD., P.E., C.I.D.

Agricultural & Biological Engineering

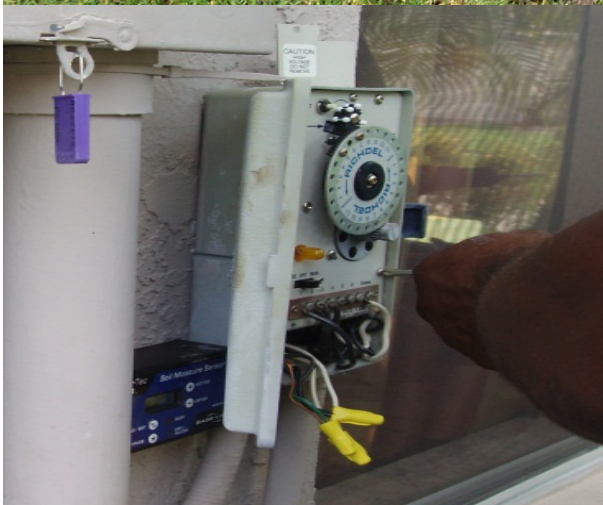
University of Florida/IFAS

# Central Florida Water Initiative





# Soil Moisture Sensor Controller





# Evapotranspiration (ET) Controllers

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



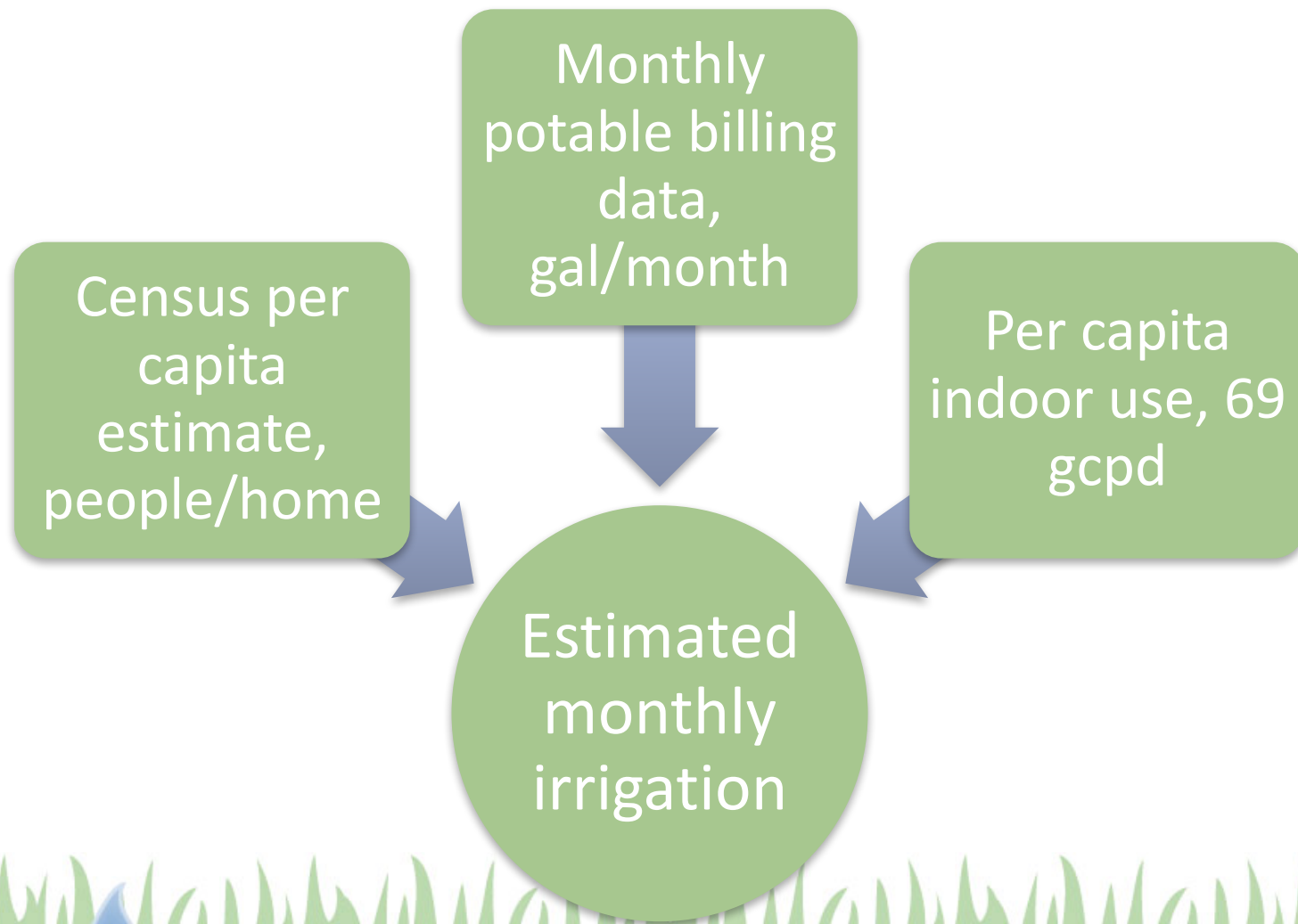


# Selection of Cooperators



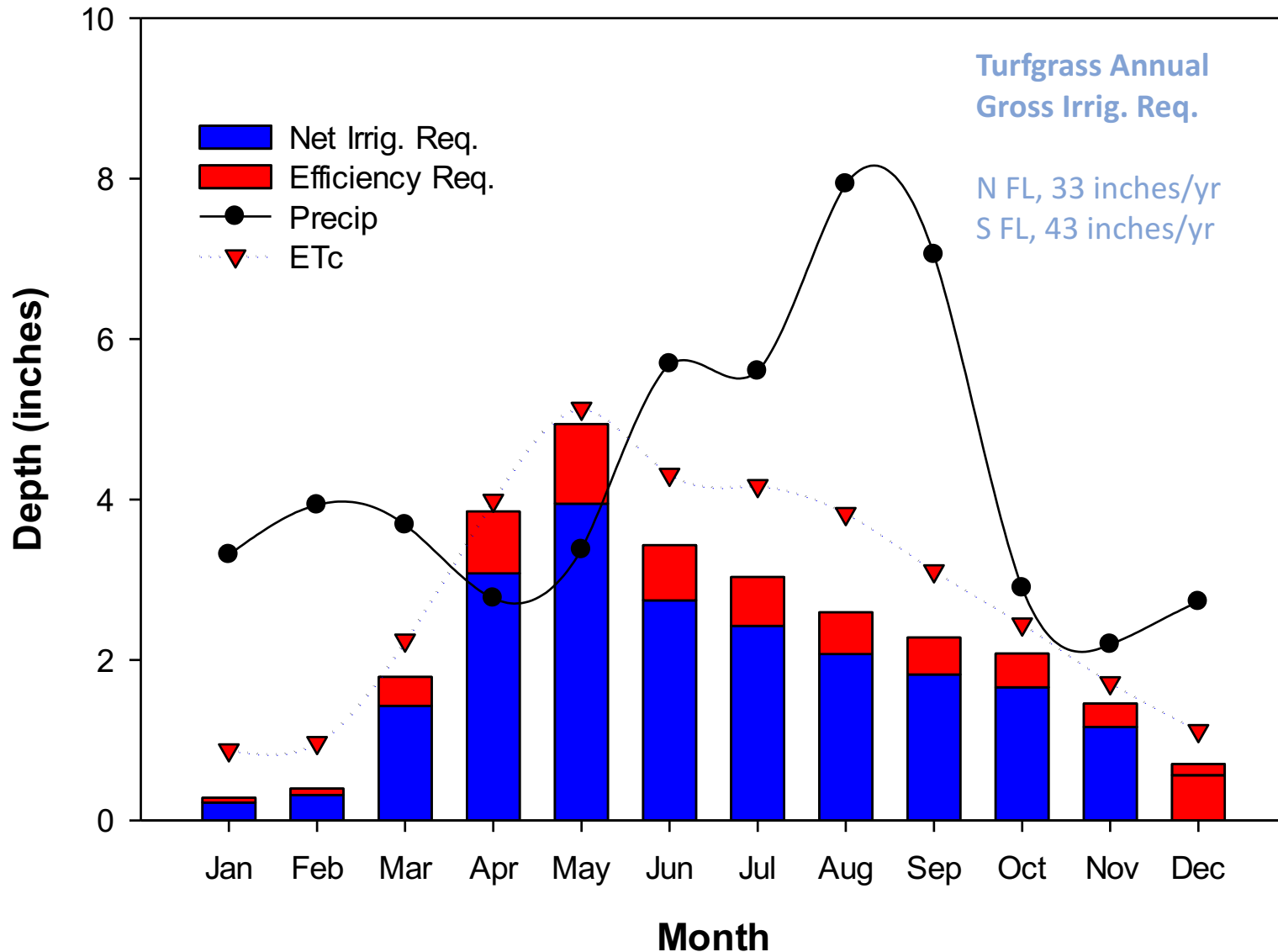
~130,000 Single Family Customers

# Estimated Irrigation

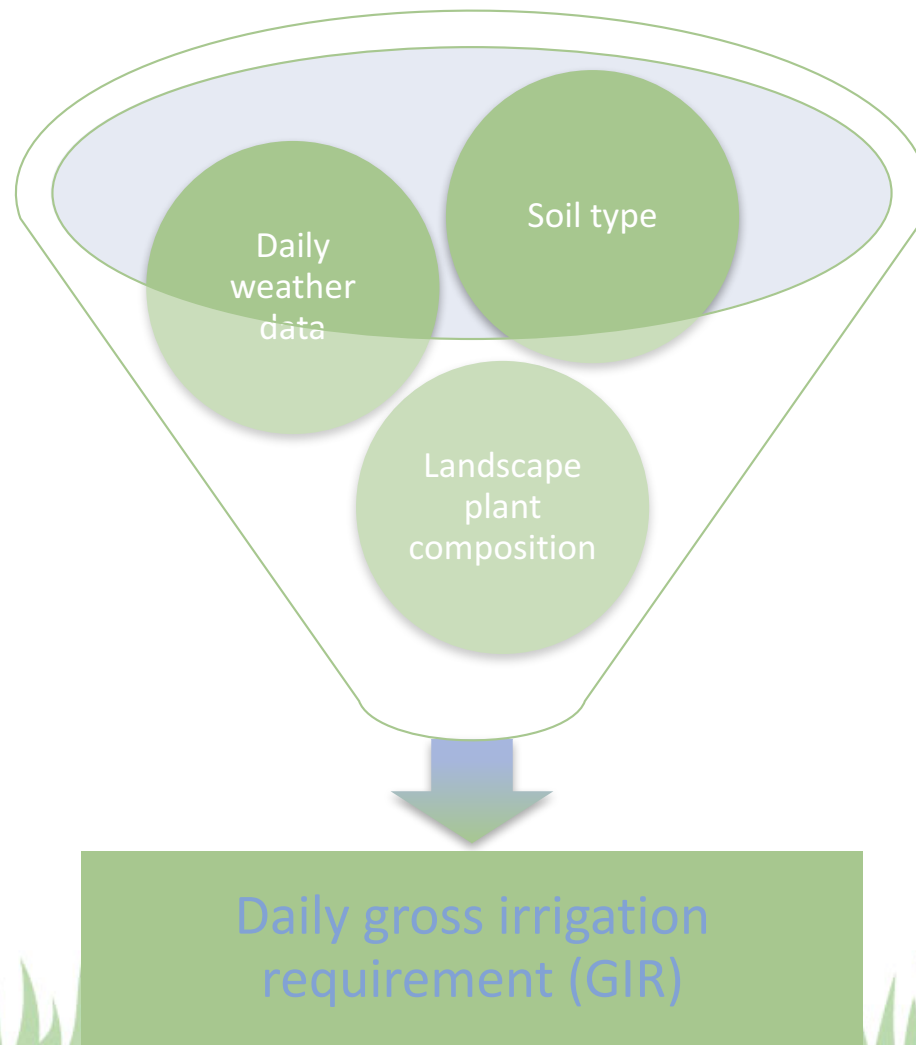




# Gross Irrigation Requirements

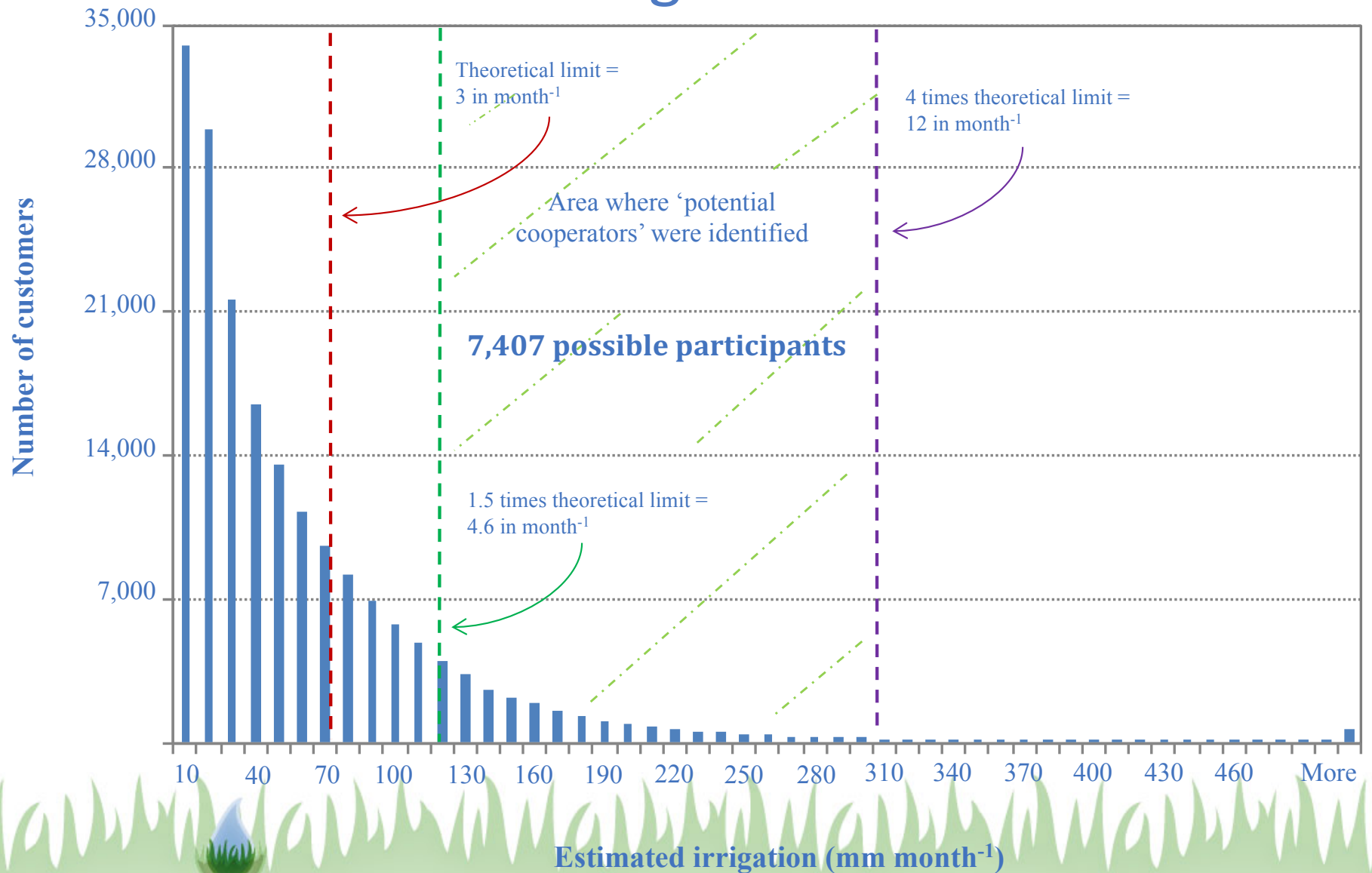


# Irrigation Requirements





# Orange County Evaluation Selection of Excess Irrigators



# Selection of Cooperators

~130,000 Single Family Customers

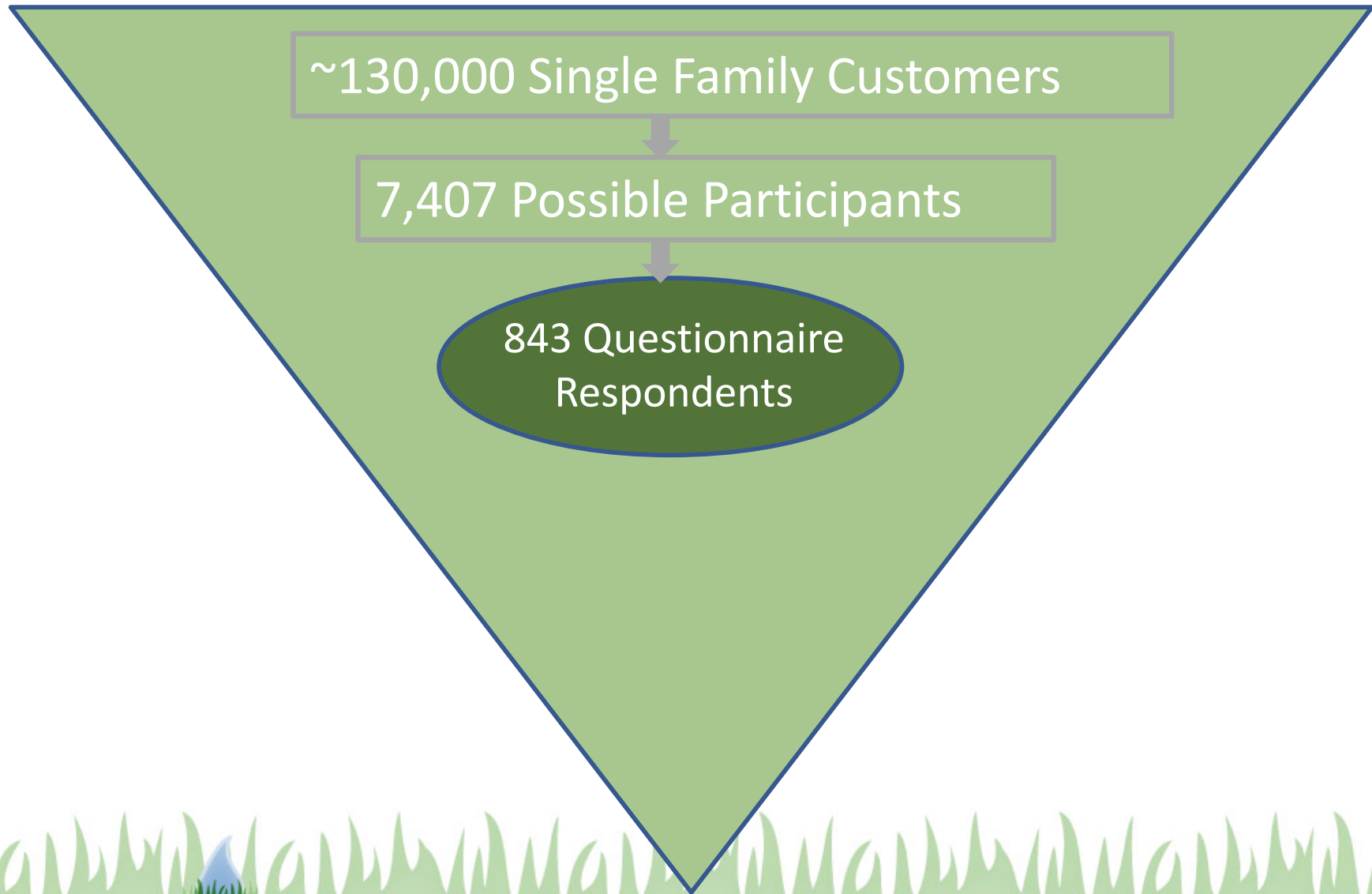
7,407 Possible Participants



# Cooperator Questionnaire

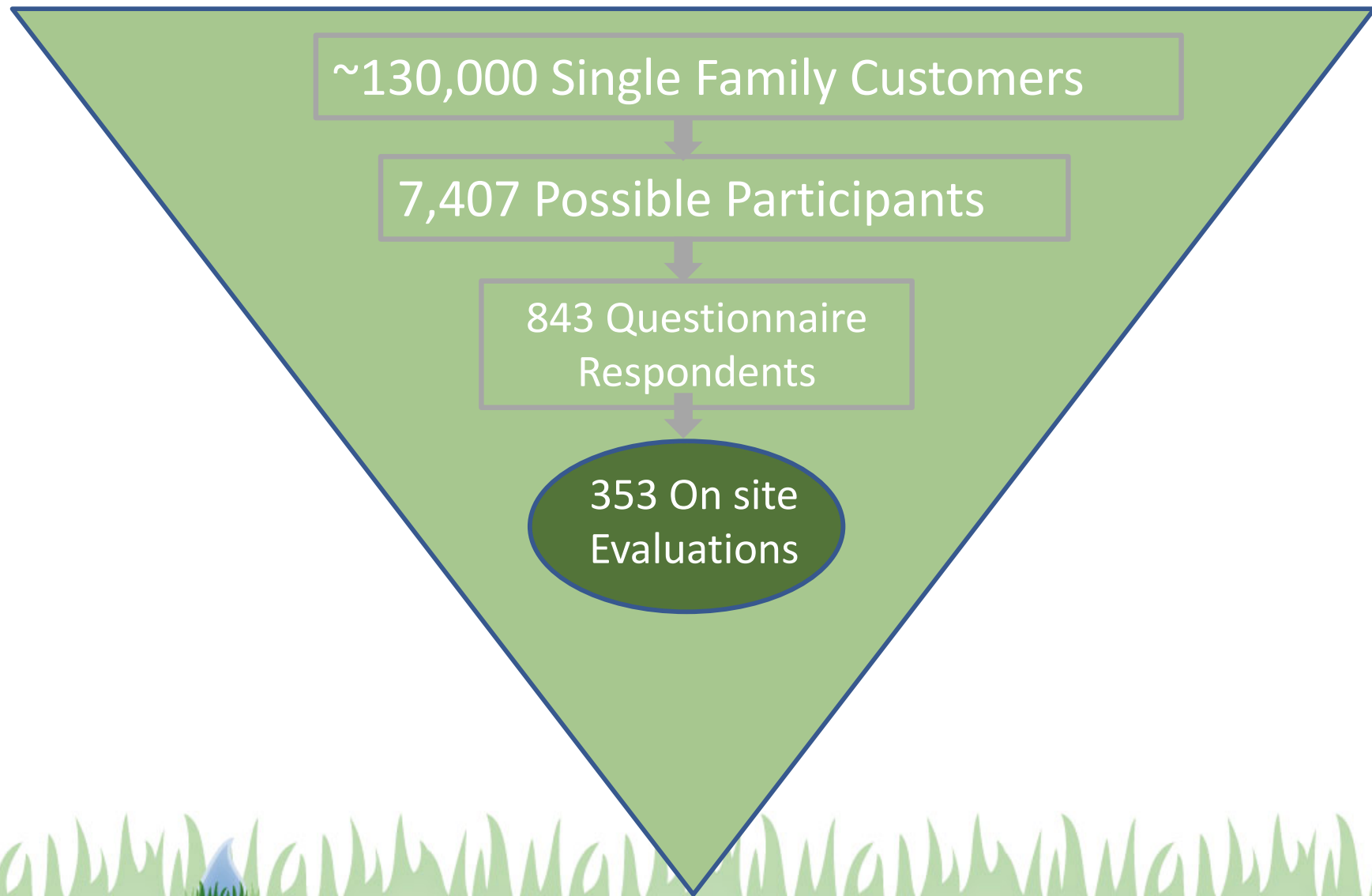
- Determined homeowner's study interest & Irrigation knowledge
- Irrigation controller or automated irrigation system needed.
- Not a renter
- Intended on living at residence for two or more years

# Selection of Cooperators





# Selection of Cooperators



# Irrigation System Evaluation



**UF UNIVERSITY of FLORIDA IFAS** **IRRIGATION SYSTEM EVALUATION** **UF UNIVERSITY of FLORIDA**  
Agriculture and Biological Engineering

• **Address:** \_\_\_\_\_ **Date:** \_\_\_\_\_

• **Timer location:** Garage  Outside wall  Other: \_\_\_\_\_

• **Original schedule:**

○ A) Start time(s): Mon \_\_\_\_\_ Tue \_\_\_\_\_ Wed \_\_\_\_\_ Thu \_\_\_\_\_ Fri \_\_\_\_\_ Sat \_\_\_\_\_ Sun \_\_\_\_\_

○ A) Run time/zone (min): 1 \_\_\_\_\_ 2 \_\_\_\_\_ 3 \_\_\_\_\_ 4 \_\_\_\_\_ 5 \_\_\_\_\_ 6 \_\_\_\_\_ 7 \_\_\_\_\_ 8 \_\_\_\_\_

○ B) Start time(s): Mon \_\_\_\_\_ Tue \_\_\_\_\_ Wed \_\_\_\_\_ Thu \_\_\_\_\_ Fri \_\_\_\_\_ Sat \_\_\_\_\_ Sun \_\_\_\_\_

○ B) Run time/zone (min): 1 \_\_\_\_\_ 2 \_\_\_\_\_ 3 \_\_\_\_\_ 4 \_\_\_\_\_ 5 \_\_\_\_\_ 6 \_\_\_\_\_ 7 \_\_\_\_\_ 8 \_\_\_\_\_

• **Rain sensor:** Location: Roofline \_\_\_\_\_ Not connected  Obstructed  Misplaced  Absent

Irrigation Zones (stations)		1	2	3	4	5	6	7	8
1. Zone location from the house	a. Front	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
	b. Left	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
	c. Center	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
	d. Right	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
	e. Back	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
2. Sun reaching the zone	a. Full sun	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
	b. Mostly sunny	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
	c. Mostly shady	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
	d. Full shade	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
3. Plant type	a. Turf	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
	b. Ornamentals	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
	c. Mixed (%)	Turf _____	Orn. _____						
4. Turf Quality (1=Dead, 9=Top Qual.)									
5. Num. of irrigation heads	a. Sprinklers	_____							
	b. Rotors	_____							
	c. Microirrigation	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

**Irrigated Area:** Calculated (Aerial photo) \_\_\_\_\_ ft<sup>2</sup> Corrected (In situ) \_\_\_\_\_ ft<sup>2</sup>

**Flow Test:** Run time per zone \_\_\_\_\_ minutes Meter reading before \_\_\_\_\_ Meter reading after \_\_\_\_\_

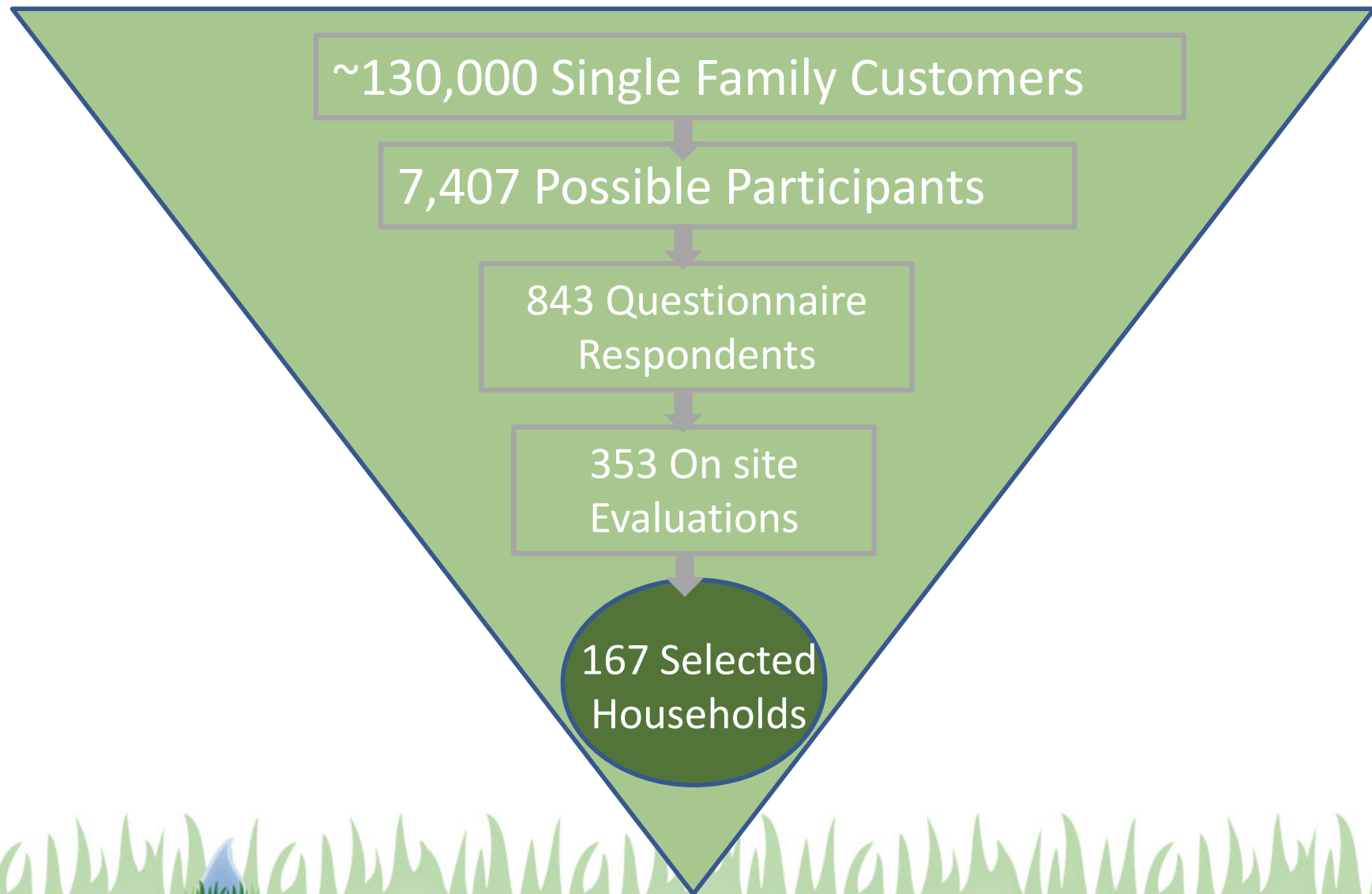
**Comments:** \_\_\_\_\_

FOR UF USE ONLY \_\_\_\_\_ Evaluator

Y \_\_\_\_\_ M \_\_\_\_\_ N \_\_\_\_\_



# Selection of Cooperators

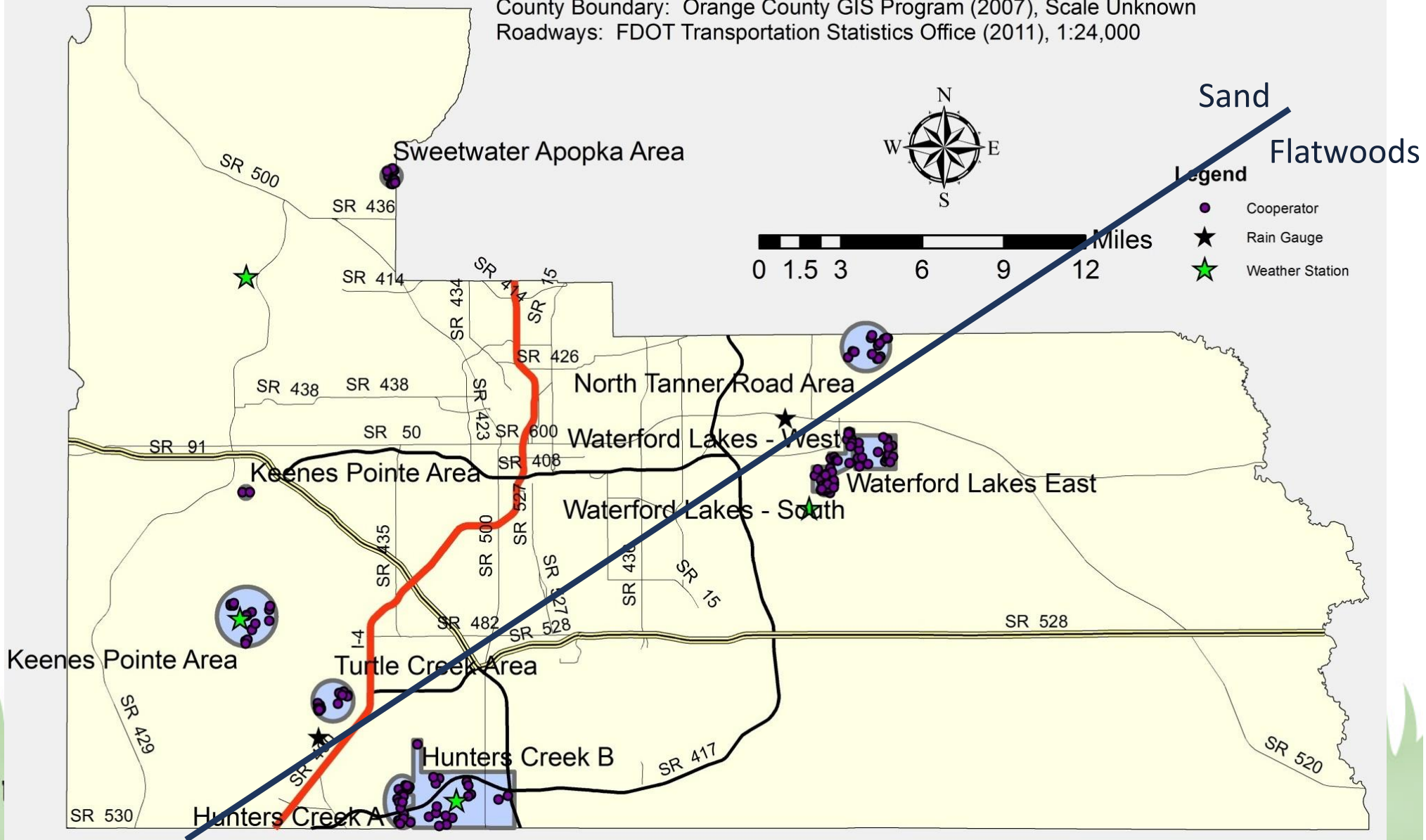


# Summary of Participants

Sources:

County Boundary: Orange County GIS Program (2007), Scale Unknown

Roadways: FDOT Transportation Statistics Office (2011), 1:24,000



# Two Smart Controllers Evaluated

## – Rain Bird ESP-SMT

- ET treatment



## – Baseline WaterTec S100

- SMS treatment





# Contractor Groups

- ET
  - Contractor programmed with default landscape settings
  - Daily water windows
  - Rare interaction with homeowner
- SMS
  - Buried at 6 inches in minimally compacted soil
  - Re-programmed time clock schedules for daily irrigation:
    - 20 minutes spray
    - 45 minutes rotor
  - Rare interaction with the homeowner

# “EDU” Groups

- Educational Training
  - ET+Edu treatment
    - Reprogrammed for site specifics
    - 5 minute tutorial
  - SMS+Edu treatment
    - Inserted into soil column at 3 inch depth
    - Reprogrammed for 0.25” per event, 2 events per day, 3 d/wk
    - 5 minute tutorial





# Automatic Meter Recording devices (AMRs)

- Separated flow meter to measure irrigation only
- Records hourly irrigation volumes
- Monthly downloads



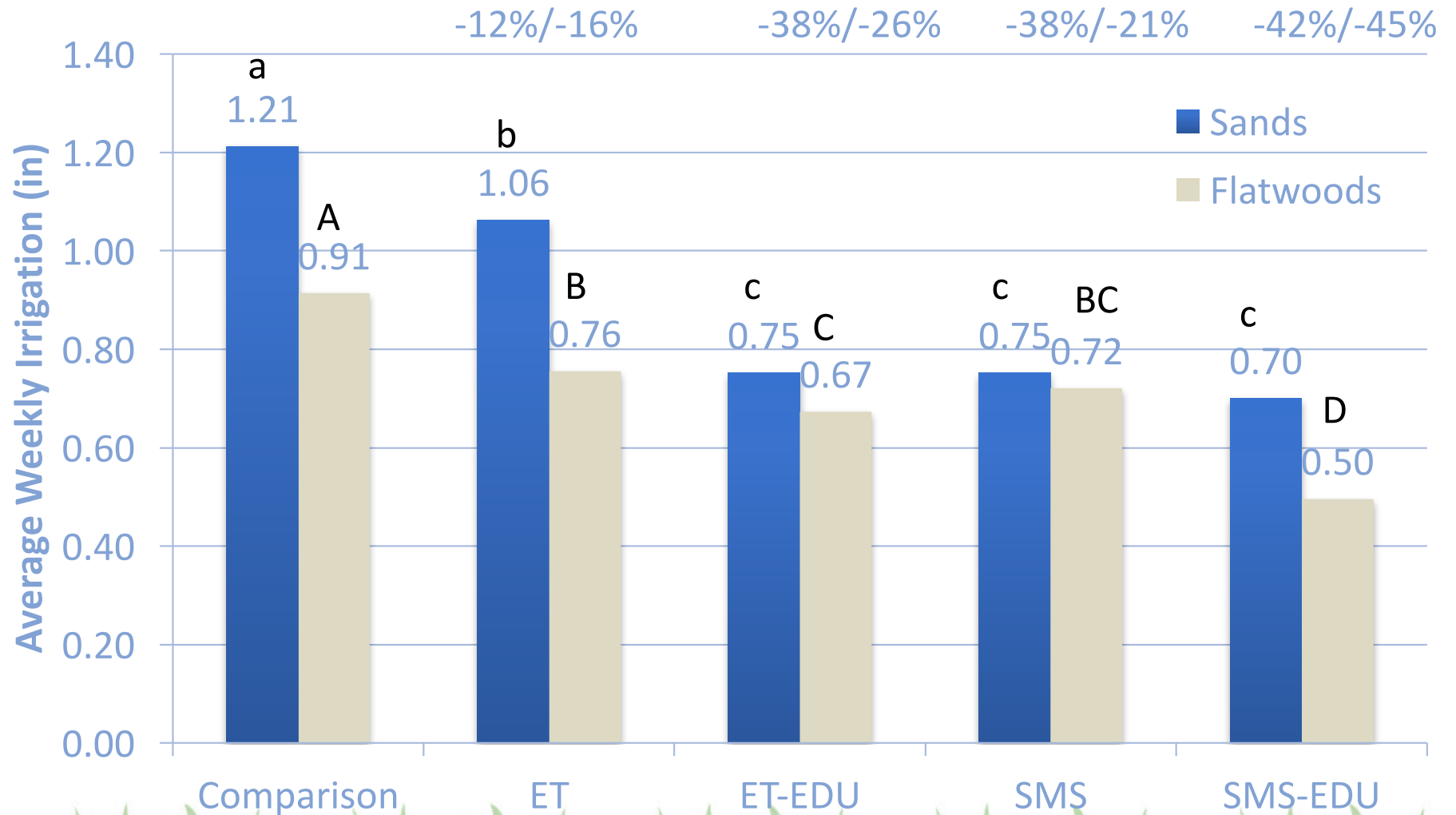


# OCU Technologies & Expt. Design

Treatment	ET	ET+Edu	SMS	SMS+Edu	Comparison
	Rain Bird ESP-SMT	Rain Bird ESP-SMT	Baseline WaterTec S100	Baseline WaterTec S100	
Technology					--
Locations Installed	7	9	7	9	9
Number Installed	28	38	28	38	35

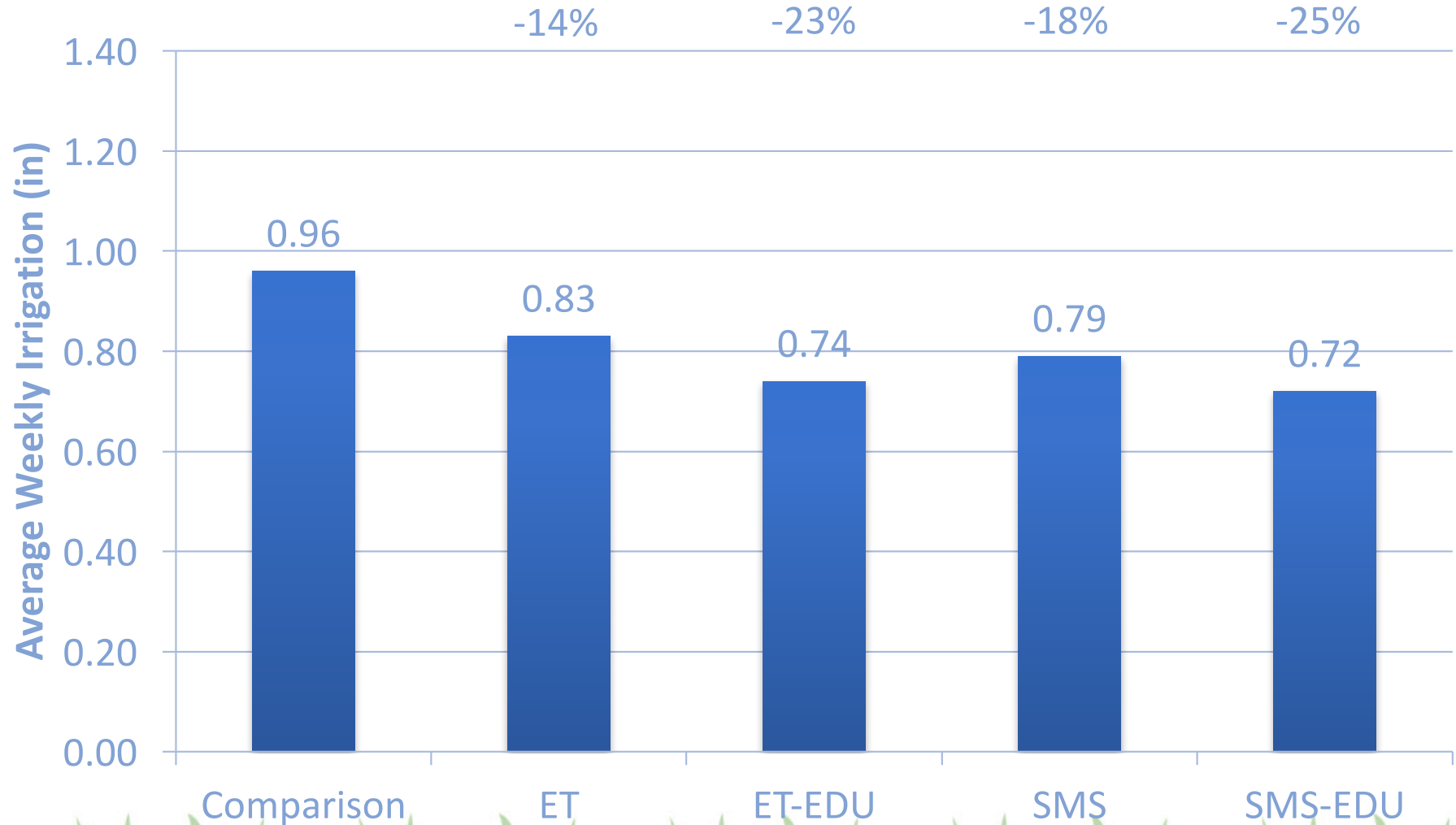
# Phase I

## Irrigation Nov 2011-Nov 2014



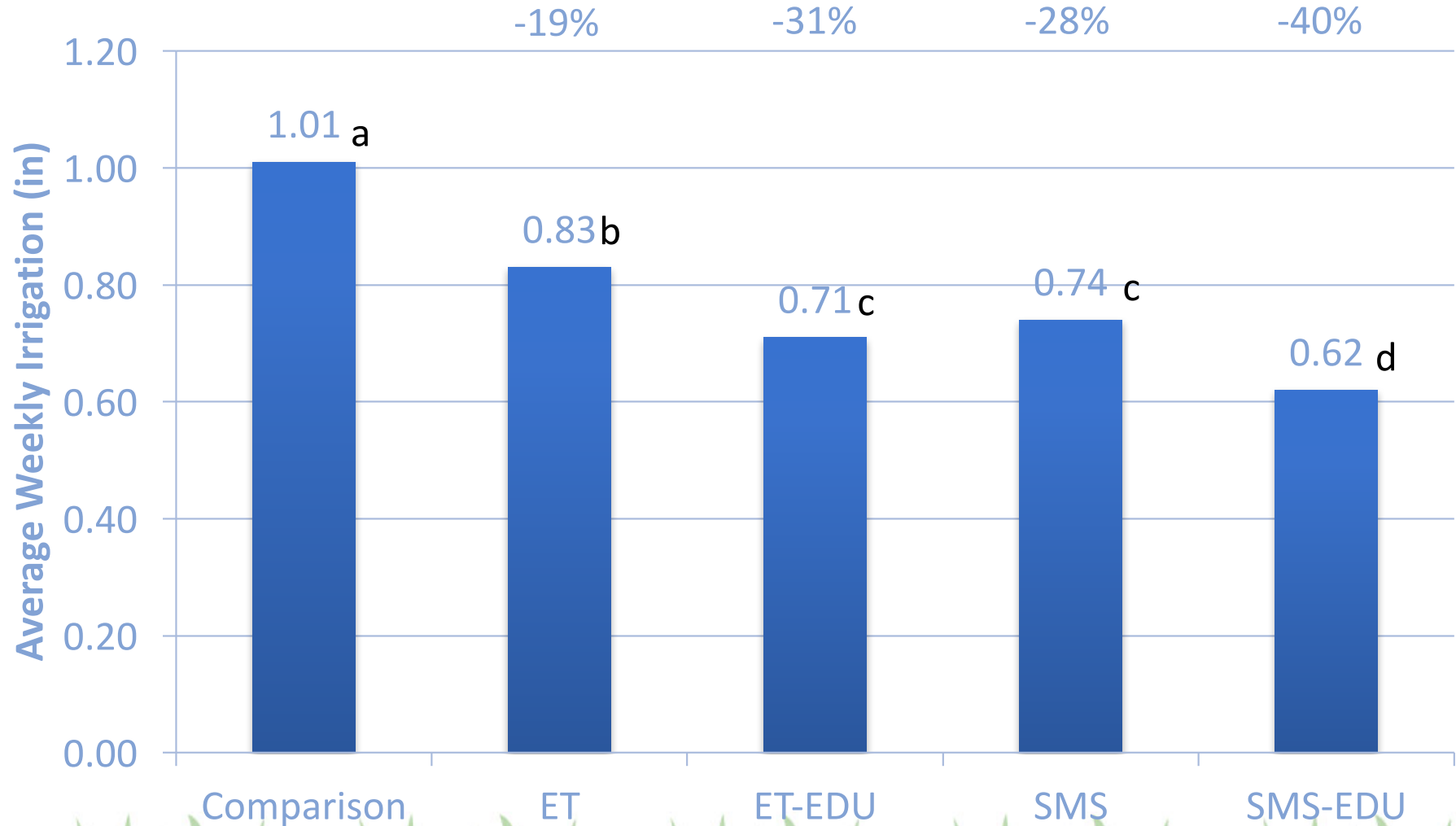
# Phase II

## Irrigation Nov 2014-Oct 2015



# Phase I & II

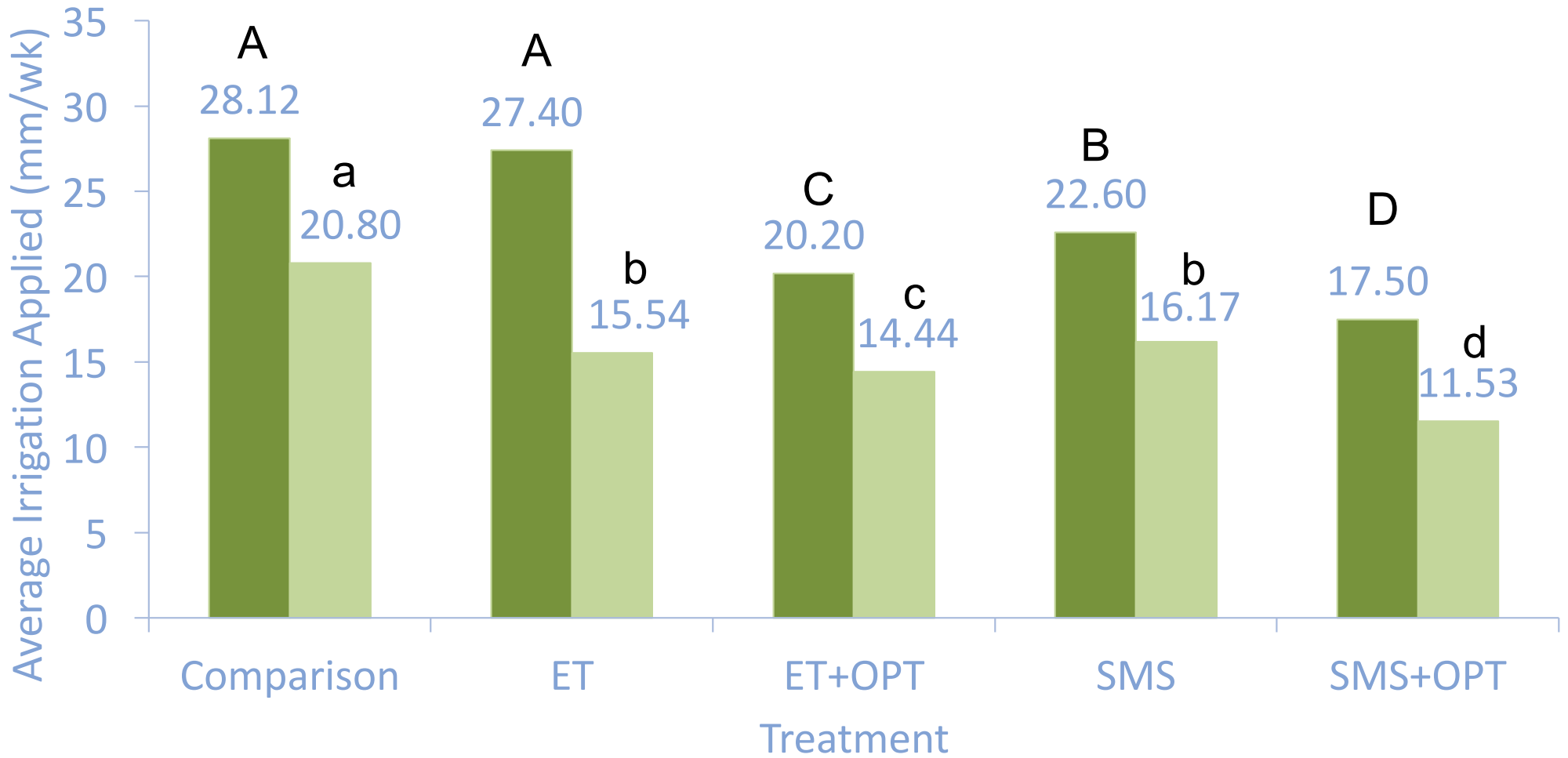
## Irrigation Nov 2011-Oct 2015



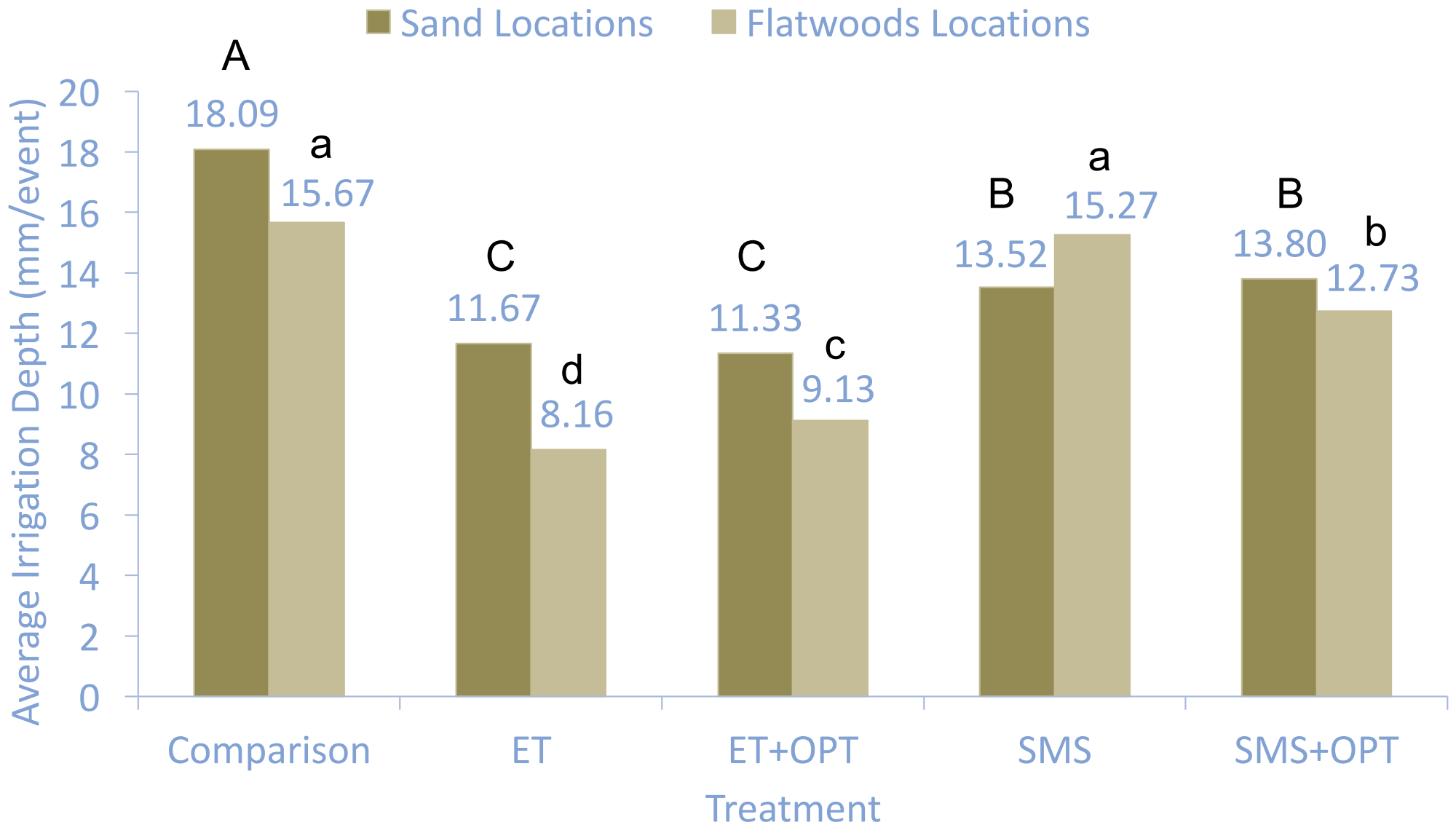


# Irrigation/Week Nov 2011-Feb 2016

■ Sand Locations    ■ Flatwoods Locations

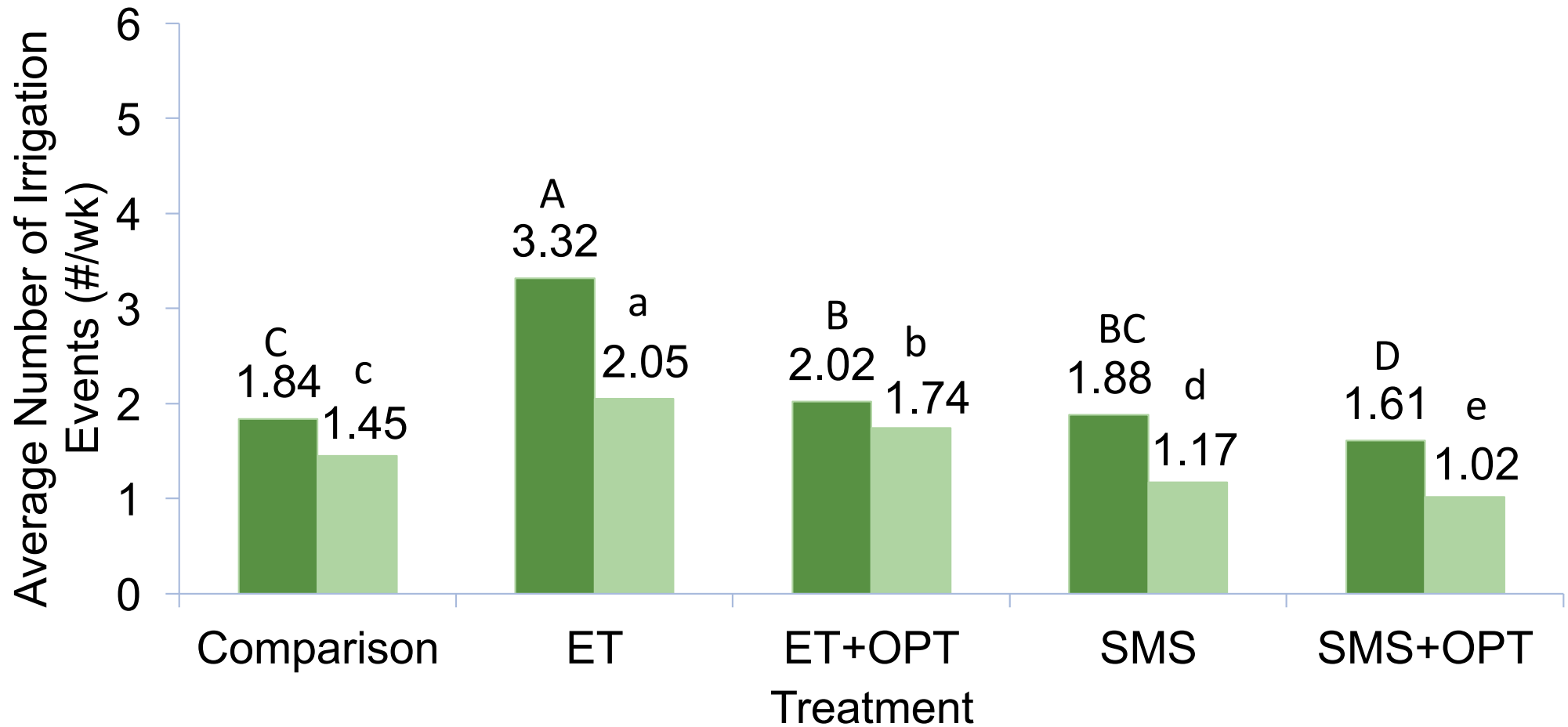


# Irrigation/Event Nov 2011-Feb 2016



# Irrigation Events/Week Nov 2011-Feb 2016

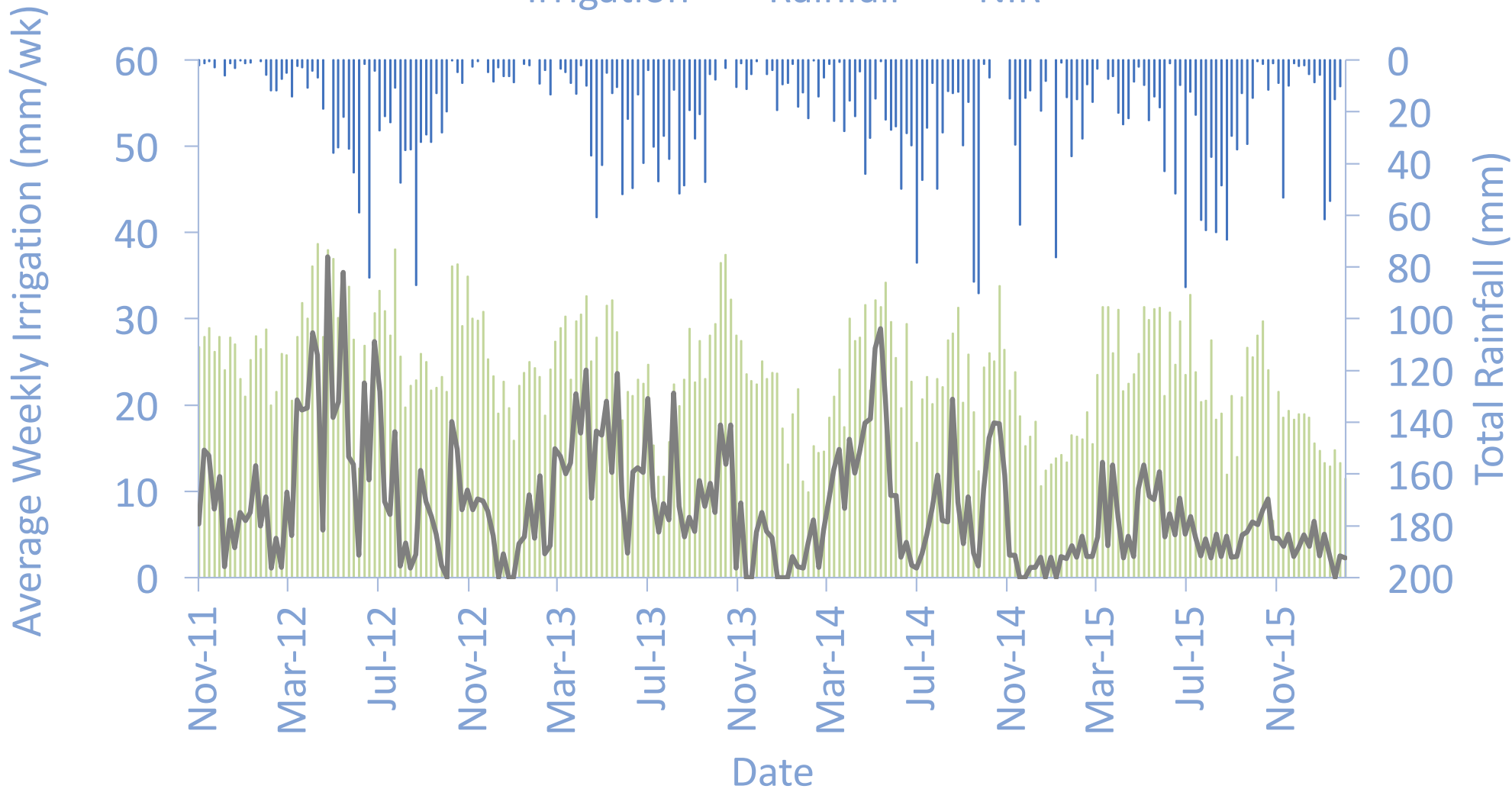
■ Sand Locations    ■ Flatwoods Locations





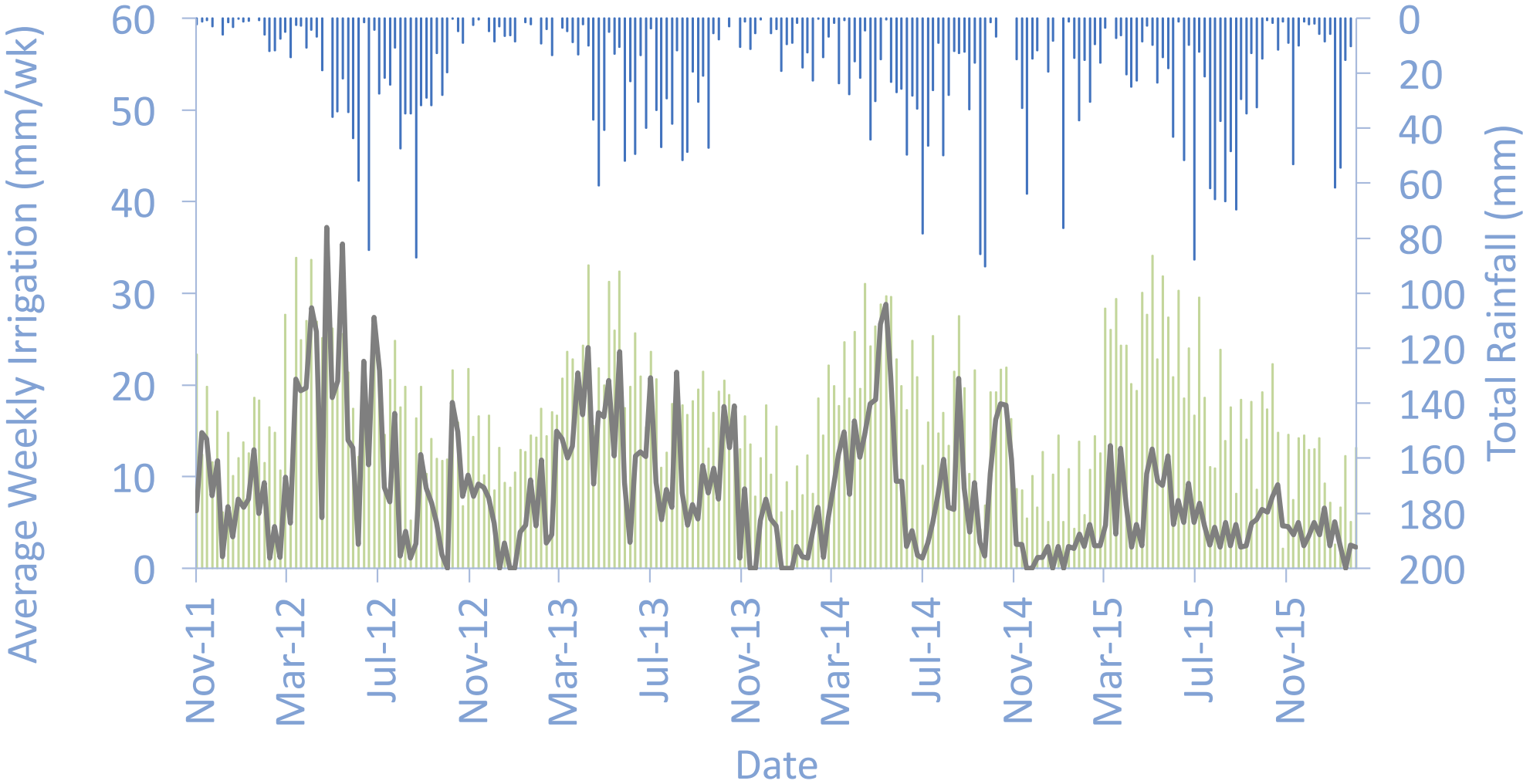
# Comparison Results

Irrigation Rainfall NIR



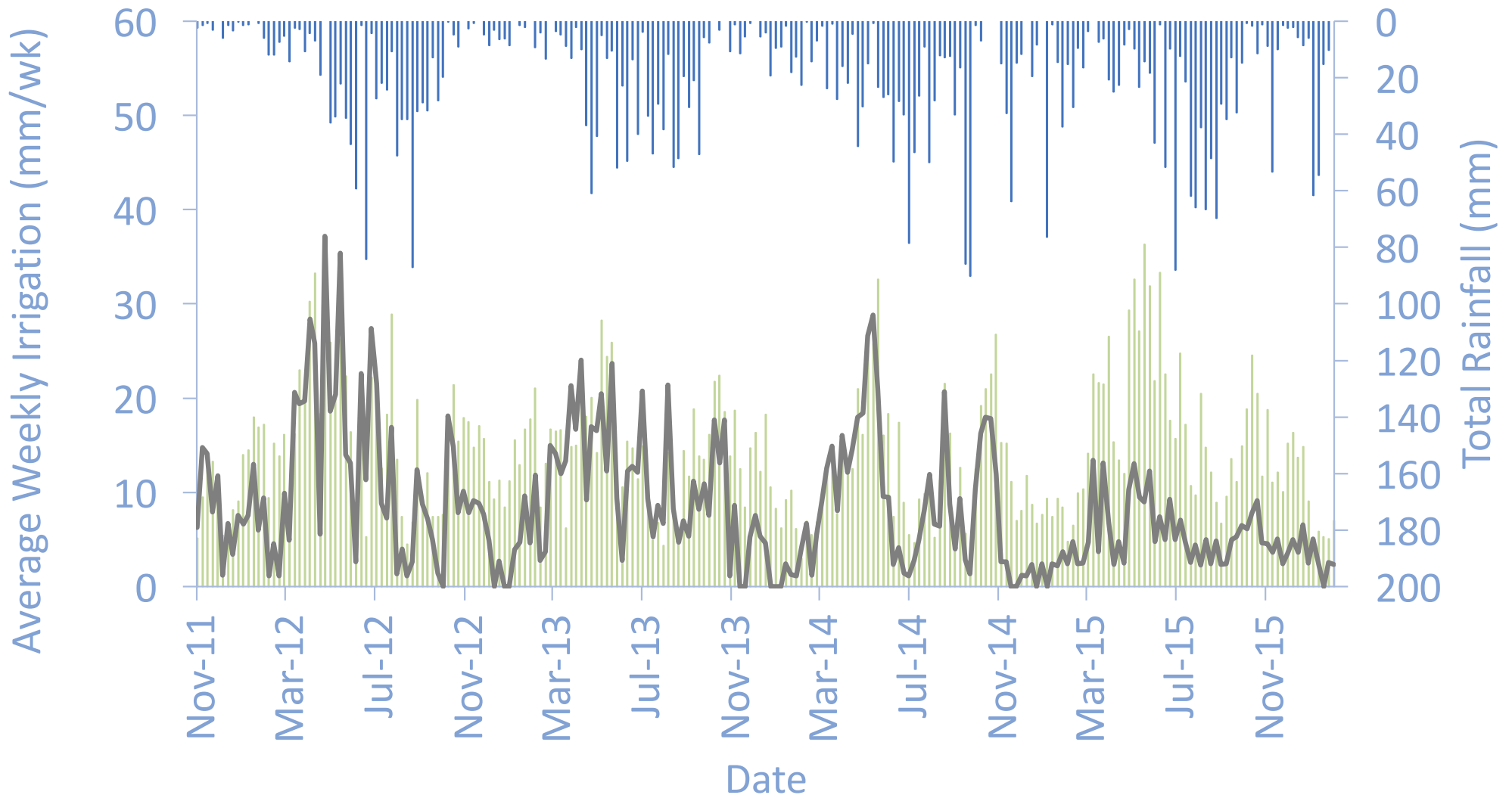
# ET+OPT Results

Irrigation Rainfall NIR



# SMS+OPT Results

Irrigation Rainfall NIR





# Turfgrass Quality



5



Center for  
**LANDSCAPE**  
Conservation & Ecology

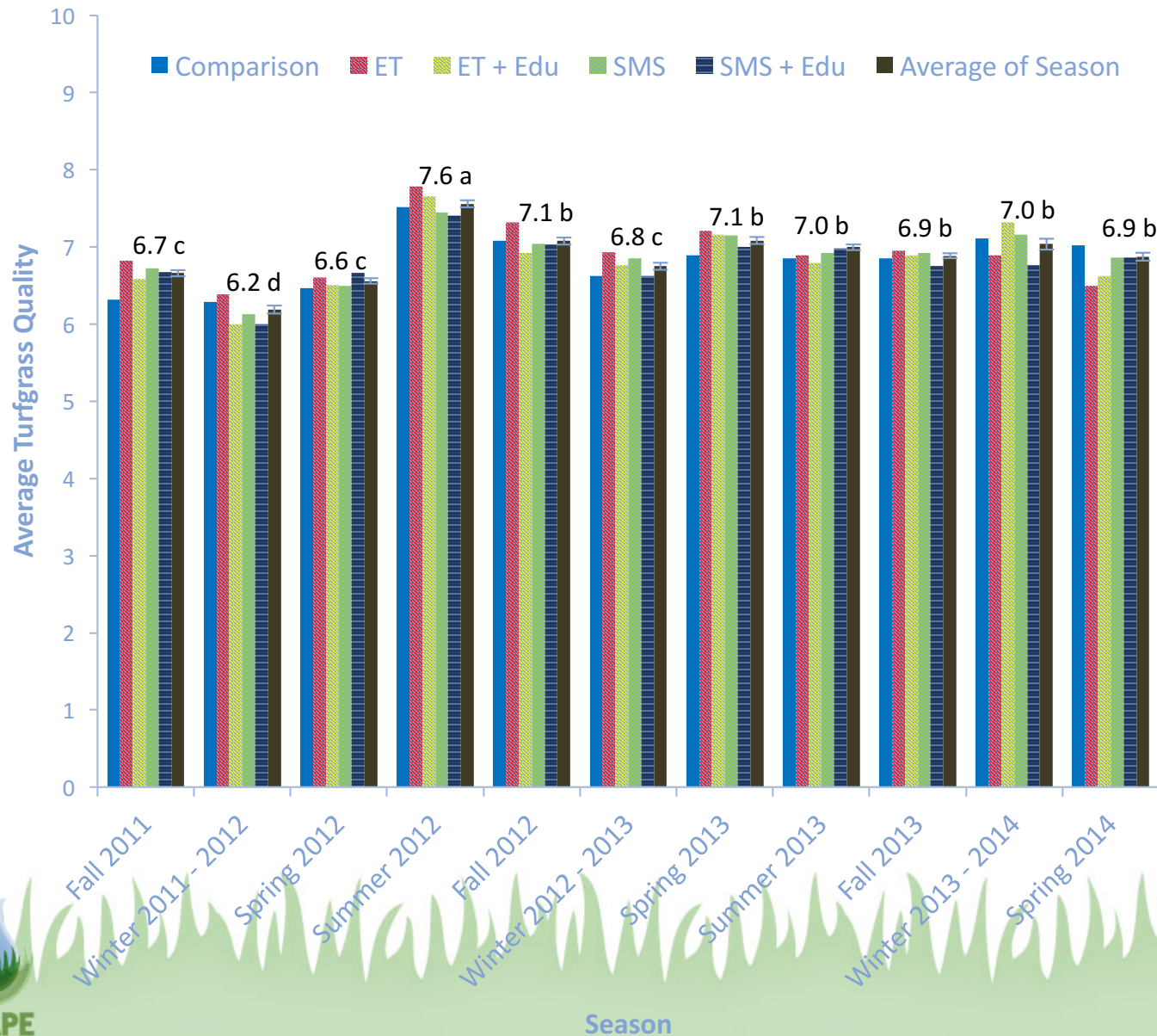
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IFAS

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# Turfgrass Quality



# Smart Controllers – Bottom Line

- ET/SMS significantly reduce over-irrigation
- ET controllers must be targeted to sites with savings potential
- Proper installation enhances savings
- Longevity of savings?

Acknowledgements: Water Research Foundation, Orange County Utilities, St. Johns River Water Management District, Southwest Florida Water Management District, Stacia Davis, Eliza Breder, Michael Gutierrez

