



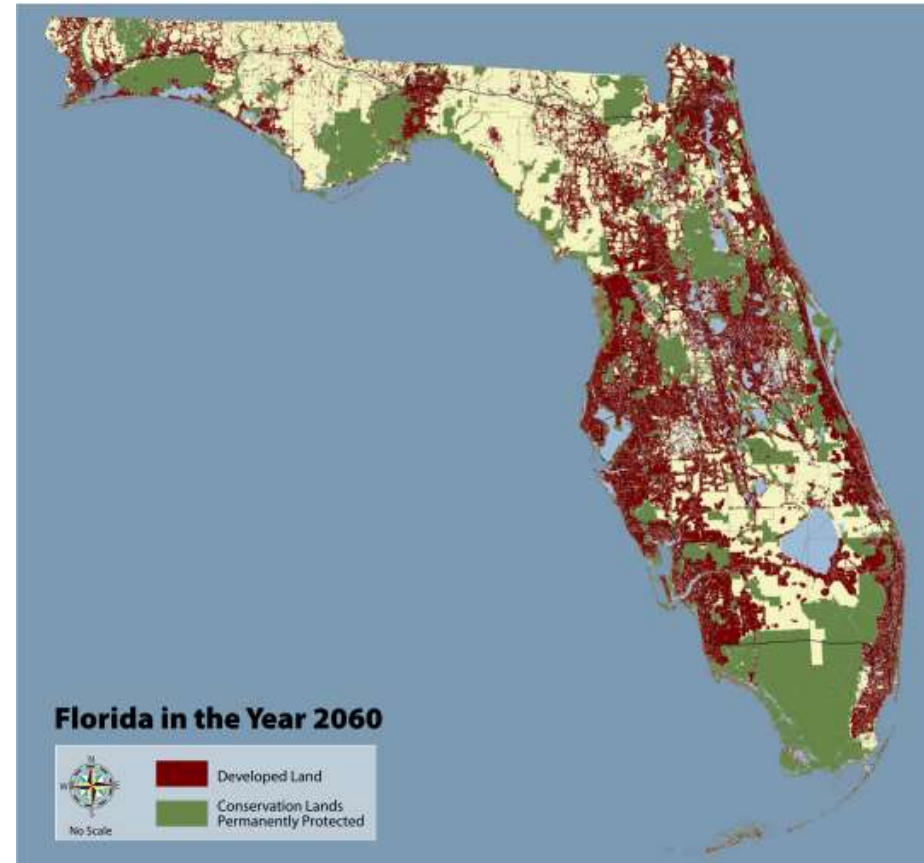
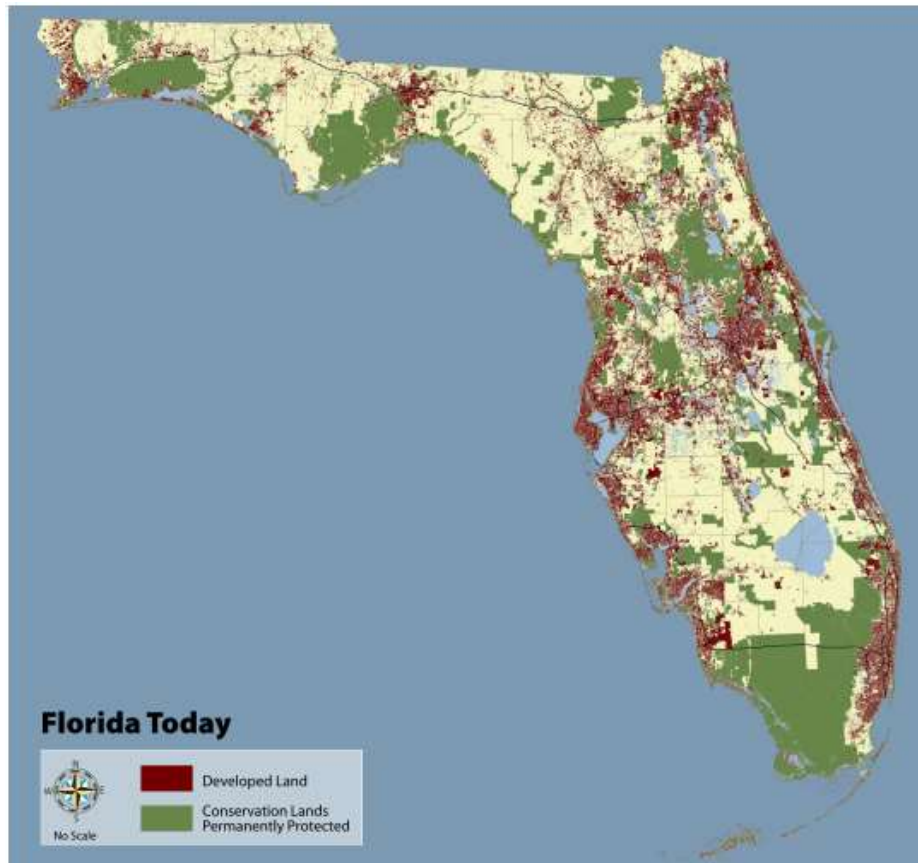
# Smart Irrigation Controllers: What Makes Them So Smart and How They Reduce Wasted Irrigation

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Agricultural & Biological Engineering  
Institute of Food and Agricultural Sciences (IFAS)

66<sup>th</sup> Annual Southeastern Turfgrass Conference  
UGA Tifton Conference Center, Apr 24, 2012

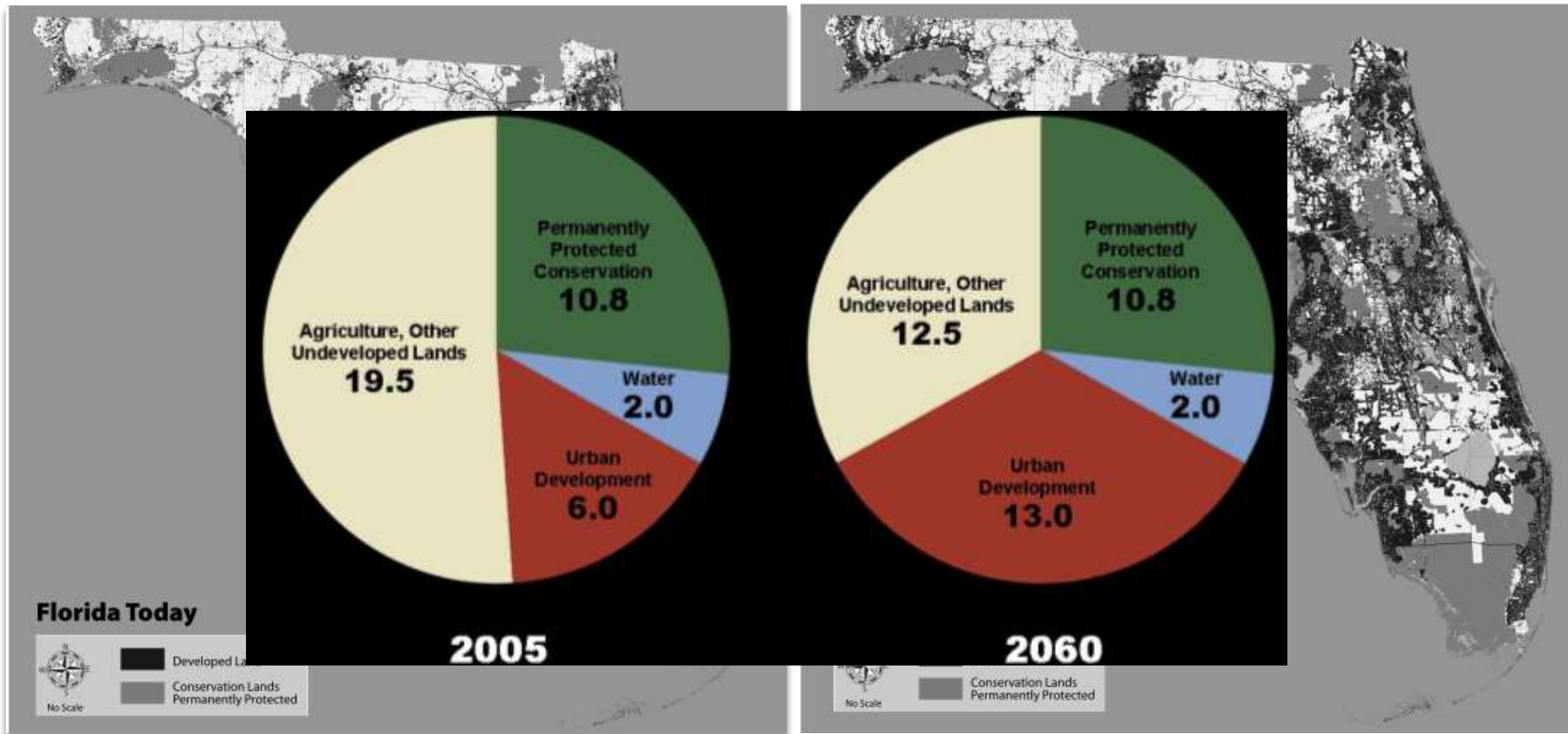
# Development of Land in Florida



Maps from 1,000 Friends of Florida  
<http://www.1000friendsofflorida.org/planning/2060.asp>



# Development of Land in Florida



Maps from 1,000 Friends of Florida  
<http://www.1000friendsofflorida.org/planning/2060.asp>

# Irrigation is a Standard “Appliance”

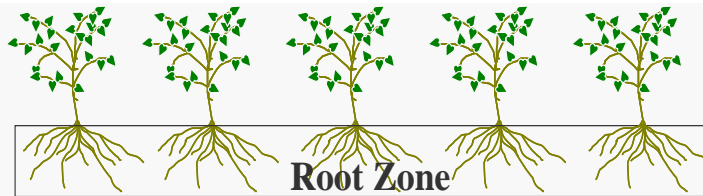




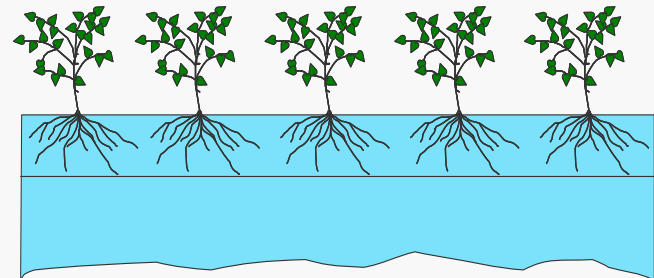
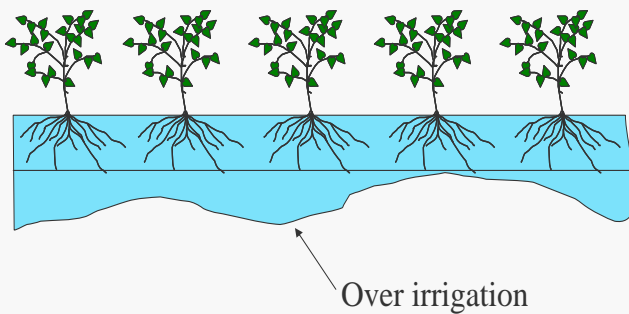
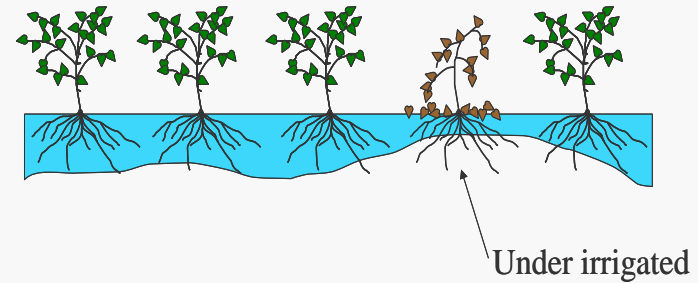
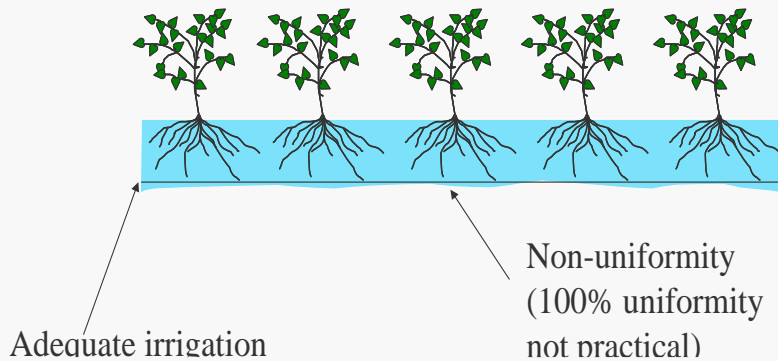
# Lake Okeechobee 2007, Water Control Structure



# Inefficiency: Design/maint. + Management



Soil Below Root Zone



# Improper Design & Installation: Improper Coverage





# Improper Design & Installation: Inadequate Pressure



Photo credit: Dr. Bryan Unruh

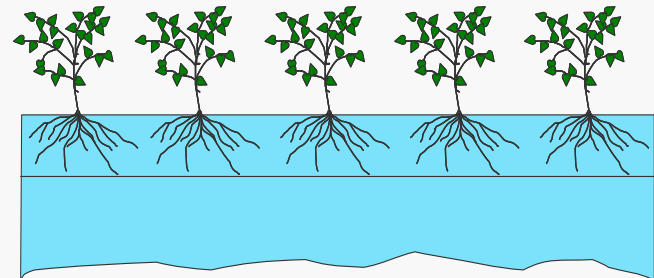
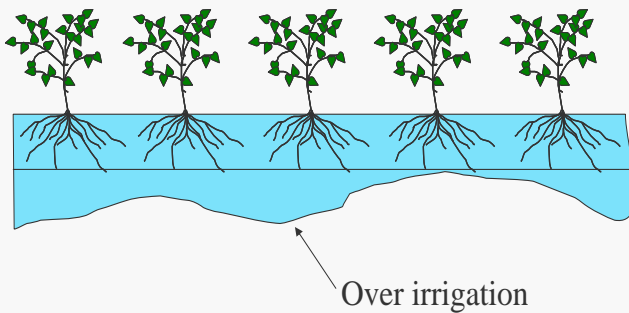
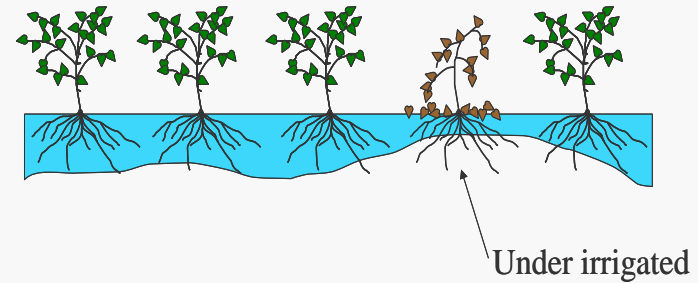
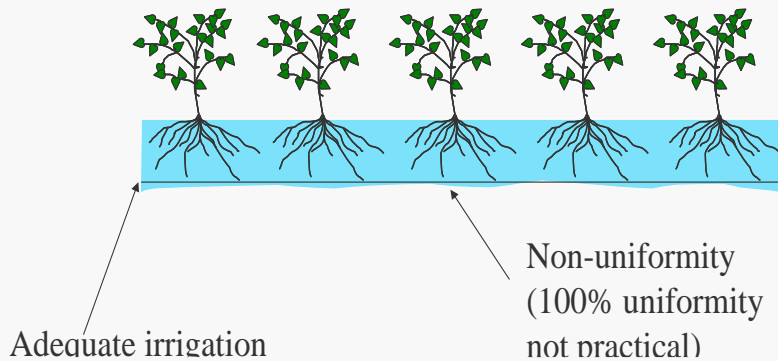




# Inefficiency: Design/maint. + Management

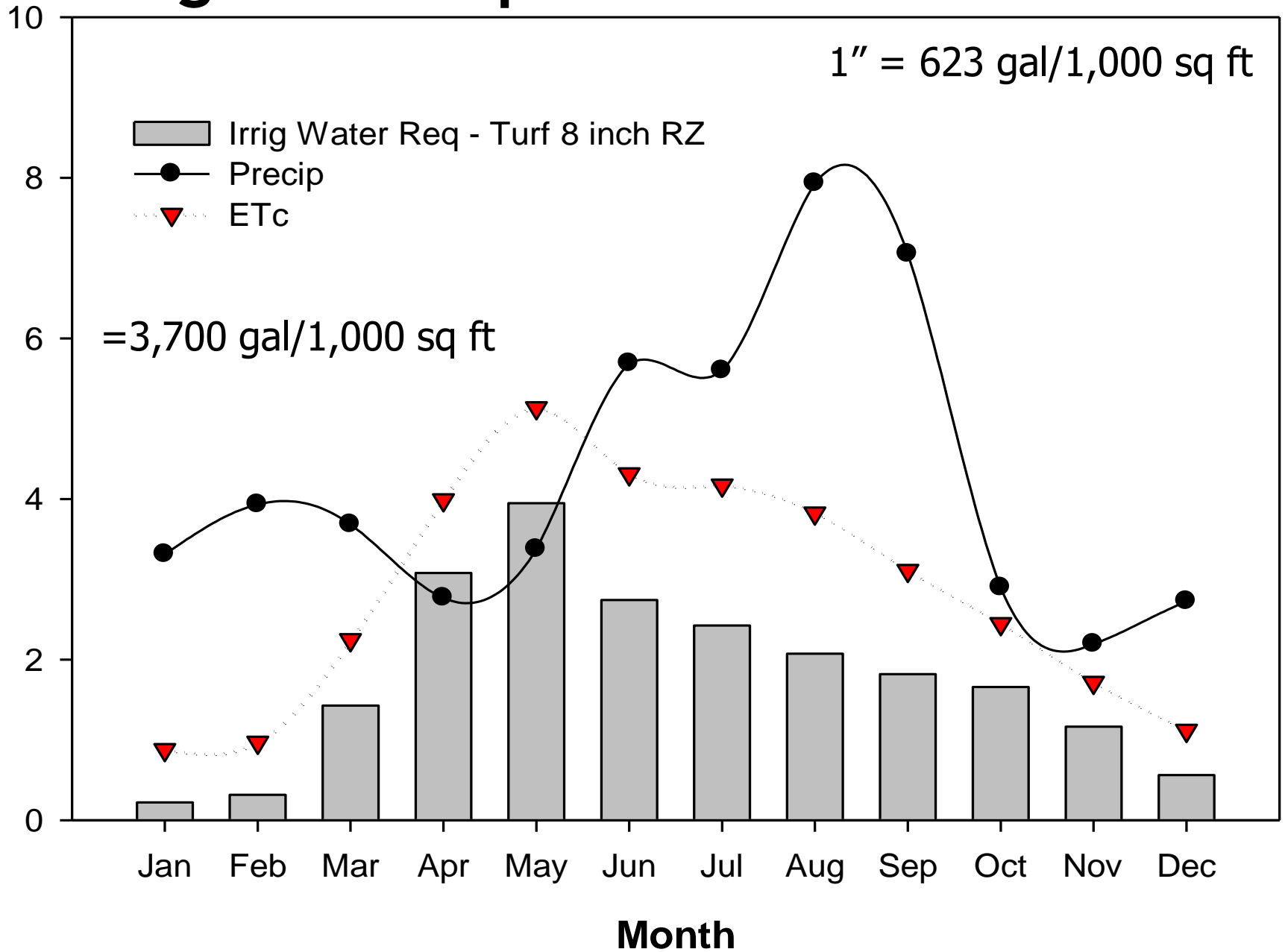


Soil Below Root Zone



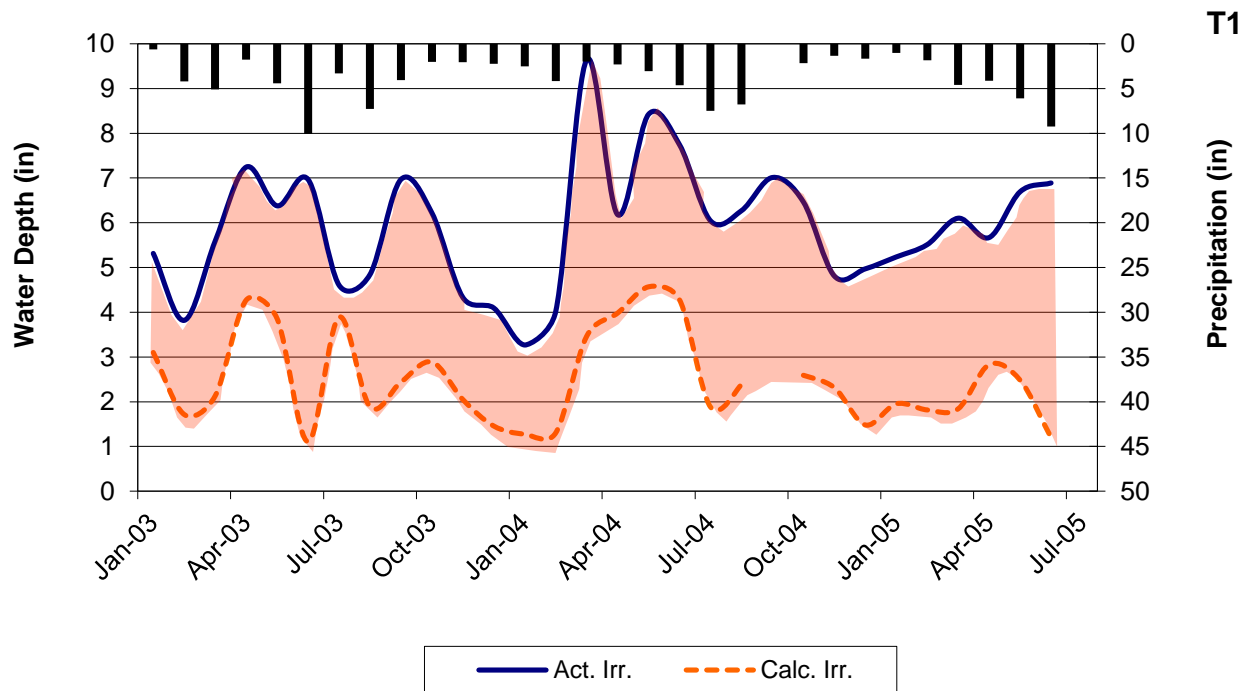


# Irrigation Requirements Estimation



# Central Florida - Typical Irrigator

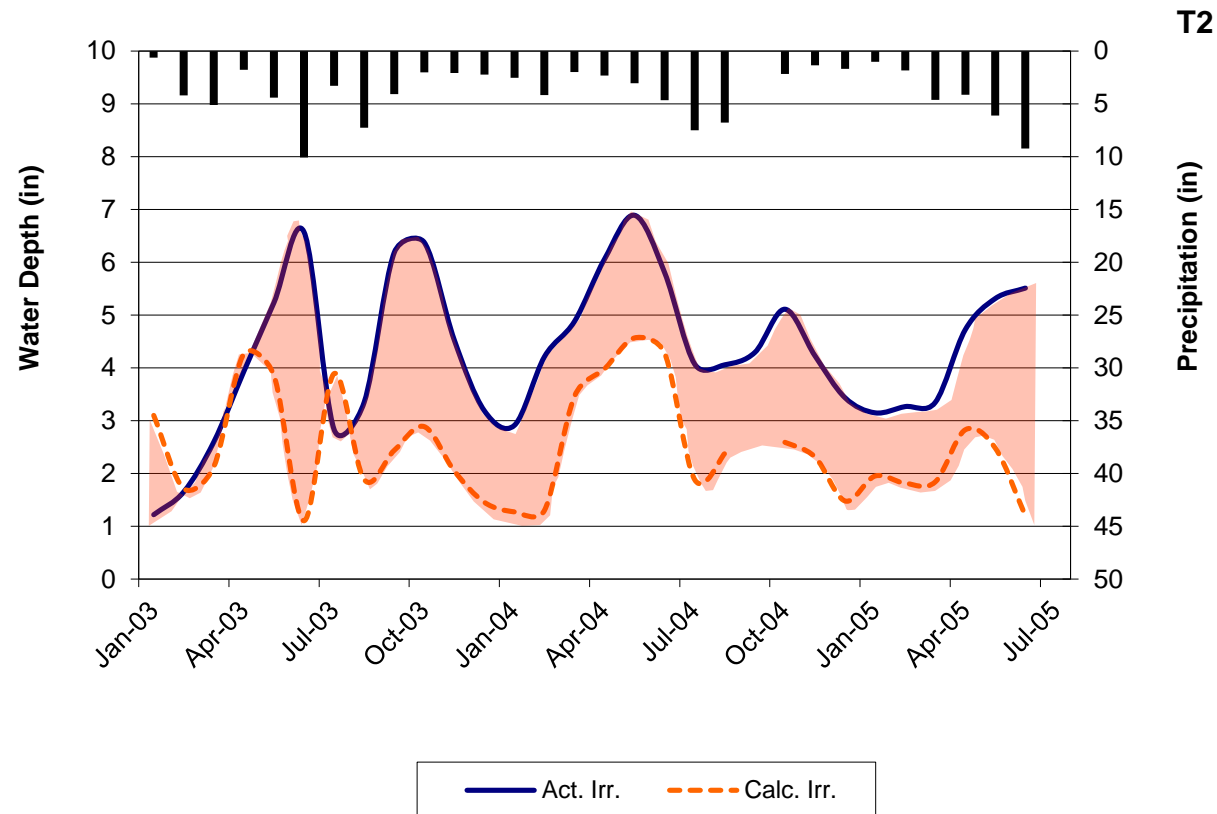
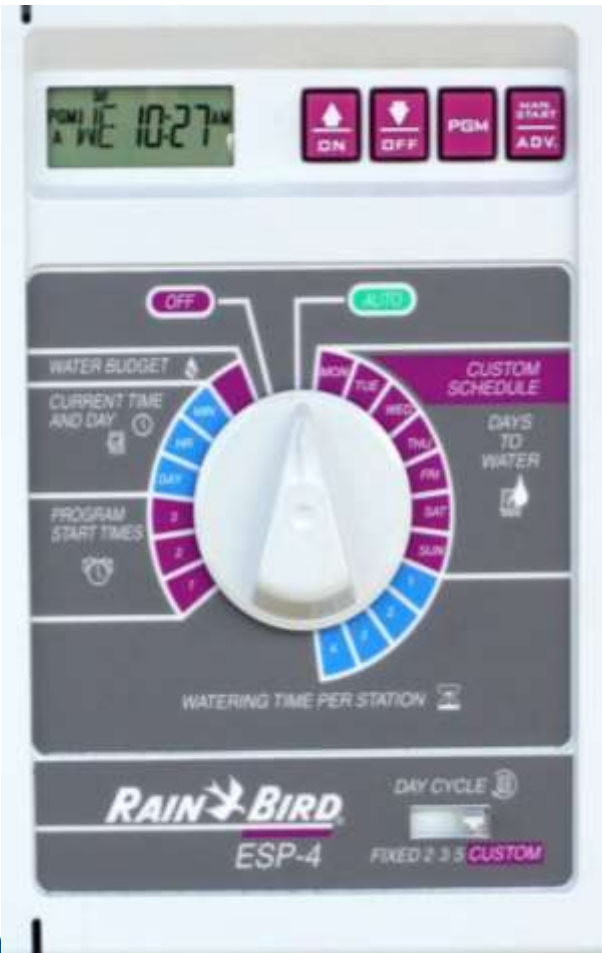
- Irrigation:
  - ♦ Actual, 70 inches/yr
  - ♦ Max need, <30 inches/yr
- Rainfall, 50 inches/yr





# Central Florida - Monthly Time Clock Adjustment

- 30% savings by adjusting time clock monthly



# IFAS Recommended Irrigation Run Times

	<b>Weekly Irrigation (inches)</b>	<b>Monthly Irrigation (inches)</b>
Jan	0.04	0.16
Feb	0.00	0.00
Mar	0.09	0.34
Apr	0.49	1.98
May	0.84	3.34
Jun	0.75	3.00
Jul	0.70	2.79
Aug	0.64	2.57
Sep	0.82	3.28
Oct	0.54	2.15
Nov	0.34	1.34
Dec	0.13	0.52
<b>Total</b>		<b>21.5</b>

## Operation of Residential Irrigation Controllers<sup>1</sup>

Michael D. Dukes and Dorota Z. Haman<sup>2</sup>

### Introduction

Automatic landscape irrigation systems have become quite common in Florida in recent years. Electronic irrigation controllers are used to control these systems; however, it is not always obvious how to program these controllers to apply the desired amount of irrigation water.

### Irrigation Controllers

The document "Irrigation System Controllers" (IFAS Publication SS-AGE-22; on the Web at <http://edis.ifas.ufl.edu/AE077>) discusses various types of typical irrigation controllers in detail. In general, commercially available controllers are mechanical, electromechanical, electronic, or computer based. Electronic controllers are commonly installed in residential and small commercial landscape irrigation systems. We will discuss the general operation common to most residential irrigation controllers. For details specific to a given controller the reader should refer to the owner's manual.

### Electronic Controller Operation

Generally, electronic controllers allow flexible scheduling of irrigation systems (Figure 1).



Figure 1. Typical residential irrigation controller.

Some scheduling options provided by controllers are:

#### Days of the week

1. This document is CIR1421, one of a series of the Agricultural and Biological Engineering Department, Florida Cooperative Extension Service, Institute of Food and Agricultural Sciences, University of Florida. Original publication date July 2002. Reviewed December 2005. Visit the EDIS Web Site at <http://edis.ifas.ufl.edu>.

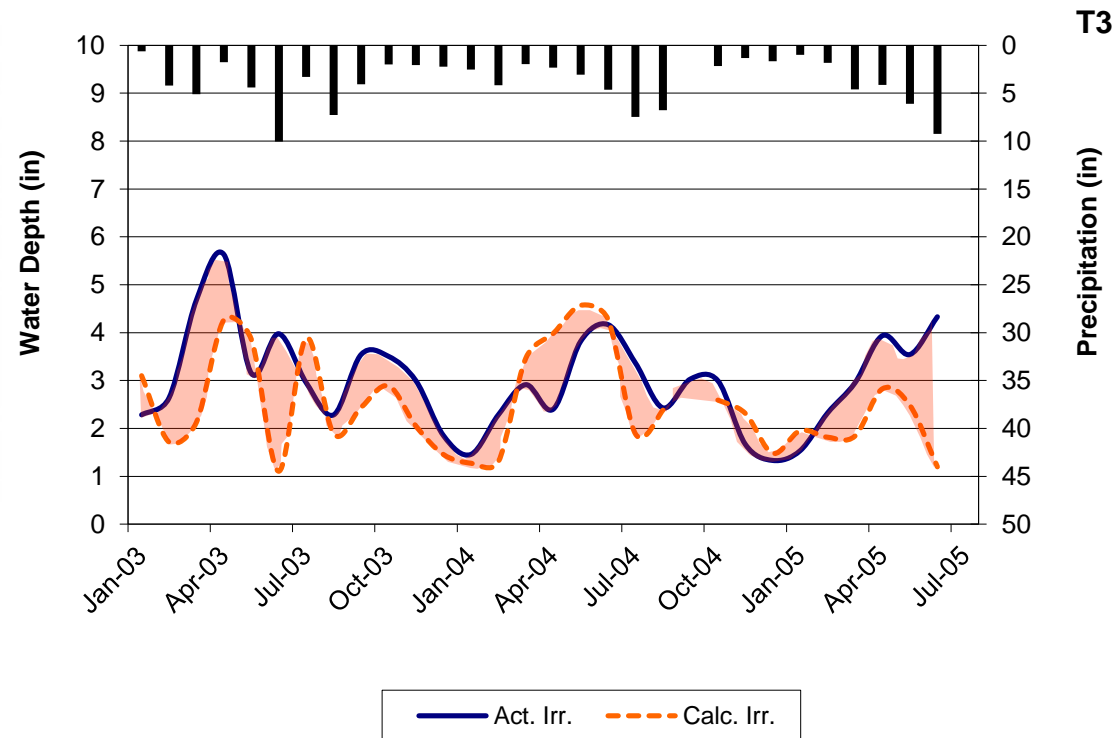
2. Michael D. Dukes, assistant professor; Dorota Z. Haman, associate professor; Agricultural and Biological Engineering Department, Institute of Food and Agricultural Sciences, University of Florida, Gainesville.

The appearance of trade names in this publication does not imply endorsement of any product by the authors or by the Institute for Food and Agricultural Sciences at the University of Florida.



# Central Florida - Monthly Time Clock Adjustment + Extensive Microirrigation

- 50% savings by adjusting time clock monthly & adding >50% microirrigated area





# SMART WATER APPLICATION TECHNOLOGY (SWAT)

# What is Smart Water Application Technology (SWAT)?

- SWAT → Irrigation technologies designed to conserve water
- SWAT concept created approx. 2001 by Irrigation Association (IA) & water purveyors



# Smart Water Application Technologies (SWAT)



*Evapotranspiration (ET) based controllers*

*Soil moisture sensor (SMS) controllers*



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

*Rain sensors (RS)*



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## Landscape Irrigation Controllers

Did you know that there are an estimated 13.5 million irrigation systems currently installed in residential lawns across the United States and an additional 308,000 new systems are installed each year as a part of new home construction? Of the 13.5 million installed units, less than 10 percent use weather-based controllers to schedule irrigation, with the majority using standard clock timer controllers.

Weather-based irrigation controllers use local weather and landscape conditions to tailor irrigation schedules to actual conditions on the site or historical weather data. Instead of irrigating according to a preset schedule, advanced irrigation controllers allow irrigation to more closely match the water requirements of plants. These new control technologies offer significant potential to improve irrigation practices in homes, businesses, parks, and schools across the United States. WaterSense plans to label weather-based irrigation controllers and soil moisture sensors.

WaterSense has developed a draft [Specification for Weather-based Irrigation Controllers](#). To earn the WaterSense label, controllers must be able to adequately meet the watering needs of a landscape without overwatering. Once the specification has been finalized, products will be independently tested and certified by a licensed certifying body to ensure that they meet these performance criteria. In addition, the draft specification proposes that labeled products must contain a number of supplementary features, such as the ability to hold multiple irrigation schedules, to ensure the product is capable of keeping up with ever-changing weather patterns and watering needs.

Replacing a standard clock timer controller with a WaterSense labeled irrigation controller or installing a

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### DID YOU KNOW?

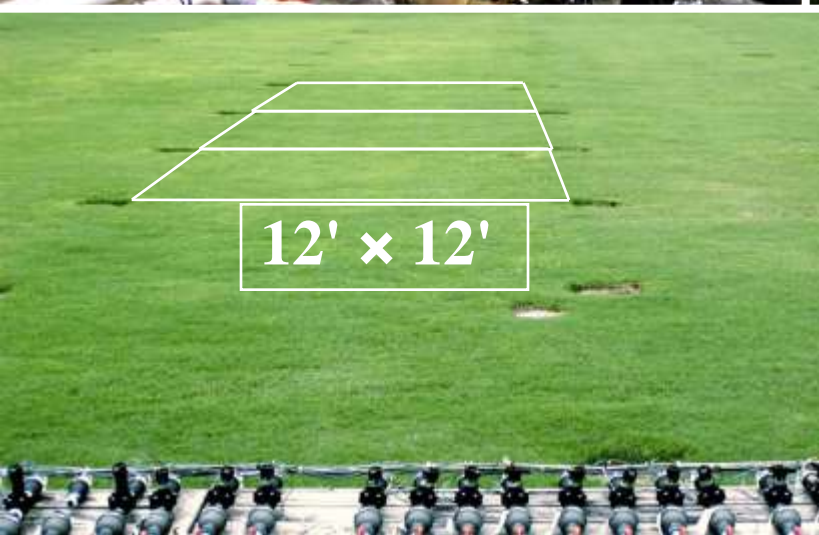
You can save **11,000 gallons a year** by updating your bathroom with a WaterSense labeled toilet. [Learn more >](#)





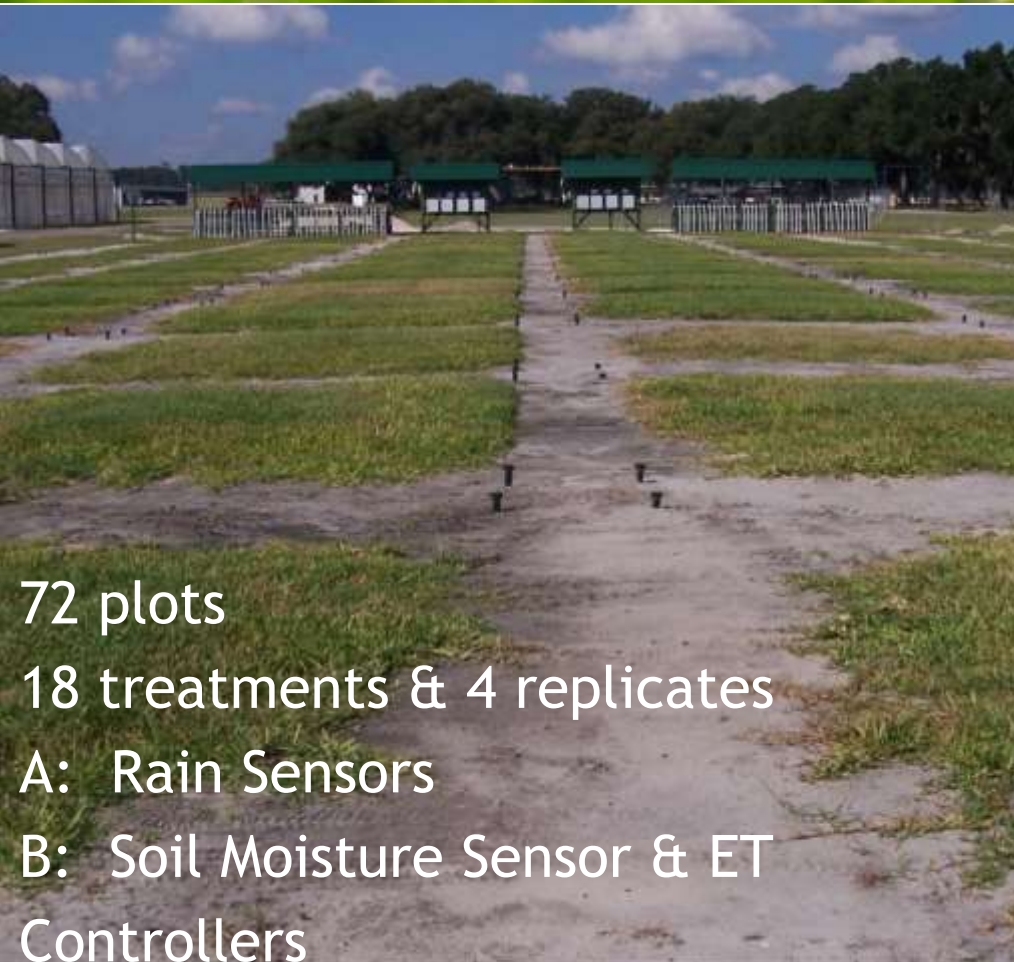
# **SMS CONTROLLER TESTING ON PLOTS**

# Research (2004 - 2008)





# SMS/ET Controllers 2006-08, Drought Conditions



St. Augustinegrass  
testing ongoing since  
March 2006

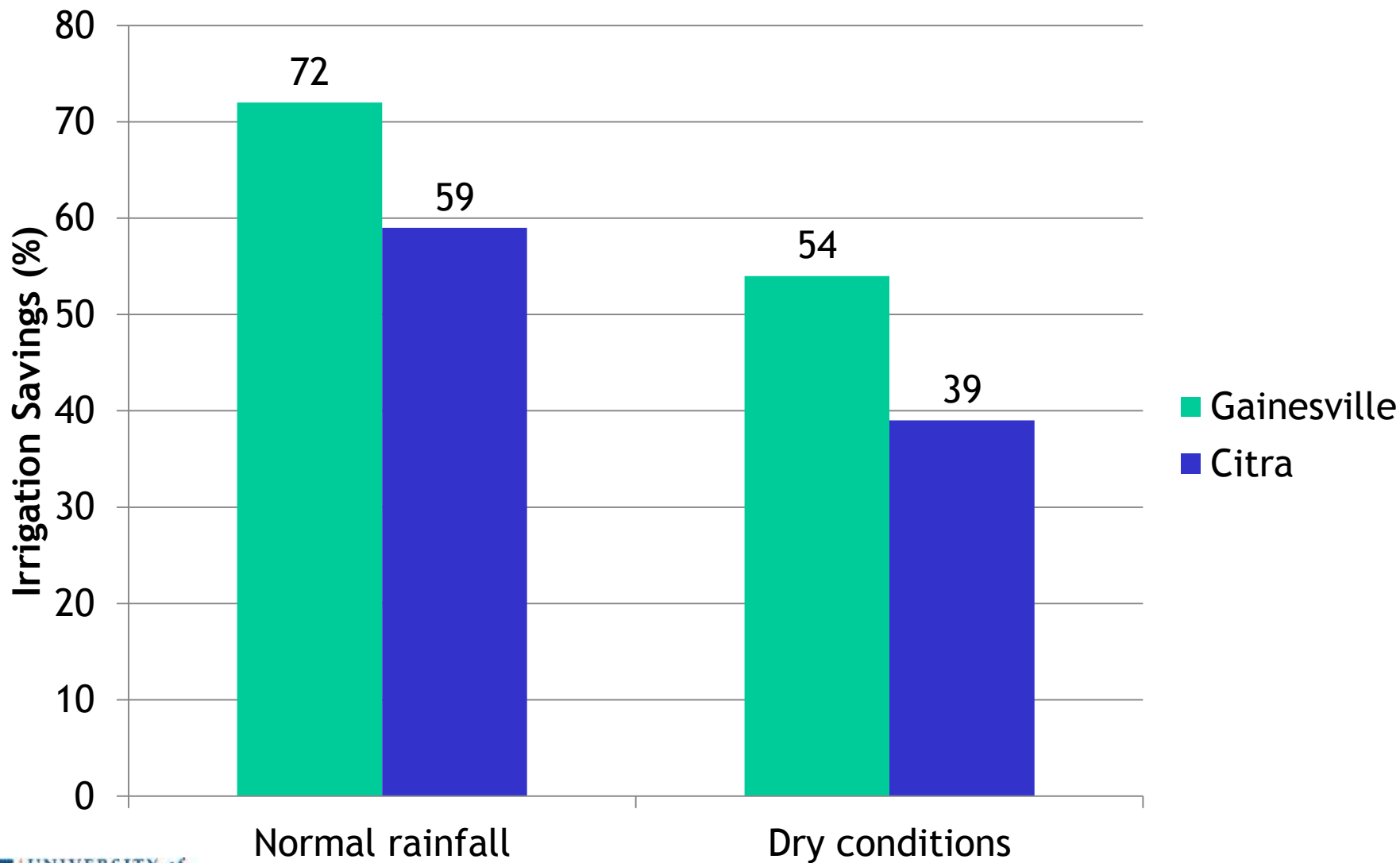
72 plots  
18 treatments & 4 replicates  
A: Rain Sensors  
B: Soil Moisture Sensor & ET  
Controllers

Photo May 2006, M.L. Shedd





# Irrigation Savings Compared to a Time Schedule No Rain Sensor





# **SMS TESTING ON COOPERATING HOMES, PINELLAS CO.**

# Treatments

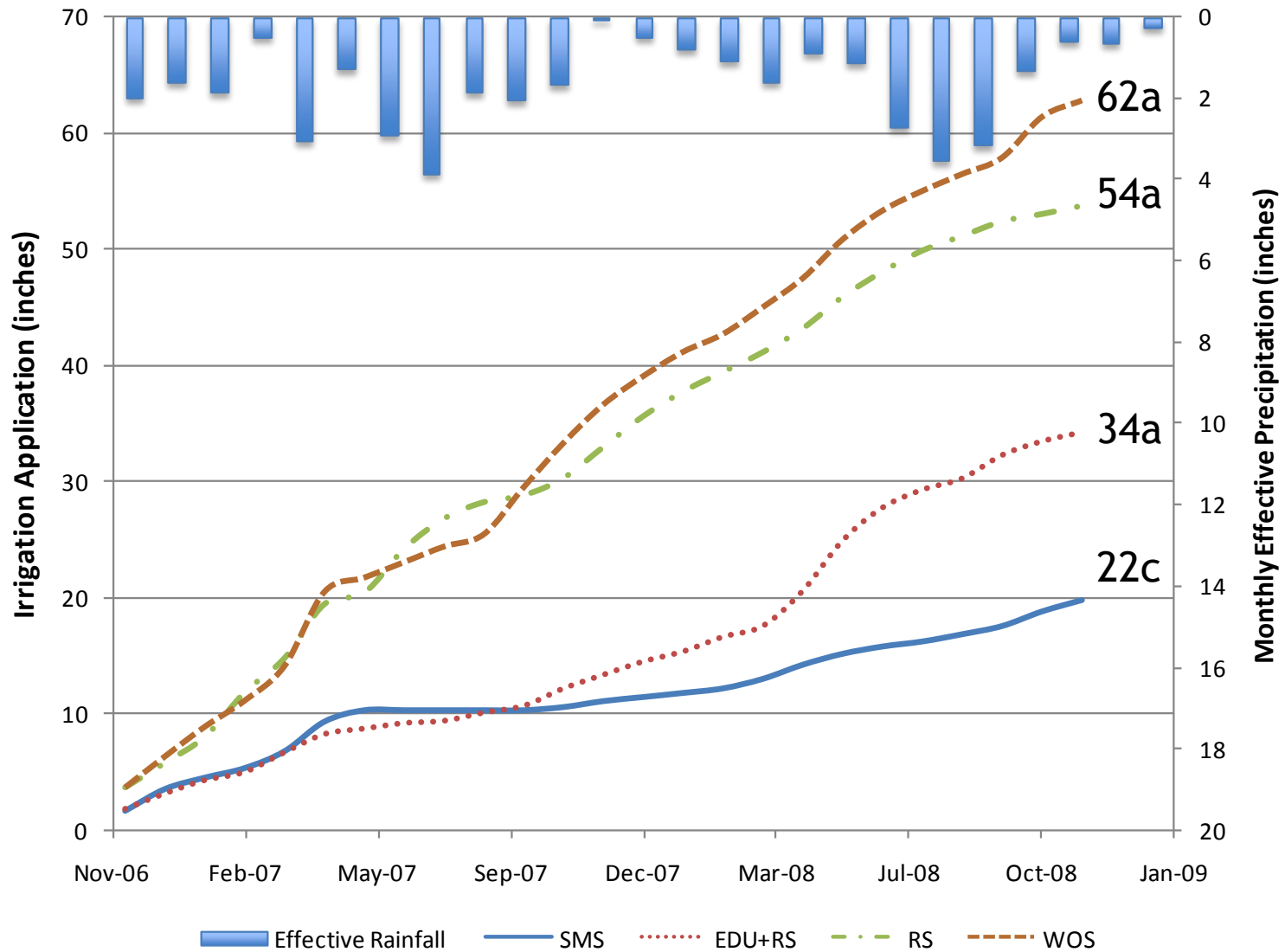
- SMS, Current irrigation system **without** rain sensor and **with** a soil moisture sensor controller
- EDU+RS, Current irrigation system **with** rain sensor & seasonal run time guidelines
- RS, Current irrigation system **with** rain sensor
- WOS, Current irrigation system **without** a sensor





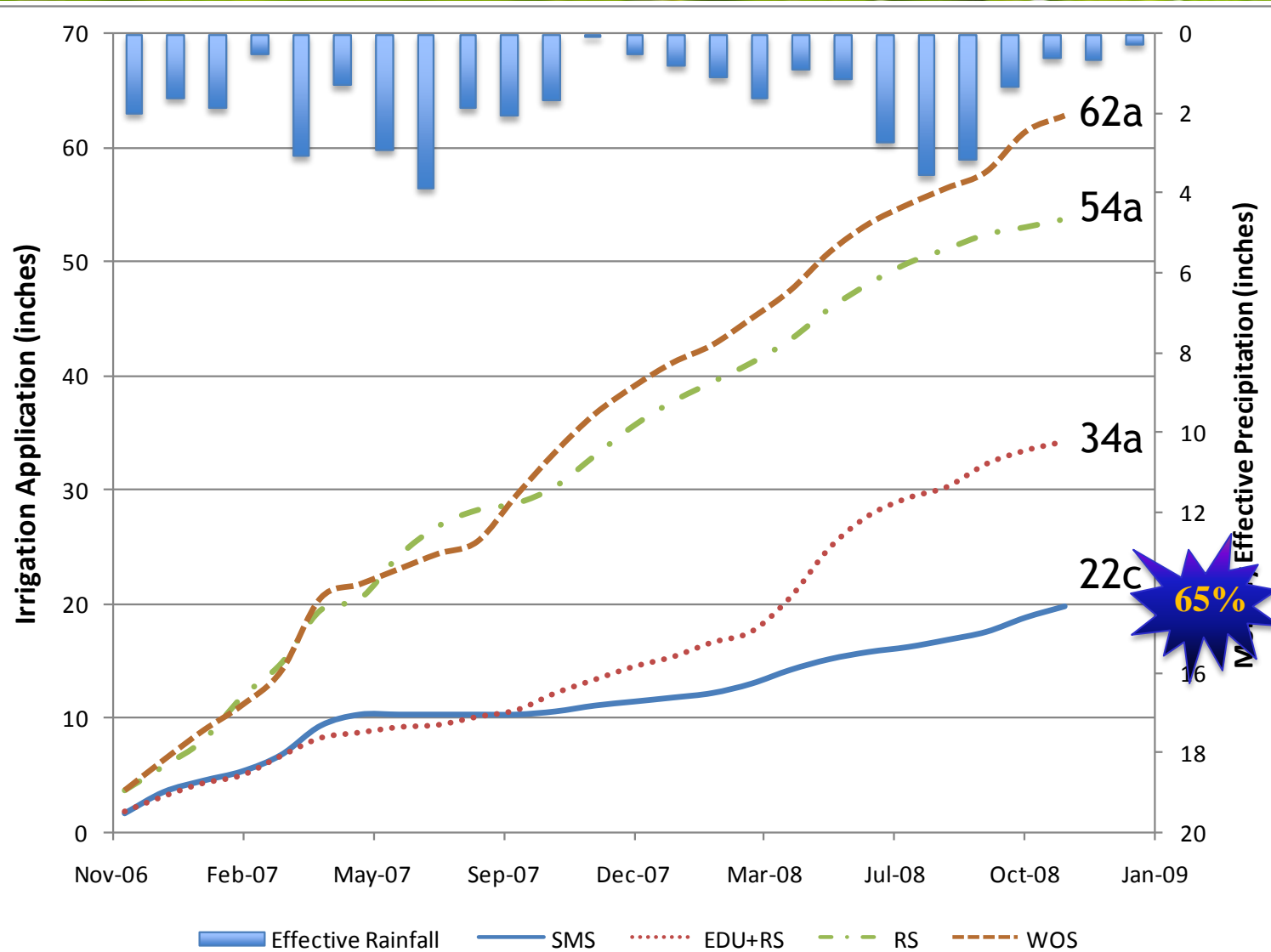
# Pinellas County Homes, Irrigation

## Nov 06 - Dec 08



# Pinellas County Homes, Irrigation Savings

## Nov 06 - Dec 08

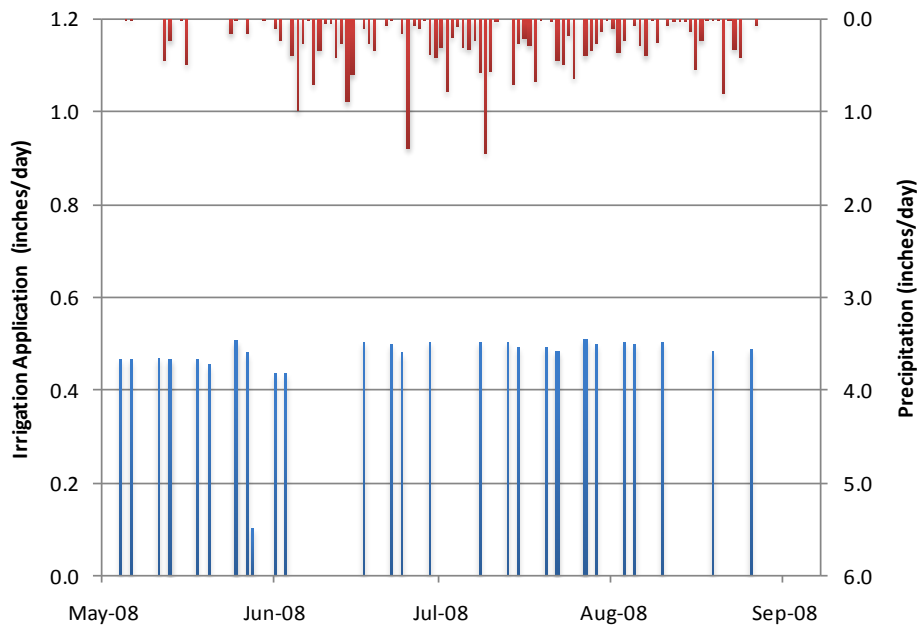


# Irrigation Frequency (# Irrig. Events per Month)

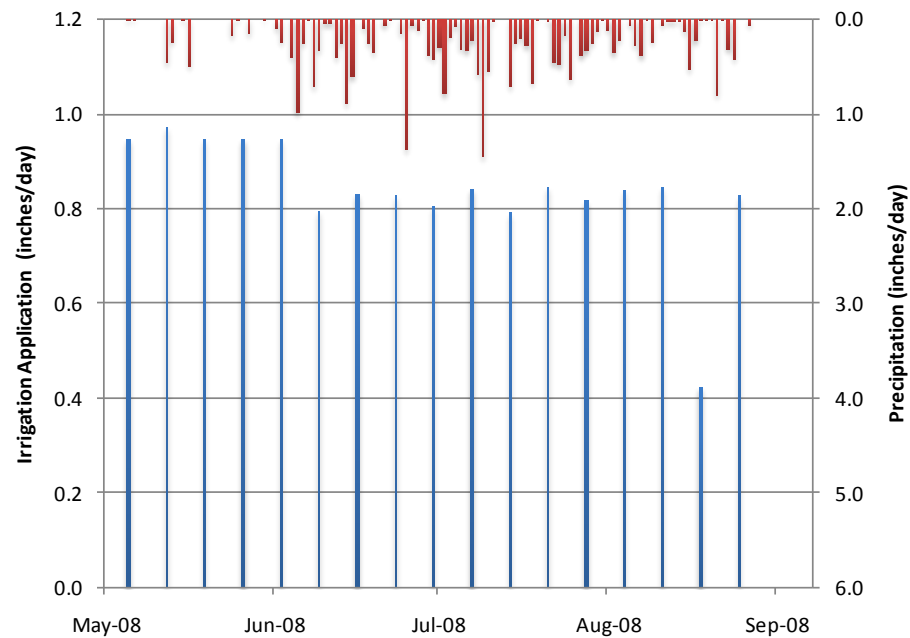
Treatment	Mean (#/month)	Std. Dev. (#/month)	Max (#/month)	Min (#/month)
SMS	2.1 b	2.8	11	0
EDU+RS	3.6 ab	4.1	20	0
RS	4.7 a	5.6	22	0
WOS	5.2 a	6.5	29	0



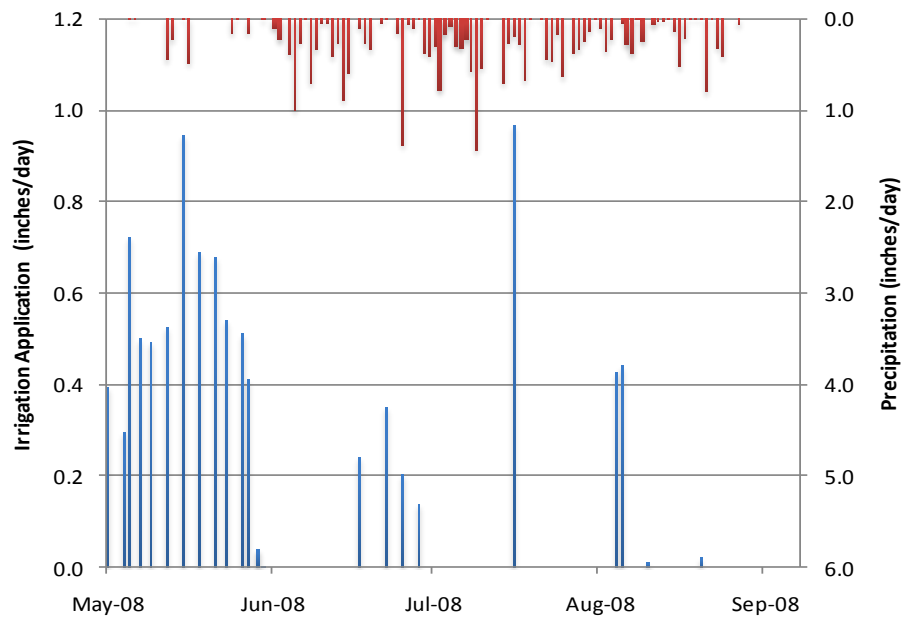
### Meter Only Home (not in compliance)



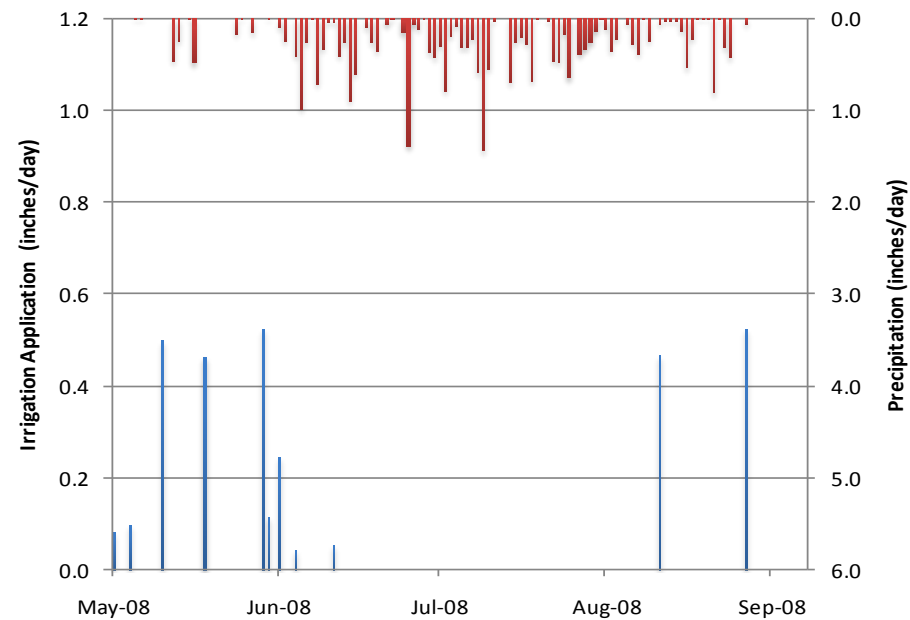
### Meter Only Home (in compliance)



### Rain Sensor Home



### Soil Moisture Sensor Home





# ET CONTROLLER TESTING, HILLSBOROUGH CO.

# ET Controller Study

## GCREC Hillsborough County

- Three ET controllers:
  - ♦ Weathermatic, Smartline SL800
  - ♦ Toro, Intellisense TIS-6120D
  - ♦ ETwater, Smart Controller 100
- Timeclock with RS
- Reduced timeclock schedule with RS



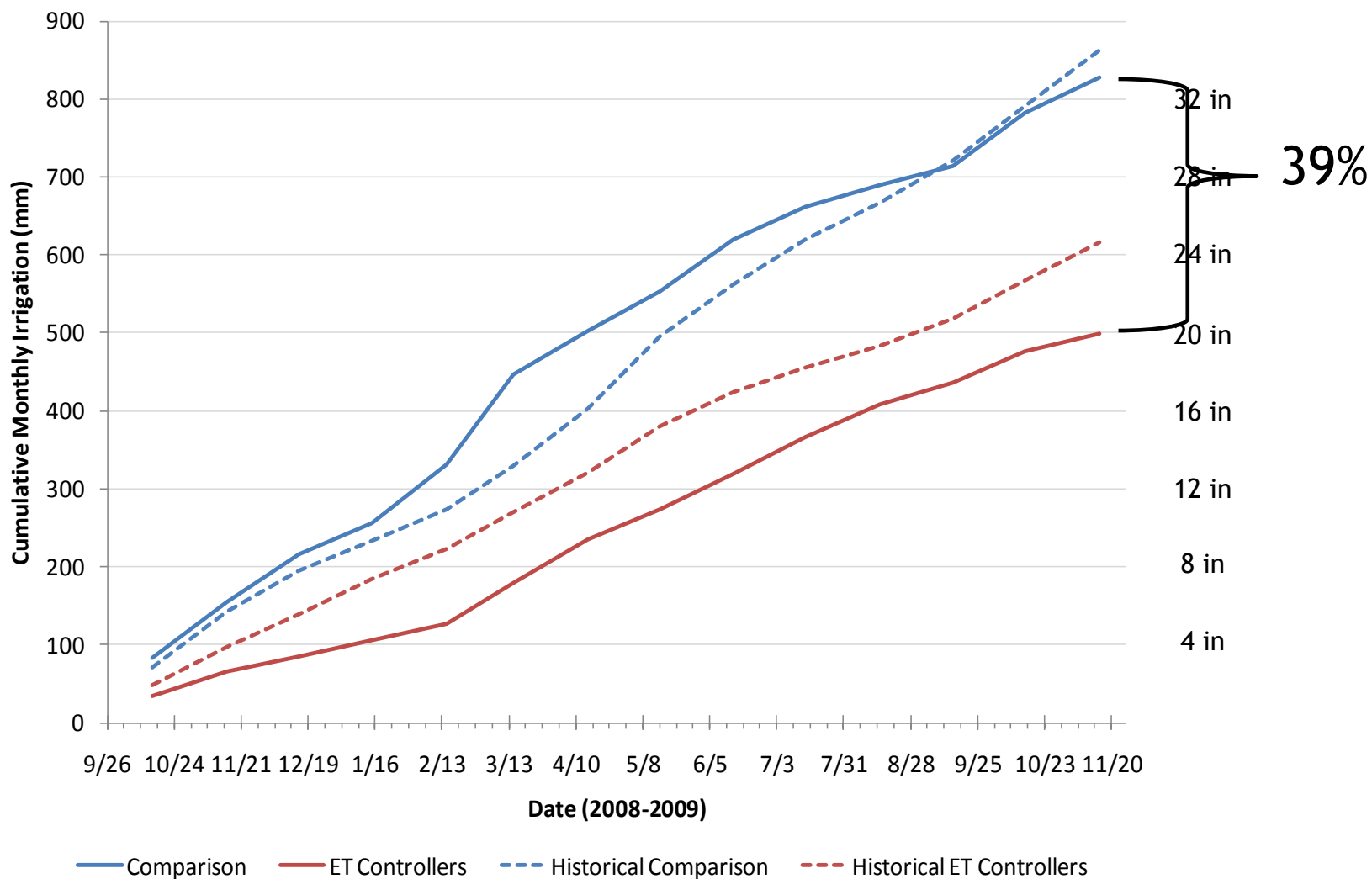


# But will ET controllers work in the real world?!

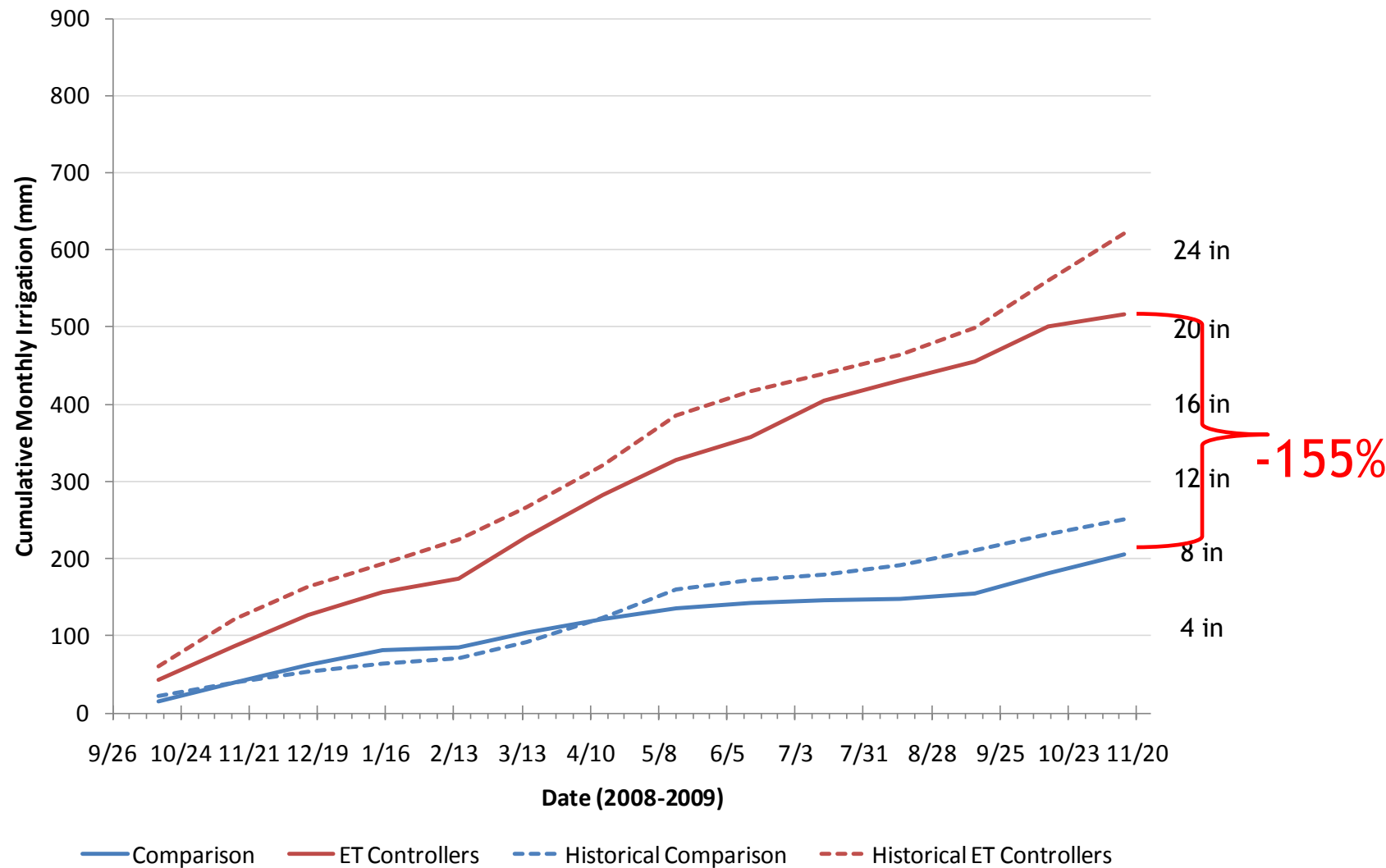


- 38 residential cooperators in Hillsborough Co.
  - 21 homes have an ET controller
  - 17 homes are a comparison group
- All volunteers are moderate to high water users

# Some Homes Have Water Savings



# .....And Some Homes Have Increased Usage





# Smart Irrigation Controller Irrigation Reduction *Potential*

Method	Location	Irrigation Savings	Weather	Funding agency
Time clock adjustment w/ rain sensor	Homes in Central Fla.	30%	Normal to rainy	SJRWMD
Rain sensor	Plots in Gainesville	34%	Normal to rainy	SWFWMD
		15%	Dry	
Soil moisture sensor control	Plots in Gainesville	70-90%	Normal to rainy	SWFWMD
	Plots in Gainesville/Citra	Up to 40%	Dry	
	Homes in Pinellas Co.	65%	Dry (1 d/wk)	SWFWMD
ET controllers	Plots in Hillsborough Co.	Up to 60%	~Normal	Hillsborough Co./FDACS
		Up to 40%	Dry	
	Homes in Hillsborough Co.	-155-39%	Dry (ET, variance)	

# The Answer is **NOT** Only Smart Controllers

- Smart Controllers have considerable water conservation potential
- Irrigation use must exceed a threshold to achieve maximum benefit
- Proper installation is critical to achieve savings

# Take Home Lessons

- High municipal water use is due to *mismanagement*/inefficient systems
- Routine maintenance can go a long way
  - ♦ Sprinkler coverage
  - ♦ Pressure issues
- Microirrigated areas can reduce water use substantially
- If irrigation use is still high ( $>4,000$  gal/1,000 ft<sup>2</sup> in peak month, Apr-Jun), check uniformity, leaks, etc.....consider a smart controller
- Changing plant palettes should be a secondary objective after improving irrigation maintenance & management



# See Videos & Narrated Power Point

- <http://abe.ufl.edu/mdukes>
- Video
  - ♦ Irrigation controllers
  - ♦ Rain sensors
  - ♦ Soil moisture controllers
  - ♦ Weather based (ET) controllers
  - ♦ Smart Water App. Tech. (virtual turf field day)
- Narrated ppts
  - ♦ ET controllers
  - ♦ Irrigation scheduling
  - ♦ Irrigation components
  - ♦ Irrigation myth busters
  - ♦ Soil moisture sensor controllers