SUMMARY OF SMART CONTROLLER TESTING IN FLORIDA & LESSONS LEARNED

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Development of Land in Florida

Maps from 1,000 Friends of Florida
http://www.1000friendsofflorida.org/planning/2060.asp
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Significance of Irrigation in FL

- Population served by public supply
  - 5.4 million 1970
  - 17 million 2004
  - 20 million 2020 (est.)
- 11% U.S. new home construction in FL
- + ~1,000 people/day
- FL uses the most groundwater in the U.S.
- Most new homes in FL include irrigation
- ~60% household water use for irrigation
- High quality landscapes and low water holding capacity
Irrigation is a Standard “Appliance”
Smart Irrigation Controller Technology

- Substantial wasted irrigation is due to wrong time & wrong amount of irrigation
  - Homeowner convenience issues
  - Lack of understanding of plant water needs
  - Irrigation system is an “appliance” to maintain a desired landscape

- Smart Irrigation Controllers aim to automate these decisions based on feedback from the irrigated system
Overall Objectives

Compare irrigation applied & turf quality on SMS, ET & RS controlled irrigation to time clock irrigation
SMS Testing 2004-05, Normal Rainfall Frequency

- 1 d/wk four brands SMS
- 2 d/wk four brands SMS
- 7 d/wk four brands SMS
- Time 2 d/wk with rain sensor
- 60% of time 2 d/wk with rain sensor
- Time 2 d/wk without rain sensor
- Non-irrigated

3 SMS frequencies

Comparisons
Soil Moisture Control Sensors

- Water Watcher
- Irrometer
- Rainbird

Acclima
### TIME vs. SMS Control 2004+05

<table>
<thead>
<tr>
<th>Treatment</th>
<th>TOTAL (mm)*</th>
<th>Savings compared to 2-WORS (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>2-WORS</td>
<td>1514</td>
<td>0</td>
</tr>
<tr>
<td>2-WRS</td>
<td>995</td>
<td>34</td>
</tr>
<tr>
<td>2-DWRS</td>
<td>623</td>
<td>59</td>
</tr>
<tr>
<td>Sms Avg</td>
<td>420</td>
<td>72</td>
</tr>
</tbody>
</table>

WRS = With Rain Sensor  
WORS = Without Rain Sensor  
DWRS = 60% Deficit With Rain Sensor  
Sms = Soil Moisture Sensors  
Avg = Average
SMS Controllers on Homes in Pinellas Co.
Rain Sensor Testing, 2005
Expanding Disk Rain Sensor
## Rain Sensor Performance

<table>
<thead>
<tr>
<th>Treatment</th>
<th>Water savings vs. WORS (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>WL</td>
<td>44</td>
</tr>
<tr>
<td>1/8-MC</td>
<td>30</td>
</tr>
<tr>
<td>1/2-MC</td>
<td>17</td>
</tr>
<tr>
<td>1-MC</td>
<td>3</td>
</tr>
<tr>
<td>WORS</td>
<td>0</td>
</tr>
</tbody>
</table>

WORS = without RS

### Cumulative Frequency of Occurrences (%)

<table>
<thead>
<tr>
<th>Interval of hours for dry-out period</th>
<th>Frequency of occurrences (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>0-6</td>
<td>13</td>
</tr>
<tr>
<td>6-12</td>
<td>31</td>
</tr>
<tr>
<td>12-18</td>
<td>64</td>
</tr>
<tr>
<td>18-24</td>
<td>91</td>
</tr>
<tr>
<td>24-30</td>
<td>98</td>
</tr>
<tr>
<td>30-36</td>
<td>99</td>
</tr>
<tr>
<td>36-42</td>
<td>100</td>
</tr>
</tbody>
</table>

### Frequency of Occurrences (%)

- WL

![Mini Click (MC)](image)
72 plots
18 treatments & 4 replicates
A: Rain Sensors
B: Soil Moisture Sensors
ET Controllers

Photo May 2006, M.L. Shedd
# Technology Being Tested

<table>
<thead>
<tr>
<th>Soil Moisture Sensors</th>
<th>Rain Sensors</th>
<th>ET Controllers</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Lawn Logic® LL1004</strong></td>
<td><strong>Hunter Mini-Clik®</strong></td>
<td><strong>TORO Intelli-sense TIS612</strong></td>
</tr>
<tr>
<td><strong>Acclima Digital TDT® RS500</strong></td>
<td></td>
<td><strong>RainBird ET Manager™</strong></td>
</tr>
</tbody>
</table>

- 2 days/week
- 3 levels of soil moisture content (Low, Medium and High)

- 1, 2, or 7 days/week
- 2 depths of rainfall

- 2 days/week
- Signal from a weather station to calculate ET
Each plot monitored individually with TDR probes

- Non-irrigated plots
  - Shows rainfall events
  - Dry Spring Season

Turf quality reduction
SMS/ET Testing Results

- Sandy soil threshold, 10% volumetric water content
- 1 d/wk may lead to poor turf quality
- Savings
  - SMS: 18-53%
  - ET: 25-63%
  - RS: 7-30%
ET Controller Testing, Hillsborough Co. 2006-07, Drought Conditions

- Three ET controllers:
  - T1, Weathermatic, Smartline SL800
  - T2, Toro, Intellisense TIS-612OD
  - T3, ETwater, Smart Controller 100
- T4: Timeclock with RS
- T5: 60% of T4
Controller Performance Example

Rainfall

Weathermatic -50%

Toro -60%

Time -21%

0.6*Time -49%

Time without Rain Sensor

Rainfall (mm)

Date (2006-2007)

Depth (mm)

Rainfall (mm)
Savings compared to time schedule adjusted monthly & no rain sensor

- Spring: 9-30%
- Summer: 11-49%
- Fall: 15-17%
- Winter: 50-60%
SMS Implementation Example Lake Jovita, Pasco Co.

- Fall 2005: Requested variance from 50/50 county landscape ordinance
- All new homes required to have SMS irrigation control
- Fully irrigated landscapes installed under variance
- Extensive SMS installs began in 2006
- SMS controllers did not seem to be effective initially
SMS Controller Installations

- Original “indoor” controllers installed outside
Lake Jovita Case Study

- Mapped as Arredondo, Sparr, Kendrick fine sands
- Actual soil significantly disturbed
Development Example
Key Vista, Pasco Co. ~700 homes

- Indoor use = minimum of lowest winter month or 4,000 gal
- Effective rain from TR-21
- \( ET_c = ETo \times KL \) (KL = 0.7)
- Irrig = ETc - Eff Rain
--Indoor use = minimum of lowest winter month or 4,000 gal
--Effective rain from TR-21
--ETc = ETo*KL (KL = 0.7)
--Irrig = ETc-Eff Rain
Development Water Use Characteristics

- **Lake Jovita**
  - The 25% highest water use records result in 60% of the irrigation water.
  - The 50% highest water use records result in 90% of the irrigation water.

- **Key Vista**
  - The 25% highest water use records result in 42% of the irrigation water.
  - The 50% highest water use records result in 85% of the irrigation water.
Municipal Water District of Orange County

- 899 Smart Controllers (ET based) on single family homes
- 8 brands
  - 33% → decreased use
  - 18% → increased use
  - ~50% no change
- Similar trends on commercial installations
Implementation Examples (cont’d)

- **San Antonio Water Systems**
  - No change between “water efficient homes” and comparison group
  - Actual use (~170 kgal/yr) double water budget (~80 kgal/yr)

- **Irvine Ranch**
  - After pilot program ended, 50% of homeowners refused to pay controller subscription fee of $5/month
  - Statewide ET network in development

- **Otay Water District**
  - Nearly half of Smart Controllers not set up properly
## Smart Irrigation Controller
### Irrigation Reduction Potential

<table>
<thead>
<tr>
<th>Method</th>
<th>Location</th>
<th>Irrigation Savings</th>
<th>Weather</th>
<th>Funding agency</th>
</tr>
</thead>
<tbody>
<tr>
<td>Time clock adjustment w/ rain sensor</td>
<td>Homes in Central Fla.</td>
<td>30%</td>
<td>Normal to rainy</td>
<td>SJRWMD</td>
</tr>
<tr>
<td>Rain sensor</td>
<td>Plots in Gainesville</td>
<td>34%</td>
<td>Normal to rainy</td>
<td>SWFWMD</td>
</tr>
<tr>
<td>Soil moisture sensor control</td>
<td>Plots in Gainesville</td>
<td>70-90%</td>
<td>Normal to rainy</td>
<td>SWFWMD</td>
</tr>
<tr>
<td></td>
<td></td>
<td>15%</td>
<td>Dry</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Homes in Pinellas Co.</td>
<td>Up to 40%</td>
<td>Dry</td>
<td>SWFWMD</td>
</tr>
<tr>
<td>ET controllers</td>
<td>Plots in Hillsborough Co.</td>
<td>Up to 70%</td>
<td>Dry (1 d/wk)</td>
<td>SWFWMD</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Up to 60%</td>
<td>~Normal</td>
<td>Hillsborough Co./FDACS</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Up to 40%</td>
<td>Dry</td>
<td></td>
</tr>
</tbody>
</table>
The Answer is *NOT* Only Smart Controllers

- Smart Controllers have potential
- Should be targeted to "high" water users
- Must be implemented with hands on training of contractors
- Ongoing certification/verification program should be implemented
Funding Partners

- Irrigation efficiency study
  - SJRWMD

- Soil moisture sensor research
  - Pinellas Anclote Basin Board, SWFWMD
  - Florida Dept. Ag. and Consumer Services
  - Florida Nursery Growers & Landscape Association
  - Florida Turfgrass Association

- ET controller research
  - Hillsborough County Water Dept.
  - Florida Dept. Ag. and Consumer Services
  - Florida Nursery Growers & Landscape Association
  - Florida Turfgrass Association

- Industry Partners
Questions?

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http://irrigation.ifas.ufl.edu