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Cover Page Footnote

The authors would like to acknowledge Donna Fries, Morgan Hopkins, Kati Migliaccio, and Michael Dukes for their inputs during the project implementation period. This material is based upon work that is supported by the National Institute of Food and Agriculture, U.S. Department of Agriculture, under the Hatch Project No. FLA-TRC-005751. Any opinions, findings, conclusions, or recommendations expressed in this publication are those of the authors and do not necessarily reflect the view of the U.S. Department of Agriculture.

Lessons from a Landscape Irrigation Rebate Program in Miami Dade County

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Abstract. We calculated savings in outdoor water uses from 37 properties in Fisher Island, Florida, that were retrofitted with smart Evapotranspiration-based irrigation controllers through the Miami Dade County's Landscape Irrigation Rebate Program. We found average water savings of 11.4 million gallons per year from the 37 properties on the island. We discuss the roles of extension personnel in developing and effectively managing an irrigation rebate program and the implications of results from this program for large scale efforts towards efficient use of freshwater resources.

INTRODUCTION

Florida's continued population growth combined with climatic and environmental variables is expected to result in more pressure on the state's existing freshwater resources (Taylor & Lamm, 2016). While agriculture is reported to use the majority of irrigated freshwater, outdoor urban irrigation also uses a significant amount of freshwater (Marella, 2014). Therefore, implementing efficient urban irrigation systems is critical for water conservation (Davis et al., 2009). Extension programs have a major role in educating water users and policymakers on the various technologies available for water conservation and in promoting adoption of the most efficient technologies that save water (Ryan & Lamm, 2017). The use of smart controllers can play a significant role in minimizing water losses and nutrient leaching from excessive irrigation. Evapotranspiration (ET) based irrigation controllers are categorized as "smart irrigation" technologies (Haley et al., 2007; Morera et al., 2017). ET controllers schedule irrigation based on the soil-water balance principle (Dukes, 2018). They operate based on various inputs, such as soil, irrigation type, plant type, and microclimate (Dukes et al., 2019a; Kisekka et al., 2019). These controllers can collect weather data from a publicly available source (signal-based) or an on-site weather station (Dukes et al., 2019b). However, the efficient use of these smart controllers in reducing outdoor water consumption needs to be investigated to better understand their effectiveness and identify potential areas for improvement (Davis et al., 2007). The aim of this paper is to

present case study results from a landscape irrigation rebate program in Miami Dade County and to describe the roles of extension personnel in the successful implementation and functioning of such programs. We expect that this paper will be helpful to extension personnel in other counties who are responsible for establishing an irrigation rebate program.

LANDSCAPE IRRIGATION REBATE PROGRAM (LIRP)

The Florida Yards and Neighborhoods (FYN) program of the Miami-Dade County Extension, University of Florida Institute of Food and Agricultural Sciences (UF/IFAS) has been working with the Miami-Dade Water and Sewer Department (WASD) since 2008 to promote outdoor water conservation through various methods, including the LIRP. The LIRP offers landscape and irrigation site assessments conducted by the FYN program to single-family and large properties with functioning in-ground irrigation systems to evaluate their current water use and determine how they can be water efficient. Properties that participate in the LIRP are eligible to receive rebates for water-efficient retrofits made to their landscapes and irrigation systems. The rebates include \$500/year for five years for single-family homes and \$2,850 for large properties. The LIRP promotes Florida-Friendly Landscaping™ and EPA WaterSense® products. Detailed information about the LIRP can be found at: <http://sfyl.ifas.ufl.edu/miami-dade/natural-resources/florida-yards-and-neighborhoods-fyn/>.

THE ROLES OF EXTENSION PERSONNEL

Extension agents and program assistants are responsible for managing several aspects of the LIRP including scheduling appointments, conducting assessments, completing reports, and submitting rebate requests. Once a participant signs the program-application, Extension personnel schedule an appointment to conduct a pre-evaluation of the irrigation system. During the pre-evaluation, Extension personnel review the system components, such as controller, system design, leaks, and plants in the landscape. Following the pre-evaluation, Extension personnel provide the homeowner a written report containing recommendations of ways to make the landscape irrigation system more water efficient. Extension personnel also educate homeowners about the nine Florida-Friendly Landscaping™ principles and how to maintain a sustainable landscape. Once the irrigation system has been retrofitted, the homeowner contacts the Extension personnel to schedule a post-evaluation of the irrigation system to verify the upgrades and to ensure the system continues functioning to achieve intended water conservation results. The homeowner then provides copies of the invoice and proof of payment to the Extension personnel who submit all documentation to the funding agency so that the participant receives a rebate. State extension agents can provide technical support and assist with data analysis and evaluating the broader impacts of the program.

CASE STUDY: FISHER ISLAND

The role of the state extension agent in this case study was exclusively related to data analysis to quantify water savings from the program and to write this paper with inputs from the other co-authors. Fisher Island is located about three miles offshore from downtown Miami, with a landmass of just under one square mile, consisting mainly of high-end condominiums and a golf course (Figure 1).

Figure 1. Map showing part of the city of Miami and the Location of Fisher Island.

The Fisher Island Community Association uses potable water for landscape irrigation and controls the irrigation systems for the entire island. Irrigation assessments conducted by the FYN team in November 2014 and 2016 confirmed irrigation scheduling on the island was inefficient. Leaks and pipe breaks were also detected leading to excessive water loss, in turn, causing runoff. (Figure 3).

The Fisher Island community participated in the LIRP and all properties on the island were retrofitted with EPA WaterSense® certified Rain Bird® ESP-LXME smart irrigation controllers and flow meters. In addition, an IQ™ v2.0 central control software was also implemented. The ESP-LXME ET controller is programmable and uses weather data to determine when to turn on/off the irrigation system. The project was implemented in two phases. Phase 1 with 19 properties was completed in August 2015, while Phase 2 with 18 properties was completed in August 2017.

DATA ANALYSIS

Water consumption data was analyzed from the two LIRP phases based on accounts associated with each property. However, some properties had multiple accounts, which resulted in a total of 41 accounts. In addition, since project length for both phases was different, the data was analyzed separately. For Phase 1, we compared 36 months of water consumption data before and after August 2015. While for Phase 2, data was available for only 12 months after project implementation (August 2017). 12 months of water consumption data before project implementation was used for comparison. We checked the water consumption data for quality and ensured that water usage was within the expected range. Five data points (two from Phase 1 and three from Phase 2) were outliers, as evident from excessive monthly water consumption of more than 10 million gallons. As a result, these five data points and all missing values were not included in the final analysis.

RESULTS AND DISCUSSIONS

LONG-TERM RAINFALL AND EVAPOTRANSPIRATION RATES

Rainfall and potential Evapotranspiration (ET) rates greatly affect irrigation requirements and need to be accounted for while calculating the water needs of plants. However, rainfall and ET data were not available from Fisher Island during the whole project period (2012–2018). As a result, we analyzed data from three nearby weather stations: S-26 at Spillway Headwater on Miami Canal and at Tidewater from South Florida Water Management District (SFWMD) (<https://www.sfwmd.gov/science-data/dbhydro>) and from the Florida Automated Weather Network (FAWN) (<https://fawn.ifas.ufl.edu/>) stations located in Homestead and Fort Lauderdale, using average rainfall and ET data from these sites to approximate rainfall and ET characteristics in Fisher

Lessons from a Landscape Irrigation Rebate Program in Miami Dade County

Figure 2. Aerial view of the Fisher Island community.

Figure 3. Examples of water loss due to runoff from over-irrigation in the island.

(a)

(b)

Figure 4. Pictures of the old irrigation controller, (a) Rain Bird® RC-1260 C, and (b) the newly installed Rain Bird® IQ™ v2.0 (b).

Figure 5. Characteristics of monthly rainfall (a) and potential evapotranspiration (ET) (b) records from nearby weather stations.

Island. The S-26 SFWMD station is located approximately 10 miles from the island, and only rainfall data was available at this station. Overall, rainfall at the three stations tends to be comparable and show comparable seasonal trends (Figure 5a). Similarly, while ET was greater in Fort Lauderdale than in Homestead, seasonal ET trends at the two locations followed similar patterns (Figure 5b).

Based on observations from 2012 to 2018, the mean annual rainfall was 1,527, 1,400, and 1,683 mm/year in Fort

Lauderdale, Homestead, and S-26, respectively. Mean annual ET at the Fort Lauderdale and Homestead FAWN stations were 1,546 and 1,384 mm/year, respectively (Table 1). ET is smaller in Homestead as compared to the rainfall amount in Fort Lauderdale, while rainfall was the highest at S-26. Based on observations in Fort Lauderdale and Homestead, annual ET rates were relatively similar.

Table 1. Mean Annual Rainfall and ET Values with Standard Deviations (SD) from FAWN and SFWMD Stations

Year	Rainfall (mm)			ET (mm)	
	Fort Lauderdale	Homestead	S-26	Fort Lauderdale	Homestead
2012	1557	1685	1855	1493	1414
2013	1628	1173	1842	1466	1270
2014	1384	1211	1690	1553	1433
2015	1272	1279	1557	1598	1381
2016	1332	1368	1622	1558	1430
2017	2079	1600	1754	1583	1406
2018	1446	1485	1462	1570	1357
Mean	1528	1400	1683	1546	1384
SD	273	196	146	48	57

Lessons from a Landscape Irrigation Rebate Program in Miami Dade County

Figure 6. Monthly average water consumption before and after the LIRP implementation during Phase 1 and Phase 2 of the project.

Figure 7. Monthly average water savings before and after the LIRP implementation during the two phases of the project.

Table 2. Summary of Water Consumption Data from 37 Properties in Fisher Island

Phase	One year before LIRP	One year after LIRP	One-year water savings	Monthly water savings
(Gallons)				
One	38,102,123	32,590,111	5,512,012	459,334
Two	39,540,028	33,565,004	5,975,024	497,919
Total			11,487,036	957,253

WATER SAVINGS

Overall, results showed that the LIRP resulted in significant reductions in outdoor water consumption throughout Fisher Island. Average reductions in annual outdoor water consumption from Phase 1 and Phase 2 were about 5.5 and 5.9 million gallons, respectively. This suggests that LIRP has resulted in a total reduction of outdoor water consumption in Fisher Island by more than 11 million gallons annually. However, it should be also noted that a few months had greater water consumption with the new system compared to the old system.

Overall, the LIRP resulted in water savings of approximately 15% of the annual outdoor water consumption on the island.

This results in an average water savings of 11,487,036 gallons per year in Fisher Island.

CONCLUSION

This case study evaluated outdoor water savings from 37 properties equipped with smart Evapotranspiration-based irrigation controllers through the County's Landscape Irrigation Rebate Program. Results showed that average water saving from the 37 properties included in this case study was 11.4 million gallons per year. However, it is important to highlight the significance of the roles of Extension personnel in planning, implementing, and managing the rebate program. We believe that the County's LIRP has proven to be successful in achieving water conservation goals and other extension personnel, who are interested in developing their irrigation rebate programs, could easily adapt the methods and guidelines from the County's LIRP.

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REFERENCES

- Davis, S., M.D. Dukes, S. Vyapari & G.L. Miller. (2007). *Evaluation and demonstration of evapotranspiration-based irrigation controllers*. [Paper presentation]. The World Environmental and Water Resources Congress 2007, American Society of Civil Engineers, Tampa, FL, United States, pp. 1–18. [https://doi.org/10.1061/40927\(243\)237](https://doi.org/10.1061/40927(243)237)
- Davis, S., M.D. Dukes & G.L. Miller. (2009). Landscape irrigation by evapotranspiration-based irrigation controllers under dry conditions in Southwest Florida. *Agricultural Water Management*, 96(12), 1828–1836. <https://doi.org/10.1016/j.agwat.2009.08.005>
- Dukes, M.D. (2018). *Smart irrigation controllers: What makes an irrigation controller smart?* University of Florida IFAS Extension. <https://edis.ifas.ufl.edu/ae442>
- Dukes, M.D., M.L. Shedd & S.L. Davis. (2019a). *Smart irrigation controllers: operation of evapotranspiration-based controllers*. University of Florida IFAS Extension. <https://edis.ifas.ufl.edu/ae446>
- Dukes, M.D., M.L. Shedd & S.L. Davis. (2019b). *Smart irrigation controllers: Programming guidelines for evapotranspiration-based irrigation controllers*. University of Florida IFAS Extension. <https://edis.ifas.ufl.edu/ae446>
- Haley, M. B., Dukes, M. D., & Miller, G. L. (2007). Residential irrigation water use in central Florida. *Journal of Irrigation and Drainage Engineering*, 133(5), 427–434. [https://doi.org/10.1061/\(ASCE\)0733-9437\(2007\)133:5\(427\)](https://doi.org/10.1061/(ASCE)0733-9437(2007)133:5(427))
- Kisekka, I., K.W. Migliaccio, M.D. Dukes, J.H. Crane, B. Schaffer, H.K. Bayabil & S. Guzman. (2019). *Evapotranspiration-Based irrigation for agriculture: Implementing evapotranspiration-based irrigation scheduling for agriculture*. University of Florida IFAS Extension. <http://edis.ifas.ufl.edu/ae457>
- Marella, R. L. (2014). *Water withdrawals, use, and trends in Florida, 2010* (Scientific Investigations Report No. 2014–5088). U.S. Geological Survey. <https://pubs.usgs.gov/sir/2014/5088/pdf/sir2014-5088.pdf>
- Morera, M. C., Monaghan, P. F., Dukes, M. D., & Breder, E. (2017). Predicting satisfaction with smart irrigation controllers and their long-term use among homeowners in Central Florida. *JAWRA Journal of the American Water Resources Association*, 53(4), 929–943. <https://doi.org/10.1111/1752-1688.12542>
- Ryan, C. & A.J. Lamm. (2017). Extension's role in developing opinion leaders to drive water conservation. *Journal of Extension*, 55(1). <https://archives.joe.org/joe/2017february/rb4.php>
- Taylor, M. & A.J. Lamm. (2016). Minimizing disparities and developing support by identifying differences in confidence and knowledge related to water issues. *Journal of Extension* 54(6). <https://archives.joe.org/joe/2016december/a6.php>