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Informing Urban Landscape Water Conservation Extension Programs using Behavioral Research

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Abstract

Water availability is an important issue addressed by Cooperative Extension programs nationwide. Rapid population growth and urbanization present unique challenges and opportunities for Extension programming. In this study, we explored whether urban Extension audiences in Florida had unique characteristics that could be used to design tailored programs. We used electronic surveys to collect water conservation and landscape management behaviors along with demographic information. Applying audience segmentation concepts, we divided respondents into subgroups by rural-urban continuum codes. We then described the resulting subgroups and made comparisons to identify differences that could inform Extension programming. The most urban residents had lived in Florida the longest, were least engaged in most water conservation practices, most likely to use a professional landscape company for landscape maintenance activities, and most likely to reside in a homeowners' association. The findings revealed somewhat of a disconnect between urban residents and protection of water resources. Understanding these differences among urban audiences can be useful insights to guide impactful Extension programs. Urban landscape water conservation programming should be designed to build a connection between residents and their local water bodies, and should engage the many partners present in urban systems. More research is needed to examine the relationship between residing in more urban areas and engaging less in landscape water conservation practices.

Keywords: behavior change, social marketing, urban extension, water conservation

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Introduction

There is growing evidence that human activities are placing unsustainable demands on fresh water resources with groundwater supplies being over extracted and many major river systems experiencing inadequate water flows (Fielding, Russel, Spinks, & Mankad, 2012; National Resource Defense Council [NRDC], 2010). With projected population growth and increased economic development, water resources will continue to be placed under pressure and that will likely be further exacerbated by climate change (Bates, Kundzewicz, Wu, & Palutikof, 2008; Fielding et al., 2012; NRDC, 2010). A study conducted by the NRDC (2010) found that more than

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1,100 counties will face higher risks of water shortages with the Midwest and South, particularly Florida, projected to be confronted with extremely high risk of water shortages. Water security poses a serious challenge for policy makers and other key stakeholders who need to promote strategies that meet the increasing human demand for water while not compromising fragile ecosystems (Fielding et al., 2012; NRDC, 2010).

The country's once rural population has shifted dramatically and more than 80% of America's population is now considered urban (U.S. Census Bureau, 2010). As the population continues to change, it is important to identify strategies "that will allow Extension to maximize and demonstrate its potential impact in all locations for all people" (Harder & Wells, 2017, p. 55). Urban populations comprise an important and underreached audience that will need to be served for Extension to continue its success as a change agency and commitment to the land-grant mission (National Urban Extension Leaders, 2015; Ruemenapp, 2017; Warner, Vavrina, Campbell, Elliott, Northrop, & Place, 2017). Trends toward more urban populations have opened up "vast possibilities" (Tiffany, 2017, p. 38) for Extension professionals serving communities nationwide. While urban Extension should not be seen as a separate entity, it may be accompanied by unique challenges and approaches. Partnerships, diversity, overlapping governmental jurisdiction, the existence of other service providers, recruitment of community members, access to technology, and specialized training needs are some distinguishing characteristics of urban Extension (Harder & Wells, 2017; National Urban Extension Leaders, 2015; Ruemenapp, 2017; Tiffany, 2017; Warner, Vavrina, et al., 2017).

As a policy tool, education plays an important role in raising environmental awareness and promoting conservation behaviors to ensure future water security. Since the majority of household water can be used for landscape irrigation, organizations such as Extension are focusing on influencing residential landscape practices through education to promote water conservation (St. Hilaire et al., 2008; Warner, Rumble, Martin, Lamm, & Cantrell, 2015; Warner & Lamm, 2017). In Florida, Extension promotes residential landscape water conservation through practices such as low-volume irrigation and precise irrigation scheduling techniques (University of Florida / Institute of Food and Agricultural Sciences Extension, 2013).

Studies have shown there are key determinants of household conservation including demographic, psychosocial, behavioral, and infrastructure variables that influence water use (Fielding et al., 2012; Warner & Lamm, 2017). Complex issues such as water scarcity are likely to affect clientele regardless of where they live (National Urban Extension Leaders, 2015). However, it is important to consider rural and urban audiences may exert different influences on participation in environmentally supportive behavior that may be important and need to be incorporated in Extension programs promoting water conservation (Huddart-Kennedy, Beckley, McFarlane & Nadeau, 2009). It is critical for Extension to deliver innovative programs that meet the needs of urban audiences (Harder, Lamm, & Strong, 2010).

A lack of understanding of how rural and urban audiences potentially differ may pose a significant obstacle for educators working with urban audiences who reside in areas that are at the highest risk of water shortages. For Extension to have a fundamental urban impact, it will be vital for local Extension faculty and staff, state systems, and the national system to understand how to position water conservation programs in large metropolitan regions (Ruemenapp, 2017). Behavioral market research can be used for such a purpose to understand and predict habits, responses and decisions people make regarding their residential water use (DeVault, 2016; McKenzie-Mohr, 2000). The process of integrating market research with Extension practice is essential for developing educational programs that promote sustainable behavior (McKenzie-Mohr, 2000). As Extension strives to remain relevant to all clientele, understanding these differences will strengthen educational interventions based on the needs of each specific audience and contribute to the advancement of urban Extension.

Conceptual Framework

Extension has recently embraced *social marketing*, or the application of commercial marketing principles to encourage behavior change that benefits the target audience and society as a whole (McKenzie-Mohr, Lee, Schultz, & Kotler, 2012; Rogers, 2003). *Audience segmentation* is one social marketing principle which “breaks down a heterophilous audience into a series of relatively more homophilous subaudiences” (Rogers, 2003, p. 292). Educational programs that ignore the inherent variability among a potential audience and use one approach are likely to be ineffective (Andreasen, 2006). When employing concepts of audience segmentation Extension should design different strategies for different subgroups (Lee & Kotler, 2011).

There are an unlimited number of audience segmentation strategies, ranging from subdividing a potential audience by demographic characteristics to grouping them by behavioral or psychological profiles (Andreasen, 2006). Possible audience segments can be evaluated and prioritized by those who are easiest to reach, most likely to take action, or most in need of making a change, among others (Lee & Kotler, 2011). As adult educators, Extension professionals need to fully understand the context within which they are designing and delivering programs (Boone, Safrit, & Jones, 2002). The process of audience segmentation can serve as both a needs assessment activity and a guide for program design.

Extension has recently applied this concept to water conservation strategies. Huang, Lamm, and Dukes (2016) identified important differences among high waters users in central Florida and recommended Extension to focus on this subgroup as an important target audience separate from the general public. Warner, Kumar Chaudhary, Rumble, Lamm, and Momol (2017) constructed behavioral profiles of national home irrigation users and identified three possible target audiences, suggesting the subgroup that was unengaged in landscape water conservation but likely to adopt comprised an important Extension audience. Monaghan, Ott, Wilber, Gouldthorpe, and Racevskis (2013) segmented residents who lived within homeowners' associations (HOAs) in central Florida, finding the HOA subgroup was less likely to use good irrigation practices.

Few behavioral studies have explored the influence of an urban or non-urban environment on pro-environmental behaviors. A worldwide study on climate change awareness found urban residents in China were more aware of climate change than rural residents but reported geographic location was not an important predictor in the United States (Lee, Markowitz, Howe, Ko, & Leiserowitz, 2015). Other researchers have identified unique and specific communication needs of urban populations for emergency communications (Lachlan, Spence, & Eith, 2013). Urban residents have been found to place less of a priority on the environment and to be less engaged in conservation behaviors (Huddart-Kennedy et al., 2009) which may be a result of less exposure to green space (Shanahan et al., 2017). To date there has been little to no behavioral research evaluating the differences in water conservation practices among rural and urban audiences. This is an important area to explore as these audience segments could exhibit different priorities and levels of environmentally supportive behaviors (Huddart-Kennedy et al., 2009; Warner, Kumar Chaudhary, et al., 2017).

Purpose and Objectives

The purpose of this study was to evaluate possible differences among Extension audiences living in urban areas with different population size in Florida. The specific objectives were to first divide Florida residents by their county's population size, and later compare different population size subgroups based on their demographic characteristics, irrigation water sources, hiring of landscape professionals, and current engagement in water conservation practices so that impactful and tailored Extension programs can be designed.

Methods

Data collected for this study were part of a multi-year project exploring water conservation behaviors of Florida residents over a period from 2014 to 2016. As there is no existing sampling frame of our target population (Warner et al., 2015; Warner, Kumar Chaudhary, et al., 2017), Florida residents with irrigated lawns/landscapes, we used a professional survey sampling company to secure a purposive sample using an online opt-in panel, which is considered appropriate for understanding an audience when random sampling is not possible (Baker et al., 2013; Bryman, 2008). We used a researcher-developed electronic survey instrument to collect data during the three-year period.

While the generalizability of non-probability samples is somewhat limited, they can still produce either comparable or sometimes better results compared to probability-based samples (Abate, 1998; Twyman, 2008; Vavreck & Rivers, 2008). Completion rate is reported when purposive sampling is used (Baker at al., 2016), and over the period of three years, out of 7,888 eligible respondents, we secured complete responses from 3,832 respondents for a completion rate of 48.6%. Out of completed 3,832 responses, 338 respondents were exposed to an experimental treatment in the year 2015 and were removed from further analysis. Another 18 respondents were also removed due to their non-agreement with population size coding, so final analysis sample used 3,476 responses. Prior to data collection, we secured approval from the University of Florida Institutional Review Board.

Instrumentation and Data Collection

To determine eligibility of respondents for our target sampling frame, we used screening questions to ensure respondents were 18 years and older, had a lawn and/or landscape with irrigation, and control over irrigation of their lawn and/or landscape. Only respondents who were eligible based on these screening questions could proceed to complete the survey.

The survey had four parts. The first part of the survey asked respondents to identify their source of irrigation water using a multiple-choice question with three possible response options: *city (municipal), irrigation well,* and *reclaimed water*. We also provided two additional response options: *other* and *I don't know*, which we did not include in the analysis. The second part of the survey collected information about respondents' hiring of landscape professionals for different purposes using a *select all that apply* question, where they were provided with six response options: *irrigation services, lawn maintenance, tree pruning, pest management, landscape design and installation*, and *I do not hire a landscape professional company for any services*.

In the third part of the survey, respondents reported their engagement in water conservation behaviors through 16 statements with a binary response option (*yes*/*no*) with an additional response option of *unsure*. These behaviors were identified through a review of landscape best management practices promoted by Florida Extension and refined by a panel of experts. The water conservation behaviors included:

- *I calibrate my sprinklers,*
- *I follow watering restrictions imposed by local government and/or water management districts,*
- *I have converted turfgrass areas to landscaped beds,*
- *I have installed smart irrigation controls (such as soil moisture sensors (SMS) or an evapotranspiration device (ET)) so irrigation won't turn on when it isn't needed,*
- *I have low-water consuming plant materials in my yard,*
- *I have replaced high volume irrigated areas with low volume irrigation,*
- *I have replaced high water plants with drought tolerant plants,*
- *I have retrofitted a portion of my landscape so that it is not irrigated,*
- *I have turned off zone(s) or capped irrigation heads for established woody plants,*
- *I seasonally adjust irrigation times,*
- *I use a rain gauge to monitor rainfall for reducing/skipping irrigation,*
- *I use a rain sensor to turn off irrigation when it is not needed,*
- *I use different irrigation zones/zone run times based on plants' irrigation needs,*
- *I use drip (micro) irrigation,*
- *I use high efficiency sprinklers, and*
- *I use recycled waste water to irrigate my lawn/landscape.*

The final part of the survey collected respondents' demographic characteristics. We measured age on a continuous scale using a drop-down list for respondents' date of birth. We captured zip codes along with information about whether respondents owned or rented their homes and belonged to a HOA. We also asked respondents to indicate the highest level of education they had completed. Finally, respondents were asked to indicate their household income.

To ensure the instrument we used for data collection provided valid inferences within the context of our study, we established face and content validity of instruments using a panel of experts (Hardesty & Bearden, 2004; Haynes, Richard, & Kubany, 1995). The panel specialized in Extension programming, agricultural and biological engineering, landscape best management practices, water conservation, and survey methodology. In addition to using a panel of experts, we pilot tested the instrument with a small number of respondents who belonged to the target audience and were not included in the full study. We made minor changes to the instrument based on recommendations from the panel of experts and the pilot test.

Data Analysis

We used the United States Department of Agriculture's rural-urban continuum codes to differentiate respondents based on population size (Economic Research Service, 2013). These codes provide researchers with the ability to approach data with a more detailed analysis to identify trends related to urban proximity. They "form a classification scheme that distinguishes metropolitan (metro) counties by the population size of their metro area, and nonmetropolitan (nonmetro) counties by degree of urbanization and adjacency to a metro area or areas" (Economic Research Service, 2013, para. 1). This classification system has three metro and six non-metro classifications. In addition to three metro areas, only one of the non-metro county designations occur in Florida, and few respondents reported living in these areas. There were adequate respondents to make robust comparisons in the non-metro county designation (non-metro areas with a population size of 20,000 or more, adjacent to a metro areas), and we excluded the few respondents living in other non-metro areas. We matched respondents' zip codes with Florida census data to segment respondents into four county population size segments:

- metro areas with a population of 1 million or more,
- metro areas with a population of 250,000 to 1 million,
- metro areas with a population of less than 250,000,
- and non-metro areas with a population size of 20,000 or more.

To examine demographic characteristics of Florida residents based on their population size, we used descriptive statistics with means and percentages. We used chi-square analyses to differentiate Florida residents for hiring of landscape professionals, landscape irrigation water source, and engagement in water conservation behaviors based on their urban-rural area. To measure the practical significance of chi-square tests, we calculated effect sizes using Cramer's *V*, where less than 0.10 values were interpreted as negligible effect, 0.10 to 0.19 values were interpreted as a weak effect, 0.20 to 0.39 values were interpreted as a moderate effect, 0.40 to 0.59 values were interpreted as a relatively strong effect, 0.60 to 0.79 values were interpreted as a strong effect, and 0.80 to 1.00 values were interpreted as a very strong effect (Rea & Parker, 1992). We analyzed data using SPSS (version 23.0; IBM Corp., Armonk, NY).

Results

Demographic Characteristics

There were similarities and differences among the segments (see Table 1 and 2). Florida residents in a metro area with more than one million population were youngest (45.9 years) and residents staying at a non-metro area with 20,000 or more population were oldest (53.0 years).

Table 1

Age and year living in Florida among Florida residents segmented based on population size of areas where they live (N = 3,476)

Demographic variable	Metro area with 1 million or more population (*N* = 2,080) % (*SD*)	Metro area with 250,00 to 1 million population (*N* = 982) % (*SD*)	Metro areas with fewer than 250,000 population (*N* = 204) % (*SD*)	Non metro areas with population of 20,000 or more (*N* = 210) % (*SD*)
Age in years	45.9 (16.0)	51.2 (16.4)	48.0 (15.8)	53.0 (17.0)
Number of years living in Florida	23.7 (15.5)	22.5 (16.1)	20.1 (14.6)	19.6 (16.0)

More than half of residents in a metro area with one million or more population (53.9%, *n* = 1,121) resided in an HOA, while one third of residents in metro areas with 250,000 or less population (35.8%, *n* = 73) and non-metro areas with 20,000 or more (36.2%, *n* = 76) resided in an HOA. Most residents in all four segments owned their home and more than 50% of residents in all four areas were females. More than 50% of residents in metro areas with one million or more population (55.8%, *n* = 1,162) had a four-year college degree or higher education, compared to only 37.2% (*n* = 78) in non-metro areas with 20,000 or more population. The most common income category for residents in metro areas with one million or more in population was $75,000 to $149,999 (37.1%, *n* = 772), while for the other three groups the most common income category was less than $49,999.

Table 2

Demographic characteristics of Florida residents segmented based on population size of areas where they live (N = 3,476)

Demographic variable	Metro area with 1 million or more population (*N* = 2,080) % (*n*)	Metro area with 250,00 to 1 million population (*N* = 982) % (*n*)	Metro areas with fewer than 250,000 population (*N* = 204) % (*n*)	Non metro areas with population of 20,000 or more (*N* = 210) % (*n*)
HOA membership	53.9 (1,121)	43.6 (428)	35.8 (73)	36.2 (76)
Gender				
Females	56.3 (1,172)	56.7 (557)	58.3 (119)	55.7 (117)
Males	43.7 (908)	43.3 (425)	41.7 (85)	44.3 (93)
Home ownership				
Own	86.9 (1,807)	87.5 (859)	85.3 (174)	84.8 (178)
Rent	12.0 (249)	11.8 (116)	14.2 (29)	13.8 (29)
Other	1.2 (24)	0.7 (7)	0.5 (1)	1.4 (3)
Education				
Less than high school	0.3 (7)	1.0 (10)	0.5 (1)	1.4 (3)
High school/GED	11.3 (234)	14.2 (139)	15.2 (31)	22.4 (47)
Some college	19.3 (401)	26.3 (258)	19.6 (40)	27.1 (57)
2-year college degree	13.3 (276)	12.6 (124)	17.6 (36)	11.9 (25)
4-year college degree	34.8 (724)	30.1 (296)	24.5 (50)	20.5 (43)
Master's degree	15.9 (330)	13.1 (129)	16.7 (34)	12.4 (26)
Doctoral degree	2.5 (53)	1.2 (12)	2.5 (5)	0.0 (0)
Professional degree (JD, MD)	2.6 (55)	1.4 (14)	3.4 (7)	4.3 (9)

Table 2 (continued)

Demographic characteristics of Florida residents segmented based on population size of areas where they live (N = 3,476)

Demographic variable	Metro area with 1 million or more population (*N* = 2,080) % (*n*)	Metro area with 250,00 to 1 million population (*N* = 982) % (*n*)	Metro areas with fewer than 250,000 population (*N* = 204) % (*n*)	Non metro areas with population of 20,000 or more (*N* = 210) % (*n*)
Family income				
Less than $49,999	27.6 (574)	35.5 (349)	35.3 (72)	48.1 (101)
$50,000 to $74,999	25.4 (528)	25.2 (247)	28.4 (58)	24.3 (51)
$75,000 to $149,999	37.1 (772)	32.7 (321)	30.4 (62)	24.8 (52)
$150,000 to $249,999	8.3 (173)	5.6 (55)	5.4 (11)	2.4 (5)
$250,000 or more	1.6 (33)	1.0 (10)	0.5 (1)	0.5 (1)

The residents in all four segments used city water more than any other source for irrigating their landscapes (see Table 3). More residents in a metro area with one million or more in population (63.0%, *n* = 1,236) used city (municipal) water to irrigate their landscapes while more residents in metro areas with fewer than 250,000 population used irrigation wells (43.1%, *n* = 85). In all of the segments, only a small number used reclaimed water.

Table 3

Comparison of water source for landscape irrigation among Florida residents by segmenting residents based on population size of areas where they live (N = 3,476)

Water source	Metro area with 1 million or more population (*N* = 1,962) % (*n*)	Metro area with 250,00 to 1 million population (*N* = 940) % (*n*)	Metro areas with fewer than 250,000 population (*N* = 197) % (*n*)	Non metro areas with population of 20,000 or more (*N* = 196) % (*n*)
City (municipal)	63.0 (1,236)	47.8 (449)	51.8 (102)	49.5 (97)
Irrigation well	21.8 (427)	36.3 (341)	43.1 (85)	39.3 (77)
Reclaimed water	15.2 (299)	16.0 (150)	5.1 (10)	11.2 (22)

Note. Pearson chi-square = 119.37, $p < 0.001$; Cramer's $V = 0.14$. *Other* and *I don't know* responses were treated as missing data and excluded from analysis.

Residents in all four segments differed in their hiring a landscape professional for different purposes, excluding pest management (see Table 4). As the population size decreased, likelihood of not using a professional increased. Residents in metro areas with one million or more population were most likely (76.0%, $n = 1{,}581$) to hire landscape professional for any purpose, while residents in non-metro areas with 20,000 or more population were least likely (64.3%, $n = 135$). The effect sizes for hiring of landscape professionals by different population areas were negligible. For specific purposes (e.g., lawn maintenance, tree pruning), the residents in metro areas with one million or more population were most likely to hire professionals for lawn maintenance (53.5%, $n = 1{,}113$). Hiring of professionals for other three segments other than one million or more population had no specific pattern.

Table 4

Comparison of hiring of landscape professional for different purposes among Florida residents by segmenting residents based on population size of areas where they live (N = 3,476)

Hiring a landscape professional	Metro area with 1 million or more population (*N* = 2,080) % (n)	Metro area with 250,00 to 1 million population (*N* = 982) % (n)	Metro areas with fewer than 250,000 population (*N* = 204) % (n)	Non metro areas with population of 20,000 or more (*N* = 210) % (n)	χ^2	Cramer's *V*
Do not hire a professional for any services	24.0 (499)	30.7 (301)	31.9 (65)	35.7 (75)	26.7**	0.09
Any purpose	76.0 (1,581)	69.3 (681)	68.1 (139)	64.3(135)	26.7**	0.09
Lawn maintenance	53.5 (1,113)	44.9 (441)	43.6 (89)	45.2 (95)	25.7**	0.09
Tree pruning	38.8 (808)	30.4 (299)	33.3 (68)	27.6 (58)	27.2**	0.09
Landscape design and installation	19.7 (409)	13.1 (129)	16.7 (34)	19.0 (40)	20.0**	0.08
Irrigation services	26.5 (552)	20.1 (197)	21.6 (44)	19.0 (40)	19.2**	0.07
Pest management	46.4 (966)	42.0 (412)	41.7 (85)	46.7 (98)	6.57	0.04

Note. ** $p < 0.01$

Out of 17 water conservation behaviors, there was a significant difference in engagement in 12 behaviors (see Table 5). The effect sizes for differences in water conservation behaviors among residents of four areas were negligible. For all of the significant water conservation behaviors except for use of recycled wastewater for irrigation and installation of smart irrigation controls (e.g., soil moisture sensors), the residents in non-metro areas with 20,000 or more population had highest engagement in water conservation behaviors. Almost two-thirds (62.9%, $n = 132$) in non-metro areas with 20,000 or more population had replaced high volume irrigated areas with low volume irrigation areas, compared to around 45% of residents in other three areas. More than 50% of residents (62.9%, *n* = 132) in non-metro areas with 20,000 or more population had used rain gauge to monitor rainfall for reducing/skipping irrigation, compared to around 40% in other three areas.

Table 5

Comparison of current water conservation behaviors among Florida residents by segmenting residents based on population size of areas where they live (N = 3,476)

Water conservation behavior	Metro area with 1 million or more population (*N* = 2,080) % (*n*)	Metro area with 250,00 to 1 million population (*N* = 982) % (*n*)	Metro areas with fewer than 250,000 population (*N* = 204) % (*n*)	Non metro areas with population of 20,000 or more (*N* = 210) % (*n*)	χ^2	Cramer's *V*
I have replaced high volume irrigated areas with low volume irrigation	45.7 (950)	41.2 (405)	42.2 (86)	62.9 (132)	41.4**	0.08
I have converted turfgrass areas to landscaped beds	39.9 (829)	34.1 (335)	42.2 (86)	50.5 (106)	28.2**	0.06
I use recycled waste water to irrigate my lawn/landscape	36.6 (762)	31.4 (308)	24.5 (50)	33.3 (70)	26.6**	0.06
I have low-water consuming plant materials in my yard	65.7 (1,367)	62.2 (611)	60.8 (124)	76.2 (160)	23.1**	0.06
I use a rain gauge to monitor rainfall for reducing/skipping irrigation	38.1 (793)	37.4 (367)	39.7 (81)	52.9 (111)	22.5**	0.06
I have retrofitted a portion of my landscape so that it is not irrigated	36.3 (755)	31.2 (306)	41.2 (84)	43.3 (91)	22.5**	0.06

Table 5 (continued)

Comparison of current water conservation behaviors among Florida residents by segmenting residents based on population size of areas where they live (N = 3,476)

Water conservation behavior	Metro area with 1 million or more population (N = 2,080) % (n)	Metro area with 250,00 to 1 million population (N = 982) % (n)	Metro areas with fewer than 250,000 population (N = 204) % (n)	Non metro areas with population of 20,000 or more (N = 210) % (n)	χ^2	Cramer's V
I have installed smart irrigation controls (such as soil moisture sensors (SMS) or an evapotranspiration device (ET)) so irrigation won't turn on when it isn't needed	30.8 (640)	23.7 (233)	25.5 (52)	30.5 964)	21.84*	0.06
I follow watering restrictions imposed by local government and/or water management districts	89.8 (1,867)	91.3 (897)	83.3 (170)	92.9 (195)	17.7**	0.05
I have turned off zone(s) or capped irrigation heads for established woody plants	49.9 (1,038)	46.2 (454)	50.0 (102)	59.5 (125)	17.4**	0.05
I have replaced high water plants with drought tolerant plants	55.0 (1,143)	52.0 (511)	49.0 (100)	63.3 (133)	15.7*	0.05
I use high efficiency sprinklers	62.7 (1,305)	59.9 (588)	58.3 (119)	68.1 (143)	11.8	0.04

Table 5 (continued)

Comparison of current water conservation behaviors among Florida residents by segmenting residents based on population size of areas where they live (N = 3,476)

Water conservation behavior	Metro area with 1 million or more population (*N* = 2,080) % (*n*)	Metro area with 250,00 to 1 million population (*N* = 982) % (*n*)	Metro areas with fewer than 250,000 populatio n (*N* = 204) % (*n*)	Non metro areas with populatio n of 20,000 or more (*N* = 210) % (*n*)	χ^2	Cramer's *V*
I use different irrigation zones/zone run times based on plants' irrigation needs	63.6 (1,323)	63.6 (625)	65.2 (133)	70.5 (148)	6.1	0.03
I seasonally adjust irrigation times	79.9 (1,661)	80.3 (789)	79.4 (162)	83.8 (176)	4.1	0.02
I calibrate my sprinklers	65.0 (1,353)	62.7 (616)	62.3 (127)	63.8 (134)	2.36	0.02
I use a rain sensor to turn off irrigation when it is not needed	51.3 (1,068)	50.1 (492)	52.5 (107)	52.9 (111)	1.40	0.01

Note. *$p < 0.05$, **$p < 0.01$, Numbers in table represent percentage who responded yes to current water conservation behavior. Possible responses were yes, no, and unsure.

Conclusions, Implications, and Recommendations

People living in different urban-rural areas are different in important ways. The most critical difference is that individuals who live in more urban areas are less engaged in most water conservation behaviors than their less urban counterparts, which is consistent with Huddard et al. (2009). As the most urban audiences are least engaged in conserving water, this study highlights the importance of tailoring Extension programs to the behaviors of the urban audience. Urban Extension programs should encourage the use of specific water conservation practices with which urban residents are least engaged.

Many of the discrepencies in engagement among different urban-rural areas can be considered somewhat permanent landscape and irrigation modifications, such as converting turfgrass to landscape beds or replacing high volume irrigation with low volume irrigation. Urban residents may be less likely to engage in these conservation strategies because they would cause the landscape to deviate from an accepted norm in the neighborhood. Further, as more urban residents reside in HOAs, it is possible that restrictions prevent urban residents from making these changes to the landscape. Alternatively, urban residents may perceive their HOA guidelines prevent them from making changes to the landscape that lead to water conservation even if there are no actual restrictions. For these reasons, we suggest urban Extension programs explore and address local barriers to water conservation and possibly target behavior change on a neighborhood scale.

An exception to the pattern we identified is that the more urban residents are more engaged in using smart irrigation controls and using recycled wastewater than less urban residents. The greater number of urban residents living in HOAs could be one possible explanation to the exception. It is possible access to recycled water and standard smart irrigation systems are part of many of these planned communities. As more urban residents are using these conservation strategies, Extension programs in urban areas might emphasize the compatibility of additional conservation practices. For example, Extension could help residents who use smart irrigation controllers with standard high volume irrigation to convert some of their landscape to plants that require little or no supplemental water. Extension might also consider using these individuals as advocates for these conservation technologies. They could serve as Extension program guest speakers and demonstrators to encourage greater adoption of the conservation technologies they personally use.

People who live in more urban areas are also less likely to be do-it-yourselfers, and are more likely to hire professionals for their landscape maintenance and related tasks. For this reason, urban Extension programs need to engage the landscape professional stakeholder group, including landscape maintenance, irrigation, tree pruning, and irrigation specialists, to ensure the many influences on the home landscape are included. Those who live in more urban areas tend to be younger and with higher levels of education and more income. Those in more urban areas have lived in Florida for a longer period of time and are also more likely to live in HOAs. While the practical differences among the groups are somewhat small, they point to differentiated strategies that can improve the impact of Extension water conservation programs. There are also differences in the source of residents' irrigation water. As the subgroups become more urban, residents are more likely to irrigate their landscapes using municipal water. In the less urban areas, wells are more prevalent. Landscape water conservation programming targeting non-metro residents needs to focus more directly on the residents, who are most likely to be doing landscape tasks themselves. Extension programs for non-metro residents could appeal to a desire to maintain private wells appropriately, while this topic would not interest more urban residents.

Following principles of audience segmentation, the audience with the greatest need for change that Extension programs should target are the more urban audiences (Lee & Kotler, 2011), but the traditional rural audiences should not be ignored. We agree with others who recommend Extension programs should be modified as appropriate for urban audiences and the locally-specific context without losing focus on the guiding principles of the Extension organization (Harder & Wells, 2017). Serving increasingly urban Extension audiences with relevant programming may be a way to develop Extension advocates among a group that does not have a history of engaging with Extension (Harder et al., 2010).

The findings point to a need to engage more partners in Extension programming for urban residents, a recommendation from our research which is consistent with the current conversation on best practices for urban Extension (National Urban Extension Leaders, 2015; Warner et al., 2017). Urban residents are more likely to live in an HOA and use a professional company for some landscape management tasks, and urban water conservation programs need to incorporate these entities which play a role in home landscape management decisions. As others have reported, HOAs may be playing some role in reducing engagement in water conservation behaviors (Monaghan et al., 2013) as more HOAs correspond somehow to less conservation in more urban areas. Therefore, Extension must collaborate with HOAs, especially in the most urban areas. Similarly, utility companies are another important partner with the majority of urban residents using city water for irrigation. Water and utility bills are likely to be a good medium of communication, especially with the most urban groups.

Living in a more urban area could promote reduced connection to environment and natural resources. This would make sense given that urban environments provide fewer opportunities to experience nature (Shanahan et al., 2017). Extension should focus on fostering a connection to nature, especially among the most urban audiences, and help residents understand how their landscape management practices connect to local watersheds, springs, rivers, lakes, and other natural systems. While the need to provide access to green space is often highlighted as a route to increased connection to the environment and associated health benefits (Shanahan et al., 2017), we suggest access to local water bodies, or "blue space" should also be considered. Extension professionals might consider working with city and county planners to devise ways to provide exposure to and experience with local water bodies.

This study revealed new research questions that should be addressed. There is some relationship between living in a more urban location and being less engaged in landscape water conservation. Future research should explore these and other barriers that may be present in urban areas. There is also a question as to whether the practical significance among the differences we identified will increase as Florida continues to become more urban. Florida is considerably more urban than much of the nation and we did not have a rural subgroup to use in our analysis for comparison. It is possible larger practical differences could be identified by a national study with a truly rural population size subgroup, and future research should explore this possibility. It would be advantageous to find ways to subdivide Florida residents more precisely than on a county scale and if future researchers are able to secure a random sample of different subgroups then generalizability of findings would be more appropriate

Since the more urban residents are younger and have lived in the state for longer could suggest more rural residents could be moving to the state later in their lives, such as upon retirement. That they are conserving more than their younger, more urban counterparts implies these new residents are bringing water conservation ethics with them to Florida or perhaps people are moving to a more rural area upon retirement and have more time to engage in landscaping and water conservation practices. Further research needs to be conducted to examine these possibilities. In addition to the recommendations we offer here, we encourage Extension professionals to consider the many factors that may influence the differences we identified, which extend beyond population size to include available resources, infrastructure, and other factors. Even though study results indicated non-metro residents were slightly older and more likely to manage their lawn and/or landscape individually with minimal assistance from a professional, future research is needed to explore the relationship between hiring of a professional and age of residents. Minimal or no work has segmented Extension audiences by their population size, and there is potential for this approach to inform more impactful programming across the country and across programmatic areas.

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