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Assessing Connectedness to Water as a Catalyst for Change: A Multidimensional Approach to Extension Education on Water Conservation

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Abstract

As issues of water security remain pervasive, extension educators continue to search for strategies to promote water conservation. Social marketing represents such a strategy that can be leveraged as a tool to better understand target audiences and develop strategic communication campaigns to promote practice adoption and behavior change. Research demonstrates that social marketing efforts that focus on understanding and developing personal norms and values hold promise for increasing the implementation of residential conservation behaviors. The construct of Connectedness to Nature is one strategy for developing environmentally aligned personal norms. This study leverages a similar concept, connectedness to water, to understand how an emotional connection to water creates values that promote water conservation. We take an audience segmentation approach to understand how water conservation relates to connection to water, sociodemographic characteristics, and future conservation intentions. We conducted cluster analysis to identify audience segments followed by ANOVAs and Chi-Square tests to determine significant variations among the segments. We found that the strongest effect size was associated with connectedness to water. Interestingly, the higher an individual's connection to water, the higher the degree to which they were engaged with water conservation practices. This relationship represents an opportunity to tailor relevant extension education strategies to focus on the advancement of an individual's personal connections to water and perpetuate an enhanced sense of personal obligation to conserve.

Keywords

Concise Connectedness to Water Scale; Behavior Change; Water Conservation; Audience Analysis; Cluster Analysis

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As issues of water security remain pervasive, extension educators continue to search for strategies to promote water conservation. Social marketing represents such a strategy that can be leveraged as a tool to better understand target audiences and develop strategic communication campaigns to promote practice adoption and behavior change. Research demonstrates that social marketing efforts that focus on understanding and developing personal norms and values hold promise for increasing the implementation of residential conservation behaviors. The construct of Connectedness to Nature is one strategy for developing environmentally aligned personal norms. This study leverages a similar concept, connectedness to water, to understand how an emotional connection to water creates values that promote water conservation. We take an audience segmentation approach to understand how water conservation relates to connection to water, sociodemographic characteristics, and future conservation intentions. We conducted cluster analysis to identify audience segments followed by ANOVAs and Chi-Square tests to determine significant variations among the segments. We found that the strongest effect size was associated with connectedness to water. Interestingly, the higher an individual's connection to water, the higher the degree to which they were engaged with water conservation practices. This relationship represents an opportunity to tailor relevant extension education strategies to focus on the advancement of an individual's personal connections to water and perpetuate an enhanced sense of personal obligation to conserve.

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Introduction

Water security stands as one of the foremost environmental challenges confronting communities and policymakers in contemporary times (Russell & Knoeri, 2020). Global urbanization trends coupled with inadequate planning, pollution, poverty, and competing demands for resources continue to contribute to significant water stress (Global Water Partnership, 2013). The forecasted increase in urbanization presents a looming challenge for water management, particularly in urban areas, with projections from the United Nations indicating that at least two-thirds of the world's population, totaling 6.3 billion people, will reside in urban centers by 2050 (United Nations, 2021). The impacts of climate change compound the conservation challenges arising from urbanization, as alterations in precipitation patterns and shifts in water availability are anticipated (Russell & Knoeri, 2020).

Globally, there are acute regional examples that demonstrate the water-related challenges that stem from urbanization, including Florida in the United States. Florida witnessed a burgeoning urban population surpassing 21 million individuals in 2020 (U.S. Census Bureau, 2021), with projections indicating a further surge to 33.7 million residents by 2070 (Carr & Zwick, 2016). In addition to this massive population growth comes increasing demands on water resources which will not be met by existing supply (Borisova et al., 2020). Global forecasts suggest that Florida is not alone in this issue with a projected increase from 193 to 284 large cities globally being exposed to water scarcity issues by the year 2050 (He at al., 2021). Hence, the preservation of water resources emerges as a paramount priority intricately linked to maintaining quality of life.

Florida is currently one of the highest consumers of freshwater (Borisova et al., 2020; Dieter et al., 2017), directing over 2,371 million gallons daily toward public supply (Marella, 2019). The water is provisioned by public or private entities for public consumption, which includes household uses, bathing, and landscape irrigation (Dieter et al., 2017). While nationally, outdoor water use (e.g., lawn and landscape irrigation) may average 30% of a home’s total water consumption (Environmental Protection Agency, 2022), this number can approach 70% in parts of Florida (Taylor et al., 2023). Thus, Florida’s conservation challenges represent struggles other global regions may face in the future as they urbanize.

Researchers and extension educators argue that significant opportunities exist to accomplish water conservation objectives through purposeful efforts within residential landscapes, a domain increasingly recognized as the forefront of water conservation initiatives (St. Hillaire, 2009). For an average-sized yard in Florida, baseline irrigation levels can surpass 158,000 gallons annually (Boyer & Dukes, 2015). By utilizing modern technologies like smartphone applications and smart irrigation systems, residents can potentially slash their irrigation water usage by over 50% (Cardenas et al., 2020). Yet, realizing these substantial water savings requires a willingness among people to embrace behavioral changes and adopt new practices and technologies.

In recent years, there has been a vibrant discussion among extension educators regarding the effectiveness of social marketing in promoting water conservation (Evans et al., 2014; Lowe et al., 2014; Peattie & Peattie, 2009; Warner, 2019; Warner et al., 2018). Social marketing modifies procedures from commercial marketing to stimulate behavioral changes among target groups (McKenzie-Mohr et al., 2012). In contrast to conventional methods like the knowledge-deficit model, which presupposes that behavior change occurs once individuals are furnished with ample information (Suldovsky, 2017), social marketing represents a distinct approach. It entails comprehensive audience analysis to pinpoint genuine obstacles to adoption and to underscore possible benefits that may aid implementation (McKenzie-Mohr et al., 2012). This method frequently utilizes audience segmentation to identify significant subgroups within the broader audience, enabling the implementation of more focused and efficient extension education interventions customized to the particular characteristics and factors influencing the behavior being studied (McKenzie-Mohr et al., 2012).

Theoretical Framework

Within the realm of extension education, the audience analysis component of social marketing is of immense importance, as it is vital to grasp the psychosocial factors that underpin conservation behavior, thereby playing a pivotal role in promoting behavior change (Diaz et al., 2020; Huang & Lamm, 2015; Russell & Knoeri, 2020; Warner & Murphrey, 2015). Understanding an audience can be aided by environmental concerns, which can be categorized based on their value basis (Bouman et al., 2018; Stern & Dietz, 1994). This perspective, encompassing altruistic, egoistic, hedonic, or biospheric values, shapes individuals' perception of their actions. Values, as unwavering beliefs, consistently shape behaviors across diverse situations and contexts (Martin & Czellar, 2017; Stern & Dietz, 1994).

Altruistic values are defined as integral components within an individual's value system or overarching moral compass, propelling them towards actions that benefit the welfare of others or society collectively (Schwartz, 1972; Stern et al., 1995). People who prioritize altruistic values consider how their actions will affect other people. Biospheric values refer to the inherent worth and importance of ecosystems and the biodiversity they sustain, emphasizing their role in supporting life and providing essential services to humanity (Martin & Czellar, 2017). When individuals are inclined toward biospheric values, they tend to consider how their actions may benefit or harm the environment (de Miranda Coelho et al., 2016). Egoistic values are characterized by an emphasis on the personal gains and losses associated with a decision concerning one's resources, power, or attainment (Bouman et al., 2018). Lastly, hedonic values prioritize the pursuit of pleasure, positive emotions, and the minimization of effort (Bouman, et al., 2018). Individuals who adhere to egoistic values are often primarily focused on how their actions will impact them personally, whereas those who prioritize hedonic values are more likely to consider their comfort or pleasure. However, individuals aligned with these values are not inherently disinclined to embrace pro-environmental behaviors; rather, they are motivated when such actions offer personal benefits (Stern and Dietz, 1994). Martin and Czellar (2017) emphasized the significance of social marketers in cultivating biospheric values among their target audience to encourage greater participation in pro-environmental behaviors.

Individuals who possess stronger biospheric and altruistic values may generally be more inclined to change and likely to make personal sacrifices for the betterment of society (Bouman et al., 2018). Such individuals are inclined to actively seek information on how their actions can contribute positively to these domains (Stern & Dietz, 1994). Strong biospheric values create a personal standard, nurturing a feeling of duty to protect the environment, which correlates with involvement in environmental actions like water conservation (Kumar Chaudhary et al., 2017; Ruepert et al., 2016; Russell & Knoeri, 2020; Warner et al., 2024). Consequently, researchers in extension education interested in comprehending pro-environmental behaviors may explore the factors contributing to the development of biospheric values.

As a potential bridge to biospheric values, an intriguing aspect to consider is the concept of Connectedness to Nature (CTN). This notion was initially introduced by Leopold (1949), who posited that perceiving one's environment and land as an interconnected community fosters a sense of moral obligation to preserve it. Martin and Czellar (2017) recently established a link between connectedness to nature and biospheric values, marking the first connection of these otherwise largely independent concepts. Individuals who experience a profound emotional bond with nature view the natural environment, as an essential component of their identity, thereby exhibiting a greater inclination to protect it (Brügger et al., 2011; Frantz & Mayer, 2014; Martin & Czellar, 2017; Warner & Diaz, 2021). Currently, CTN is employed to elucidate various pro-environmental behaviors, especially in agricultural and extension education (Mayer & Frantz, 2004; Gill et al., 2022). The examination of this concept focuses on understanding how individuals identify themselves with nature and the connections they establish with it (Restall & Conrad, 2015). In extension education, CTN has been utilized in range of contexts including to facilitate youth development trajectories aimed at thriving (Mayer & Frantz, 2004), as well as to cultivate global leadership skills through extension experiences (Gill et al., 2022).

Research suggests a notable correlation between individuals' connectedness to nature and their inclination to safeguard it (Brügger et al., 2011; Dutcher et al., 2007; Frantz & Mayer, 2014; Mackay & Schmitt, 2019; Mayer & Frantz, 2004). Several assessment tools have been developed to measure this concept, including the Connectedness to Nature Scale (Frantz & Mayer, 2014), the Connection to Nature Index (Cheng & Monroe, 2010), the Inclusion of Nature in Self Scale (Schultz, 2002), and the Nature Relatedness Scale (Nisbet et al., 2009). Among these, the Connection to Nature Scale (CNS) stands out for its foundation in the concept of land ethic, evaluating individuals' emotional attachment and sense of parity with the natural world (Frantz & Mayer, 2014).

Research utilizing the CNS framework has revealed strong relationships between environmentally-desirable behaviors and connection to nature (Frantz & Mayer, 2014). Furthermore, enhancements in CTN have been correlated with heightened environmentally responsible behavior, as highlighted in a meta-analysis comprising 92 studies on connectedness to nature (Mackay and Schmitt, 2019). Frantz and Mayer (2014) advocate for prioritizing the improvement of participants' CTN, emphasizing its importance as an assessment tool for initiatives aimed at fostering environmentally responsible behaviors.

Recently, Warner and Diaz (2021) brought forth a critique of the CTN literature for its omission of water as a component of the natural world construct. They explained that while the instruments used to assess CTN explicitly mention plants, animals, and soils, it lacks any reference to water. Following the tenets of CTN one could argue that a connection to water (CTW) might similarly influence protective behaviors. Recent research (Muwelu et al., 2024; White et al., 2016; Warner et al., 2018; Warner et al., 2019) delved into Connectedness to Water (CTW) to refine the understanding of this paradigm and shed light on behaviors aimed at protecting water.

White et al. (2016) initiated an examination into how connections to water bodies impact environmentally friendly behaviors in the United Kingdom. Their research revealed that individuals residing closer to the coast and with increased exposure to water tended to engage in more pro-marine behaviors, such as reducing plastic usage and refraining from littering, in efforts to preserve water body integrity. Similarly, Warner et al. (2018) observed a lower level of engagement in landscape water conservation among residents in more urbanized areas of Florida, United States, suggesting a disconnection from local water bodies served as a barrier to protection of water resources.

Along a similar vein, Warner et al. (2019) observed that individuals who spend more time around different water bodies showed a greater inclination to adopt fertilizer practices aimed at reducing negative impacts on water quality, underscoring the role of water connections in promoting pro-environmental behaviors. Muwelu et al (2024) also explored how a connection to water through accessibility to water resources influenced household water conservation behaviors in Singida Municipality, Tanzania. They found a strong positive relationship between connection to water and engagement in conservation behaviors, calling for efforts to increase households' connection to water to advance water conservation outcomes in urbanizing regions (Muwelu et al., 2024).

Beyond the internal self, individuals' communities may also link to their conservation practices. It is possible a person's community attributes, such as population density, could align with engagement in conservation. For example, Warner et al. (2018) found individuals in the most densely populated areas under study were engaged in fewer water conservation practices. Further, more interactions with others, in general, could somehow influence alignment with value systems encompassing the greater good (i.e., altruistic and biospheric).

There is a growing demand for a deeper comprehension of human-water interactions and their implications for water conservation efforts, aiming to enhance agricultural and extension education program efficacy in planning, execution, and assessment (Warner, Diaz, and Kumar Chaudhary, 2018, 2019; White et al., 2016). To meet this need, Warner and Diaz (2021) developed the Concise Connectedness to Water Scale (CCWS), derived from the CNS. Through principal components analysis, they identified an 11-item instrument that bolstered the predictive power of the Theory of Planned Behavior concerning residents' intentions to conserve water in Florida, USA (see Appendix A; Warner & Diaz, 2021).

This study's importance for informing extension education behavior change strategies globally lies in its timely focus on water security, a pressing environmental challenge affecting urban communities worldwide. By examining the effectiveness of social marketing in promoting water conservation and employing a robust theoretical framework rooted in social psychology, the study offers valuable insights into the psychosocial factors driving conservation behavior. The development and validation of instruments such as the Concise Connectedness to Water Scale (CCWS) provide practical tools for assessing individuals' connections to water, enabling extension educators to tailor interventions that resonate with diverse audiences' intrinsic motivations and values. With water scarcity becoming increasingly prevalent due to urbanization and climate change, the study's findings have broad applicability beyond its specific context in Florida, offering extension educators globally actionable strategies to address this critical issue and drive meaningful behavioral change towards water conservation.

Methods

Purpose and Objectives

The study aimed to delineate audience segments based on participation in residential lawn and landscape water conservation practices, analyzing potential variations in each subgroup's characteristics, including Connectedness to Water (CTW), future conservation intentions, and sociodemographics. These findings were intended to inform customized nonformal educational programming in Florida, USA, as well as provide an example for other regions. The objectives that guided this inquiry were to 1) create audience segments demarcated by the extent of current engagement in water conservation, 2) determine whether the resulting audience segments differ in CTW, and 3) examine whether sociodemographics and future intentions of water conservation among the resulting segments.

Population and Sample

Non-probability sampling was used to recruit survey respondents through an online opt-in panel design (Baker et al., 2013). While probability sampling remains the preferred method whenever possible, nonprobability sampling and the use of opt-in panels is an increasingly common approach to making estimates about a population while balancing what is possible (due to available sampling frames, and resources) with what is desirable (Ansolabehere & Rivers, 2013; Baker et al., 2013; Lamm & Lamm, 2019; Wiśniowski et al., 2020). Non-probability-based opt-in internet panel data may provide accurate estimations, especially when the focus is on relationships between variables (i.e., multivariate analyses) (Ansolabehere & Rivers, 2013; Pasek, 2016). We implemented quota sampling to address potential selection and coverage errors associated with this design (Baker et al., 2013; Lamm & Lamm, 2019). We established quotas reflective of the current demographic composition of the state targeting sex, race and ethnicity, and age. Contact with potential participants was made through a professional survey sampling company (Qualtrics; Provo, UT), who provided study details, and those expressing interest were furnished with a web link to participate. Participants who opted in then received further information about the study, and were asked to provide informed consent. They were subsequently screened to ensure they met the selection criteria. This study was reviewed and approved by the [University] Institutional Review Board for Human Subjects Research (IRB2020-02650).

Study context

Water scarcity is a wicked problem for many communities globally, especially for those in coastal locations with large populations (Bischel, 2011). In the United States, Florida provides an example of this problem and has been cited as an extreme user of water, consuming more water than every state in the country except for three (Dieter et al. 2017). Water resource concerns continue to grow in Florida as droughts have become recurrent events and competition for water continues to increase (Obeysekera et al. 2017). These water quantity issues are only exacerbated by the desire among residents for aesthetically pleasing yards year-round, resulting in the overuse of resources to maintain landscape aesthetics (Baum et al., 2005; Kumar Chaudhary et al. 2017). Hence, the conservation challenges encountered in Florida serve as a precursor to the struggles that other global regions may confront as they undergo urbanization.

Screening and Quality Control

To access the study's target audience of residential decision-makers who used irrigation on their home lawn/landscape (N = 315), we employed three nested criteria. First, respondents needed to be adults 18 years of age or older according to their provided birth year. The second and third screening criteria identified residents who *made home lawn/landscape decisions* and also *used an irrigation system to apply water to their yards*, respectively. If the individuals did not meet the three basic criteria we did not collect this study's data from them and they were not included in this research.

Participant Characteristics

On average, participants were 47 years old (SD = 17.36) and had resided in [State] for over two decades (M = 21.27, SD = 15.49). More than 60%, were male, and nearly 80% identified as white. The most common educational attainment among respondents reported was a 4-year college degree or master's degree, and the most prevalent 2019 family income range fell between $75,000 and $99,999 US dollars. The majority of respondents lived in urban counties with populations exceeding one million, owned their homes, and indicated that their property was part of a homeowners' association. Slightly over 50% noted the presence of community water restrictions affecting their lawn watering practices.

Measures and Instrumentation

Sociodemographic variables that were used in analyses included population density (designated by the rural-urban continuum (RUC) code), political affiliation and ideology, homeowners' association membership, home ownership, family income, educational level, and years of residence in the state. Homeowners association membership was condensed into a binary variable for data analysis, with "yes" coded as 1 (responses of "no" and "unsure" were merged and coded as 0). Similarly, homeownership was transformed into a binary variable for data analysis, with "yes" coded as 1 (responses of "rent" and "other" were merged and coded as 0).

RUC codes refer to a set of classifications determined by the urban or non-urban nature and population size of a specific county (Economic Research Service, 2013). In the United States, there are three metro and six nonmetro categories, with seven of these categories present in Florida. To consolidate urban/suburban/rural population categorizations, one categorical variable with three possible values was generated. The first two RUC codes retained their original classifications (urban, 1 = populations of 1 million people or more; peri-urban, 2 = 250,000 – 1 million), while the remaining categories were merged into a single variable (suburban/rural, 3 = populations of 250,000 or less).

The assessment of connection to water utilized the Concise Connectedness to Water Scale (CCWS; Warner and Diaz, 2021), comprising 11 items designed to gauge various facets of an individual's emotional bond with water resources. We instructed participants to indicate their agreement with each of the 11 items on a five-point Likert-type scale ranging from strongly disagree to strongly agree. Consistent with Warner and Diaz (2021), responses were coded from -2 (strongly disagree) to 2 (strongly agree), and a mean score was computed to generate a Connection to Water (CTW) index, indicating the degree of an individual's connection to water. A mean CTW value closer to -2 signified a significant disconnect from water, whereas a value nearing 2 indicated a strong connection to water (Warner & Diaz, 2021). The CTW underwent expert validation and principal component analysis, yielding a Cronbach's alpha of .90 (Warner & Diaz, 2021).

Lastly, respondents' current conservation behaviors and future conservation intentions were evaluated using a set of 18 practices adapted from Warner et al. (2020). Participants indicated whether they engaged in each practice by selecting "yes" or "no." A conservation score variable was derived by tallying the affirmative responses, forming an additive index. This variable reflects the cumulative count of affirmative responses, with each practice contributing equally to the score. Consequently, a respondent who reported conducting all practices would receive a score of 18.

Data Analysis

Initially, we performed a hierarchical cluster analysis to identify the appropriate number of segments based on current water conservation engagement score. We specified Squared Euclidean Distance as the similarity measure (Burns & Burns, 2008). The analysis identified three segments, which we input into a succeeding k-means cluster analysis to assign each respondent to a segment.

Subsequent to cluster analysis, a series of one-way analyses of variance (ANOVA) and chi-square analyses were conducted to discern similarities and differences among the segments. Eta squared was utilized for ANOVA, while Cramer’s V was employed for Chi-Square as measures of effect sizes in cases of significant differences. The interpretation of results was facilitated by effect size classifications outlined in Table 1. Post-hoc Tukey tests were applied to compare values following significant ANOVAs, whereas post-hoc z-tests were utilized to compare column proportions subsequent to significant relationships identified by Chi-square analyses.

Table 1

Effect Size Variables and Effect Classification

Effect Size Variable	Effect Classification
Eta Squared ($\eta2$)	Small = 0.01 Medium = 0.06 Large = 0.14
Cramer's V	Negligible effect= < 0.10 Weak effect = 0.10 to 0.19 Moderate effect = 0.20 to 0.39 Relatively strong = 0.40 to 0.59 Strong = 0.60 to 0.79 Very strong = .80 to 1.00

Study Limitations

It is important to interpret the findings with the understanding that there may be disparities between individuals who volunteer for an online research panel and the intended population (Baker et al., 2010). Furthermore, researchers have noted distinctions between residents who utilize irrigation and the broader public (Warner et al., 2016, 2018), which is reflected in the variance between our target sample and the attributes outlined in the quota criteria.

Results

Respondent Segments determined by Water Conservation Engagement

The hierarchical cluster analysis indicated that three segments were optimal for maximizing differences in the current extent of water conservation engagement among the resultant groups. Following the k-means cluster analysis to allocate individuals to the groups, a one-way ANOVA (see Table 2) revealed a statistically significant difference in conservation engagement among the three groups ($F(5719.236, 1008.161) = 884.978$, $p < 0.001$). Notably, the effect size was large, as denoted by partial eta squared ($\eta2$). These segments, arranged from the smallest proportion of respondents to the largest, were delineated as high engagement (subgroup 1), low engagement (subgroup 2), and moderate engagement (subgroup 3) in water conservation. Specifically, the high engagement segment exhibited a conservation score of 15.6, indicating that they were, on average, engaged in nearly 16 of the 18 conservation practices. In comparison, the moderate engagement group attained a conservation score of 9.55, while the low engagement group scored 3.90 in conservation practices.

Table 2

Comparison of Water Conservation Among Respondent Subgroups

	Subgroup 1 (*n* = 72; 23%) High Engagement		Subgroup 2 (*n* = 98; 31%) Low Engagement		Subgroup 3 (*n* = 145; 41%) Moderate Engagement				
Variable	*M*	*SD*	*M*	*SD*	*M*	*SD*	*p*	*F*	*η2*
Water conservation	15.60**[23]	1.96	3.90**[13]	1.76	9.55**[12]	1.74	< 0.001	884.98	.850

Note. ***post-hoc* Tukey test $p < .001$; [123]Indicates difference from segments 1,2,3. Water conservation score could range from 0 to 18.

Respondent segment membership and CTW

Significant differences in CTW were observed among the three segments, accompanied by a substantial effect size, as indicated by partial eta squared (η2; Huck, 2012) (see Table 3). Respondents exhibited elevated levels of CTW in the high conservation segment, moderate levels in the moderate engagement segment, and lower levels in the low engagement segment.

Table 3

Comparison of CTW among Respondent Subgroups

	Subgroup 1 (*n* = 72; 23%) High Engagement		Subgroup 2 (*n* = 98; 31%) Low Engagement		Subgroup 3 (*n* = 145; 41%) Moderate Engagement				
Variable	*M*	*SD*	*M*	*SD*	*M*	*SD*	*p*	*F*	*η2*
CTW	1.23**[23]	0.62	.35**[13]	0.84	0.81**[12]	0.70	< .001	30.814	.17

Note. ***post-hoc* Tukey test $p < .001$; [123]Indicates difference from segments 1,2,3. CTW could range from -2 to 2.

Respondent segment membership, sociodemographics, and future conservation intentions

A one-way ANOVA analysis indicated that there was no statistically significant difference in the duration of respondents' residency in Florida among the three groups (F(448.49, 74871.58)= [.934], $p = .394$). However, a subsequent one-way ANOVA revealed a statistically significant difference in the age of respondents across the three groups (F(8368.19, 86270.34) = [15.13], $p < .001$). Specifically, age was significantly lower in the high conservation group compared to the other two groups (see Table 4). This discrepancy was associated with a medium effect size, as quantified by partial eta squared (η2; Huck, 2012). Moreover, no significant difference in the age of respondents was observed between subgroups 2 and 3.

Table 4

Comparison of Age Among Subgroups

	Subgroup 1	Subgroup 2	Subgroup 3

	(*n* = 72; 23%) High Engagement		(*n* = 98; 31%) Low Engagement		(*n* = 145; 41%) Moderate Engagement				
Demographic Variable	*M*	*SD*	*M*	*SD*	*M*	*SD*	*p*	*F*	*η2*
Age	37.89**[23]	11.65	52.01[1]	18.48	47.11[1]	17.38	< .001	15.132	0.09

Note. ***post-hoc* Tukey test *p*< .01; [123]Indicates different from subgroup 1,2,3.

Among the categorical sociodemographic characteristics examined, homeowners association presence, educational level, income, political beliefs, and RUC were found to be associated with segment membership (see Table 5). Subsequent post-hoc z-tests, conducted following significant chi-square analyses, indicated that members of the high engagement subgroup were more inclined to reside in urban areas, dwell in neighborhoods with an HOA, report higher income ranges, and espouse liberal or very liberal political values. Notably, effect sizes were predominantly weak, as assessed by Cramer's V (Rea & Parker, 1992).

Table 5

Comparison of Socio-Demographic Characteristics Among Subgroups in a Study of Urban Water Conservation Practices (n = 315)

	Subgroup 1 (*n* = 72; 23%) High Engagement	Subgroup 2 (*n* = 98; 31%) Low Engagement	Subgroup 3 (*n* = 145; 41%) Moderate Engagement			
Demographic Variable	% (*f*)	% (*f*)	% (*f*)	*p*	x^2	Cramer's *V*
Sex				.283	2.53	.09
Male	15.6[a] (49)	17.5[a] (55)	28.6[a] (90)			
Female	7.3[a] (23)	13.7[a] (43)	17.5[a] (55)			
Gender						
Male	15.6[a] (49)	17.1 [a] (54)	28.6 [a] (90)	.294	4.93	.09
Female	7.3 [a] (23)	13.7 [a] (43)	17.5 [a] (55)			
Trans	0[a] (0)	0.3[a] (1)	0[a] (0)			
HOA*				.001	13.78	.21
Yes	17.8[a] (56)	15.6[b] (49)	29.2[a,b] (92)			
No/Unsure	5.1[a] (16)	15.6[b] (49)	16.8[a,b] (53)			
Homeownership				.313	2.33	.09
Own	18.1[a] (57)	26.7[a] (84)	40.0[a] (126)			
Rent/Other	4.8[a] (15)	4.4[a] (14)	6.0[a] (19)			
Rural-Urban* Continuum Code (n= 311)				.005	14.70	.15
Urban 1 mill +	20.9[a] (65)	20.9[b] (65)	34.1[b] (106)			

Urban 250k - < 1mill	1.0[a] (3)	7.7[b] (24)	9.0[b] (28)			
Urban/nonurban counties < 250k	1.0a (3)	2.6[a] (8)	2.9[a] (9)			
Education Level*				.001	35.58	.24
Less than High School	0[a] (0)	1.0[a] (3)	0.3[a] (1)			
High School/GED	3.5[a] (11)	4.4[a,b] (14)	2.5[b] (8)			
Some college	1.6[a] (5)	5.1[a,b] (16)	9.5[b] (30)			
2-year college degree	1.6[a] (5)	2.5[a] (8)	6.7[a] (21)			
4-year college degree	2.5[a] (16)	11.4[a] (36)	11.7[a] (37)			
Master’s degree	6.3[a] (20)	5.4[a] (17)	10.2[a] (32)			
Doctoral degree	2.5[a] (8)	0.6[b] (2)	2.9[a,b] (9)			
Professional degree (JD, MD)	2.2[a] (7)	0.6[a] (2)	2.2[a] (7)			
Family Income*				.001	46.72	.27
Less than $24,999	2.2[a] (7)	3.2[a] (10)	2.2 (7)			
$25,000 - $49,999	2.9[a] (9)	7.0[a] (22)	7.3 (23)			
$50,000 - $74,999	3.5[a] (11)	4.1[a] (13)	7.0 (22)			
$75,000 - $99,999	1.9[a] (6)	9.2[b] (29)	9.5 (30)			
$100,000 - $124,999	0.6[a] (2)	1.6[a] (5)	5.7 (18)			
$125,000 - $149,999	2.9[a] (9)	3.2[a] (10)	6.0 (19)			
$150,000 - $174,999	2.5[a] (8)	1.3[a] (4)	2.5 (8)			
$175,000 - $199,999	2.2[a] (7)	0.3[b] (1)	2.2 (7)			
$200,000 - $224,999	0.3[a] (1)	0[a] (0)	1.3 (4)			
$225,000 - $249, 999	1.0[a] (3)	0.3[a] (1)	0.3 (1)			
$250,000 or more	2.9[a] (9)	1.0[a] (3)	1.9 (6)			
Political Affiliation				.163	9.20	.12
Republican	10.5[a] (33)	10.2[a] (32)	17.1[a] (54)			
Democrat	8.9[a] (28)	11.7[a] (37)	17.1[a] (54)			
Independent	2.9[a] (9)	7.0[a] (22)	10.8[a] (34)			
Non-affiliated	0.6[a] (2)	2.2[a] (7)	1.0[a] (3)			
Other	0[a] (0)	0[a] (0)	0[a] (0)			
Political Beliefs/Values*				.00	30.35	.22
Very liberal	5.4[a] (17)	2.5[b] (8)	5.7[a,b] (18)			
Liberal	4.4[a] (14)	4.4[a] (14)	7.0[a] (22)			
Moderate	5.7[a] (18)	15.2[b] (48)	16.5[a,b] (52)			

Conservative	2.5^{a} (8)	$5.4^{a,b}$ (17)	13.3^{b} (42)
Very Conservative	4.8^{a} (15)	$3.5^{a,b}$ (11)	3.5^{b} (11)

Note. * Indicates significance. Post-hoc z-tests were conducted to compare column proportions when a significant relationship was identified. Each superscript denotes a subset of Cluster Number of Case categories whose column properties do not differ significantly from each other at the level.

Lastly, a one-way ANOVA was performed to assess the relationship between segment membership on future conservation intentions (see Table 5). The analysis revealed a significant effect [$F(2, 313) = 55.852$, $p < .001$). Subsequent post hoc tests utilizing Tukey's HSD test unveiled significant differences in future conservation intentions between the high ($M = 1.31$; $SD = .72$) and moderate engagement groups ($M = 0.71$; $SD = .73$); between high ($M = 1.31$; $SD = .72$) and low engagement groups ($M = 0.17$; $SD = .61$); and low ($M = 0.17$; $SD = .61$) and moderate engagement groups ($M = 0.71$; $SD = .73$). This difference exhibited a large effect size, as indicated by partial eta squared (η2; Huck, 2012).

Table 5

Comparison of Future Water Conservation Intentions Among Subgroups in a Study of Urban Water Conservation Best Management Practices (n= 314)

	Subgroup 1 (*n* = 72; 23%) High Engagement		Subgroup 2 (*n* = 98; 31%) Low Engagement		Subgroup 3 (*n* = 145; 41%) Moderate Engagement				
Variable	*M*	*SD*	*M*	*SD*	*M*	*SD*	*p*	*F*	*η2*
Future Intention Index	1.31^{**23}	0.72	$.17^{**13}$	0.61	0.71^{**12}	0.73	< .001	55.852	.264

Note. ***post-hoc* Tukey test $p< .01$; [123]Indicates different from subgroup 1,2,3. Future intention index could range from -2 to 2.

Conclusions

Our study reinforces the significance of fostering connections between individuals and nature, particularly water, in enhancing the efficacy of extension educators in achieving conservation objectives. We observed a clear relationship between heightened water conservation efforts and a deeper emotional attachment to water, as assessed by the CCWS. Specifically, the low, moderate, and high water conservation engagement groups exhibited distinct levels of connectedness to water, corresponding to their respective conservation engagement levels. These findings underscore the importance of promoting both emotional bonds with water and water conservation practices within extension education initiatives, building upon prior research (Warner & Diaz, 2021).

Results also demonstrate the influence that political beliefs, HOAs, family income, and education levels have on residential water use. Additionally, those in the high engagement group lived in the most urbanized area, which was surprising given findings from previous research that reported possible disconnects from water leading to less engagement in environmentally-desirable behaviors among urban residents (Warner et al., 2016; Warner et al., 2018). Even though these sociodemographic characteristics were shown to be significant, there was a small effect size for each significant difference that was identified. This means that regardless of extension audiences' sociodemographics, there needs to be a push to connect audiences to water.

This study underscores the utility of the CCWS in extension education as both a design and evaluation tool for promoting water conservation practices. By fostering a sense of connectedness to water, akin to a personal obligation for protection and conservation, educators can gauge the effectiveness of their initiatives in cultivating stronger biospheric and altruistic values conducive to adopting environmentally responsible behaviors (Frantz & Mayer, 2014). Moreover, a connection to water empowers participants to take an active role in conservation efforts, actively seeking educational resources to enhance their conservation endeavors (Bouman et al., 2018; Stern & Dietz, 1994).

Extension educators worldwide aiming to promote water conservation can find inspiration in organizations like the National Wildlife Federation (NWF) in the United States, which have implemented strategies that integrate education with fostering connections to nature to enhance environmental stewardship (NWF, 2006). They have reimagined the teaching and learning experience using strategies such as outdoor classrooms, nature-inspired curricula, and outdoor exploration. Programs such as the Backyard Habitat Program focus on nurturing a bond with nature among stakeholders, which is viewed as an intermediary step toward achieving the desired environmental goals of programs. These positive outcomes indicate a promising approach for extension educators globally to consider, especially within the realm of water ecosystems, for encouraging water conservation among residential decision-makers. Extension educators can rethink their approach to the extension classroom and teaching methods to go beyond information dissemination. They can explore alternative modalities like outdoor classrooms and set new programmatic goals, such as fostering connections with nature, to enhance the design and evaluation of their programs.

Future research presents an opportunity to delve into the specific experiences that foster a deeper emotional bond and cultivate values conducive to water conservation. This insight is crucial for refining program and policy frameworks aimed at enhancing residential landscape water conservation efforts. Moreover, there is a need for further investigation into audience differences based on learning preferences to enable the customization of programs in a culturally sensitive manner. This entails considering not only learning modalities and resources but also message content, language delivery, and illustrative examples, among other factors. Such endeavors align with existing research highlighting the influence of cultural identity on learning and advocating for culturally responsive education and communication to drive improved learning outcomes and behavioral changes (Blanchet-Cohen & Reilly, 2013; Gay, 2002; Stern et al., 2010).

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Appendix A
Concise Connectedness to Water Scale (CCWS)

Using the following scale, answer how you honestly feel. There are no right or wrong answers.

The **water around you** refers to the lakes, rivers, canals, streams, oceans, springs, and stormwater ponds that you may see.

Question	Strongly disagree	Somewhat disagree	Neither disagree nor agree	Somewhat agree	Strongly agree
1. I often feel a sense of oneness with the water around me.	O	O	O	O	O
2. I think of the water around me as a community to which I belong.	O	O	O	O	O
3. I appreciate the plants and animals that live in the water around me.	O	O	O	O	O
4. I think of humans as part of the water cycle.	O	O	O	O	O
5. I feel a kinship with the animals and plants that live in the water around me.	O	O	O	O	O
6. I feel as though I belong to the water around me as equally as it belongs to me.	O	O	O	O	O
7. I have a deep understanding of how my actions affect the water around me.	O	O	O	O	O
8. I often feel a part of the water cycle.					
9. I feel that everyone and everything connected to the water around me shares a common energy.	O	O	O	O	O
10. Like a drop of water can be part of the ocean, I am connected to the water around me.	O	O	O	O	O
11. I often feel like I am only a small part of the natural world around me, and that I am no more important than the water in the streams or the fish in the rivers.	O	O	O	O	O