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Using Home Irrigation Users' Perceptions to Inform Water Conservation Programs

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Abstract

Targeted agricultural education programs can play a role in solving complex water issues. This article applies importance-performance analysis to examine dimensions of water resources that may inform local water conservation campaigns in the United States. The purpose of this study was to generate a deep understanding of home irrigation users' preferences and perceptions about water to inform landscape irrigation water best practices campaigns among this audience nationwide. Importance-performance analysis was conducted using quantitative survey research. Responses were drawn from 2,675 people who use home landscape irrigation in all states nationwide and from three areas experiencing serious water issues: Florida, California, and the Chesapeake Bay Watershed. There were differences among respondents as a function of geographical location, which revealed people are likely influenced by their exposure to and experience with water issues. There were significant differences between respondents' perceived importance with clean water for different purposes and plentiful water for different purposes. We identified gaps between importance of and satisfaction with clean and plentiful water for different purposes which demonstrate dissatisfaction around important water topics, such as clean water for local and large water bodies. The findings provide insight for targeted programs surrounding local needs and issues. Agricultural education professionals who work on water issues should emphasize home irrigation users' influence on water quality issues over water quantity issues, and should incorporate locally specific findings into programs.

Keywords: home landscape irrigation users, importance-performance analysis, water conservation,

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Introduction

Water is one of the most important public issues ever faced by the global population. The United States has the third largest water footprint in the world, where each resident consumes an average of 2,842 cubic meters of water per year (Hoekstra & Mekonnen, 2012). The country has experienced severe long and short-term droughts and water quality disasters, and certain locations have experienced more intense water issues than others (Georgakakos et al., 2014). Water issues have increased in severity and both drought and water quality issues are projected to intensify in most of the United States (U.S.; Georgakakos et al., 2014).

While much of the country has experienced some form of water issue, problems are highly diverse, and several areas of the U.S., including Florida, California, and the Chesapeake Bay Watershed, are more vulnerable than others (Maupin et al., 2014). Researchers have reported amounts exceeding 50% and even 60% of a household's water may be applied in the landscape (DeOreo, Mayer, Dziegielewski, & Kiefer, 2016; EPA, 2015). Both California and Florida are known for green home landscapes and the irrigation required to maintain them; yet, these states are the first and third greatest domestic water consumers in the U.S. (Maupin et al., 2014) and their residents face outdoor water use restrictions (EPA, 2015).

One of the most well-known water quality problems in the U.S. exists in the 68,500 square mile Chesapeake Bay Watershed, which receives deposits of sediment and excess nutrients from more than 150 streams and rivers (USDA, n.d.). Parts of six states make up this large watershed with approximately 30% agricultural land (USDA, n.d.). While water quality has been a long-term issue here since the 1970s, farmers have been engaged in solving the problem; water quality remains a concern although it has improved somewhat in recent years (USDA, n.d.).

Water issues present opportunities for agricultural education professionals. Through programs such as *There's No New Water,* agricultural education professionals help 4-H youth to explore water quality and quantity issues (National 4-H Council, n.d.). Agricultural education professionals help people to make informed decisions by providing education to decision-makers and the public (Lamm, Taylor, & Lamm, 2016). Extension professionals diffuse current water-related technologies and research to help residents and professionals adopt landscape best management practices (Warner, Rumble, Martin, Lamm, & Cantrell, 2015). While numerous agricultural education professionals work to encourage water protection practices in the home landscape, adequate attention has not been given to understanding how to deliver programs that influence behaviors (Leal, Rumble, & Lamm, 2015; Syme et al., 2000). The study aligned with the National Research Agenda of the American Association for Agricultural Education priority *Addressing Complex Problems* (Roberts, Harder, & Brashears, 2016). Among these problems, one of "our most pressing challenges … lies with water" (Roberts et al., 2016, p. 69). Anthropogenic effects on water cycles (e.g., water withdrawals for drinking, irrigation) "coupled with the excessive use of ground water and the deterioration of water quality, provide significant issues for our global communities with respect to our most precious resource" (Roberts et al., 2016, p. 69).

Theoretical / Conceptual Framework

Water-related programs have been primarily information-based and often incorporate minimal formative audience research, both of which impede effectiveness (Shaw, 2010; Syme, Nancarrow, & Seligman, 2000). Tailoring programs to meet the target audience's needs is one of the most important components of effective programs (McKenzie-Mohr, 2011). Agricultural education professionals are increasingly exploring and engaging innovative approaches, but there is still much research that needs to be done to effectively tailor home irrigation water conservation

programs. Through message testing with Floridians who use irrigation, Warner et al. (2015) found strategically designing messages that appealed to either personal or social values increased two factors that lead to behavior change: perceived control over and attitude toward good irrigation practices when compared to messages that appealed to environmental or economic values. While the Warner et al. (2015) study revealed the potential message framing according to the audience's needs could enhance water conservation, the authors did not consider how perceived importance of water could influence audience behaviors.

Some agricultural education professionals have examined importance in the context of water issues. Adams et al. (2013) found the higher people rated the importance of water quality, water conservation, and water for different uses, the more likely they were to conserve water outside of the home. Lamm, Lundy, Warner, and Lamm (2016) also found understanding an audience's perceived importance provided insight into their water conservation behaviors. Others (Warner, Kumar Chaudhary, & Lamm, 2016) have suggested considering satisfaction along with perceived importance could provide a valuable means for understanding an Extension audience's programming needs. Warner, Kumar Chaudhary, and Lamm (2016) used Importance-Performance Analysis (IPA; Martilla & James, 1977) to measure the aggregated importance and satisfaction of different dimensions of water resources and hypothesized using this strategy could reveal differences in programming needs according to an audience's unique experiences with water issues. The authors posited IPA could be used to rank an audience's preferences and needs (Warner, Kumar Chaudhary, & Lamm, 2016).

IPA is a technique historically used to understand consumer perceptions of specific attributes (Martilla & James, 1977) and prioritize those that are highly important yet perceived with low performance (satisfaction). IPA is characterized by a four-quadrant matrix on which each characteristic is plotted according to the audience's perceived importance and satisfaction. Concepts that fall into the quadrant with high importance and low satisfaction values are interpreted as needing utmost attention and represent areas where limited resources should be directed for the greatest impact (Martilla & James, 1977).

IPA has been applied to evaluating visitor satisfaction with characteristics of places such as recreational destinations. For example, Hugo and Lacher (2014) used IPA to understand the role culture and heritage play in community festivals. IPA has not been used within the context of water conservation behaviors, although Sanderson (2013) used this approach to investigate the North Carolina Bed and Breakfast industry's engagement in environmentally-friendly initiatives. While usually used to evaluate places, and recently applied to understanding Extension audiences' needs surrounding water conservation programs (Warner, Kumar Chaudhary, & Lamm, 2016), IPA has not been used to examine differences in importance of or satisfaction with water among target audiences as a function of geographical location.

When people are unsatisfied with something that is important to them, they may be motivated to take action to resolve the difference. Feelings of obligation to conserve are activated when individuals believe violating their values would have an adverse effect on those values, and by conserving they can take responsibility for those consequences (Stern, 2000; Stern, Dietz, Kalof, & Guagnano, 1995). Agricultural education professionals can activate this feeling of obligation if they first understand their audience's values, and they direct attention to the concepts of importance as they relate to water conservation behaviors. Therefore, we designed this study to examine satisfaction and importance surrounding home irrigation users' perceptions of water so agricultural education professionals can make water issues most salient when designing programs to influence outdoor water use (Warner, Kumar Chaudhary, & Lamm, 2016).

Purpose and Objectives

People who use irrigation in the home landscape play a critical role in addressing water issues and, thus, represent an important audience for agricultural education programs nationwide (EPA, 2015; Warner, Lamm, Rumble, Martin, & Cantrell, 2016; Warner et al., 2015). The purpose of this research was to generate a deep understanding of nationwide home landscape irrigation users' perceptions surrounding water to inform effective landscape irrigation water conservation campaigns. Three target locations were selected to examine possible variability in perceptions nationwide. Specific objectives were to a) document and compare home landscape irrigation users' perceived importance of clean and plentiful water for various purposes (e.g., drinking, recreation); b) document and compare home landscape irrigation users' perceived satisfaction with clean and plentiful water for various purposes (e.g., drinking, recreation); and to c) document and compare the gaps between home landscape irrigation users' perceived importance of and satisfaction with clean and plentiful water for various purposes (e.g., drinking, recreation).

Method

This study assessed home landscape irrigation users' perceptions nationwide, with a focus on Florida, California, and the Chesapeake Bay area. The target population consisted of residents who used landscape irrigation because they have a great capacity to conserve water if they adopt conservation practices (EPA, 2015; Warner et al., 2015; Warner, Lamm, et al., 2016). Prior to commencing this study, the research protocol was approved by the University of Florida Institutional Review Board (Protocol #2015-U-1102).

Recruitment of Participants

We collected data in December of 2015. We screened study participants to ensure they were at least 18 years of age; had a lawn and/or landscape; and had an irrigation system they controlled. We used a web-based survey sampling company to recruit the sample. We used non-probability sampling because there was "no way to identify a full listing of the population" (Baker et al., 2016, p. 4). Because there is not an existing sampling frame for the target population, the best possible non-probability opt-in panel for recruitment of target audiences was used (Warner et al., 2015). Non-probability opt-in panels are considered non-representative of the target population (Bryman, 2008) and the reader should exercise caution when interpreting the findings. However, they are often used to make inferences about the target population when the target population sampling frame is unavailable (Baker et al., 2013) and can generate results comparable to and sometimes better than probability samples (Abate, 1998; Twyman, 2008; Vavreck & Rivers, 2008).

A total of 14,364 potential participants were invited to participate in the study. The screening questions revealed 5,540 belonged to the target population and these individuals proceeded to complete the survey instrument. Out of the eligible residents, 2,675 responses were considered complete for the purpose of data analysis, which resulted in a participation rate of 48.3% (Baker et al., 2016). We selected a large sample size to make robust comparisons of the target areas.

Description of the Population

The overall sample (N = 2,675) included home irrigation users nationwide (from all states of U.S.; n = 1,052), and from three target areas: Florida (n = 525), California (n = 526), and the Chesapeake Bay Watershed (n = 572). Just over half of the respondents were female in the national sample (51.4%; n = 541), California sample (54.9%; n = 289), Chesapeake Bay area sample (58%; n = 332), and Florida sample (54.3%; n = 285). The majority of respondents reported they owned

their homes among the national sample (83.9%; n = 883), California sample (79.3%; n = 417), Chesapeake Bay area sample (79.7%; n = 456), and Florida sample (83.6%; n = 439). The mean ages were 40.0 (national sample), 41.6 (California sample), 39.3 (Chesapeake Bay area sample), and 47.9 (Florida sample) years old.

Study Design and Data Analysis

We used IPA to examine home irrigation users' perceived importance of and satisfaction with different dimensions of water. Most applications of IPA have used individual statements (Hugo & Lacher, 2014; Martilla & James, 1977; Siniscalchi, Beale, & Fortuna, 2008). However, we developed indices based on best survey methodology practices (Babbie, 2013). We asked each respondent to indicate the level of importance they associated with each of the 19 items that corresponded to clean or plentiful water for various purposes and then in a separate question they were asked to indicate their satisfaction with the availability of each of the 19 items. We used the 19 importance statements to form three indices for the importance of clean water and three indices for the importance of plentiful water, and the 19 satisfaction statements to form three indices for the satisfaction of clean water and three indices for the satisfaction of plentiful water (see Table 1).

We measured the importance of clean and plentiful water on a five-point Likert-type scale (1 = *not at all important*; 2 = *slightly important*, 3 = *fairly important*; 4 = *highly important*; 5 = *extremely important*). We also measured satisfaction with the availability of clean and plentiful water on a five point Likert-type scale (1 = *not at all satisfied*; 2 = *slightly satisfied*; 3 = *fairly satisfied*; 4 = *highly satisfied*; 5 = *extremely satisfied*). We used these values to calculate six importance index means and six satisfaction index means. Each of these index means could range from one to five. We included quality control questions in the questionnaire to ensure the quality of responses and attention of respondents (Lavrakas, 2008).

We established face and content validity of the instrument using an expert panel review with experts specializing in water conservation programming, agricultural and biological engineering, and survey methodology. After the review, we pilot tested the instrument with home landscape irrigation users and made minor changes for clarity prior to the full study. We calculated post hoc reliability coefficients for the six indices in the full study and found them to be satisfactory with Cronbach's alpha coefficient values ranging from 0.71 to 0.93 (Fraenkel & Wallen, 2008). We used Statistical Package for Social Sciences (SPSS version 22.0) for data analysis.

We used one-way ANOVA to compare the importance and satisfaction means of the six indices among the three targeted areas and presented the national sample means for comparison. All the assumptions of one-way ANOVA (homogeneity of variance, normality, and independence of errors) were satisfied except homogeneity of variance for seven of the twelve importance and satisfaction indices. For these indices, we used the Welch test to calculate F-statistics for one-way ANOVA. We used the Tukey HSD test to examine differences among samples post-hoc for the five indices with equal variances and the Games-Howell test for the remaining seven indices with unequal variances. We calculated effect sizes for posthoc comparisons using Cohen's d, and interpreted the values as 0.2 = small, 0.5 = medium, and 0.8 = large (Cohen, 1988).

Table 1

Water Conservation Indices in a Study to Assess the Communication Preferences Among People Who Use Landscape Irrigation in the United States

Index Name	Individual Statements in Index
Importance[a] of clean water for local and large water bodies	Clean lakes, springs, rivers
Satisfaction[b] with clean water for local and large water bodies	Clean oceans
	Clean bays and estuaries
Importance[a] of clean water for recreation	Clean water for shellfishing
Satisfaction[b] with clean water for recreation	Clean beaches
	Clean water for recreation
Importance[a] of clean water for consumption	Clean drinking water
Satisfaction[b] with clean water for consumption	Clean groundwater
	Clean water for food preparation
Importance[a] of plentiful water for business	Plentiful water for commerce and industry
Satisfaction[b] with plentiful water for business	Plentiful water for power
	Plentiful water for agriculture
Importance[a] of plentiful water for people	Plentiful water for household landscapes
Satisfaction[b] with plentiful water for people	Plentiful water for cities
	Plentiful water for golf courses
	Plentiful water for recreation
Importance[a] of plentiful water in local water bodies	Plentiful water in aquifers and springs
Satisfaction[b] with plentiful water in local water bodies	Plentiful water in rivers
	Plentiful water in lakes

Note: [a]Importance stem: Please identify the level of importance you associate with each of the following water-related items. [b]Satisfaction stem: Please indicate how satisfied you are with the availability of clean/plentiful water for each of the following items. Individual items were presented for both importance and satisfaction.

We used gaps and IPA maps to compare the difference between importance of and satisfaction with each of the six dimensions of water within each sample (Levenburg & Magal, 2005). To calculate gaps, we subtracted each sample's mean importance from the mean satisfaction

for the six clean and plentiful water indices. We used paired sample *t*-tests to assess whether the gaps were statistically significant.

This study focused on dimensions that fell into the quadrant with high importance and low satisfaction values, or *target motivational areas* (Warner, Kumar Chaudhary, & Lamm, 2016). To construct the IPA maps, we plotted the mean importance and satisfaction score for each index on a two-dimensional graph (Martilla & James, 1977). Because the maps are constructed using the mean importance and satisfaction scores, IPA quadrants are not equal in size. We placed the six importance and satisfaction index means into four quadrants divided by the overall grand importance and satisfaction means (see Figure 1).

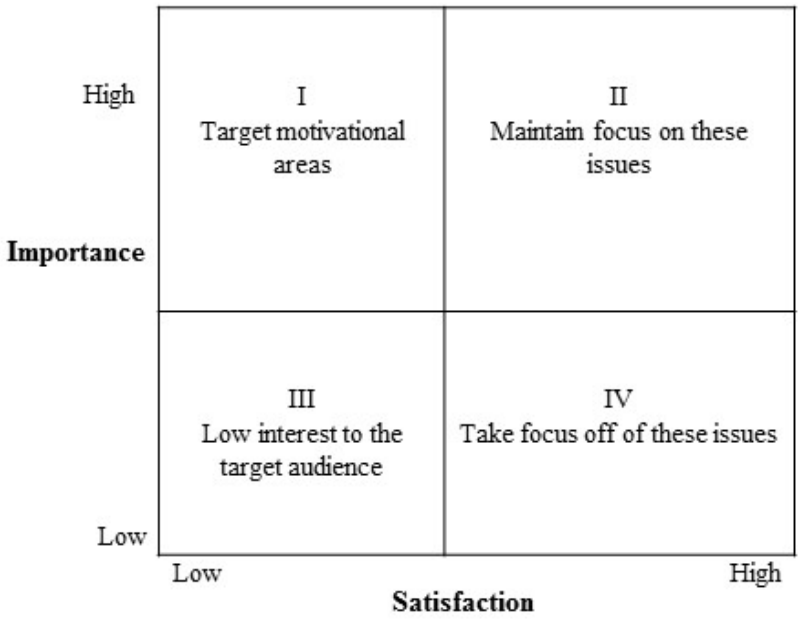

Figure 1. Matrix used to guide interpretation of importance-performance analysis data in a study of home irrigation users' water-related values. Adapted from "Importance-Performance Analysis" by J. A. Martilla and J. C. James, 1977, *Journal of Marketing, 10*(1), p. 78. Copyright 1977 by the American Marketing Association.

Findings

Objective One: Document and Compare Home Irrigation Users' Perceived Importance of Clean and Plentiful Water for Various Purposes (e.g., drinking, recreation)

We calculated six importance means for the national sample and the three targeted areas (California, the Chesapeake Bay area, and Florida; Table 2). The overall importance of clean water for various purposes ranged from 4.26 (*SD* = 0.76) to 4.65 (*SD* = 0.51) on a possible scale from 1 to 5. The overall importance of plentiful water for various purposes ranged from 2.90 (*SD* = 0.79) to 4.22 (*SD* = 0.75) on a possible scale from 1 to 5. *Clean water for consumption* had the highest importance rating among each of the four samples. One-way, between subjects ANOVA revealed significant differences in mean importance ratings for three indices (*clean water for consumption*, *clean water for recreation*, *plentiful water for people*) among California, the Chesapeake Bay area, and Florida.

Table 2

National, California, Chesapeake Bay Area, and Florida Residential Irrigation Users' Perceptions of the Importance of Clean and Plentiful Water for Various Purposes

	National (n = 1052)	California (n = 526)	Chesapeake Bay (n = 572)	Florida (n = 525)	
	M (SD)	*M (SD)*	*M (SD)*	*M (SD)*	*F*
Plentiful water for people	3.11 (.82)	2.90 (.79)	3.04 (.76)	3.13 (.83)	12.02**
Clean water for recreation	4.35 (.69)	4.26 (.76)	4.30 (.71)	4.44 (.66)	9.54**
Clean water for consumption	4.59 (.57)	4.60 (.56)	4.55 (.58)	4.65 (.51)	4.95*
Clean water for local and large water bodies	4.46 (.68)	4.46 (.68)	4.42 (.68)	4.50 (.64)	1.85
Plentiful water in local water bodies	4.19 (.73)	4.14 (.76)	4.16 (.70)	4.22 (.75)	1.83
Plentiful water for business	3.98 (.72)	3.94 (.76)	3.97 (.75)	4.02 (.74)	1.72

Note. * $p < 0.05$, ** $p < 0.01$, Responses ranged from 1 = *not at all important* to 5 = *extremely important*

Post-hoc tests revealed the respondents residing in Florida placed significantly greater importance (M = 4.44, SD = 0.66) on *clean water for recreation* compared to respondents residing in the Chesapeake Bay area (M = 4.30, SD = 0.71; p = .002; d = 0.20) and California (M = 4.26, SD = 0.76; $p < 0.001$; d = 0.25). Respondents residing in Florida assigned significantly higher importance value (M = 4.65, SD = 0.51) on *clean water for consumption* compared to those residing in the Chesapeake Bay area (M = 4.55, SD = 0.58; p = .004; d = 0.18). Respondents residing in California (M = 2.90, SD = 0.79) rated *plentiful water for people* significantly less important than the respondents in the Chesapeake Bay area (M = 3.04, SD = 0.76; p = .05; d = 0.18) and Florida (M = 3.13, SD = 0.83; p = .05; d = 0.28). The effect sizes for each of these significant differences were interpreted as small practical effects (Cohen, 1988). There were no significant differences in the importance of *clean water for local and large water bodies*, *plentiful water for business,* and *plentiful water in local water bodies* among the target samples.

Objective Two: Document and Compare Home Irrigation Users' Perceived Satisfaction with the Availability of Clean and Plentiful Water for Various Purposes (e.g., drinking, recreation)

We calculated six satisfaction means for each of the samples (see Table 3). On a possible scale from 1 to 5, satisfaction with the availability of clean water for various purposes ranged from 2.82 (SD = 1.03) to 3.34 (SD = 0.93) and satisfaction with the availability of plentiful water for various purposes ranged from 2.76 (SD = 1.07) to 3.50 (SD = 0.85). Respondents residing in California assigned the lowest satisfaction to *plentiful water in local water bodies*, while the other samples assigned the lowest satisfaction to *clean water for local and large water bodies*. We used one-way, between subjects ANOVA to compare the mean satisfaction ratings for the three targeted areas (California, the Chesapeake Bay area, and Florida), and we identified significant differences for all indices.

Table 3

National, California, Chesapeake Bay area, and Florida Residential Irrigation Users' Satisfaction with Clean and Plentiful Water for Various Purposes

	National (n = 1052) *M (SD)*	California (n = 526) *M (SD)*	Chesapeake Bay (n = 572) *M (SD)*	Florida (n = 525) *M (SD)*	*F*
Plentiful water in local water bodies	3.24 (1.05)	2.76 (1.07)	3.34 (.93)	3.45 (1.02)	70.71**
Plentiful water for business	3.39 (.91)	2.98 (.98)	3.44 (.82)	3.51 (.88)	54.16**
Plentiful water for people	3.43 (.85)	3.06 (.88)	3.46 (.75)	3.50 (.85)	45.95**
Clean water for recreation	3.04 (.97)	2.89 (.95)	3.01 (.91)	3.12 (.95)	8.60**
Clean water for local and large water bodies	2.90 (1.01)	2.82 (1.03)	2.84 (.99)	2.99 (.93)	4.61*
Clean water for consumption	3.33 (1.02)	3.19 (1.03)	3.34 (.93)	3.31 (.98)	3.29*

Note. *$p < 0.05$, **$p < 0.01$, Responses ranged from 1 = *not at all satisfied* to 5 = *extremely satisfied*

Post-hoc tests revealed respondents residing in Florida rated satisfaction with *clean water for local and large water bodies* (M = 2.99, SD = 0.93) higher than those residing in California (M = 2.82, SD = 1.03; p = .014; d = 0.17) and the Chesapeake Bay area (M = 2.84, SD = 0.99; p = .033; d = 0.16). Respondents in the Chesapeake Bay area rated satisfaction with *clean water for consumption* (M = 3.34, SD = 0.93) higher than those in California (M = 3.19, SD = 1.03; p = .015; d = 0.15). Respondents residing in California assigned significantly lower satisfaction (M = 2.89, SD = 0.95) to *clean water for recreation* than the respondents residing in Florida (M = 3.12, SD = 0.95; p < .001; d = 0.24) and the Chesapeake Bay area (M = 3.01, SD = 0.91; p = .03; d = 0.13).

Respondents residing in California (M = 2.98, SD = 0.98) reported significantly less satisfaction with *plentiful water for business* than both those in Florida (M = 3.51, SD = 0.88; p <.001) and the Chesapeake Bay area (M = 3.44, SD = 0.82; p = <.001). The effect sizes were 0.56 and 0.51, and were interpreted as medium practical significance. Respondents residing in California also reported significantly lower satisfaction with *plentiful water for people* than those in Florida (M = 3.50, SD = 0.85; p <.001) and the Chesapeake Bay area (M = 3.46, SD = 0.75; p <.001). The effect sizes were 0.51 and 0.49 and were interpreted as medium practical significance. Respondents residing in California also reported significantly lower satisfaction with *plentiful water in local water bodies* than those residing in Florida (M = 3.45, SD = 1.02; p <.001) and the Chesapeake Bay area (M = 3.34, SD = 0.93; p <.001), with medium effect sizes of 0.66 and 0.58.

Objective Three: Document and Compare Significant Gaps between Importance and Satisfaction with Clean and Plentiful Water for Various Purposes (e.g., drinking, recreation)

We constructed IPA maps for the four samples. The target motivational areas for the national sample were *clean water for large and local water bodies* and *clean water for recreation* (see Figure 2). Both of these dimensions were target motivational areas for all four samples.

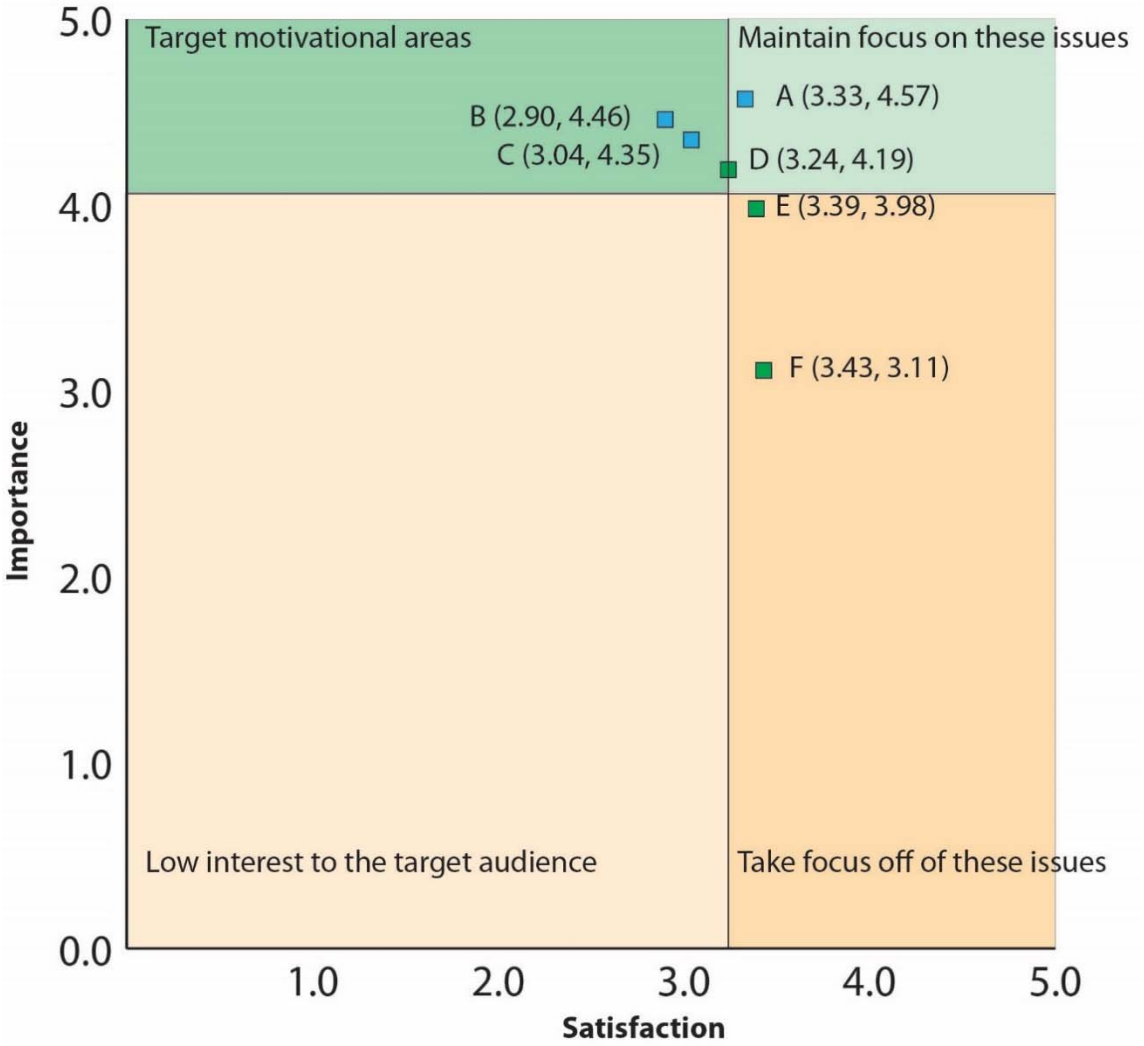

Figure 2. National sample importance-performance analysis of clean and plentiful water indices. Data label points denote: A - clean water for consumption; B - clean water for local and large water bodies; C - clean water for recreation; D - plentiful water in local water bodies; E - plentiful water for business; F - plentiful water for people

Similarly, California's IPA map (see Figure 3) revealed *clean water for large and local water bodies* and *clean water for recreation* were target motivational areas. However, *plentiful water in local water bodies* was an additional target motivational area for respondents residing in California.

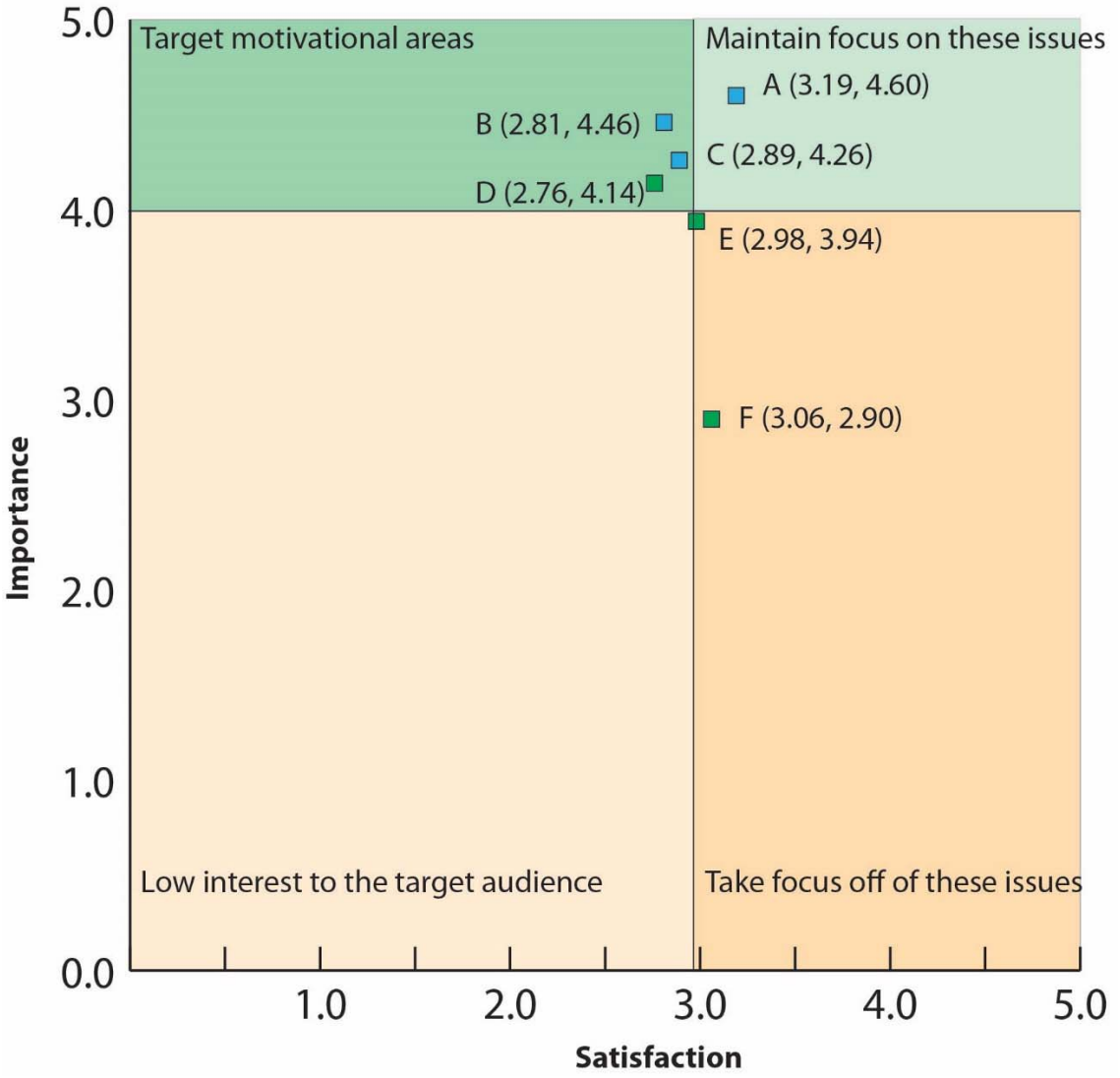

Figure 3. California sample importance-performance analysis of clean and plentiful water indices. Data label points denote: A - clean water for consumption; B - clean water for local and large water bodies; C - clean water for recreation; D - plentiful water in local water bodies; E - plentiful water for business; F - plentiful water for people

Similar to the national sample, the Chesapeake Bay area sample's IPA map (see Figure 4) revealed *clean water for large and local water bodies* and *clean water for recreation* were target motivational areas.

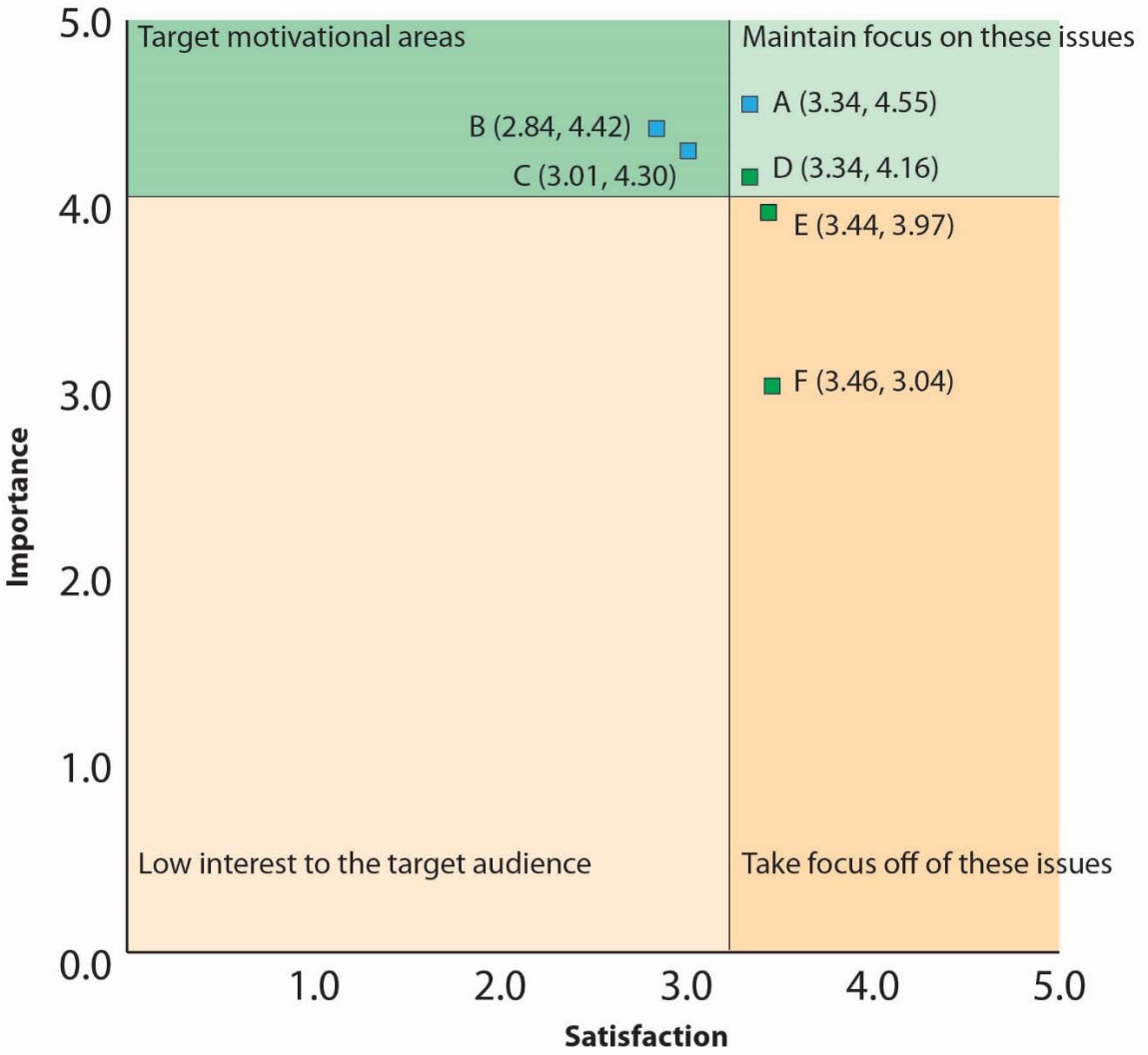

Figure 4. Chesapeake Bay area sample importance-performance analysis of clean and plentiful water indices. Data label points denote: A - clean water for consumption; B - clean water for local and large water bodies; C - clean water for recreation; D - plentiful water in local water bodies; E - plentiful water for business; F - plentiful water for people

The Florida sample's IPA map revealed *clean water for large and local water bodies* and *clean water for recreation* were target motivational areas. Additionally, *clean water for consumption* was a third target motivational area for respondents residing in Florida (see Figure 5).

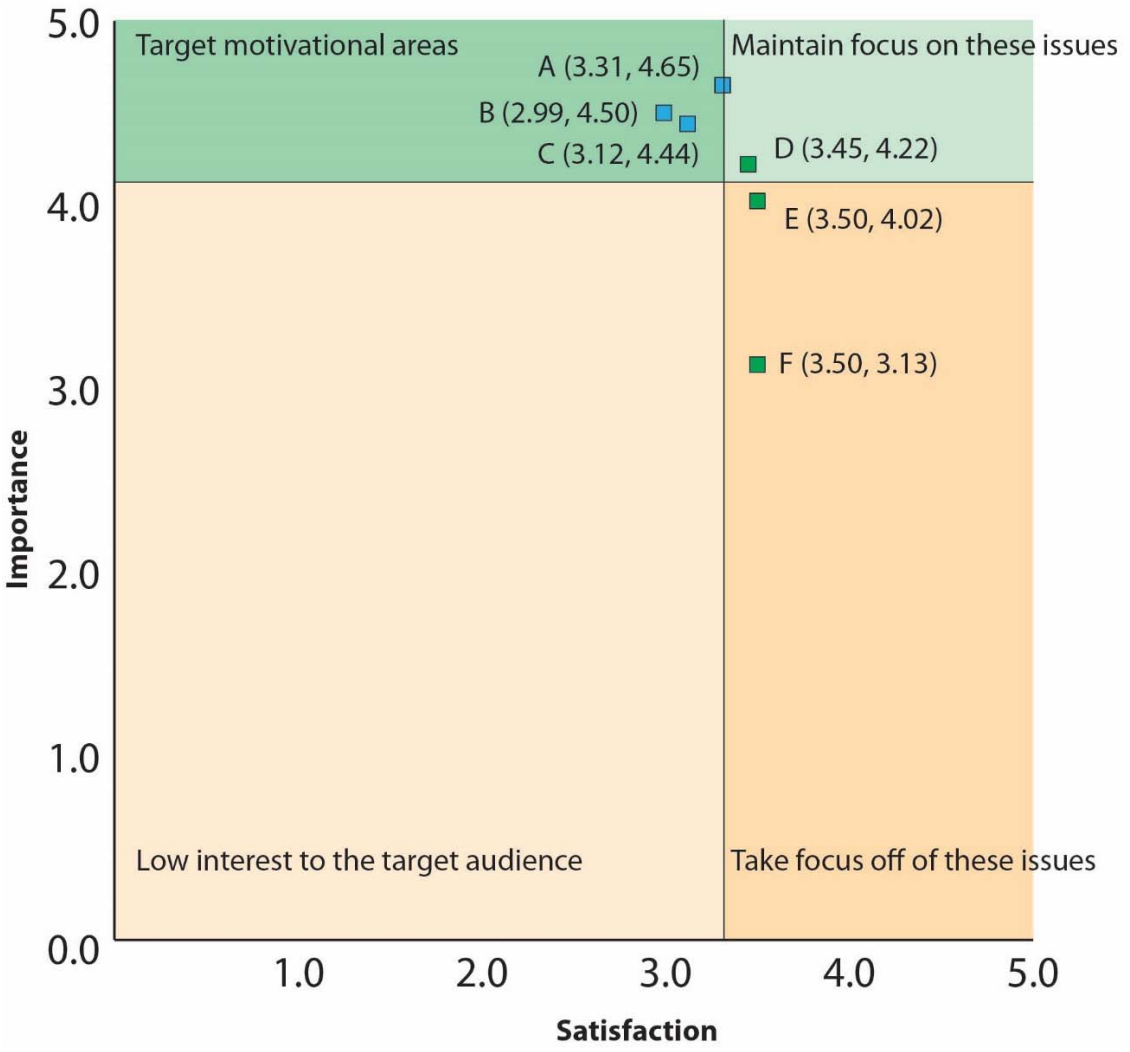

Figure 5. Florida sample importance-performance analysis of clean and plentiful water indices. Data label points denote: A - clean water for consumption; B - clean water for local and large water bodies; C - clean water for recreation; D - plentiful water in local water bodies; E - plentiful water for business; F - plentiful water for people

We calculated gaps between satisfaction and importance for the six indices to compare differences quantitatively (see Table 4). Paired sample *t*-tests indicated there were significant differences between importance and satisfaction for all six indices within all three target areas at $p < 0.001$. All of the gaps were negative, indicating greater importance and lower satisfaction for all indices excluding plentiful water for people. The largest gap (target motivational areas) was for *clean water for local and large water bodies*. *Clean water for recreation* was the second largest gap for the national and Chesapeake Bay area samples. *Clean water for consumption* was the second largest gap for the California and Florida samples.

Table 4

Gaps between Reported Importance and Satisfaction in the Availability of Clean and Plentiful Water for Various Purposes among National, California, Chesapeake Bay area, and Florida Residential Irrigators

	Gap[a] (Mean Satisfaction[c] – Mean Importance[b])			
	National (*n* = 1052)	California (*n* = 526)	Chesapeake Bay (*n* = 572)	Florida (*n* = 525)
Clean water for local and large water bodies	-1.54	-1.64	-1.58	-1.51
Clean water for recreation	-1.31	-1.38	-1.29	-1.32
Clean water for consumption	-1.26	-1.41	-1.21	-1.35
Plentiful water in local water bodies	-0.95	-1.38	-0.82	-0.78
Plentiful water for business	-0.59	-0.96	-0.53	-0.51
Plentiful water for people	0.32	0.17	0.42	0.37

Note. [a] gaps are statistically different at $p < 0.001$ based on results of paired sample *t*-test. [b]Responses ranged from 1 = *not at all important* to 5 = *extremely important*, [c]responses ranged from 1 = *not at all satisfied* to 5 = *extremely satisfied*

Discussion, Conclusions, and Practical Applications

Home landscape irrigation users consider water quality issues to be more significant than water quantity. This implies that people understand their personal impact on water availability but they tend to not perceive their influence on water quality issues (Blaine, Clayton, Robbins, & Grewal, 2012; Clay et al., 2007). Therefore, agricultural education professionals working on water issues may find their clientele will perceive the highest benefits when water conservation behavior changes are presented with their impact on water quality as opposed to water quantity.

Clean water for consumption is the most important dimension of water among home irrigation users nationwide. This implies awareness surrounding this dimension is much higher than other dimensions. Floridians assign greater importance to clean water for consumption than home irrigation users in other regions of the country. This implies the value of clean water for various purposes may be higher than in other areas because of media attention. At the time of the study, the

media had recently publicized red tides in the Tampa Bay area, salt water intrusion in the Everglades and Okeechobee area, and detrimental effects of lower river levels in Florida's panhandle on the oyster and fishing industry because of rising salinity levels.

California home irrigation users are less concerned about plentiful water for people than their counterparts in other regions of the country, even though the state was experiencing severe drought issues at the time of the study. This implies Californians have been overexposed to water conservation messages stating people consume too much water and need to reduce their consumption. Therefore, they would believe having plentiful water for cities and home landscapes is not as important as having enough for business, agriculture, or other purposes. Or, perhaps, this perception relates to the fact that they have never run out of water for cities and recreation but they have observed businesses and agriculture running out of water during the drought.

National, Florida, and Chesapeake Bay area samples are very unsatisfied with clean water for local and large water bodies, which implies that people have been exposed to water quality problems in each of these locations. Agricultural education professionals should recognize that home landscape irrigation users in most of the country are unhappy with the availability of clean water for various purposes. The audience may be most likely to take action when they perceive they have the opportunity to contribute to improvement of clean water issues with their home landscape irrigation practices. There are dissimilarities among respondents as a function of geographic location, which reveals people are influenced by their exposure to and experience with water issues. Those agricultural education professionals who focus on water issues should understand the experiences their clientele has had with water issues so programming can be made relevant (Huang & Lamm, 2015).

The greatest practical significance in satisfaction with plentiful water in local water bodies is occurring in California. Among satisfaction with the availability of plentiful and clean water, the greatest practical differences are in the plentiful water indices. This is not surprising given the level of contention surrounding water in California at the time of the study. Perceived importance and satisfaction tend to follow the severity of water issues in a given locale. However, it is not known how long perceptions reflect local issues. Residents in the Chesapeake Bay are satisfied with clean water despite their history of water quality issues. This implies that there is a point at which people become desensitized to water problems, which is consistent with reports that repeated environmental messages reduce recipients' reactions (Heimlich & Ardoin, 2008). The presence of desensitization to water issues presents unique challenges for agricultural education professionals who must identify strategies to motivate an audience that has become less responsive to long-term issues. This desensitization also reveals questions and opportunities for agricultural education professionals working on emerging water issues: Given current and forthcoming effects of climate change on water resources, how can people be prevented from becoming desensitized to environmental issues that are likely to be longstanding? How can agricultural education professionals prepare for and counteract these effects?

The universal target motivational area for home irrigation users is clean water for local and large water bodies, with the greatest disparities between importance and satisfaction. This implies home landscape irrigation users may be most motivated to adopt landscape water use best practices and technologies if agricultural education professionals help them understand the connection between their landscape practices and clean water for local and large water bodies. As a secondary focus, agricultural education professionals working in the Chesapeake Bay area should motivate home landscape irrigation users to adopt best practices by connecting their landscape behaviors to their value of beaches and recreation while people working in California and Florida may find home

landscape irrigators are most motivated when they understand how landscape management practices can protect their water for drinking or food preparation.

The target motivational areas have implications for encouraging water conservation practices because home landscape irrigation users who are unsatisfied with something important to them may be inspired to take action to resolve the difference (Warner, Kumar Chaudhary, & Lamm, 2016). We recommend agricultural education professionals incorporate the localized nature of perceptions surrounding water and design programs to meet the identified needs.

There are disparities surrounding all dimensions of water, excluding plentiful water for people, among home irrigation users in all regions. We concluded that despite the nation's current and emerging water crises, home landscape irrigation users do not perceive running out of water as a possibility. This is concerning because it indicates people may not be aware of the magnitude of current water issues. Agricultural education professionals should focus on geographic-specific target motivational areas. Agricultural communications professionals might explore how these motivational areas can be translated into messages that resonate with the target audience. Extension professionals can develop programs that highlight how adoption of landscape best management practices can address water issues by appealing to the dimensions with which people are most concerned. Outreach should first focus on the issues most relevant to the audience.

This application focused specifically on home landscape irrigation users to inform campaigns that may be used to promote the adoption of landscape irrigation best management practices. It is essential to raise awareness of the connection between home landscape irrigation management practices and water quality issues. Agricultural education professionals can help to correct the disconnect between what people do in their landscape and perceptions of how they affect local watersheds and larger water bodies.

Future Research

This study presents several opportunities for research. While this research documented home landscape irrigation users' perceptions at one point in time, it is not known whether the target motivational areas are variable. To explore this further, future research should examine the relationship between current environmental issues, media coverage, and this audience's values and satisfaction. Since the time of this study, serious water issues have emerged in other locations, which presents opportunities to explore the effect of emerging media focus at a national scale. People's perception regarding water conservation can change over time and we recommend that future researchers can repeat these types of studies in a repeated manner to see whether the perceptions stay the same or they change.

Further research needs to be conducted to inform home landscape best management practice program design and delivery. Message testing should be conducted to verify the usefulness of this approach. Finally, future research should test programs tailored to home landscape irrigation users target motivational areas to confirm whether an appeal to those issues with high importance and low satisfaction can influence their home irrigation practices and, ultimately, increase participation in the protection of water resources.

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