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Exploring the Effect of Personal Norms and Perceived Cost of Water on Conservation

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Abstract

In recent studies, between 50% to 75% of residential water was used for outdoor irrigation (Milesi et al., 2012). Turfgrass lawns are widely used in outdoor landscapes and are the largest irrigated crop by total area in the United States (Milesi et al., 2005). Consequently, as more American homes utilize turfgrass lawns, outdoor irrigation is expected to increase (Devitt, Carstensen, & Morris, 2008). Increases in outdoor water usage coupled with urbanization pressures water resources and intensifies the need for conservation. This study utilized hierarchical multiple regression to determine factors affecting urban residents' intent to engage in water conservation. It also evaluated the effect of the Theory of Planned Behavior (TPB) variables on intent to conserve water, then included perceived cost of water and personal norms as additional factors affecting intent to conserve. A total of 1,809 urban residents in the U.S. were surveyed via a researcher-developed questionnaire using non-probability purposive sampling. Findings revealed both social and personal norms had strong effects on intent to conserve water. Recommendations follow that social and personal norms be made known to target audiences and used collectively in extension water conservation programs to promote behavior change.

Keywords: hierarchical regression; perceived cost; personal norms; theory of planned behavior; water conservation

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Introduction and Literature Review

Predictions for the year 2050 indicates over 9 billion people on the planet (United Nations, 2009). This figure is an additional 1.4 billion who will join the current 7.4 billion people already putting stress on global food, water, and energy resources (U.S. Census Bureau, 2017). The United Nations Department of Economic and Social Affairs predicts that the 23% of the global population currently residing in cities (with at least 1 million inhabitants) will rise to 27% by 2030 (United Nations, 2016). Rapid urbanization compounded by global population growth will continue to increase water demand, "making it difficult to meet goals for the provision of a safe, affordable, domestic water supply" (Parry, Canziani, Palutikof, Van der Linden, & Hanson, 2007, p. 351). Climate change also has the capacity to upset current water-use systems by altering the quantity, quality, and temperature of global water resources disrupting patterns of demand and availability. For example, New York City's Department of Environmental Protection considers the "effect of

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climate change on turbidity" (Miller & Yates, 2006, p. 49) a significant concern for the city's water supply. Increased turbidity levels in primary city reservoirs require substantial treatment and monitoring in order to meet legal quality standards (Parry et al., 2007). The disturbance of New York's water turbidity is one example of the complex ways in which the influence of climate change, population growth, and urbanization can be measured on local and national scales. Focusing on national trends in water-use can help detangle the complexity of water-related issues by identifying areas where water-use can be reduced.

Consistent with global population growth projections, the U.S. Census Bureau (2017) predicts that the U.S. population will increase from 325 million to almost 417 million by 2060 (Colby & Ortman, 2015). Despite increasing national population growth, the latest study conducted by the U.S. Geological Survey (USGS) found that water withdrawals in the U.S. decreased by 13% between 2005 and 2010 to an estimated 355 billion gallons per day (Maupin et al., 2010). Freshwater withdrawals in 2010 represented one of the lowest total withdrawals in the U.S. prior to 1970. This reduction included categories specific to industrial, domestic, and agricultural use (Maupin et al., 2010). The USGS considers improvements to thermoelectric power-plant technology and the Clean Water Act to be major influences on this trend (Maupin et al., 2010). The USGS noted the decline in freshwater withdrawals specifically for industrial purposes was likely caused by environmental regulation, limited freshwater resources, and a decline in industrial production (including metal, paper, and chemicals) following the 2008 recession (Maupin et al., 2010). Factors such as urbanization, a changing political climate, economic fluctuations, and climate-related environmental variations demonstrate potential to influence national water usage in unprecedented ways. For the purpose of this research, further contextualization of water-use in the U.S. will focus specifically on domestic use (indoor and outdoor residential) including lawn irrigation (Maupin et al, 2010).

While many studies analyzing the correlation between climate related factors and irrigation practices focused on the agricultural industry, fewer attempted to demonstrate the influence of climate-related factors on irrigation practices specific to residential landscapes. Studies that did, reported several significant findings for the influence of climate factors on residential water-use behaviors. A higher average proportion of water-use for outdoor irrigation was measured in regions with arid climates as compared to regions with high precipitation rates (Mayer, 1999). The influence of climate change-related factors adds an additional pressure on the necessity of encouraging water conservation behaviors. Recent studies generally reported the percentage of residential water-use for outdoor irrigation fell between 50% and 75% (Milesi et al., 2012). This finding becomes significant as more American homes install expansive turfgrass lawns, the largest irrigated crop sector in the U.S. by total area (Milesi et al., 2005). Increasing turfgrass area was linked to increasing water usage (Devitt, Carstensen, & Morris, 2008) and is positively correlated with urbanization and suburban development (Robbins & Birkenholtz, 2003). These trends demonstrate the importance of considering how water conservation practices may reduce water consumption for residential lawn irrigation.

In 2015, the state of California implemented pricing mechanisms attempting to encourage water conservation and prevent wasteful water-use due to severe drought conditions (California Environmental Protection Agency, 2016). Executive Order B-29-15 outlined California's policy for saving water and increasing enforcements against water waste. Policies designed to save water stated, "the State Water Resources Control Board shall impose restrictions to achieve a statewide 25% reduction in potable urban water usage through February 28, 2016…and requires cities and towns to reduce usage as compared to amount used in 2013" (California Executive Department, 2016, p. 2). The Order also issued the Department of Water Resources (DWR) in collaboration with local agencies to "replace 50 million square feet of lawns and ornamental turf with drought tolerant landscapes" (California Executive Department, 2016, p. 2). Additionally, the DWR was authorized funding for lawn replacement programs to help communities most in need. The DWR prohibited the use of potable water for outdoor irrigation, as well as irrigation for new homes not using a drip or microspray system. A rebate program led by the California Energy Commission was also underway which sought to offer monetary incentives to households to replace inefficient appliances. Policies designed to heighten enforcement against water waste: required urban suppliers to report water usage and conservation every month; increased efficient water systems (e.g. irrigation systems) and prohibited the amount of turfgrass lawns used in the landscape.

In addition to conservation water pricing policies, the International Food Policy Research Institute (IFPRI) predicts future "conservation and technological improvements will lower per capita domestic water-use in developed countries with the highest per capita water consumption," (Rosegrant, Cai, & Cline, 2002, p. 6) of which the U.S. qualifies. While there are numerous technological improvements to residential irrigation and best use practices, broad adoption of technologies like rain sensors and evapotranspiration controllers (Moore, 2012) is needed to aid in achieving IFRPRI's predicted trend by reducing the pressures of high national turfgrass coverage and water-use associated with residential irrigation (Bremer, 2012; Devitt et al., 2008). Due to substantial variation around the country in information access, financial means, climate, and prevailing attitudes towards the environment, trained Extension professionals are uniquely positioned to facilitate broad adoption of these water-saving technologies and practices (Warner, Lamm, Rumble, Martin, & Cantrell, 2016; Welch & Braunworth, 2010). Despite evidenced importance of water conservation, the public's lack of knowledge and demonstrated apathy towards water issues continues to hinder water conservation efforts (Devitt et al., 2008; Lamm, Lamm, & Carter, 2015). Many interventions targeting the public promote widespread behavior change as a critical factor in achieving water conservation goals. However, the public remains less informed on water issues than leaders in the agriculture and natural resource fields (Lamm et al., 2015). Alternatively, adequate knowledge of an issue does not directly guarantee a change in behavior, even if the behavior's benefits are well known.

Several barriers inhibiting the adoption of water conservation behaviors include social norms: if adoption of these behaviors contrasts with the behaviors accepted by the community, and personal norms: if adoption of these behaviors contradict one's own personal values (Doran & Larson, 2015). For example, studies comparing advanced irrigation systems to manual systems demonstrated a reduction in water consumption by an additional 20% over the control (Devitt et al., 2008). Yet, standard irrigation controllers that require the user to enter the irrigation schedule were found to increase irrigation water volume in comparison to manual irrigation control (Loh & Cochlan, 2003; Syme, Shoa, Po, & Campbell, 2004). This trend is possibly the result of water users valuing time saved over water saved, and the perception that this technology is overly complex, due to the time it takes to manually set the schedule (Salvador, Bautista-Capetillo, & Playán, 2010). However, Syme et al. (2004) interpreted this trend to be a result of user error in setting the timer for extended irrigation periods or at high frequency. Because the impact of these barriers may be hard to distinguish, one might consider addressing both issues together. This can be done by extending education services on proper use of advanced irrigation systems while further investigating the impact of water conservation attitudes on the use of these technologies (Syme et al., 2004). An additional barrier to the adoption of water conservation behaviors is the relatively low cost of water. A study conducted by Salvador et al. (2010) analyzing water-use behaviors of residents in Spain found higher incomes and access to water at a lower cost were factors contributing to over-irrigation of residential lawns. This suggests users may value lawn aesthetics over water conservation, or associate low water cost with plentiful water. Because the low cost of water may hinder some water conservation efforts, Salvador et al. (2010) suggested a "water pricing policy seems to be one of the most important tools for decreasing private landscape irrigation water use" (p. 303). These results demonstrate the necessity of informed public policy and user education to encourage water-conserving lawn irrigation practices.

In 1948, the U.S. government recognized the need to address water quality and quantity issues on a public policy level passing the Water Pollution Control Act (WPC) as the first regulatory water control policy (Huang & Lamm, 2016). While several regulatory policies were passed after the WPC Act, public involvement was lacking possibly due to insufficient knowledge or lack of personal experience with water issues (Huang & Lamm, 2015). Several studies demonstrated the importance of civic engagement and public policy knowledge in the adoption of water conservation behaviors and supported the expansion of Extension services to address this knowledge gap (Huang & Lamm, 2015). In addition to addressing knowledge gaps, extension programs are proven to substantially improve the adoption of water conservation behaviors. For example, the 40 Gallon Water Challenge is an educational program adopted and implemented by the University of Georgia Center for Urban Agriculture to teach the public about water conservation through voluntary behavior change pledges. As of December 2016, most participants (86%) were committed to their conservation pledges, totaling 1.8 million gallons of water saved per day. One of the most frequent pledges was reducing irrigation run times. The 40 Gallon Challenge is considered a "flexible, easy-to-use water conservation education tool" (Sheffield, Bauske, Pugliese, Kolich, & Boellstorff, 2016, p. 2) effective in encouraging "Extension audiences to adopt indoor and outdoor conservation practices" (p. 2).

Another study conducted in the Chinyanja Triangle of Southern Africa analyzed factors contributing to land, soil, and water conservation practices. The authors found adopters of improved agricultural practices had a 10% advantage in accessing agricultural advice and extension services than did non-adopters (Mango, Makate, Tamenes, Mponela, & Ndengu, 2017). The study concluded that "extension (agricultural advice) remains the main source of information on improved production methods and sustainable agricultural practices in smallholder agriculture" (Mango et al., 2017, p. 127). There is also significant evidence to suggest that extension programs are a worthwhile economic investment in a number of key focus areas. For example, a meta-analysis conducted by IFPRI analyzed all evidence of return in agricultural research and development published since 1953. Findings suggested that the rate of return in economic investment for extension services was 62.9%, just above the accepted normal range of 40%-60% return on agricultural research (Alston, Chang-Kang, Marra, Pardy, & Wyatt, 2000). Collectively, extension services have demonstrated substantial potential to improve public awareness and behavior change, and in several cases, provide the opportunity for positive economic return. With these considerations in mind, broadening extension programs that address residential irrigation may prove beneficial to reducing national domestic water consumption.

Across the U.S., the intersectional issues of population growth, urbanization, and climate change experience greater public awareness. As water users begin to experience the effects of these factors on a personal level, further research may be appropriate to investigate the correlation between public awareness or personal experience with these issues, and adoption of water conservation behaviors. Measuring factors such as attitudes, norms, perceived behavioral control, and perceived cost of water may help Extension professionals further refine and strengthen behavior change in water conservation programs.

Purpose and Objectives

The Theory of Planned Behavior (TPB) guided this research which sought to determine factors affecting urban residents' intent to engage in water conservation in the United States. The specific objectives of this study were to:

- Evaluate the influence of TPB factors on intention to engage in water conservation.
- Evaluate the influence of perceived cost and personal norms on intention to engage in water conservation.

Theoretical Framework

The TPB expands the Theory of Reasoned Action which accounts for cognitive processes of a persons' control over performing a behavior (Ajzen, 2012). The TPB comprises three main variables: *attitudes, social norms,* and *perceived behavioral control (PBC)* that affect intention to engage in some behavior. Behavioral beliefs are a person's attitude towards the behavior; that is whether performance of the behavior is positively or negatively valued by the individual. Normative beliefs, or social norms, are the social pressures to engage or not engage in the behavior. This considers, what do others expect of me? Control beliefs comprise an individual's perception of their ability to perform the behavior - their perceived behavioral control. PBC is a proxy for actual behavioral control which is the degree of resources and skills a person requires to perform the behavior (Ajzen, 2012). If all prerequisites needed to perform the behavior are present, PBC can directly impact behavior. Overall, the theory states "the more favorable a person's attitude and social norms, and the more they believe they are capable of performing the behavior, the stronger should be their behavioral intentions" (Ajzen, 2012, p. 447).

Previously, the TPB was applied in behavior change and adoption of water conservation practices. However, it did not include potential factors influencing water conservation practices such as personal norms or perceived cost of water. In some studies, these factors were found to be important considerations impacting water conservation practices. Attari (2014) investigated perceptions of water-use and found improving the public's understanding of their personal water-use can impact strategies geared towards the adoption of water-saving practices. Fan, Wang, Liu, Yang, & Qin (2014) found significant associations between resident perceptions of personal water-use and actual water-use. Particularly, residents underestimated their outdoor water-use and overestimated the amount of water consumed indoors. Ultimately, those accurately estimating their water-use had better awareness of water conservation practices compared to those who did not. As such, Extension initiatives that target awareness of water-use (through norms) could support the acceptance and implementation of water conservation practices.

The perceived cost of water was explored from various perspectives with mixed results on conservation behaviors, partly because of the complexity of this approach (Saurí, 2013). Block rates and levies on consumer water-use were two of several strategies used in Singapore to reduce water-use (World Bank, 2006), although this strategy may be ineffective among higher-income consumers (Corral-Verdugo, Frías-Armenta, Tapia-Fonllem, & Frijo-Sing, 2012). However, there is promise in exploring the perceived cost of water as part of a behavior change strategy because "the efficacy of pricing for water conservation appears to be higher for outdoor uses than for indoor uses" (Saurí, 2013, p. 233). Jordan (2011) highlighted pricing information necessary for decision-making was not provided on water bills as compared to other goods. Additionally, actual water-use information was not clearly articulated to consumers on their bill. In a survey conducted with 400 people from Georgia, about 62% were aware of their water bill while 26% were unaware as water costs were included in their rent bills. Since water costs can be clearer to consumers and can play a role in motivating outdoor water conservation, perceived cost of water is an important factor when considering changing water consumption behaviors.

Norms are powerful tools Extension professionals can use to stimulate changes in behavior (Kumar Chaudhary, Warner, Lamm, Rumble, & Cantrell, 2015). Personal norms or "self-expectations for behavior backed by the anticipation of self-enhancement or depreciation"

(Schwartz & Fleishman, 1978, p. 307) shape an individual's decision to act. Such obligations to oneself to perform an act are useful when considering behavior change strategies. In the study by Kumar Chaudhary et al. (2015), over 80% of participants agreed they had a personal responsibility to conserve water in the landscape. In other recent studies, social and personal norms showed promising signs of encouraging pro-environmental behavior change (de Groot, Abrahamse, & Jones, 2013).

Methods and Procedures

The theoretical target audience for this study were urban residents in the United States who engaged in landscaping and irrigation practices. It should be noted this audience is different from the general population and is an important target audience having the most potential to conserve water in the landscape (Warner, Lamm, Rumble, Martin, & Cantrell, 2016). A sampling frame was developed using an online survey company employing a non-probability purposive sampling technique. Purposive sampling entails selection of criteria to obtain a specific population. Given that the study used a non-probability sampling procedure, results cannot be generalized, therefore non-response error was not an issue. Screening questions in the survey confirmed those in the sampling frame had a lawn /landscape, an irrigation system, and had control of their home irrigation system. The final sample size (*N*) obtained was 1,809. A researcher-developed questionnaire was administered via an online survey. Overall, most respondents (70.0%) were female, and on average 41 years of age where 34.3% had a 4-year college degree, and 21.9% earned between $50,000 to $74,000 per year.

An expert panel qualified in urban water resources engineering, extension education, and water conservation reviewed the questionnaire to ensure validity. A pilot study tested for reliability to ensure there were no significant issues with question construction and ordering. Construct variables in this study were, attitudes, social norms, PBC, personal norms, perceived cost of water, and intent to engage in water conservation. The reliabilities for all variables were between 0.69 and 0.88 indicating acceptable internal consistency (Field, 2006). See Table 1.

Constructs

Indexes were developed by averaging all items under each construct shown in Table 1. Five statements measured on a 5-point scale comprised the attitudes construct using the question stem, *please indicate your attitude toward the phrase, "Implementing good irrigation practices is…".* The social norms construct included four statements and used a 5-point Likert scale from *strongly disagree* to *strongly agree.* The question stem was, *please indicate your level of agreement or disagreement with the following statements.* PBC was measured on a 5-point scale and consisted of five statements using the question stem, *"please indicate how you feel about the phrase "Implementing good irrigation practices is…".* The perceived cost of water construct included three statements ranging from *strongly disagree* to *strongly agree* on a 5-point Likert scale. The question stem was, *for this question, please think about the cost of water.* Four statements comprised the personal norms construct which ranged on a 5-point scale from *strongly disagree* to *strongly agree*. The question stem for this question was, *please indicate your level of agreement or disagreement with the following statements".* Twelve statements, measured on a 5-point Likert scale from *very unlikely* to *very likely,* were included for the intent to engage in water conservation construct. The question stem, *please indicate how unlikely or likely you are to engage in the following water conservation behaviors in the future*.

Table 1

Reliabilities for all Variables

Indexes and individual items	Cronbach's alpha (α)
Attitudes	0.85
Good: Bad*	
Important: Unimportant*	
Foolish: Wise	
Beneficial: Harmful*	
Positive: Negative*	
Unnecessary: Necessary	
Social norms	0.81
The people who are important to me expect that I will manage my landscaping using the smallest amount of water possible	
The people who are important to me expect me to avoid watering the landscape when it is raining	
The people who are important to me would approve if I conserve water in my home landscape	
The people who are important to me would expect that I use good landscape watering practices	
Perceived Behavioral Control	0.86
Possible for me: Not possible for me*	
Easy for me: Not easy for me*	
In my control: Not in my control*	
Up to me: Not up to me*	
Practical for me: Not practical for me*	
Perceived cost of water	0.69
If my water bill was more expensive, I would use less water on my lawn /landscape	
The cost of my water bill affects how much I water my lawn /landscape	
If my water bill was less expensive, I would use more water on my lawn /landscape	

Table 1 (continued)

Reliabilities for all Variables

Indexes and individual items	Cronbach's alpha (α)
Personal norms	0.82
It is important to manage my landscape using the smallest amount of water possible	
I feel a personal obligation to water my landscape using only what is needed	
It is important to encourage my friends and family to manage their landscape using the smallest amount of water possible	
I feel a personal obligation to explore ways to reduce my landscape's impact on water quantity	
Intent	0.88
Eliminate irrigated areas in my landscape	
Turn off zone(s) or cap irrigation heads for established woody plants	
Convert turf-grass areas to landscaped beds	
Replace high water plants with drought tolerant plants	
Replace high volume irrigated areas with low volume irrigation	
Install smart irrigation controls (such as soil moisture sensors (SMS) or an evapotranspiration device (ET)) so irrigation will not turn on when it is not needed	
Calibrate my sprinklers	
Use a rain gauge to monitor rainfall for reducing/skipping irrigation	
Use a rain barrel or cistern	
Use different irrigation zones/zone run times based on plants' irrigation needs	
Seasonally adjust irrigation times	
Follow watering restrictions	

*Items reversed in survey to reduce response-set bias.

Interpretation of Constructs

For the dependent variable intent, a higher score indicated a greater likelihood to engage in irrigation best practices. For the independent variable attitude, a higher score indicated more positive attitudes toward good irrigation practices. Higher social norms scores indicated a greater level of agreement concerning the expectations others had of an individual to conserve water in their landscape. Higher perceived behavioral control scores indicated greater perceived ability to engage in good irrigation practices. A higher perceived cost of water score indicated a greater perception that the cost of water influenced personal water-use. Higher personal norms scores indicated greater personal obligation to conserve water in the landscape.

Analysis

Two models were tested using hierarchical multiple regression analysis. For model one, independent variables (predictors of intention) were aligned with the TPB variables - attitudes toward implementing good irrigation practices, perceived social norms about water conservation, and perceived control over implementing good irrigation practices. The dependent variable was intent to engage in water conservation. Model one:

$$I = f(A, SN, PBC)$$

Where I = intent to engage in water conservation; A = attitudes toward implementing good irrigation practices; SN = perceived social norms; and PBC = perceived control over engaging in good irrigation practices.

Model two included two additional independent variables - perceived cost of water and personal norms regarding water quantity (using good irrigation practices to conserve water) were added to the TPB variables in model one. Model two:

$$I = f(A, SN, PBC, PC, PN)$$

Where PC = perceived cost of water; PN = personal norms concerning good irrigation practices.

Results

Evaluate the Influence of TPB Factors on Intention to Engage in Water Conservation

Table 2 presents the results for the TPB variables (model one). Overall, the model was statistically significant ($F = 166.14$; $p < 0.001$), and independent variables explained 21.6% of the variance in intent to engage in water conservation. Both social norms and PBC were statistically significant variables in the model. There was a statistically significant and positive association between social norms and intent to engage in water conservation ($t = 18.13$, $p < 0.001$). A one standard deviation unit (SD-unit) increase in perceived social norms was associated with a 0.412 SD-unit predicted increase in intent to engage in water conservation. That is, an increase in social norms (the expectations others had of an individual to conserve water) was positively correlated with an increase in intent to engage in water conservation.

There was also a statistically significant and positive association between PBC and intent to engage in water conservation ($t = 5.48$, $p < 0.001$). A one SD-unit increase in PBC to implement good irrigation practices was associated with a 0.140 SD-unit predicted increase in intent to engage in water conservation. Therefore, an increase in a person's perceived ability to engage in good irrigation practices was positively correlated with intent to engage in water conservation. The standardized beta values indicated social norms had a stronger effect (0.412) on intent to engage in water conservation than PBC (0.140).

Table 2

OLS Results for Model 1 – TPB Variables

Variable	β	Std. Error	*t*	Std. β	*p*
Constant	1.521	0.157	9.718	-	0.000
Attitudes	-0.070	0.036	-1.933	-0.048	0.053
Social norms	0.478	0.026	18.133	0.412	0.000***
PBC	0.157	0.029	5.478	0.140	0.000***

Note. *$p < 0.05$, **$p < 0.01$, ***$p < 0.001$. $R^2 = 0.216$ ($F = 166.14$, $p < 0.001$)

Evaluate the Influence of Perceived Cost and Personal Norms on Intention to Engage in Water Conservation

Table 3 presents results for the inclusion of two additional independent variables; perceived cost of water and personal norms partialling out the effects of the TPB variables. The omnibus F test indicated the model was statistically significant ($F = 133.28$; $p < 0.001$), and independent variables explained 27% of the variation in intent to engage in water conservation. Notably, the change in the R^2 value was statistically significant. All variables in the model had statistically significant correlations with intent to engage in water conservation.

There was a statistically significant and negative association between attitudes and intent to engage in water conservation ($t = -2.30$, $p < 0.05$). A one SD-unit increase in attitudes (toward positive) was associated with a 0.056 SD-unit predicted decrease in intent to engage in water conservation. That is, an increase in positive attitudes was negatively correlated with intent to engage in water conservation. There was also a statistically significant and positive relationship between social norms and intent to engage in water conservation ($t = 6.65$, $p < 0.001$). A one SD-unit increase in perceived social norms was correlated with a 0.200 SD-unit predicted increase in intent to engage in water conservation. That is, an increase in social norms (the expectations others had of an individual to conserve water) was positively correlated with an increase in intent to engage in water conservation. There was a statistically significant and positive association between PBC and intent to engage in water conservation ($t = 4.92$, $p < 0.001$). A one SD-unit increase in PBC was associated with a 0.122 SD-unit predicted increase in intent to engage in water conservation. Therefore, an increase in a person's perceived ability to engage in good irrigation practices was positively correlated with intent to engage in water conservation.

Both perceived cost (PC) and personal norms (PN) had statistically significant associations with intent to engage in water conservation. There was a statistically significant and positive association between PC and intent to engage in water conservation ($t = 5.70$, $p < 0.001$). A one SD-unit increase in perceived cost of water was positively associated with a 0.116 SD-unit predicted increase in intent to engage in water conservation. That is, an increase in the perceived cost of water was positively correlated with intent to engage in water conservation. There was also a statistically significant and positive relationship between PN and intent to engage in water conservation ($t = 9.49$, $p < 0.001$). A one SD-unit increase in personal norms concerning using good irrigation practices was positively associated with a 0.284 SD-unit predicted increase intent to engage in water conservation. An increase in personal obligations to conserve water in the landscape increased was positively correlated with intent to engage in water conservation. Overall, personal norms had the strongest effect (0.284) on intent to engage in water conservation. Given the statistically significant change in R^2 from 21.6% to 27%, perceived cost of water and personal norms increased the predicting power of model two. Therefore, model two was a better fit for predicting intent to engage in water conservation practices.

Table 3

OLS Results for Model 2 – Inclusion of Cost and Personal Norms Variables

Variable	β	Std. Error	*t*	Std. β	*p*
Constant	1.018	0.161	6.330	-	0.000
Attitudes	-0.082	0.035	-2.304	-0.056	0.021*
Social norms	0.232	0.035	6.652	0.200	0.000***
PBC	0.137	0.028	4.923	0.122	0.000***
PC	0.090	0.016	5.696	0.116	0.000***
PN	0.326	0.034	9.489	0.284	0.000***

Note. $*p < 0.05$, $**p < 0.01$, $***p < 0.001$. $R^2 = 0.270$ ($F = 133.28$, $p < 0.001$)

Conclusions and Recommendations

This study applied the Theory of Planned Behavior (TPB) to determine significant factors affecting urban residents' intent to engage in water conservation. When considering only those variables in the TPB, social norms and perceived behavioral control (PBC) were statistically significant predictors of intent to conserve water. Social norms had a stronger impact on intent to engage in water conservation than PBC. This result is similar to results reported by de Groot et al., (2013) highlighting the significance of social norms in encouraging pro-environmental behaviors. Social norms are essential tools for stimulating decision-making processes to act on some desired behavior. With the inclusion of two additional independent variables, perceived cost (PC) and personal norms (PN), all variables were statistically significant predictors of intent to conserve water. Attitudes, social norms, PBC, PC, and PN were influential on intent to conserve water. Attitudes were not statistically significant in model one, however negatively correlated with intent to engage in water conservation in model two. While statistical significance was present for attitudes in model two, its associated standardized beta value was negligible. The result of this statistical significance can be due to the large sample size. Other factors such as motivation to act can be influenced by norms and should also be an important consideration (Schultz, 1999). Social norms and PBC were statistically significant predictors of intent to conserve (model one) consistent with previous studies. With all variables considered (model two), personal norms had the strongest effect on intent to engage in water conservation. This finding highlights the importance of personal norms on intentions to act, similar to findings by de Groot et al. (2013) and Schwartz and Fleishman (1978). Perceived cost of water was also a statistically significant predictor of intent to engage in water conservation, suggesting the importance of residents' perceptions of water-use (Attari, 2014) and awareness of how much their water costs.

Both social and personal norms had the greatest effect on intent to engage in water conservation. This result highlights the significance of norms as factors of intent, and eventual behavior adoption, consistent with literature by Schultz (1999). As a result, we recommend making known (and implementing together) social and personal norms in extension water conservation programs. The use of norms in water conservation programs can help increase resident awareness of water-use and ultimately inspire engagement in water saving practices. Community members should be involved in planning and implementation of water conservation campaigns. For example, regular workshops supported by Extension but led by community members can help build a water conservation ethic within the community. Residents might feel a personal obligation and motivation to conserve water if their friends and neighbors and others in the community engage in these practices. Perhaps water conservation can be made truly social through community conservation parties where small groups can go house to house with an extension professional and strategize collectively on customized ways to save water.

Messages to residents communicating positive reinforcement can help to build internal obligations to conserve water. For example, a utility company might share a household's water savings compared with a previous year or billing cycle with the household in their monthly utility bill. The message should frame their saving water as a way to serve as role models, and as a way to ensure they personally have water available for their needs (i.e., household water use, recreation). Additionally, collaborations among Extension, homeowners' associations (HOAs), and local utility companies can also help promote water saving practices. Through collaborations with HOAs, information on water saving practices by others in the community can be made apparent to residents. Involving individuals on a community level can encourage others to engage in water conservation practices. It is also important that these behaviors continue into the future. Therefore, the use of social marketing tools such as prompts, and commitments can act as reminders and pledges to help support future engagement in reducing water-use.

Partnering with a local utility company provides information on water costs to residents. Awareness of water conservation behaviors adopted by others in the community (e.g. friends and neighbors), as well as the community's total water-use and cost can encourage further engagement by others. Knowledge of personal water-use and cost can also stimulate water saving behaviors as residents may seek to lower their costs if perceived as high. With information on conservation behaviors practiced by others in the community, the community's total water-use and cost, and personal water-use and cost can collectively stimulate personal obligations and motivation to conserve water. Extension professionals should follow-up with residents in the future to evaluate if this strategy was useful in encouraging water conservation practices. The results of this study align with research priority seven of the National Research Agenda of the American Association for Agricultural Education. Research priority seven addresses complex problems such as water conservation and seek to determine effective methods and programs that help people solve complex problems (Roberts, Harder, & Brashears, 2016).

As this study applied non-probability sampling and results cannot be generalized, we recommend replication of this research using random sampling. Future studies can explore a person's awareness of their water bill and the perceived amount allocated to outdoor irrigation. An experimental design can determine if knowledge of water cost would influence changes in the amount of water used for outdoor irrigation. Based on the literature by Jordan (2011) and Saurí (2013), the difference between awareness of water consumption, and consuming less water based on income and cost is one possible area that can be studied. Since a clear understanding of the actual cost of water used for the lawn and landscape might be lacking, it is unknown whether clarifying the actual cost could play a role in eliciting water conservation behaviors. There is an opportunity for agricultural communication professionals to work on helping residents to fully understand the cost of water. There are likely instances where one strategy may be effective over another, and residents' personal characteristics may influence the selected approach. Since personal norms had the greatest effect on intent, a field experiment can test this result in the context of extension programming. Further research is needed to better understand the source of stronger personal norms among some residents; the findings could be used to inform strategies that enhance existing personal norms. Comparing the results of future research to this study will help determine the accuracy of these recommendations.

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