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# Using the Theory of Planned Behavior to Encourage Water Conservation among Extension Clients

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**Abstract**

*Extension professionals can play a role in addressing water scarcity issues by helping home landscape irrigation users to conserve water. This study used survey research to examine the relationship between several variables, including attitudes, subjective norms, perceived behavioral control, personal norms, demographic factors, and past behaviors, on intention to use good irrigation practices among Florida home landscape irrigation users (N = 1,063). Following subsequent hierarchical linear regression models, the final model explained 39% of the variance in intentions to engage in good landscape irrigation practices. Subjective norms had a strong influence on intention to engage in landscape water conservation, and past behaviors and personal norms improved the prediction. Extension professionals should incorporate subjective norms into water conservation programs by emphasizing somewhat invisible conservation behaviors to improve perceptions of peers' practices. When personal norms are strong, the subjective norms are slightly less important. Residents who feel a personal obligation to conserve water may be more open to information related to water conservation, and they may be more likely to act, even in the absence of social support. Finally, Extension professionals should consider the audience's past behaviors to design programs that are compatible with actions that Extension clients are likely to take.*

**Keywords:** behavioral intentions; past behaviors; personal norms; theory of planned behavior; water conservation

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## Introduction

Water plays a pivotal role in society, and it serves multiple purposes, including agricultural needs, recreation, industry, and public health (Lamm, Lamm, & Carter, 2015). However, only three percent of the earth's total water is fresh and of that only a small portion is available for human use (Feldman, 2012). This limited water supply is threatened by a growing population, climate change, and increasing water pollution (Adams et al., 2013; Wolters, 2014), and by 2050 almost one-third of all U.S. counties will encounter water scarcity issues (Spencer & Altman, 2010).

Florida has seen an increase in its population by 580 percent (16.03 million) over a time span of 60 years (1950 to 2010) due to its pristine beaches and attractive residential landscapes (Marella, 2014). Many Florida residents embrace a culture of aesthetically pleasing landscapes, investing substantial resources to maintain them (Baum, Dukes, & Miller, 2005). Florida residents consume nearly 71% of their total public supply water through landscape irrigation (Baum et al., 2005; Haley, Dukes, & Miller, 2007). To maintain their culturally-important lush landscapes, Florida residents use thousands of gallons of fresh water per watering cycle via automatic irrigation systems, often using more water than is needed (Baum et al., 2005; Haley et al., 2007). This consumption, driven by the desire for aesthetically-pleasing landscapes among a rapidly-growing, urbanizing population, has increased the withdrawal of water by 465 percent (12,334 Mgal/day) just in 60 years (1950 to 2010), and this has contributed to scarcity of water in Florida (Marella, 2014). These factors have caused water issues to become more contentious in Florida in recent years (Lamm et al., 2015).

There are numerous water conservation practices and technologies available to home irrigation users. Addressing landscape irrigation water use and conservation can be extremely difficult because of the diversity of the end users as well as their irrigation systems (Kjelgren, Rupp, & Kilgren, 2000). Some of the available water-conservation options include converting from high water to low-water use landscapes or using alternative sources of water, such as recycled water (Kjelgren et al., 2000). Residents can also use technologies such as rain shutoff devices or soil moisture sensors to ensure water is not applied to the landscape when it is not needed (St. Hilaire et al., 2008). The University of Florida Institute of Food and Agricultural Sciences (UF/IFAS) conducts educational programs to encourage the use of water-conservation practices and technologies through traditional Extension classroom programs and workshops along with printed materials (UF/IFAS, n.d.). UF/IFAS Extension also incorporates innovative electronic and video-based communication and social marketing techniques for encouraging behavior change in their public outreach programs for water conservation (UF/IFAS, n.d.). To encourage conservation, Extension professionals who focus on water issues need to understand personal and social factors that influence residents' intentions to adopt water conservation behaviors and technologies (Gregory & Di Leo, 2003; Huang, Lamm, & Dukes, 2016).

## Theoretical Framework

This study was guided by the Theory of Planned Behavior (TPB; Ajzen, 1988). The TPB explains that individual behavior is predicted by behavioral intentions, or the motivation to perform a behavior. Stronger intention to perform a specific behavior corresponds to greater likelihood that the behavior will be performed (Ajzen, 1991). Intentions are predicted by attitude toward the behavior, perceived approval of the behavior by others (subjective norms), and the perceived control an individual has over the performance of the behavior (perceived behavioral control; Ajzen, 1988, 1991). These components of the TPB have been used successfully to predict behaviors such as residential water conservation (Clark & Finley, 2007; Lam, 2006), environmental practices (Harland, Staats, & Wilke, 1999), driving violations (Parker, Manstead, & Stradling, 1995), and engagement in preventive dental care and cancer evaluations (McCaul, Sandgren, O'Neill, & Hinsz, 1993). The predictive power of attitudes, subjective norms, and perceived behavioral control on behavioral intentions varies across different situations and behaviors, and thus it is important to explore these factors relative to the specific context (Ajzen, 1991).

Attitude toward water conservation refers to the degree to which a resident has a positive or negative evaluation of water conservation behaviors (Ajzen, 1991; Armitage & Conner, 2001; Trumbo & O'Keefe, 2001). Willis, Stewart, Panuwatwanich, Williams, and Hollingsworth (2011) found residents who had very positive water conservation and environmental attitudes saved more water than those with moderately positive attitudes. Lam (1999) found that positive attitudes among Taiwanese government employees toward limiting use of water significantly predicted their water conservation intentions and ultimately water conservation behavior. Similarly, Clark and Finley (2007) found that attitude toward water conservation was significantly and positively correlated with water conservation intentions among household water users.

Subjective norms are the general social pressure an individual perceives to perform or not perform a specific behavior such as conserving water (Ajzen, 1988; 1991; Trumbo & O'Keefe, 2001). Subjective norms are conceptualized as perceived approval or expectations of water conservation behavior felt externally (Ajzen, 1988; Armitage & Conner, 2001; Trumbo & O'Keefe, 2001). Schultz, Nolan, Cialdini, Goldstein, and Griskevicius (2007) found positive subjective norms promoted energy use reductions among individual households. Similarly, Goldstein, Cialdini, and Griskevicius (2008) found an appeal to subjective norms increased towel reuse among hotel guests.

Perceived behavioral control is perceived capability to engage in a specific behavior such as water conservation (Ajzen, 1988; Armitage & Conner, 2001; Trumbo & O'Keefe, 2001). Parker, Manstead, Stradling, Reason, and Baxter (1992) found motorists with lower perceived behavioral control over aberrant driving behaviors (e.g., speeding) were more likely to commit driving violations. In a meta-analysis of TPB factors, Godin and Kok (1996) found that perceived behavioral control explained 13% of the variation in behavioral intentions and 12% additional variation in actual behaviors. In another meta-analysis, Armitage and Conner (2001) found that perceived behavioral control increased prediction of behavior intentions by 6%. In summary, several studies have demonstrated significant effects of the TPB core variables (attitudes, subjective norms, and perceived behavioral control) on individuals' intentions to conserve water (Clark & Finley, 2007; Lam, 1999; 2006; Trumbo & O'Keefe, 2001).

## Extending the Theory of Planned Behavior

Ajzen (1991) confirmed that the TPB is "open to the inclusion of additional predictors if it can be shown that they capture a significant proportion of the variance in intention or behavior after the theory's current variables have been taken into account" (p. 199). Researchers have found incorporating additional variables along with the core TPB variables (attitude, subjective norms, and perceived behavioral control) can increase this model's predictive power (Armitage & Conner, 2001). The following is a discussion of selected extra variables that have been tested along with the standard TPB model.

**Psychological and Environmental Factors.** Researchers have reported incorporating psychological and environmental factors into the TPB core variables improves the understanding of water conservation behaviors (Clark & Finley, 2007; Lam, 1999; 2006; Trumbo & O'Keefe, 2001). Lam (1999) added perceived moral obligation and perceived water rights to the TPB variables to predict Taiwan residents' intentions to conserve water in general and specifically to install water-saving appliances. This model explained a 41% variation in intentions to conserve water and 24% variation in actual installation of water-saving appliances (Lam, 1999). By incorporating environmental values, information-seeking efforts, and socio-demographic variables along with core TPB variables, Trumbo and O'Keefe (2001) explained an additional 27% of the variation in behavioral intentions to conserve water among three communities in California and Nevada, USA. In a study of residents of Blagoevgrad, Bulgaria, Clark and Finley (2007) added "sociodemographics, environmental attitudes, information possession, and concern over future water shortages" (p. 618) to the standard TPB variables and the resulting model explained 27.2% of the variation in residents' intentions to conserve water.

**Personal Norms.** Personal norms are the perceived commitments an individual feels toward internal values, and they are experienced as personal obligations to engage in a certain behavior such as water conservation (Schwartz, 1977). Personal norms are different from attitudes as "attitudinal concepts refer to evaluations based on material, social, and/or psychological payoffs, [while] personal norms focus exclusively on the evaluation of acts in terms of their moral worth to the self" (Schwartz & Howard, 1984, p. 245). Harland et al. (1999) found adding a personal norm variable to the three core TPB variables increased the proportion of variance explained in five pro-environmental behavioral intentions (e.g., installing energy-saving light bulbs) and four self-reported measures of environmentally supportive behaviors (e.g., turning off the faucet). It is well documented that adding personal norms to TPB can explain numerous other behaviors such as drinking skim milk (Raats, Shepherd, & Sparks, 1995), avoiding driving violations (Parker et al., 1995), and engaging in pro-environmental behaviors (Harland et al., 1999). However, personal norms have not been added to the core TPB variables and studied in the context of landscape water conservation behaviors.

**Demographic Factors.** Demographic factors may reveal further insights into whether people engage in environmental behaviors (Stern, 2000). For example, studies conducted by Dietz, Stern, and Guagnano (1998) and Lam (2006) reported females exhibited more pro-environmental behavior. In a review of 12 studies, Lam and Chao (2003) found females had greater intentions to demonstrate pro-environmental behavior. However, Clark and Finley (2007) reported sex had no effect in their study on water conservation behaviors. Age has been reported to both positively and inversely explain pro-environmental behaviors (Dietz et al., 1998; Theodori & Luloff, 2002), yet some studies have found no relationship between age and intentions to conserve water (Lam, 2006; Trumbo & O'Keefe, 2001). Mixed findings for the effect of age could be explained by a possible non-linear relationship between age and behavioral intentions (Wiernik, Dilchert, & Ones, 2016). Income is considered an important demographic factor that can explain pro-environmental or water conservation behavior (Lam, 2006; Trumbo & O'Keefe, 2001). According to Trumbo and O'Keefe (2001), lower-income residents have greater intentions to conserve water. Hamburg, Haque, and Everitt (1997) found that people who recycled had greater income levels, were younger, and more educated than people who did not. Variance explained while assessing TPB influence on landscape water conservation intentions could be more meaningful when controlling for demographic variables.

**Past Behavior.** The effect of past behaviors stands out among the variables that have been used to increase the predictive power of attitude on behavior (Fielding, Russell, Spinks, & Mankad, 2012; Gregory & Di Leo, 2003; Ouellette & Wood, 1998). Past behavior can directly influence an individual's future behaviors with limited mediating effects from attitudes, future intentions, norms, and perceived behavioral control (Ouellette & Wood, 1998). Past behaviors have also been shown to influence the development of an individual's attitude both positively and negatively toward a specific behavior (Aarts, Verplanken, & van Knippenberg, 1998).

The addition of variables to the TPB, such as psychological and environmental factors (perceived moral obligation, environmental values), demographic variables (sex, age and income), personal norms, and past behaviors such as water conservation can increase the power to predict intentions to conserve water. Despite the literature demonstrating the applicability of the TPB to water conservation behaviors, this model has not been fully applied to landscape water conservation behaviors, and research has not considered the addition of personal norms, past behaviors, and demographics to intentions to engage in good landscape irrigation practices.

## Purpose and Research Questions

The purpose of this study was to assess residents' landscape water conservation behavioral intentions using TPB constructs, assuming strong intentions are good predictors of actual landscape water conservation behaviors (Ajzen, 1991). This research aligns with research priority 7 of the American Association for Agricultural Education National Research Agenda, *Addressing Complex Problems* (Roberts, Harder, & Brashears, 2016) by examining factors that influence residents' behavioral intentions to conserve water to inform impactful Extension programs. The research questions were:

- How well can the TPB core variables (attitude, perceived behavioral control, and subjective norm) predict Florida residents' intentions to engage in good landscape irrigation practices?
- Does the addition of personal norms, past water conservation behaviors, and demographics to core TPB variables improve the prediction for Florida residents' intentions to engage in good landscape irrigation practices?

## Methodology

This cross-sectional study was part of a larger study conducted to examine Florida residents' landscape water conservation practices and perceptions. The target population was Florida residents who use landscape irrigation because this group has the potential to conserve substantial amounts of water by adopting good irrigation practices (Warner, Lamm, Rumble, Martin, & Cantrell, 2016). Participants were required to be at least 18 years of age, Florida residents, have lawn or landscape, have an irrigation (e.g., sprinkler) system, and have responsibility for controlling their irrigation. We used a web-based survey sampling company to recruit a purposive sample ($N$ = 1,063). We used non-probability sampling because landscape irrigation use is not systematically documented and therefore random sampling was not possible. Though the findings are restricted to the participants, non-probability samples have value and can generate results comparable to or sometimes better than probability samples, especially when there is no specific sampling frame of the target population (Baker et al., 2013; Twyman, 2008; Vavreck & Rivers, 2008). A study on the same target audience attempted to recruit individuals to match Florida census data and found that the target population differed from the overall state population (Warner, Rumble, Martin, Lamm, & Cantrell, 2015).

Among 2,829 potential respondents who received an invitation, 98 chose not to participate. Of the 2,731 respondents who agreed to participate, 1,683 met the four screening criteria, indicating that they belonged to the target population, and were therefore eligible to complete the survey. We incorporated quality control questions to ensure respondents' attention and maintain integrity of data (Lavrakas, 2008). Those who did not respond as instructed were not permitted to proceed with the survey, which reduced the overall completion rate. Out of 1,683 eligible respondents a total of 1,063 responses were considered complete for the purpose of data analysis, for a participation rate of 63.2% (Baker et al., 2016).

We assessed variation in behavioral intention to engage in good landscape irrigation practices using the TPB model. The dependent variable, behavioral intention to engage in good landscape irrigation practices, was calculated using the mean score of twelve statements which were each measured on a five-point Likert-type scale where -2 = *very unlikely,* -1 = *unlikely*, 0 = *undecided*, 1 = *likely*, 2 = *very likely* to engage in specific future water conservation behaviors. We selected the statements from best irrigation practices recommended by major Florida Cooperative Extension initiatives that promote residential landscape water conservation, such as the Florida Friendly Landscaping™ Program (FFL, n.d.). Respondents who selected *not applicable* ($n$ = 228) for one or more of the twelve practices were excluded from further analysis. We asked respondents to indicate how likely or unlikely they were to engage in the following good landscape irrigation practices in future: *Eliminate irrigated areas in my landscape; Turn off zone(s) or capped irrigation heads for established woody plants; Convert turfgrass 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 won't turn on when it isn't 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;* and *Follow watering restrictions.*

The survey instrument incorporated the term *good irrigation practices*, which was considered to be understood by the Florida general public because of the state's high percentage of water conscious people due to high awareness of water issues, extensive conservation programming, and numerous landscape water conservation options (Warner et al., 2016). Following Ajzen (1988), we quantified attitude using the mean score of six items each measured on a five-point semantic differential scale. There was one main statement: *implementing good irrigation practice is*, which participants completed using six different five-point semantic scales (-2 to 2): *good* to *bad, important* to *unimportant, wise* to *foolish, beneficial* to *harmful, positive* to *negative*, and *necessary* to *unnecessary.* We quantified subjective norms using the mean score of five statements measured on a five-point Likert type scale (-2 = *strongly disagree*, -1 = *disagree*, 0 = *undecided*, 1 = *agree*, 2 = *strongly agree*). The statements were: *the people who are important to me would approve if I reduced my landscape's impact on water resources; the people that I am close to think I should encourage others to protect our water resources; it is expected that I will manage my landscape using the smallest amount of water possible; the people whose opinions I value expect that I will minimize my personal impact on local water resources*; and *the people that I am close to would approve if I explored ways to reduce my impact on water resources*.

We calculated perceived behavioral control using the mean score of five items measured on a five-point semantic differential scale. There was one main statement: *implementing good irrigation practice is*, which was completed using five different five-point semantic scales (-2 to 2): *possible for me* to *not possible for me; easy for me* to *not easy for me; in my control* to *not in my control; up to me* to *not up to me;* and *practical for me* to *not practical for me*. We measured personal norms, past water conservation behaviors, and demographics in addition to the core TPB variables. We quantified personal norms using the mean score of five statements measured on a five-point Likert type scale (-2 = *strongly disagree*, -1 = *disagree*, 0 = *undecided*, 1 = *agree*, 2 = *strongly agree*). The statements were: *I feel a personal obligation to explore ways to reduce my landscape's impact on water resources; it is important to manage my landscape using the smallest amount of water possible; it is important to encourage my friends and family to protect our water resources; I feel a personal obligation to minimize my personal impact on local water resources*; and *I should be responsible for doing whatever I can to protect water resources*.

We measured past water conservation behaviors using five statements alongside a dichotomous response (1 = *no*, 2 = *yes*) with *unsure* option. The statements were: *I have low-water consuming plant materials in my yard; I use recycled waste water to irrigate my lawn/landscape; I use high efficiency sprinklers; I use drip (micro) irrigation*; and *I use a rain sensor to turn off irrigation when it is not needed*. For analysis purposes, past water conservation behaviors were dummy coded with a base as not engaging in the water conservation behavior (0) and remaining as engaging in the water conservation behavior (1). We excluded respondents who indicated that they were *unsure* ($n$ = 399) for one or more of the five practices from further analysis. We created the past water conservation behavior index by summing five statements and therefore the index could range from zero to five.

Demographics included sex, age, and total family income from all sources before taxes. We dummy coded the sex variable as 1 = *male*, 0 = *female*. We measured age on a continuous scale calculated based on respondents' year of birth. We measured family income through five income categories (1 = *less than $49,999,* 2 = *$50,000 to $74,999,* 3 = *$75,000 to $149,999,* 4 = *$150,000 to $249,999,* and 5 = *$250,000 or more*) and treated income as a continuous variable for data analysis following Trumbo and O'Keefe (2001).

We used an expert panel to establish the instrument's face and content validity. We selected experts for the panel based on proficiency in survey methodology, water conservation outreach programming, and water conservation practices and technologies. The study was approved by the University of Florida Institutional Review Board. Once the face and content validity were established, we pilot-tested the instrument. We calculated post-hoc reliability for the pilot test using Cronbach's alpha and deemed it satisfactory at 0.80 or greater (Cohen, 1988) for all items. We made no major changes to the instrument based on the pilot test. Following the full study, we calculated post-hoc reliability on the final instrument using Cronbach's alpha and found it to be satisfactory for all components [attitude (0.89), perceived behavioral control (0.89), personal norms (0.90), social norms (0.88), and behavioral intentions (0.87)].

We analyzed data using SPSS (version 22.0; IBM Corp., Armonk, NY). We used means and standard deviations to describe the data and hierarchical linear regression to assess the effect of components of TPB variables. In hierarchical linear regression, we regressed the behavioral intention to engage in good landscape irrigation practices against the set of independent variables. In the first block (model 1) of hierarchical regression, we entered all core TPB variables- *attitude, subjective norm and perceived behavioral control*, then we added the *personal norms* variable to create the second block (model 2). In the third block (model 3) we entered *past water conservation behavior*. In the final block (model 4), we added all three demographic variables (*sex, age,* and *family income*). Prior to analysis, we examined the data and found it satisfied all assumptions of hierarchical linear regression regarding multi-collinearity, independence of residuals, homoscedasticity, linearity, and normally distributed errors.

Out of 1,063 responses, 535 were included in the final analysis. The sample had slightly more females (52%; $n$ = 279), the average age was 50.1 years, and 66.9% ($n$ = 358) of respondents earned between $50,000 and $149,000 per year. The percentage of females in our sample was equivalent to percentage of females in Florida (51.1%) in 2014, but sample respondents earned more income compared to median Florida household ($47,212) income in 2014 (USCB, n.d.).

## Results

Respondents' behavioral intentions to engage in good landscape irrigation practices in the future ranged between undecided and likely on a five-point scale (1 = *very unlikely* to 5 = *very* *likely*). Using the real limits of the five-point scale, the majority of respondents had strong perceived norms (personal and subjective), had positive attitudes toward good landscape irrigation practices, and indicated they had perceived control over water conservation (see Table 1). On average, respondents' past engagement in water conservation behaviors ranged from one to four behaviors with five being the maximum.

Table 1

*Descriptive Statistics of Behavioral Intentions, Theory of Planned Behavior and Demographic Variables (n = 535) for Good Landscape Irrigation Practices of Residents*

| Predictor | *M* | *SD* |
|---|---|---|
| Behavioral intentions[a] | 0.82 | 0.74 |
| Age | 50.11 | 15.90 |
| Past water conservation behavior[b] | 2.50 | 1.36 |
| Personal norm[c] | 1.26 | 0.64 |
| Subjective norm[c] | 0.96 | 0.78 |
| Attitude[d] | 1.72 | 0.49 |
| Perceived behavioral control[e] | 1.47 | 0.62 |

*Note.* [a]Five-point scale (-2 = *very unlikely* to 2 = *very likely*); [b]Summed score of engagement in five water conservation practices ranging from zero = does not engage to 5 = engages in all five practices; [c]Five-point scale (-2 is weak perceived norm and 2 is strong perceived norm); [d]Five-point semantic differential scales (-2 is negative attitude and 2 is positive attitude); [e]Five-point semantic differential scales (-2 is no perceived behavioral control and 2 is high perceived behavioral control)

All four models were significant predictors of intentions to engage in good landscape irrigation practices (see Table 2). The results of hierarchical linear regression indicated that each block added significantly to the overall model. The final model with all variables had an $R^2 = 0.388$, revealing the overall model explained 39% of the variance in intentions to engage in good landscape irrigation practices.

Table 2

*Hierarchal Linear Regression Models in a Study of Good Landscape Irrigation Practices of Florida Residents Examining Effect of Demographic Variables, Past Water Conservation Behavior, Personal Norms, and Theory of Planned Behavior Variables on Intentions to Conserve Water (n = 535)*

| Model | $R^2$ | $R^2$ change | *F* | *P* |
|---|---|---|---|---|
| Model 1 | 0.251 | 0.251 | 59.17 | < 0.001 |
| Model 2 | 0.278 | 0.028 | 51.05 | < 0.001 |
| Model 3 | 0.370 | 0.092 | 62.26 | < 0.001 |
| Model 4 | 0.388 | 0.017 | 41.64 | < 0.001 |

*Note*. Model 1 = core TPB variables (attitude, subjective norm and perceived behavioral control), Model 2 = Model 1 + personal norms, Model 3 = Model 2 + past water conservation behavior, Model 4 = Model 3 + demographic variables (sex, age, and family income)

The first block included the three core TPB variables, out of which subjective norms and perceived behavioral control significantly explained intentions to engage in good landscape irrigation practices. Attitude did not significantly explain intentions to engage in good landscape irrigation practices. The hierarchal regression standardized beta coefficients for TPB variables indicated that residents with higher subjective norms and perceived behavioral control had higher intentions to engage in good landscape irrigation practices (see Table 3). The largest effect size was for subjective norms, which individually explained 13% variation, followed by perceived behavioral control, which explained 1.9% variation in intentions. Overall, model 1 explained 25.1% variation in intentions with core TPB variables (subjective norms, attitudes, and perceived behavioral control) only. This is substantially higher than the 10-18% variation in intentions to conserve water explained by the TPB core variables reported by others (Clark & Finley, 2007; Lam, 2006; Trumbo & O'Keefe, 2001).

Table 3

*Demographic Variables, Past Water Use Behavior, Personal Norms, and Theory of Planned Behavior Variables in Hierarchal Linear Regression Analysis of Florida Residents (n = 535)*

| Predictor | Model 1 (β) | Model 2 (β) | Model 3 (β) | Model 4 (β) | $R^2$ change |
|---|---|---|---|---|---|
| Subjective norm | 0.40** | 0.25** | 0.21** | 0.18** | 0.130 |
| Attitude | 0.02 | -0.03 | -0.01 | -0.01 | 0.001 |
| Perceived behavioral control | 0.17** | 0.15** | 0.11** | 0.14** | 0.019 |
| Personal norm | | 0.24** | 0.19** | 0.18** | 0.028 |
| Past water conservation behavior | | | 0.32** | 0.33** | 0.092 |
| Sex (male) | | | | -0.07* | 0.004 |
| Age | | | | -0.11** | 0.010 |
| Family income | | | | 0.01 | 0 |

*Note.* *$p \leq 0.05$ **$p \leq 0.01$, reported $\beta$ are standardized regression coefficients

The second block added the personal norms variable, and this model significantly explained intentions to engage in good landscape irrigation practices. The addition of personal norms increased the $R^2$ by .028, meaning that when TPB variables were controlled, personal norms explained 2.8% of the variation in intentions to engage in good landscape irrigation practices. This 2.8% increase in explained variation solely by personal norms demonstrates its effect size. When the subjective norm variable was removed from first block, the variance explained in behavioral intentions to engage in good landscape irrigation practices by personal norms was similar (12.4%) to subjective norm. This shows that when only one norm variable (subjective norm or personal norm) is used in the full model, the effect on intent is comparable. This effect is similar to findings of Harland et al. (1999), who reported that additions of personal norms to standard TPB explained an additional 3 to 7% variation in behavioral intentions to engage in environmentally responsible behaviors. The third block added the past landscape water conservation behavior variable to block two, and in this model the added variable significantly explained intentions to engage in good landscape irrigation practices. The addition of the third block increased the $R^2$ by 9.2%, meaning that when TPB and personal norm variables were controlled, past water conservation behaviors alone explained 9.2% of the variation in intentions to engage in good landscape irrigation practices. Because past water conservation behavior was significant with a positive beta, we interpreted this to mean that residents who were engaged in good landscape irrigation practices in the past are more likely to do so in the future.

In the fourth and final block, which included Florida residents' demographic characteristics, only age and sex significantly explained residents' intentions to engage in good landscape irrigation practices. Family income was a non-significant predictor. The negative beta for age indicates that as age increased, engagement in good landscape irrigation practices decreased. In terms of effect size, the age variable explained more of the variance (1.1%) in behavioral intentions compared to other demographic variables. This finding is consistent with those of Dietz et al. (1998) and Hamburg et al. (1997). The negative beta for sex indicates that males are less likely to conserve water, and this finding is consistent with others who reported higher pro-environmental behavior among females (Clark & Finley, 2007; Lam, 2006; Lam & Chao, 2003). The addition of demographic variables in the final block increased the overall $R^2$ by 1.7%, meaning that as core TPB variables, personal norms, and past water conservation behaviors were controlled, demographics explained 1.7% of the variation in the intentions to engage in good landscape irrigation practices. This finding is consistent with Clark and Finley (2007), who found that among their measured demographic variables only age, education, residence type, and presence of a garden significantly related to intentions to conserve water. Our findings are inconsistent with those of Trumbo and O'Keefe (2001) who reported that only income explained the intentions to conserve water among several demographic characteristics. The non-significant income variable may be explained by the higher overall income among study participants compared to the Florida population overall. Overall, addition of personal norms, past water conservation behaviors, and demographics to core TPB variables improved the prediction by explaining an additional 13.7% variance in Florida residents' behavioral intentions to engage in good landscape irrigation practices.

## Conclusions and Recommendations

Florida residents have an overall positive disposition toward landscape water conservation. The addition of past water conservation behaviors and personal norms to the core TPB variables significantly improves the explanation for intentions to conserve water. Only a few researchers have incorporated past water conservation behaviors into the standard TPB model, and the current study was the first to apply them to landscape water conservation. In Trumbo and O'Keefe's (2001) study, past behaviors were non-significant in explaining residents' intentions to conserve water. Past water conservation behaviors significantly influence intentions, and we agree with others who have asserted that residents who conserved water in the past are likely to conserve water in the future (Aarts et al., 1998; Fielding et al., 2012; Gregory & Di Leo, 2003; Ouellette & Wood, 1998). Thus, it would behoove water conservation outreach professionals to consider residents' past behaviors carefully when developing new water conservation programs.

To increase the adoption of water conservation behaviors, Extension professionals should reinforce the behaviors they want people to continue by specifically targeting and providing support for people who engaged in landscape water conservation in the past. This may be especially important among people who have engaged in landscape water conservation but have discontinued these practices. Further, different outreach strategies may need to be used for residents who have not previously engaged in landscape water conservation.

Personal norms have previously been studied along with TPB variables to explain behaviors (Harland et al., 1999; Parker et al., 1995), and this study explored whether personal norms explained landscape water conservation behaviors. Several conclusions were drawn from this element. First, the addition of personal norms significantly predicts water conservation behaviors when controlling for TPB core variables, and personal norms uniquely explains an additional 2.8% variation in behavioral intentions. This reveals that the influence of residents' moral consideration on water conservation behavioral intentions is not fully captured by the TPB core variables. Second, the decrease in the unique contribution made by subjective norms on behavioral intentions reveals that personal norms increase the TPB's conceptual clarity. An adjustment to subjective norms while controlling personal norms reveals the actual influence of non-internalized norms (Schwartz, 1977).

Additionally, we concluded that when personal norms are strong then subjective norms are slightly less important. This finding can be used to promote water conservation behaviors (e.g., seasonally adjusting irrigation times) in communities where social support is low. Residents who feel a personal obligation to conserve water may be more open to information related to water conservation, and they may be more likely to act, even in the absence of social support. Extension professionals should therefore include personal norms in their working agenda. For example, if a large group of residents in the target audience perceive personal obligation to conserve water (personal norm), then Extension professionals can help to translate this personal norm into a broader social norm to promote water conservation practices and technologies. Extension professionals can translate water conserving personal norms into social norms by making demonstration at the lawns of community volunteers' lawns that how slight changes in water use behavior (skipping irrigation twice a week) can save a great amount of water. In settings where personal norms are low, Extension professionals should develop strategies to increase the personal sense of obligation to engage in landscape water conservation practices.

Excluding attitude, the TPB core variables (subjective norms and perceived behavioral control) significantly predict intentions to conserve water. Although residents have positive water conservation attitudes overall, the effect of the attitude variable on intent is not significant. There is likely a ceiling effect with attitudes toward the water conservation behavior (high mean attitude score and low variability) that may affect the utility of the measure as a predictor of intentions. Recent water crises and increased publicity of water issues both nationally and in Florida might have heightened awareness of and increased attitude toward water conservation, therefore stronger positive attitude might not impact behavioral intentions to conserve water. Additionally, because the survey focused on landscape water conservation, it is possible that social desirability bias is present (Krumpal, 2013). Because subjective norms and perceived behavioral control do explain behavioral intentions, we recommend that Extension professionals consider these characteristics first when planning programs to encourage landscape water conservation. When the target audience's subjective norms or perceived behavioral control are low, Extension professionals need to develop strategies to increase these characteristics. To increase perceived behavioral control, Extension professionals should provide opportunities to increase the skills needed to adopt and maintain technologies such as irrigation timers and soil moisture sensors. For example, hands-on skill building activities can be incorporated into educational programs to increase perceived behavioral control.

Among the significant TPB variables, the influence of subjective norms on variance in behavioral intentions is almost seven times greater than perceived behavioral control. This finding emphasizes the critical importance of positive support to engage in landscape water conservation within a social system. This support might exist in the form of encouragement and expectations communicated directly or indirectly by peers, neighbors, friends, and family members. As subjective norms are recognized as an effective strategy to promote behavior change among target audiences (Kumar Chaudhary & Warner, 2015; McKenzie-Mohr, 2011), we recommend that Extension professionals develop strategies to increase individuals' awareness of their peers' engagement in landscape water conservation practices (McKenzie-Mohr, 2011). For example, educational materials could provide a clear distinction regarding how many people in a target audience are already engaging in a specific desired behavior in comparison to their neighbors. A new norm for water conservation also can be encouraged in the community by collaborating with local leaders to adopt and promote water conservation behaviors (Blaine, Clayton, Robbins, & Grewal, 2012). As conservation behaviors are often unseen (Kim, Hong, & Magerko, 2009), it would be helpful to provide opportunities for those who engage in landscape water conservation practices to share their experiences and demonstrate technologies in order to increase the perceived norm.

Extension professionals should identify factors that lead to low perceived behavioral control, such as site-specific barriers to the adoption of landscape water conservation practices or lack of required skill, and develop strategies to address them. Perceived behavioral control can be increased by helping people gain skills needed to adopt specific water conservation technologies and practices. This might be done by helping people learn how to use specific irrigation technologies and by developing clear resources and making them available online through videos or fact sheets. Extension professionals can demonstrate landscape water conservation behaviors such as installing rain barrels (Ott, Monaghan, Israel, Gouldthorpe, & Wilber, 2015), which can reduce perceptions that these technologies are difficult to use (Trumbo & O'Keefe, 2001). Perceived behavioral control can also be increased by removing residents' perceived barriers to adoption. For example, if residents associate conservation with prohibitive costs and expensive technologies, Extension professionals can reduce this barrier by educating residents on the potential financial savings that might result from saving water or by emphasizing less costly water conservation options. For example, skipping a week of irrigation can save significant amounts of water with no expense (Haley et al., 2007).

Overall, landscape water conservation behavioral intentions can be explained by the TPB model with a specific and important population that uses and makes decisions about landscape irrigation and ultimately has the opportunity to conserve substantial amounts of water. The TPB core variables explain substantially higher (25.1%) variation in landscape water conservation behavioral intentions compared to other studies (Clark & Finley, 2007; Lam, 2006; Trumbo & O'Keefe, 2001), which indicates that TPB is useful for understanding behaviors performed outside the home, and specifically landscape water conservation behaviors. The addition of personal norms and past water conservation behavior variables is beneficial and provides a better overall prediction of intent to conserve water (Clark & Finley, 2007; Lam, 1999; 2006; Trumbo & O'Keefe, 2001). Past water conservation behaviors enhance the TPB prediction model, which reveals the importance of deeply understanding the target audience's existing and past practices. Extension professionals should conduct thorough needs assessments and encourage people to use technologies and practices on a trial basis to increase the likelihood that certain water conservation behaviors will be used in the future. Subjective norms strongly guide water conservation behaviors, but they may not be absolutely required, because the influence of subjective norms on water conservation behaviors is reduced when personal norms are strong.

This study is a preliminary examination of the addition of these variables with a purposive sample. In the case of behaviors such as landscape water conservation, which are often invisible, further research is needed to understand thoroughly what factors link intentions and actual water conservation behaviors. To explain landscape water conservation behaviors among Florida residents in depth, future research should utilize a random sample of the target population and incorporate variables such as homeowners' association membership, whether the lawn or landscape is maintained by a professional landscaping company, residents' environmental values, and the amount of water bills along with core TPB variables.

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