RESIDENTIAL WATER USE AND CONSERVATION:

A TEXAS DROUGHT PERSPECTIVE

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RESIDENTIAL WATER USE AND CONSERVATION:

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ABSTRACT

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May 2013

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A survey of 273 Texas consumers included questions addressing perceived concerns about water resources as well as consumers' knowledge of the on-going drought throughout the state of Texas. The majority of participants stated that the current drought was worse compared to previous droughts, and that they were concerned about their local water resources being able to continue to provide water. However, 61% of the participants reported that there are not currently any drought restrictions in their area and only five participants knew what system is used to denote drought intensity in the United States. The leading concern expressed about the current drought was the continued

availability of water; however the second leading response was one of no concern. Only eleven consumers were concerned about permanent impacts or the possibility of the current drought becoming a long-term event. Global warming/climate change and human behavior were both commonly selected by consumers as reasons contributing to the current drought in Texas, but the history of seasonal drought may temper responses to severe drought conditions. Consumer water use and conservation was investigated across varying household types and was found to be relatively uniform. An investigation into consumer environmental attitudes revealed that the practice of water conservation may be dependent on specific environmental attitudes. Specifically, respondents' level of perceived consumer effectiveness was identified as an important component in determining household water use behaviors.

Keywords: drought, global warming, climate change, consumer behavior, Texas, residential water use, water conservation

CHAPTER I

WASTING AWAY:

CONSUMER ECOLOGICAL KNOWLEDGE AND DROUGHT RESPONSE

Introduction

Texas experienced the worst single-year drought in the state's history in 2011(Folger, Cody, Carter, 2012). Abnormally low levels of precipitation coupled with remarkably high temperatures contributed to deficiencies in water supplies. In October of 2011, 88% of the state was experiencing exceptional drought with much of the state continuing to experience extreme to exceptional drought conditions until January 2012 (Folger et al., 2012). Increased rainfall during the winter of 2012 brought relief to the eastern portion of the state, but much of the state remains in drought conditions ranging from moderate to exceptional (Folger et al., 2012; U.S. Drought Monitor, 2012). While the Congressional Research Service states that "It is difficult to predict whether drought conditions in Texas will persist through 2012 and longer", it appears that such conditions have and will continue to persist (Folger et al., 2012). This is in-line with Climate Change (CC) predictions that the American West will transition into a "more arid climate" and is evidence of a "dramatic shift" (Folger et al., 2012).

With increased aridity in the Texas climate further decreasing the amount of water available to the public, incorporating awareness/education campaigns about water scarcity and CC will be an important component of water management strategies.

Communication and education about CC and CC policies is critical, as individual actions and decisions have the power to avert or increase the worst impacts of CC (Dietz, Gardner, Gilligan, Stern, & Vandenbergh, 2009; Fisher, Leifeld, & Iwaki, 2012; Pidgeon & Fischhoff, 2011; Weingart, Engels, & Pansegrau, 2000; Wilson, 2000). Since individual actions play a large role in mitigating CC and reducing water demand, public policy aimed at changing consumer behavior is crucial. Most water use restrictions and fines are only implemented after drought conditions have already limited water supplies and are then withdrawn quickly after the drought conditions cease. Important components of any water management strategy are education and awareness campaigns that inform the public of how and why water needs to be conserved. As Texas and the American Southwest become increasingly arid due to CC, education and awareness campaigns will need to be incorporated into water management strategies that relate information about CC to the public. The purpose of this study was to identify consumer attitudes towards the 2011 drought and determine the role CC played in these attitudes. Of specific interest in this study was how different attitudes toward CC influenced what causes consumers felt were behind the 2011 drought.

Literature Review

Mounting water scarcity due to pollution, growing populations and global markets has brought into question the continued reliability of existing fresh water resources (Bozzo, 2008; Chen, Gillig, & McCarl, 2001; Jorgensen, Graymore, & O'Toole, 2009; Sun McNulty, Myers, & Cohen, 2008; Wurbs, 2005). Adding to mounting water scarcity issues are the effects of CC (Chen et al., 2001; Jorgensen et al., 2009; Sun et al., 2008; Wurbs, 2005). Depending on the model used to predict the impacts of GCC, variations in

expected climate patterns for a region differ (Sun et al., 2008). However, most models employed predict that water stress will increase throughout much of the Southwestern United States, particularly in Texas (Sun et al., 2008). Patterns of precipitation and population growth were found to be two factors having a large impact on water stress patterns in the aforementioned regions (Sun et al., 2008).

CC by many accounts will result in a decreased water supply in the state of Texas, producing a heightened level of stress on surface and ground water resources (Sun et al., 2008). The major portion of Texas' surface water is contained in streams and rivers that flow through to the Gulf of Mexico; these provide the bulk of the fresh water used in the eastern part of the State (Schoolmaster, 1984). As such, a large number of reservoirs have been constructed in East Texas to increase the quantity of fresh water available to the population in that part of the state (Schoolmaster, 1984). West Texas uses groundwater nearly exclusively as its supply of freshwater, not surprising considering this part of the state receives a minimal amount of precipitation per year (Schoolmaster, 1984). As the amount of precipitation becomes more limited due to CC, East Texas will likely begin to rely more heavily on groundwater resources, while West Texas will continue to exploit their groundwater resources at an increasingly alarming rate.

As the amount of available fresh water in Texas decreases, the population is expected to rapidly expand particularly in urban areas throughout the state (Chen et al., 2001; Sun et al., 2008; Wurbs, 2005). While only 10 to 30% of total water consumption is accounted for by residential use in developed countries, an increasing amount of water is being reallocated to meet population demands, especially in the sub-humid, semi-arid, and arid regions of the United States (Griffiths & Driscoll, 1982; OECD, 2011;

Schoolmaster, 1984). Desalination has continued to be developed as a way to provide freshwater to coastal regions in dire need, but while this technology continues to decrease in costs it still remains an unviable option for areas that would require expensive pumping and added infrastructure to move the water farther from the coast (Fishman, 2011; Solomon, 2010). Demand side strategies of water resource management are becoming ever more important, as population growth continues to exert an intensifying amount of pressure on water resources in regions that are already water stressed (Bithas, 2008; Dalhuisen, Florax, Groot, & Nijkamp, 1999; Jorgensen et al., 2009; Kenney, Goemans, Klein, Lowery, & Reidy, 2008; OECD, 2011; Sun et al., 2008). This is especially true for states such as Texas, where supply side strategies have already identified most if not all of the available freshwater resources and connecting new supplies of freshwater from other states to existing infrastructure is cost prohibitive (Schoolmaster, 1984).

Water management strategies aimed at changing consumer behavior are known as demand side management (DSM). This type of water management focuses on reducing the amount of water demanded by the consumer using strategies such as water restrictions, fines, and incentives. While most of the literature discusses means to conserve water as an everyday necessity, it is not uncommon for DSM programs to be designed for short-term effects or drought events. Often when a drought hits, water restrictions, awareness campaigns and increased water prices go into effect, but when the drought subsides many if not all of the DSM policies are discontinued or suspended until the next drought comes along. This type of DSM is reactive, which is to say that these

programs are intended to be used only after intensified water scarcity has already become an issue (Abraham, 2006; Glennon, 2005; Graymore & Wallis, 2010).

Consumer behavior is often difficult to predict and costly to change, but the benefits of campaigns aimed at doing just this have shown marked results (Dietz et al., 2009). Behavioral changes on an individual and/or household level constitute an important element of CC mitigation and "deserves increased policy attention" (Dietz et al., 2009). A key element in changing consumer behavior is understanding their attitudes toward a particular behavior. The theory of planned behavior, an extension of the theory of reasoned action, states that three main components influence a person's intention to participate in a behavior (Ajzen, 1988; Ajzen & Fishbein, 1980). These include a person's attitude toward a behavior and the expected outcome of that behavior, the person's subjective norms or perceived pressure from society to participate in the behavior, and their perceived behavioral control or their perceived ability to perform the behavior (Ajzen, 1991). Once a consumer intends to participate in a behavior, it is much more likely that they will follow through on this intention (Ajzen, 1991). Changing a consumer's behavior is hinged on understanding and influencing their attitudes, social norms, and their perceived ability to participate in the desired behavior. Understanding consumer attitudes is an important element in influencing consumer attitudes and thus the adoption of a desired behavior.

Materials & Methods

To flush out the four groups of thought on global warming in the United States, amended from Leiserowitz et al. (2012), four groups were created in the data set obtained from an on-line survey of Texas consumers. The participants were clustered by the

reasons they selected as contributing factors to the cause of the 2011 Texas drought. Specifically four groups or CC clusters were created from those who selected global warming and human behavior (GW_HB), those who chose global warming but not human behavior (GW), those who chose human behavior but not global warming (HB), and lastly those who chose neither global warming nor human behavior (Neither). The frequency with which other causes of the Texas drought were chosen by each cluster was then analyzed to get an understanding of the main characteristics of the consumers in each cluster.

An online survey was conducted using a random sample of 273 Texas consumers purchased from Qualtrics Survey Research. In order to participate in this survey, access to the use of a computer and internet service was required. As a result most of these participants came from in and around major urban areas in Texas. While this may have resulted in a bias toward city and suburb dwellers (72% of respondents), 28% of respondents still indicated living in rural or isolated settings. The decision to use an online survey was based partially on the success of past surveys conducted on-line. The on-line survey allowed for enhanced privacy and convenience to a readily accessible and diverse pool of respondents, which in turn allowed for a large number of completed responses to be attained in a short time period with a lessened chance of coding errors than a traditional survey.

The survey was 73 questions long and included five main blocks or series of questions; each block included a set of questions designed to collect information on a specific topic. The first block or topic was comprised of descriptive questions aimed at ascertaining demographic information. The bulk of the questions in this block were

obtained directly from a questionnaire used to develop an OECD report, Greening Household Behavior: The Role of Public Policy. The questionnaire pertained to household water use and lacked data on households in the United States, it was also made readily available as part of the OECD report. A secondary purpose for using the questionnaire was that it provided an easy and effective comparison of Texas households to an international baseline. Additional questions about appliance type and number were developed by faculty at Texas State University in the Department of Family and Consumer Sciences and included in this first block. The second block of questions dealt specifically with lawns/yards and lawn care; these questions were developed in conjunction with Dr. Tina Cade a professor in the Department of Agriculture at Texas State University-San Marcos. The third block of questions was concerned with water supply. Many of the questions in the third block were also taken from the previously mentioned OECD report for the purposes of comparison. Other questions in the third block were developed using information from relevant literature and knowledge of Texas' water supply system, while still other questions were developed using faculty expertise and information from previous research. The fourth block of questions dealt specifically with water behaviors; again the bulk of these questions were taken directly from the OECD report on greening household behavior. Alternatively, some of the questions in the fourth block were developed with information specific to the 2011 Texas drought in order to ascertain perceptions and awareness of the drought. Additional questions in this fourth block were developed using faculty knowledge from previous research. The fifth and last block of questions dealt with attitudes and concern. Questions about conservation and environmental attitudes were taken directly from the

OECD report, while questions relating to purchasing attitudes were developed with the help of Dr. Jiyun Kang, assistant professor in the Department of Family and Consumer Sciences at Texas State University – San Marcos. The fifth block also included questions that were developed based on specific concerns raised by the Texas drought.

The demographic variables used for this study include a subset of questions from the descriptive block of the survey. These variables were among the questions used to ascertain if there were significant differences between the demographics of the CC clusters. These variables were taken directly from the OECD report and included respondent's age, education level, yearly income, the age, type, location, size, and ownership of their residency, and years lived at their current residence. One other variable was used to ascertain the number of years respondents have lived in Texas. This question was answered using the same scale as the OECD question about the number of years lived at the respondent's current residence. This variable was used to ascertain how familiar a respondent was with Texas climate and drought patterns.

A series of questions was developed using relevant literature and faculty expertise to ascertain respondents' awareness and perception of the drought in Texas. Of these questions a subset of four questions were used in this study to ascertain respondents' awareness and perception of the current drought. These questions were used to determine if there exist significant differences in drought perception and awareness between the four CC clusters. This particular subset was chosen because it provided Likert scale data for analysis. Three of the questions used employed a 7-point Likert-type scale; these questions included: "How bad is this recent drought compared to previous droughts in Texas?" (1=much worse, 7=much better), "How concerned are you about the ability of

local water resources to continue being able to provide water to your area?" (1=very concerned, 7=very unconcerned), and "How effective is your local municipalities at handling current drought conditions?" (1=very ineffective, 7=very effective). Respondents were also asked to rank the current drought in their area using the Drought Monitor's D0-D5 scale, with an additional option of "There is not currently a drought in my area". This question was used to determine if respondents knew the actual severity of drought in their region.

A subset of questions from the attitudes block of the survey was used to ascertain the environmental and purchasing attitudes of the respondents. Thirteen statements were used, six statements dealt specifically with environmental attitudes, and seven statements dealt directly with purchasing attitudes. Both sets of statements were responded to on a 5-point likert scale (1=strongly disagree, 5= strongly agree). These two sets of questions were used in this study to determine if there were significant differences in environmental and purchasing attitudes between the four different CC clusters. The set of variables that dealt with purchasing attitudes included two matching subsets of variables; the first subset asked about purchasing attitudes in the first person and the second subset was comprised of matching questions asked in the third person.

Results

The sample was comprised of 36% males and 64% females, compared to 49.6% males and 50.4% females in the Texas population (U.S. Census Bureau, 2010). The largest age bracket was 45-64 year olds, who comprised 55% of the sample compared to 24.1% of the Texas population (U.S. Census Bureau, 2010). The average household size of the sample was 3.01, while the average household size in Texas is 2.78 according to

the American Community Survey (U.S. Census Bureau, 2010). Over half the sample had completed high school and/or received some college level education, while 37% of the study sample had a bachelor's degree or higher. This is similar to the Texas population of which 80% have graduated from high school and/or have some college level education and 25.8% who have received a bachelor's degree or higher (U.S. Census Bureau, 2010). The median income in Texas is $50,920.00, and the mean is $70,777.00, while 52% of the study sample make $47,500 or less and 42% have an annual income between $47,501 and $119,200 (U.S. Census Bureau, 2010). Of the Texas population 63.7% own their homes similarly, 65% of the study sample are home owners (U.S. Census Bureau, 2010). Of the sample 19% live in apartments, while 71% live in detached houses. Within the Texas population 24.2% live in apartments, while 65.6% living in detached homes (U.S. Census Bureau, 2010).

Clusters were created using two specific causes for the 2011 drought, "Global Warming/Climate Change" and "Human Behavior". Basic descriptive statistics were run on each cluster to ascertain the frequency with which the cluster chose other reasons as causes contributing to the 2011 Texas drought (Table 1). The frequency each cluster chose other causes of the 2011 Texas drought reveal certain characteristics about each cluster (Table 1). Over 40% of the GW_HB cluster chose burgeoning populations, water pollution, water management, lack of conservation, and human attitudes toward water availability (Table 1). None of the causes that had to do with human behavior were chosen by more than 21% of the GW or Neither clusters, while over 40% of the HB cluster chose water management and human attitudes toward water availability (Table 1). Over 60% of each cluster chose seasonal weather as a cause of the 2011 drought, but for

both the GW and Neither clusters this was the only cause that was chosen by over 42% of the cluster (Table 1). The next most frequently chosen cause by both the GW and Neither clusters was seasonal warm weather, which was chosen by 41.7% and 39.3% respectively (Table 1).

Table 1. Frequency Chart of Reasons Chosen as Contributing to the 2011 Drought by Climate Change Clusters.

Frequency Table: Drought Reasons by Clusters

		Clusters			
		GW_HB	GW	HB	Neither
Drought Causes					
Global warming/climate change	N	44	48	0	0
	f	100	100	0	0
Stress placed on local water supplies by burgeoning populations	N	24	6	13	22
	f	54.5	12.5	31.7	15.7
Water pollution	N	17	9	6	8
	f	38.6	18.8	14.6	5.7
Farming practices	N	8	1	2	6
	f	18.2	2.1	4.9	4.3
Seasonal warm weather	N	28	20	21	55
	f	63.6	41.7	51.2	39.3
God	N	8	10	2	28
	f	18.2	20.8	4.9	20.0
Water policies/litigation	N	6	4	2	5
	f	13.6	8.3	4.9	3.6
Cattle ranching	N	6	0	1	2
	f	13.6	0	2.4	1.4
La Nina	N	14	13	13	20
	f	31.8	27.1	31.7	14.3
El Nino	N	20	10	11	24
	f	45.5	20.8	26.8	17.1
Water management	N	19	9	17	10
	f	43.2	18.8	41.5	7.1
Lack of water conservation practices in your local area	N	21	9	10	10
	f	47.7	18.8	24.4	7.1
Weather patterns	N	37	35	28	86
	f	84.1	72.9	68.3	61.4
Human behavior	N	44	0	41	0
	f	100	0	100	0
Human attitudes toward water availability	N	30	10	27	9
	f	68.2	20.8	65.9	6.4
Lack of traditional habitats	N	12	4	4	3
	f	27.3	8.3	9.8	2.1
*Other	N	0	0	2	11
	f	0	0	4.9	7.9

*Responses entered for other include "crap that colleges teach the dumpasses that come out and can not help this country…", "No Current drought", "droughts happen from time to time throughout history", "It's nature and it changes from time to time over time", "Unsure", "dont know", "no rain", "damaged or improper lawn watering", "in Bastrop fires" "Unsure", "20 year cycles of weather", "Mother Nature", and "Large Cities draining our lakes".

The Neither cluster comprises over half of the sample (n=140), while the GW_HB (n=44), GW (n=48), and HB (n=42) clusters have notably smaller sample sizes. Over fifty percent of all the clusters are female, with GW having the highest percentage of females at 83% of the sample. Over fifty percent of all the clusters are between the ages

of 45 and 65. Education levels varied by cluster with 46.3% of the HB cluster having attained a bachelor's degree or higher compared to 20.9% in the GW cluster; 35.4% and 38.6% the GW_HB and Neither clusters had a bachelor's degree or higher, respectively. Income also varied by cluster, with over 50% of the Neither cluster making an annual income of $47,500 or more, while only 31.3% of the GW cluster made more than $47,500 in a year. In the GW_HB cluster 47.7% had an annual income of $47,500 or more and 46.3% of the HB cluster had an annual income of $47,500 or more.

One-way Analysis of Variance (ANOVA) tests were conducted for four sets of descriptive variables, and Chi-square analysis was performed on the descriptive variables that produced ordinal level data. The sets of variables were divided based on the type and purpose of the questions asked. The first set of variables tested via ANOVA was the demographic variables, of which education, income, residence age, and residence size were found to be significant at the .05 level (Table 2). The variables of residence age, type, location and ownership as well as that of years lived in the current residence and years lived in Texas were analyzed using a Pearson's Chi-square. Of these variables ownership was the only variable found to be significant ($p = .006$). After Ownership was determined to be a significant variable, additional Chi-squares were performed to determine which clusters exhibited significantly more or less ownership (Table 3). Ownership was determined to be a significant variable among the GW ($p = .002$) and Neither ($p = .05$) clusters (Table 3).

Table 2. Post Hoc Tukey Test Results for Descriptive Variables.

Mean of Variables as a Function of Clusters

	Clusters											
	GW_HB			GW			HB			Neither		
	N	Mean	*SD*	*N*	Mean	*SD*	*N*	Mean	*SD*	N	Mean	SE
Demographics												
Education	44	3.36_{ab}	0.94	48	2.90_{b}	0.91	41	3.45_{a}	1.03	140	3.18_{ab}	0.97
Income	44	5.82_{ab}	3.12	48	4.38_{b}	2.79	41	5.93_{ab}	3.45	140	6.33_{a}	3.59
Residence Age	44	3.55_{ab}	1.50	48	3.42_{ab}	3.13	41	2.73_{b}	1.05	140	3.45_{a}	1.54
Residence Size	44	3.82_{ab}	1.11	48	3.71_{b}	1.29	41	3.88_{ab}	1.12	140	4.28_{a}	1.33
Years Lived in Home	44	2.73_{a}	1.04	48	2.13_{abc}	1.02	41	2.71_{b}	1.08	140	2.69_{c}	1.00

Note. Means in a row sharing subscripts are not significantly different at the .05 level based on a Tukey's post hoc test.
There was no statistical significance found at the .05 level between the mean for age

Table 3. Person's Chi-square results for ownership.

		Own	Don't Own	
	Clusters	n = 178	n = 95	$\chi 2$
GW_HB	n = 44	26	18	0.86
GW	n = 48	22	26	9.63 *
HB	n = 41	31	10	2.30
Niether	n = 140	99	41	3.85 *

* p-value $\leq$ .05

The second set of variables was drought perception variables; believed severity of the 2011 drought compared to previous Texas droughts, perceived drought intensity and level of concern about local water supplies were found to be significant at the .05 level (Table 4). Among the third set of variables, aimed at ascertaining environmental attitudes, agreement with the statements that individuals can contribution to a better environment, environmental impacts are frequently overstated, environmental issues should be dealt with primarily by future generations, and my own personal actions can have an effect on current and/or future drought conditions between clusters was found to be significant at the .05 level (Table 5). The last set of variables dealt with purchasing

attitudes; of these only the statements of" I purposefully select plants/landscaping that allow me to conserve water" and "I purposefully select clothing that allows me to conserve water and/or energy" were not found to be significant at the .05 level (Tables 6). All interval level variables that were found to be significant at the .05 level were then further analyzed by conducting a Post Hoc Tukey test on the ANOVA results (Tables 2, 4-6).

Table 4. Post Hoc Tukey Test Results for Drought Perception Variables.

Mean of Variables as a Function of Clusters

	Clusters											
	GW_HB			GW			HB			Neither		
	N	Mean	SD	N	Mean	SD	N	Mean	SD	N	Mean	SD
Drought Peeception												
How severe is this drought compared to previous Texas droughts	44	5.93_{a}	1.13	48	5.08_{b}	1.53	41	5.59_{ab}	1.32	140	5.27_{b}	1.33
Local Water Supply Concern	44	5.48_{a}	1.36	48	5.02_{ab}	1.58	41	5.02_{ab}	1.56	140	4.50_{b}	1.60

Note. Means in a row sharing subscripts are not significantly different at the .05 level based on a Tukey's post hoc test.
There was no statistical significance found at the .05 level between the mean drought intensity or municipality effectiveness.

The GW_HB cluster has lived at their current residence significantly longer on average than any other cluster (Table 2). The GW_HB cluster thought the 2011 drought was significantly worse than either the GW or Neither clusters, and they were significantly more concerned about their local water supplies than the Neither cluster (Table 4). They differed significantly in their environmental and purchasing attitudes from the Neither cluster in all cases except one (Tables 5 & 6). The GW_HB cluster disagreed with the statement, "environmental issues should be dealt with by future generations", significantly more than any other cluster (Table 5).

Table 5. Post Hoc Tukey Test Results for Environmental Attitude Variables.

Mean of Variables as a Function of Clusters

	Clusters											
	GW_HB			GW			HB			Neither		
	N	Mean	SD	N	Mean	SD	N	Mean	SD	N	Mean	SE
Environmental Attitudes												
Each individual can contribute to a better environment	44	4.66 $_{a}$	0.57	48	4.33 $_{ab}$	0.72	41	4.37 $_{ab}$	0.77	140	4.07 $_{b}$	0.79
Environmental impacts are frequently overstated	44	2.00 $_{b}$	0.78	48	2.75 $_{ad}$	0.89	41	3.54 $_{ac}$	1.08	140	3.35 $_{ac}$	0.99
Environmental issues should be dealt with primarily by future generations	44	1.43 $_{b}$	0.73	48	2.27 $_{a}$	1.01	41	3.54 $_{a}$	1.08	140	3.35 $_{a}$	0.99
My own personal actions can have an effect on current and/or future drought conditions	44	4.23 $_{a}$	0.80	48	3.81 $_{ab}$	0.76	41	3.93 $_{ab}$	0.96	140	3.54 $_{b}$	0.91

Note. Means in a row sharing subscripts are not significantly different at the .05 level based on a Tukey's post hoc test.
There was no significant statistical difference found at teh .05 level between the mean response to 'environmental issues will be resolved primarily through technological progress' or 'policies intriduced by the government to address environmental issues should not cost me money'

Table 6. Post Hoc Tukey Test Results for Purchasing Attitude Variables.

Mean of Variables as a Function of Clusters

	Clusters											
	GW_HB			GW			HB			Neither		
	N	Mean	SD	N	Mean	SD	N	Mean	SD	N	Mean	SE
Purchasing Attitudes												
I purposefully select products that let me conserve water and/or energy	44	3.84 $_{a}$	0.94	48	3.44 $_{ab}$	0.94	41	3.46 $_{ab}$	1.08	140	3.31 $_{b}$	0.99
I try to limit my use of water and/or energy when performing household tasks	44	4.11 $_{ab}$	0.72	48	4.15 $_{a}$	0.68	41	4.10 $_{ab}$	0.70	140	3.82 $_{b}$	0.70
People should consider the amount of water and energy that will be required to maintain the clothes they purchase	44	3.70 $_{a}$	0.80	48	3.25 $_{ab}$	0.96	41	3.51 $_{ab}$	1.03	140	3.24 $_{b}$	0.92
People should consider the amount of water and/or energy that will be consumed to maintain the things they purchase	44	4.14 $_{a}$	0.63	48	3.96 $_{a}$	0.71	41	4.02 $_{a}$	0.79	140	3.60 $_{b}$	0.90
People should consider the amount of water that will be consumed when they buy plants/landscaping	44	4.23 $_{a}$	0.68	48	3.98 $_{ab}$	0.70	41	4.12 $_{a}$	0.78	140	3.75 $_{b}$	0.79

Note. Means in a row sharing subscripts are not significantly different at the .05 level based on a Tukey's post hoc test.
There was no significant statistical difference found at the .05 level between the mean response to the questions 'I purposefully select plants/landscapping that allow me to conserve water'or 'I purposefully select products that allow me to conserve water and/or energy'

The GW cluster's mean income and residence size were significantly less than the Neither cluster's, and they had significantly less education than the HB cluster (Table 2). Significantly less of the GW cluster own their current residence, while significantly more of the Neither cluster own their current residence compared to the other clusters (Table 3). The HB cluster had significantly younger homes on average than the Neither cluster (Table 4). The GW cluster has resided at their current residence significantly less time than any of the other clusters, and agreed significantly more than the Neither cluster with

the statement, “I try to limit my use of water and or energy when performing household tasks” (Table 2 & 6).

Discussion

The results indicate that the four clusters are in fact distinct groups with different opinions and attitudes toward what constitutes human behavior and how environmental issues should be handled. The GW_HB cluster appears to be of the mindset that action should be taken now to combat environmental issues and that an individual’s actions do matter. This cluster also felt that the 2011 Texas drought was the result of a complex set of variables including both natural causes and human activities.

The GW cluster appears to be of the mindset that the 2011 Texas drought was not that much worse than any previous drought and that it was caused mainly by natural causes. The lower levels of income, education and residence ownership of the GW cluster may indicate that this cluster is simply not as vested in environmental issues due to other concerns. It is likely that this cluster tries to limit their energy and /or water use while performing household tasks more out of concern for costs than environmental degradation. This provides useful insight into how to develop an investment on this cluster’s part when it comes to environmental issues and mitigating the effects of CC. The GW cluster may establish a greater commitment to conservation practices if the long term and short term costs of CC and its effects are explained in terms that address their household economics.

Both the GW and HB clusters exhibited the same pattern; they sided with the GW_HB cluster on certain issues and with the Neither cluster on other issues. The HB cluster is significantly younger and has significantly higher levels of education. Given its demographics, it is possible that the HB cluster is similarly focused on issues other than

the environment such as education or potentially student loans. The HB cluster agrees significantly more than the GW_HB cluster that environmental impacts are frequently overstated and that environmental issues should be primarily by future generation. However, this cluster also agrees significantly more than the Neither cluster that people should consider the amount of energy and/or energy they use when making purchases or landscaping. The HB cluster may appear to feel that they themselves cannot contribute to CC mitigation or intensification, and so campaigns should focus on the importance of individual action when addressing this cluster.

The Neither cluster, while demographically not that different from the GW_HB cluster, is almost the polar opposite of the GW_HB cluster on every other issue. This cluster represents slightly more than half of the sample, and thinks that neither global warming nor human activities contributed to the 2011 Texas drought. This cluster does not think that individual actions have an impact, and does not appear to be vested in environmental issues.

Conclusion

With nearly half of a random sample of Texas consumers indicating that they think global warming and/or human activities contributed to the 2011 drought, it would appear that the discussion can and should move forward. While the other half of the population may be unwilling to admit the impacts of human activities on the environment, waiting for the entire population to come to a consensus is time wasted. Municipalities need to establish more stringent regulations for residential water use to ensure continued water availability in the parched regions of the United States as CC continues to diminish available water resources. This study reveals that a sizable chunk

of the population is concerned enough to take individual action, while an additional third of the population is open to the idea that human activities and/or CC has a real and dangerous effect on climate resulting in severe weather events such as the 2011 Texas drought. It is time to stop trying to convince those who have no interest in being convinced and focus on the part of the population that is open to addressing the impacts of global warming/climate change.

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CHAPTER II

HOUSEHOLD & DROUGHT BEHAVIORS: THE ROLE OF ENVIRONMENTAL CONCERN AND PERCIEVED CONSUMER EFFECTIVENESS

Introduction

Research on residential water use often focuses on a particular area, activity, or appliance in the household. While these studies have highlighted particular issues related to household water conservation, it may be better to view water use as a system to create a more holistic picture of residential water use. Households use water for a variety of purposes in a variety of ways, and while water conservation measures may be in place in one part of the household water system that does not dictate that they are used throughout the entire system. Specifically water conservation in the home through the use of water efficient appliances and practices may not extend outside of the home to yards or lawns.

Environmental attitudes have begun to receive increased attention in the literature as an important factor related to consumer behavior. Whether or not consumer behavior differs according to varying environmental attitudes is an area of debate. Of particular interest is what specific environmental attitudes have an effect on consumer behavior and why. As environmental issues continue to increase in complexity and severity, the importance of sustainable resource consumption has been identified as a key component to combating environmental degradation and climate change (CC). While this is often discussed on a global and national scale, it also holds true at the household level.

Sustainable household water use is an essential part of achieving global water sustainability.

Literature Review

Less than 1% of the world's fresh water resources are readily available for human use and consumption (Solomon, 2010). This limited amount of water provides for all human life on Earth. In today's modern world, many if not all manufacturing and industrial practices are also dependent on the availability of fresh water resources (Bozzo, 2008; Solomon, 2010). Not just life but the quality of life enjoyed, especially that which has become common place in the Western world, is dependent on a small finite amount of fresh water (Bozzo, 2008; Solomon, 2010). Luckily, water is a self-renewing resource; since water tends to evaporate and precipitate in a purified form, the processes of evaporation and precipitation purify and desalinate water. Evaporation and precipitation fuel the restoration of ecosystems and sustain human life through the Earth's continuous water cycle. While the amount of fresh water available for human use and consumption is remarkably small, it has remained constant over the course of human history (Solomon, 2010). Today mounting water scarcity due to pollution, growing populations, and global markets has brought into question the continued reliability of existing fresh water resources (Bozzo, 2008; Chen, Gillig, & McCarl, 2001; Jorgensen, Graymore, & O'Toole, 2009; Sun, McNulty, Myers, & Cohen, 2008; Wurbs, 2005).

Industrial pollution, including pollution from industrial agriculture, has already contaminated much of the worlds' fresh water, and continues to do so at an alarming rate as the world continues to industrialize, especially in the global South (Bozzo, 2008). This industrial pollution forces water suppliers to invest in technology to remove

pollutants from the water before it can be delivered to the consumer, increasing pollution means increasing investment (Dalhuisen, de Groot, & Nijkamp, 1999). Drought increases the need for these water 'production' technologies; decreased water levels result in higher concentrations of pollutants further stressing water resources. It is not surprising that the most robust water conservation programs occur as a result of drought mitigation, as drought events place an extreme amount of stress on water resources. With the increasing effects of CC, severe drought events will begin to plague many parts of the globe, including the Southwestern United States (Chen et al., 2001; Sun et al., 2008). As the effects of CC increase so too will the vulnerability of water resources, and ensuring the availability of clean water to a growing population will become an ever more difficult task (Chen et al., 2001; Jorgensen et al., 2009; Sun et al., 2008; Wurbs, 2005).

Demand Side Strategies

Demand side strategies or demand side management (DSM) consists of those strategies that attempt to limit the amount of water that consumers use or demand. They have had an increasingly prominent role in water resource management since roughly the end of the 1960's (Nauges & Thomas, 2003). DSM is a necessary and important part of water resource management, mainly because the amount of available fresh water is at best constant, so as population growth continues to expand all over the globe the amount of water available for each person decreases. This means that for every additional person, each person must use less water in order to maintain the reliability of water resources. Stated more simply, increased population with no increase in water resources requires less water use per capita. DSM consists of both price and non-price strategies (Kenney, Goemans, Klein, Lowery, & Reidy, 2008). Price strategies consist of different

price structures such as flat rate billing, metered billing, or increasing block rate (IBR) billing. Non-price strategies are numerous and often geographically specific, but they can be broken up into three main categories: restrictions, technology, and education (Kenney et al., 2008).

Pricing strategies have been extensively reviewed by the available literature, but a consistent conclusion as to the best pricing strategy remains elusive (Dalhuisen, Florax, de Groot, & Nijkamp, 2003). In a 2008 review of the relevant literature on household water demand, Ferrara (2008) found that IBRs were an effective pricing strategy. This was due to the fact that simply increasing the price of water resulted in little change in demand until a certain threshold was reached (Ferrara, 2008). In a study conducted by Kenney et al. (2008), price was found to be an effective deterrent of water use, especially among high water users. In the same study IBRs were found to produce a 5% larger decrease in water demand than uniform pricing (Kenney et al., 2008). A study conducted by the OECD in 2011 reported that any charge for water, regardless of the type of pricing strategy, produced a reduction in water demand. The same study also found that metered water pricing created a larger decrease in demand than flat rate billing (OECD, 2011). The OECD (2011) study also reported that water pricing strategies, regardless of type, increased the adoption of water conservation behaviors and investments. While the literature points to the effectiveness of pricing strategies, several studies report that consumer awareness of water pricing and water consumption is limited (Dalhuisen et al., 1999; Miller & Buys, 2008; Nieswiadomy & Molin, 1989; OECD, 2011). Some studies also found that providing information about water pricing and consumption in the form of either education or water smart readers (WSR) decreased water demand (Ferrara, 2008;

Gaudin, 2006; OECD, 2011). In contradiction, one study found that WSRs in conjunction with IRBs increased household water demand by 16%, as WSRs allowed consumers to effectively use the most water while still remaining in the lower blocks of the pricing system (Kenney et al., 2008). In this instance, less information appears to have resulted in less water demand due to consumers erring on the side of caution (Kenney et al., 2008).

Most of the literature recommends a combination of price and non-price strategies as the best option for DSM, but one study by Nauges & Thomas (2000) found that "…residential [water] demand appears poorly sensitive to variations in price" (p. 84), and recommends specifically non-price strategies as the best DSM option. Restrictions as a non-price demand side strategy have been found to be twice as successful as pricing strategies in certain instances (Kenney et al., 2008). Renwick and Archibald (1998) found restrictions to be more effective than voluntary water conservation practices, and Ferrara (2008) confirmed this to be a trend among the current literature.

The promotion of investment in technology to conserve water, such as low flow toilets and water efficient washing machines, has been consistently shown to reduce water demand (Ferrara, 2008; Lam, 2006; OECD, 2011; Reinwick & Archibald, 1998; Rockaway, Coomes, Rivard, & Kornstein, 2011). Kenney et al. (2008) found that a rebate program resulted in a ten percent reduction in consumer water demand. A study done in 2011 found that the drivers of declining water demand were largely "a combination of changing household demographics and increased household efficiency, rather than active conservation or education programs" (Rockaway et al., 2011, p. 77), specifically decreasing household size and increased appliance standards. This same

study cautioned that these factors may not be a successful means of reducing water use in the future, because there is a limit to both how small a family can be and how efficient an appliance can become (Rockaway et al., 2011). While Rockaway et al. (2011) concluded that the bulk of decreased water demand was likely not the result of educational campaigns, the study also suggests that in the future strategies other than technological advancement will be necessary to decrease water demand. The study conducted by Kenney et al. (2008) suggests that consumers are more sensitive to price increases during drought events due to media coverage and public education, suggesting that education may indeed be a beneficial DSM tool.

Determinants of Consumer Water Use

Determining which demand side strategies will be most effective requires an understanding of what factors affect consumer water use. The amount of variation between studies about what factors are and are not significant makes this quite a difficult undertaking. In Ferrara's (2008) review of the literature on the determinants of residential water demand, income was identified as a consistently significant factor, but the review found that the significance of most other factors was inconclusive across multiple studies. A review of more recent literature discovers no new exception to Ida Ferrara's findings (2008). Factors that have been found to be significant in at least one study include consumer age, number of household members, size and type of house, lawn size, and local recent temperatures and precipitation (Ferrara, 2008; Kenney et al., 2008; Lam, 2006; OECD, 2011). Two other factors that continue to be given special treatment by the literature are those of consumer trust and environmental attitudes, likely due to their complexity.

Jorgensen et al. (2009) identifies the public's perception of trust to be an important factor in determining the success with which DSM decreased consumer water demand, advocating that water corporations develop a "climate of trust" (p. 234) as part of their DSM. The OECD (2011) similarly found that consumers' trust in their governments was an important factor in determining how much consumers were willing to pay for improved water quality. Of course there would be little incentive to pay for better water quality if consumers did not believe their governments would actually use the money to increase water quality. Similarly there is little reason to conserve water if consumers believe that no one else is conserving water; in fact there may be an incentive to use more water when consumers do no trust that everyone is conserving water. If a consumer believes that their neighbors are using all the water they want to, then to not use water would be foolish, as they are simply hindering their water use to the neighbors' benefits (Hardin, 1968). Therefore an atmosphere of trust that both the community and water authorities/municipalities are also making an effort to conserve water may be an integral part to the success of any DSM program.

Environmental attitudes are usually found to be non-significant factors affecting consumer water demand (Miller & Buys, 2008; OECD, 2011). One explanation for environmental attitudes having a non-significant effect on consumer water demand comes from Miller & Buys (2008). They suggest that this lack of significance indicates that consumers are not always aware of the amount of water their everyday behaviors consume (Miller & Buys, 2008). Consumers are likely to be concerned about the continued availability of water resources and want to conserve water, especially in climates where water availability is a prevailing issue. However, without the proper

information, people may be blissfully unaware of how much water their simple day-to-day activities require and/or waste (Miller & Buys, 2008).

While environmental attitudes as a single factor have been found lacking in significance, specific environmental attitudes have been shown to be significant components of consumer behavior. Specifically perceived consumer effectiveness (PCE) and environmental concern are two environmental attitudes that have garnered increasing attention in the literature. PCE was first conceptualized in 1974 as "a measure of the extent to which a respondent believes that an individual consumer can be effective…" (Kinnear, Taylor, & Ahmed, 1974, p. 21), and has since been considered a distinctly independent concept from environmental concern (Ellen, Wiener, & Cobb-Walgren, 1991). While environmental concern has had mixed results as a determinant of consumer behavior according to the literature, PCE has been shown time and time again to be an important factor effecting consumer behavior (Ellen et al. 1991; Kinnear et al., 1974; Mainieri, Barnett, Valdero, Unipan, & Oskamp, 1997; Roberts, 1995; Roberts, 1996; Straughan & Roberts, 1999; Tan & Lau, 2011; Thorgersen, 1999;). It has also been suggested that the moderating factor between consumers' environmental concerns and behaviors is their level of PCE (Berger & Corbin, 1992; Tan, 2011).

Sustainable Water Use

Several water companies in England during the 2006 drought were concerned that "restrictions might normalize drought and therefore weaken household responsiveness when really needed" (Medd & Chappells, 2007, p. 236). This reflects the attitude that water conservation is about drought mitigation, not sustainable water use. The question

then is whether DSM designed to mitigate drought effects is appropriate for promoting sustainable water use.

Following a period of drought in the 1980's, the French government decided that water should be priced at its full cost (Nauges & Thomas, 2003). This has resulted in steep increases in water prices in France since the 1990's, but consumers have still been slow to change their behaviors (Nauges & Thomas, 2003). As Rockaway et al. (2011) points out, most of the decreased water demand in the United States is due to technological advances. This indicates that even with rising water prices, people may be loath to change their water usage behaviors. There is hope provided by Luzzar & Cosse (1998) and the OECD report published in 2011 that point to a lack of awareness rather than a resistance to change as the reason for the lack of water conservation behaviors. Despite the slow consumer response, full cost pricing has been advocated as a necessary measure of generating sustainable water use (Bithas, 2008). The reason behind full cost pricing is that most consumers pay such a small fraction of their income on water, .5-1%, that there is little incentive for consumers to conserve water (Bithas, 2008). If consumers had to pay for the full cost of their water, i.e. the filtration, transportation, etc., they would be more inclined to use it sparingly and efficiently (Bithas, 2008).

Of course this would place a burden on poorer households, who theoretically could neither afford the full cost of water nor the cost of more efficient water technology to limit their water costs (Bithas, 2008; Dalhuisen et al., 1999). The counter argument is made by Bitahs (2008) that the low percentage of income spent on water "makes efficient use [of water] less sensitive to different allocations of income and wealth" (p. 223). Thus the appropriate way to "guarantee sustainable use of water" is to consider it as an

economic good that should be priced according to its full cost (Bithas, 2008; Dalhuisen, 1999, p. 2). In the developed world where most consumers already pay a monthly water bill and yet remain unaware of the cost or amount of their water use, full cost pricing may be a painful but effective way of educating consumers about the value and importance of their water resources (Dalhuisen et al., 1999; Miller & Buys, 2008; Nieswiadomy & Molin, 1989; OECD, 2011).

In Texas where many utilities & municipalities already charge the full cost of water, water conservation continues to be a struggle. This highlights the importance that non-price DSM strategies play in mitigating water use and changing consumer behavior. If people do not understand why they are being charged more for their water use and remain unaware of the value and importance of their water resources, full cost pricing alone may not be an effective means of water conservation. Further the implementation of full cost pricing for some and not others can result in merely fostering feelings of resentment and bitterness between consumers and policy makers/water managers.

Household Water Sustainability

As increasing amounts of water are being reallocated to meet growing population demands, residential water use has become an important component of water conservation and sustainability for policy makers (OECD, 2011; Schoolmaster, 1984). A review of the literature reveals dishwashers and washing machines as important contributors to the amount of water a household uses (Berkholz, Stamminger, Wnuk, Owens, & Bernarde, 2010; GilleBen, Berkholz, & Stamminger, 2012; Hustvedt, 2011; Hustvedt, Ahn, & Emmel, 2012; Richter, 2010; Richter, 2011). While water efficient appliances and household activities such as laundering and dishwashing have been the

focus of much research, there appear to be few studies that look at watering the lawn as a household activity.

Lawns have been identified as an important component of culture in the United States, and lawn care is an ever growing multi-billion dollar industry (Bormann, Balmori, & Geballe, 1993; Jackson, 1985; Jenkins, 1994; Teyssot, 1999; Weigert, 1994). The cultural importance of the "American Lawn" dates back to the English roots of North America (Bormann et al., 1993; Jenkins, 1994; O'Malley, 1999). As such a long standing part of United States history and culture, the lawn and what constitutes an appropriate and pleasing lawn aesthetic has become a deep-rooted part of social norms. Thus changing behaviors related to lawns and lawn care may be an even more difficult task than changing consumer behavior normally is, as the best predictor of behavior is past behavior (Ajzen & Fishbein, 1975). The lawn is such an engrained part of United States culture, that when the suburban "American Dream" is referred to as a house with a white picket fence the lawn is not even mentioned. It is taken for granted that the white picket fence is surrounding a lush green, neatly manicured lawn; no verbalization is needed to convey the image of the lawn in people's the minds. It seems that despite the importance that most households place on having a lush green lawn, the activity of watering the lawn has gone overlooked as a part of the household water system. While common sense dictates that those who have lawns will use more water, lawn watering is potentially overlooked by both researchers and households as an important component to water conservation (Wahlen, 2011; Weigert, 1994).

Most drought contingency plans require the restriction or elimination of lawn watering. While these restrictions, especially mandatory ones, have been presented as

effective means of limiting water use, little else is discussed on the matter of limiting outdoor water use despite its identification as a major source of residential water use (Kenney, Klein, & Clark, 2004; Wahlen, 2011). Some sources state that nearly a third of residential water use is allocated to outdoor purposes, and lawn irrigation has been listed as one of the predominate two uses of water by homeowners (Gato-Trinidad, Jayasuriya, & Roberts, 2011; Hermitte & Mace, 2012; Jacobs & Haarhoff, 2007). Despite the fact that many landscapes only require twice weekly watering to be maintained, lawn care appears to continue to drain local water resources (Kenney et al., 2004). During the 2011 Texas drought, that occurred during the single hottest and driest year in the state's recorded history, outdoor water use exceeded average water use for the last decade, but was not higher than other years as a percentage of household water use (Hermitte & Mace, 2012). These findings highlight how watering the lawn may go overlooked as part of the daily household routine, as the amount of water allocated to outdoor use is apparently uninfluenced by environmental factors. The lawn gets watered regardless of whether it needs to be and regardless of whether it should be.

One of the reasons that outdoor water use in regards to the lawn accounts for such a large portion of household water use may be the lack of technological innovations. Water efficient appliances have been increasing implemented in modern homes due in part to the emphasis that consumer researchers and the Department of Energy (DOE) has placed on developing and instituting water efficient appliances as part of adopting sustainable consumer behaviors (Berkholz et al., 2010; GilleBen et al., 2012; Heiskanen, Kasanen, & Timonen, 2005; Hustvedt, 2011; Hustvedt et al., 2012; Richter, 2010; Richter, 2011). Water efficient technology is lacking in lawn care, potentially because

outdoor water use does not require heated water and is thus neglected as an opportunity to reduce resource consumption.

Technology that does exist to limit the amount of water needed to maintain a healthy and aesthetically pleasing lawn seems to go unnoticed, as in the case of soil moisture sensors offered by Toro (The Toro Company, 2012). The XTRA SMART Precision Soil Moisture Sensor offered by Toro trigger automatic sprinkler systems only when the lawn requires more water, preventing over watering and unnecessary water use (The Toro Company, 2012). These soil moisture sensors are less money (selling for a little more than a hundred dollars on Amazon.com) than many of the water efficient appliances available for in the home, but they do require an underground sprinkler system (Amazon.com, Inc., 2013). While the dissemination of new technologies takes time, the seeming lack of communication about this lawn tech may imply that while innovations are being made in water efficient lawn technology they are going unnoticed by consumers (Rogers, 1995).

One area of water efficient lawn "technology" that has received some focus is xeriscaping. The amount of research available on the topic is not overwhelming, and suggests that many households invest in xeriscaping for aesthetic rather than water conservation purposes (Smith & Patrick, 2011). Technological advances in lawn care have been mainly in the form of grooming appliances such as mowers, seed spreaders, pesticide sprayers, and the like. Unfortunately these technologies have only served to worsen water scarcity, as they fail to address the issue of water use and the increased use of pesticides, herbicides, and fertilizers continue to decrease water quality (Bormann et al, 1993; Haith, 2011; Jenkins, 1994; Jenkins, 1999; Weigert, 1994; Whitney, 2010).

More efficient technologies may not result in changed consumer behavior, as they merely allow resources to be stretched further, but the adoption of water efficient technologies does appear to be part of the behavioral wedge on the path to water sustainability (Dietz, Gardner, Gilligan, Stern, & Vandenbergh, 2009; Shove & Chappells, 2001). Those who adopt or invest in water efficient appliances and technologies must at the very least become aware of the fact that certain household practices require less water than others, and so this may serve as the first step in changing consumer water use behavior. New technologies diffuse through a population over a period of time and similarly daily domestic activities change slowly over time, but the importance of household actions in mitigating the effects of CC requires steps be taken to quicken these processes (Dietz et al., 2009; Goldsmith & Goldsmith, 2011; Hustvedt et al., 2012; Rogers, 1995; Wahlen, 2011).

Materials & Methods

Variables

The variables used to measure the sample demographics were replicated directly from a questionnaire that was used to create an Organization for Economic Co-operation and Development (OECD) report, *Greening Household Behavior: The Role of Public Policy.* The OECD report contained household information for ten different OECD countries, and the questionnaire used to obtain the data was published as part of the report. The questionnaire provided an easily accessible source of variables related to household water use and the report itself established an international baseline to which Texas households could be compared. Additional household characteristics were obtained by using variables from the OECD questionnaire and by creating a set of

frequency variables that looked at the number of times water use behaviors were taken part in, such as the number of baths per week. The number and type of bathrooms and bathroom fixtures present in the household was also asked of each respondent to attain a better picture of the amount of water use in the home, and to determine if households that have more sinks, baths, etc. but are otherwise the same size and square footage consumer more water than those with less of these fixtures.

Water conservation behaviors were measured using a variety of variables that were divided into groups by the specific area of the house in which the behaviors would normally occur. Lawn behavior variables were developed with the help of Dr. Tina Cade, a professor in the Department of Agriculture at Texas State University-San Marcos. These behavior variables included how frequently and for how long respondent watered their lawns. Additionally a series of variables ascertained what types of features were part of the respondents' lawns. Lawn features were assessed as being either present or absent included and included a large list of common lawn aspects such as grass, paved areas, flower gardens, etc. These lawn feature questions helped to ascertain the type and style of lawn respondents had, with particular interest paid to the amount of water that would be needed to maintain the lawn. For instance, lawns with fruit trees and vegetables gardens would require more water to maintain than those that did not have these feature, while lawns that had drought resistant grasses and shrubs would require less water to maintain than others. Water conservation behavior in the home was divided into two main areas, the kitchen and the bathroom. Variables that addressed water conservation in the home rated participation in particular water conservation behaviors on a scale of Never to Always (1=Never, Always=4).

Investment in water conservation was measured as the presence or absence of specific water efficient appliances; these investment variables were created in consultation with faculty at Texas State University-San Marcos in the Department of Family and Consumer Science. To determine if participants had invested in water efficient appliance(s) since the beginning of the drought and whether or not they received an incentive to make their investment(s), the same set of investment variables were duplicated and modified. The water efficient appliances that were included in the analysis included water efficient washing machines, low volume or dual flush toilets, water flow restrictor taps/low flow shower heads, and rain water collection tanks.

Consumers' purchasing attitudes and behaviors were ascertained using seven variables that were developed with the help of Dr. Jiyun Kang, assistant professor in the Department of Family and Consumer Sciences at Texas State University (Table 7). These purchasing variables consisted of two sets of questions. Four variables measured the degree to which consumers considered water conservation when making their own purchases (Table 7). Three additional purchasing variables ranked the degree to which consumers felt that others should consider water conservation when making purchases (Table 7). All of the purchasing variables were scored on a 5-point Likert scale of (1=strongly disagree, 5=strongly agree) (Table 7).

A set of six variables pertaining to environmental attitudes were duplicated from the OECD questionnaire (Table 7). The environmental attitude variables were measured using a Likert scale, 1=strongly disagree to 5=strongly agree (Table 7). In addition to environmental attitudes, respondents' awareness and concern about the 2011 Texas drought were measure using two variables that were created based on information

relating directly to the 2011 drought and Texas' water supply system. The variable used to measure awareness of the 2011 Texas drought asked respondents how severe the 2011 drought was compared to previous Texas droughts on a Likert-type scale (1=Much better, 7=Much worse) and was labeled "Drought Severity". The variable labeled "Local Water Supply Concern" asked participants how concerned they were about the ability of their local water resources to continue providing water and was gauged on a 7-point Likert-type scale (1=Very Unconcerned, 7=Very Concerned).

Table 7. List of Environmental Attitudes and Purchasing Behaviors Variables.

#	Environmental Attitudes	Code
1	Environmental impacts are frequently overstated	Environ1
2	Environmental issues should be dealt primarily by future generations	Environ2
3	Environmental issues will be resolved primarily through technological progress	Environ3
4	Policies introduced by the government to address environmental issues should not cost me money	Environ4
5	Each individual can contribute to a better environment	Environ5
6	My own personal actions can have an effect on current and/or future drought conditions	Environ6

#	Purchasing Attitudes & Behaviors	Code
1	People should consider the amount of water and/or energy that will be consumed to maintain the things they purchase	Purch1
2	I purposefully select products that let me conserve water/or energy	Purch2
3	I try to limit my use of water and/or energy when performing household tasks	Purch3
4	People should consider the amount of water that will be consumed when they buy plants/landscaping	Purch4
5	I purposefully select plants/landscaping that allow me to conserve water	Purch5
6	People should consider the amount of water and/or energy that will be required to maintain the clothes they purchase	Purch6
7	I purposefully select clothing that allows me to conserve water and/or energy	Purch7

Survey

A random sample of 273 Texas consumers was purchased from Qualtrics, a survey research company, for the purpose of conducting an on-line survey. The on-line survey was created using Qualtrics software and distributed by Qualtrics. Access to the use of a computer including internet service was required to participate in the survey. As a result there was the chance for bias toward urban and suburban dwellers (72% of respondents), but 28% of participants still responded as living in rural or isolated settings. An on-line survey was chosen in lieu of more traditional methods based on its ability to allow for enhanced privacy and convenience to a readily accessible and diverse pool of respondents. This in turn allowed for a larger number of completed responses to be obtained in a shorter time period with a lessened chance of coding errors.

Results

Sample Demographics

The sample was comprised of slightly more females (36% males and 64% females) and had more people in the 45-65 age bracket (55%) than the Texas population (49.6% males, 50.4% females, 24.1% 45 to 65 yrs.) (U.S. Census Bureau, 2010). The average household size of the sample (3.01) was slightly larger than the average household size of Texas (2.78) (U.S. Census Bureau, 2010). The education level of the sample was comparable to that of the general Texas population with over half the sample having completed high school and/or received some college level education and 37% of the study sample having received a bachelor's degree or higher. This is compared to the general Texas population, of which 80% have graduated from high school and/or have some college level education and 25.8% have received a bachelor's degree or higher (U.S. Census Bureau, 2010). In Texas, the median and mean household income, based

on American Community 5-year estimates are $50,920.00 and $70,777.00 respectively; while 52% of the study sample make $47,500 a year or less and 42% have an annual income between $47,501 and $119,200 (U.S. Census Bureau, 2010). The bulk of the sample own their own home (63.7%) and live in a detached house (71%), while 19% live in apartments. Of the Texas population 63.7% own their residence, while 65.6% live in detached houses and 24.2% live in apartments (U.S. Census Bureau, 2010).

Household Characteristics

Over half the sample own their own home (65.2%), live in an urban setting (72.2%) and resided in a detached house or single home (72.5%). The bulk of the sample has a yard (80.6%) and is charged for their water (78.4%). Of the 80.6% who have a yard, 76.4% own their home, 82.7% are charged for their water, and 86.8% of those who have a yard live in a detached house. Within the 78.4% who are charged for water, 85% have a yard, 70.6% own their home, and 79.4% live in a detached house. 94.4% of those who own their home have a yard, 84.8% are charged for their water, and 92.1% of those who own their residence live in a detached house. Of the people who live in a detached house, 96.5% have yard, 82.8 own their detached home and 85.8% are charged for their water.

Behavior Variables

The variables that were used to measure the presence or absence of specific lawn features were used to create a "Xeriscaping" variable. The variable was created by combining three variables pertaining to lawn elements that suggested the respondent had incorporated some aspect of xeriscaping into their lawn. If the respondent answered that they had xeriscaping, and/or drought resistant grasses and/or shrubs they received a score

of 1; if the respondents answered that they had none of these features they received a score of 0. A score of one thus represented any attempt to incorporate a specific element of xeriscaping into the lawn, and a score of 0 indicated that no xeriscaping had been incorporated into the lawn. While lawns without these three specific elements may not necessarily be high water use lawns, they were not landscaped with the specific purpose of reducing water use in mind. Similarly just because a lawn had an aspect of xeriscaping incorporated into it does not necessitate that it is a low water use lawn, but it does demonstrate that the person was at least considering or trying to limit the amount of water their lawn required.

Water conservation behaviors in the home were split into two groups, based on whether these behaviors occurred in the kitchen or the bathroom, and from these two groups two new variables were created. The kitchen water conservation behavior variable was created by combining two variables, "I turn off the water while washing dishes" (1=Never, 4=Always) and "I plug the sink when washing the dishes" (1=Never, 4=Always); the resulting "Kitchen Behavior" variable had a mean of 2.89 (SD=1.18). The bathroom water conservation behavior, "Bathroom Behavior", variable was created by combing four variables that all had the same scale (1=Never, 4=Always). The variables used included how often respondent turned off the water while brushing their teeth, washing their hands, how often they took a shower instead of a bath specifically to save water, and how often they adjusted the toilet because it was running. The new "Bathroom Behavior" variable had a mean of 2.20 (SD=0.67). The seven purchasing attitudes and behaviors variables were considered to be measuring the same underlying variables, so they were combined into a single "Purchasing Behavior" variable

(1=Strongly Disagree, 5=Strongly Agree). The seven different variables all essentially asked the same questions is water conservation an important component when deciding to spend money on an item. The new "Purchasing Behavior" variable had a mean of 3.54 (SD=.67), indicating that on average the sample agreed that water conservation was an important component of making purchases.

The variables created to determine if households had invested in water efficient appliances were used to create one "Investment" variable. The "Investment" variable was created by combining the variables that measured presence or absence of a water efficient washing machine, low volume or dual flush toilet, low flow toilet and/or shower head, and/or a rainwater collection tank. (0=None, 4=Four investments). An "Investment-Date" variable was created in the same way, but combined those variables that asked if respondents had invested in any of the water efficient appliances since the start of the 2011 drought (0=None, 4=Four investments). A third "Investment-Incentive" variable was created by combining the variables that asked if respondents had received an incentive to invest in any of their water efficient appliances (0=None, 4=Incentives).

Chi-square Analysis

Chi-square analysis confirmed previously suspected relationships between household characteristics in the sample. Based on Chi-square results, significantly more people who own their residence have yards, as do those who live in detached houses and are charged for their water (Table 8). Significantly more of those who have detached houses own their residence and are charged for water, while significantly more of those who live in urban areas are charged for water (Table 8). These results were used to split the sample into groups based on whether or not they had to pay for their water use and

their yard and ownership status to determine if household water use and water conservation behaviors varied significantly among household types.

Table 8. Chi-square Analysis of Binomial Demographic Variables.

Chi-square results

		Yard	**No Yard**	
		n = 178	n = 95	χ^2
Ownership	n = 178	168	10	62.23 ***
Single Home	n = 198	191	7	116.15 ***
Charged	n = 214	182	32	6.33 *
Urban	n = 197	155	42	1.64
		Own	**Do Not Own**	
		n = 95	n = 178	$\chi 2$
Single Home	n = 198	34	164	98.70 ***
Charged	n = 214	63	151	3.02
Urban	n = 197	74	123	2.38
		Single Home	**Other**	
		n = 198	n = 75	χ^2
Charged	n = 214	170	44	8.49 **
Urban	n = 197	140	57	0.76
		Urban	**Rural**	
		n = 197	n = 76	χ^2
Charged	n = 214	162	52	12.85 ***

* p-value $\leq$ .05 ** p-value $\leq$ .01 *** p-value $\leq$ .001

Household Characteristics as Drivers of Consumer Behavior

To determine if having to pay for water is a driving force in household water use, the sample was divided into two groups: those who are charged for their water (Charged, n=214) and those who are not (Not Charged, n=26). Independent T-tests were conducted to analyze if there were any significant differences between the demographics, household characteristics, water conservation behaviors and investments, and/or environmental attitudes (Table 9 & 10). People who are charged for water have significantly larger

incomes and yards, and have lived in Texas significantly longer (Table 9). Those who are charged for water also shower significantly more often and wash dishes significantly less often (Table 9). There was no significant difference in water conservation behaviors pertaining to kitchen, bathroom, purchasing behaviors between those who are charged for water and those who are not (Table 10). Those who are charged for their water have invested in water efficient appliances significantly more since the start of the 2011 Texas drought and have used incentives significantly more to make their investments (Table 10). The only significant difference in environmental attitudes between those who are charged for their water use and those who are not charged, was that those who are charged agreed significantly more with the statement that "Policies introduced by the government to address environmental issues should not cost me money" (Environ4) (Table 10).

Table 9. Independent T-test Results for Demographic and Water Use Variables.

Difference of the means for water charged.

	Water Charge		No Water Charge			
	Mean	*SD*	Mean	*SD*	d*f*	t
Demographics & Characteristics						
Age	5.06	1.46	4.85	1.62	238	-0.69
Education	3.23	0.97	3.15	1.01	238	-0.40
Income	6.16	3.32	3.62	3.06	238	-3.72 ***
Household Size	2.72	1.38	2.35	1.23	237	-1.33
Residence Size	4.20	1.20	3.27	1.40	238	-3.67
Yard Size	3.08	1.81	3.53	2.43	197	0.95 *
Home Age	3.29	1.36	2.92	1.38	238	-1.30
Years Lived in Home	2.73	0.99	2.31	1.12	238	-2.02
Years Lived in Texas	3.67	0.70	3.31	1.05	238	-2.34 **
Number of Full Baths	1.99	0.14	0.57	0.11	238	-1.64
Number of Half Baths	1.39	0.10	0.45	0.09	238	-0.62
Number of Shower Stalls	2.12	0.15	0.68	0.13	238	-0.41
Number of Tubs	2.09	0.15	0.78	0.15	238	-1.32
Number of Sinks	2.33	0.16	1.07	0.21	238	-1.68
Monthly Water Use	5.79	3.88	7.08	3.85	238	1.61
Showers per week	7.95	4.58	6.08	4.01	238	-1.99 *
Baths per week	2.82	3.92	2.62	3.58	238	-2.51
Dishwashing episodes per week	8.18	5.08	5.96	4.27	238	-2.14 *

*p-value < .05. **p-value < .01. ***p-value <.001.

[a] equal variances not assumed

Table 10. Independent T-test Results for Water Conservation Behaviors & Environmental Attitudes.

Difference of the means for water charged.

	Water Charge		No Water Charge		
	Mean	*SD*	Mean	*SD*	t
Behaviors and Attitudes					
Kitchen Water Behavior	6.09	1.98	6.62	2.30	1.26
Bathroom Water Behavior	10.93	2.91	11.15	3.71	0.37
Purchasing Behaviors	25.00	4.69	24.12	4.39	-0.92
Investment	0.78	0.94	0.58	0.76	1.25
Investment-Date	0.54	0.65	0.46	0.58	0.79 *
Investment-Incentive	0.50	0.57	0.35	0.49	4.70 *
Drought Severity	5.48	1.33	5.27	1.22	-0.77
Local Water Supply Concern	4.83	1.63	4.85	1.52	0.06
Environ1	3.07	1.11	3.42	0.90	1.56
Environ2	2.13	1.09	2.27	1.22	0.60
Environ3	3.15	0.90	2.96	0.92	-1.03
Environ4	3.73	0.92	3.27	0.92	-2.41 *
Environ5	4.28	0.76	4.31	0.68	0.18
Environ6	3.82	0.90	3.50	1.03	-1.70

*p-value < .05. **p-value < .01. ***p-value <.001.

[a] equal variances not assumed

The sample was then split into groups based on household types, specifically the groups were determined by whether or not respondents had a yard and whether or not they owned their residence. This created four groups, those who have a yard and own their residence (Yard_Own, n = 168), those who have a yard and do not own their residence (Yard, n = 52), those who do not have a yard but do own their residence (Own, n = 43), and those who neither have a yard nor own their residence (None, n = 10).

Analysis of Variance (ANOVA) tests with Post hoc Tukey tests were then conducted to see if there were any significant differences between the demographics, characteristics, behaviors, investments and/or attitudes of the four household types (Table 11).

The Yard_Own group are significantly older, more educated, and wealthier; they also live in significantly larger and older homes with significantly more baths and sinks and they have lived in their current residencies significantly longer (Table 11). The Yard_Only group thought the 2011 drought was significantly worse compared to previous Texas droughts than the None group. Potentially the Yard_Only group's awareness of the drought is a result of their higher level of education, but this group did not participate in water conservation behaviors significantly more or less than other groups despite their higher levels of education and awarness. The Yard_Only group did agree with making purchases that help conserve water/energy significantly more than the None group; this is possibly an effect of the Yard_Only group having more available income to make such purchases (Table 11). There was no significant difference found amongst environmental attitudes between the four groups.

Table 11. Post Hoc Tukey Results for Yard/Ownership Groups.

Mean of Variables as a Function of Yard/Ownership Groups

	Groups											
	Yard_Own			Yard			None			Own		
	N	Mean	*SD*	*N*	Mean	*SD*	*N*	Mean	*SD*	*N*	Mean	*SD*
Demographics												
Age	168	5.24 $_{a}$	1.33	52	4.50 $_{b}$	1.65	43	4.35 $_{b}$	1.41	10	5.3 $_{ab}$	1.49
Education	168	3.30 $_{a}$	0.98	52	2.96 $_{ab}$	0.93	43	3.26 $_{ab}$	0.95	10	2.50 $_{b}$	0.85
Income	168	6.63 $_{a}$	3.33	52	4.44 $_{b*}$	3.09	43	4.77 $_{bc}$	3.29	10	4.50 $_{abc}$	3.75
Residence Size	168	4.50 $_{a}$	1.12	52	3.58 $_{b}$	1.21	43	3.16 $_{b}$	1.00	10	2.60 $_{b}$	1.35
Home Age	168	3.11 $_{a}$	1.19	52	4.10 $_{b}$	1.84	43	3.49 $_{ab}$	1.92	10	2.90 $_{ab}$	1.85
Years Lived in Home	168	3.01 $_{b}$	0.89	52	2.15 $_{a*}$	0.92	43	1.65 $_{c}$	0.81	10	2.00 $_{bc}$	1.16
Years Lived in Texas	168	3.73 $_{a}$	0.62	52	3.48 $_{ab}$	0.92	43	3.14 $_{b}$	1.15	10	3.10 $_{ab}$	0.99
Number of Full Baths	168	2.24 $_{a}$	2.33	52	1.58 $_{ab}$	2.33	43	1.40 $_{b}$	0.54	10	1.40 $_{ab}$	0.52
Number of Tubs (p= .49)	168	1.95	2.66	52	1.19	0.79	43	1.28	0.59	10	1.00	0.67
Number of Sinks	168	3.99 $_{a}$	2.75	52	2.83 $_{b}$	1.23	43	2.28 $_{b**}$	0.91	10	2.70 $_{ab}$	0.95
Kitchen Water Behaviors	168	6.24 $_{ab}$	2.02	52	6.19 $_{ab}$	1.79	43	5.35 $_{b}$	2.47	10	7.40 $_{a}$	1.35
Purchasing Behaviors	168	25.33 $_{a*}$	4.40	52	25.13 $_{a}$	4.62	43	22.16 $_{b}$	4.92	10	25.60 $_{ab}$	6.02
Drought Severity	168	5.59 $_{a}$	1.32	52	5.19 $_{ab}$	1.37	43	4.98 $_{b}$	1.34	10	4.90 $_{ab}$	1.52

Note. Means in a row sharing subscripts are not significantly different at the .05 level based on a Tukey's post hoc test.
* p-value < .01. ** p-value < .001.

Factor Analysis

Since there appears to be little difference in water conservation based on household types, environmental attitudes were explored as the potential driver of conservation behavior. Exploratory factor analysis was conducted on the six variables used to measure environmental attitudes using the principal components analysis (PCA) method of extraction, with varimax rotation (Table 12). The analysis revealed two components that were being measured by the six environmental attitudes variables. One variable appeared to pertain to the level of environmental concern participants had and

the other appeared to pertain to the level of perceived consumer effectiveness exhibited by the respondents (Table 12). Two measures were created out of the original six items labeled “Environmental Concern” and “Perceived Consumer Effectiveness” (Table 12). The new variable that ranked environmental concern consisted of the four items (Environ1-4) that had factor loadings above .5 and was had a resulting mean of 3.00 (SD=.65), indicating that the bulk of the sample had an environmental concern that was neutral (Table 12). The measure deemed “Perceived Consumer Effectiveness” was created by combining Environ5 and Enviorn6; both variables had factor loadings above .5 resulting in a mean of 4.00 (SD=.73). This indicated that the sample as a whole had an above neutral level of perceived consumer effectiveness (Table 12). A scale reliability analysis was conducted on the two new variables revealing a Cronbach’s Alpha of .546 and .838 for “Environmental Concern” and “Perceived Consumer Effectiveness” respectively (Table 12).

Table 12. Exploratory Factor Analysis of Variables Used to Measure Environmental Attitudes.

Exploratory Factor Analysis of Environmental Attitudes	
Item	Factor Loading
Environmental Concern	
Cronbach's Alpha = .546 Variance Explained = 31.67% Eigenvalue = 1.900	
Environmental impacts are frequently overstated	0.54
Environmental issues should be dealt with primarily future generations	0.60
Environmental issues will be resolved primarily through technological progress	0.74
Policies introduced by the government to address environmental issues should not cost me money	0.64
Percieved Consumer Effectiveness	
Cronbach's Alpha = .838 Variance Explained = 24.61% Eigenvalue = 1.477	
Each individual can contribute to a better environment	0.85
My own personal actions can have an effect on current and/or future drought conditions	0.83

Exploratory factor analysis using the PCA method of extraction, with varimax rotation was also conducted on the variables used to measure the water conservation behaviors, specifically the variables used to create “Kitchen Behavior”, “Bathroom Behavior”, and “Purchasing Behavior” (Table 13). Factor analysis confirmed that the two variables dealing with kitchen water conservation behaviors were measuring one underlying component, and the “Kitchen Behavior” variable produced from these two measures yielded a Cronbach’s Alpha of .639 (Table 13). Similarly the four variables associated with bathroom water conservation behavior were revealed to be measuring a single underlying component via factor analysis, and a scale reliability statistic produced a Cronbach’s Alpha of .546 for the “Bathroom Behavior” variable (Table 13). In the case of the purchasing variables, factor analysis confirmed that there was a single underlying variable being measured by the seven different questions pertaining to purchasing

attitudes and behaviors. A scale reliability statistic yielded a Cronbach's Alpha of .865 for the new "Purchasing Behavior" measure (Table 13).

Table 13. Exploratory Factor Analysis for Variables Used to Measure Water Conservation Behaviors.

Exploratory Factor Analysis of Water Conservation Behaviors	
Item	Factor Loading
Kitchen Behavior	
Cronbach's Alpha = .639 Variance Explained = 73.71% Eigenvalue = 1.258	
Turn off water while washing dishes	0.86
Plug the sink when washing the dishes	0.86
Bathroom Behavior	
Cronbach's Alpha = .546 Variance Explained = 42.54% Eigenvalue = 1.702	
Turn off the water while brushign teeth	0.77
Turn off water while washing hands	0.71
Take shower instead of a bath specifically to save water	0.50
Adjust the toilet because it is running	0.59
Purchasing Behavior	
Cronbach's Alpha = .865 Variance Explained = 56.00% Eigenvalue = 3.920	
People should consider the amount of water and/or energy that will be	0.79
I purposefully select products that let me conserve water and/or energy	0.80
I try to limit my use of water and/or energy when performing household tasks	0.66
People should consider the amount of water that will be consumed when they	0.75
I purposefully select plants/landscaping that allow me to conserve water	0.76
People should consider the amount of water and energy that will be required	0.77
I purposefully select clothing that allows me to conserve water and/or energy	0.70

Environmental Attitudes as Drivers of Consumer Behavior

The median was determined for the two new variables of "Environmental Concern" and "Perceived Consumer Effectiveness" and they were divided into three categories low, median, and high; low being any number under the median value, median

being those cases that had the median score, and high being any value over the median (Table 14). Similarly the variables used to assess respondents awareness of the drought (Drought Severity) and level of concern over local water resources (Local Water Supply Concern) were grouped based on the median response (Table 14). The "Drought Severity" variable was used to split the respondents into three categories, those who responded that the drought was either "much better" or "better" than previous droughts, those who responded that they thought the drought was "about the same" as previous droughts, and those who thought the drought was either "worse" or "much worse" than previous Texas droughts. The three categories were then relabeled as "Better", "Same", and "Worse" respectively. "Local Water Supply Concern" was treated in a similar manner; respondents were put into one of three categories "Concerned", "Neutral", or "Concerned" based on their response to the question on a 7-point Likert-type scale (1=Very Unconcerned, 7=Very Concerned).

ANOVA tests with post hoc Tukey tests were then used to determine if any significant differences existed between people who had low, median and high environmental concern and/or perceived consumer effectiveness (Table 14). ANOVA tests were also conducted to see if there were any significant differences in demographics, characteristics, behaviors, and/or investments between people who thought that the 2011 drought was better, about the same, or worse than previous Texas droughts. ANOVA tests were also used to determine if there were any significant differences in demographics, characteristics, behaviors, and/ or investments between those who were unconcerned, neutral, and concerned about their local water resources (Table 14).

People with high environmental concern invested in water efficient appliances significantly more than those with low or median environmental concern, and had invested in water efficient appliances significantly more since the beginning or the drought, than those with low environmental concern (Table 14). Those who exhibited a high level of environmental concern also invested in water efficient appliances for which they received an incentive significantly more than those with only median environmental concern (Table 14). The amount of time spent watering the lawn was significantly longer among those with a high level of environmental concern, but none of the other water conservation behaviors, inside or outside of the home, were participated in significantly more of less by those with varying levels of environmental concern (Table 14).

Respondents with a high level of perceived consumer effectiveness participated in water conservation behaviors in the kitchen and in the bathroom significantly more than those with lower levels of perceived consumer effectiveness. They also considered water conservation significantly more when making purchases, and invested in significantly more water efficient appliances (Table 14). The level of perceived consumer effectiveness was not linked to significantly more or less participation in outdoor water use (Table 14). Demographics between respondents with different levels of environmental concern and perceived consumer effectiveness were not significantly different. Chi-square analysis revealed that investment in xeriscaping was only significantly different between different levels environmental concern and no other variable ($\chi^2 = 0.814$, p=.004).

Table 14. Post Hoc Tukey Results for Environmental Concern & Perceived Consumer Effectiveness.

Mean of Variables as a Function of Environmental Attitudes

	Environmental Concern								
	Low			Median			High		
	N	Mean	*SD*	*N*	Mean	*SD*	*N*	Mean	*SD*
Variables									
Watering Duration	74	3.22 $_{b}$	1.57	56	3.77 $_{ab}$	1.58	90	3.82 $_{a}$	1.61
Investment	90	0.58 $_{b}$	0.89	71	0.58 $_{b}$	0.79	112	0.95 $_{a}$	0.99
Investment-Date	90	0.43 $_{b}$	0.62	71	0.44 $_{ab}$	0.65	112	0.65 $_{a}$	0.65
Investment-Incentive	90	0.41 $_{ab}$	0.58	71	0.37 $_{b}$	0.54	112	0.58 $_{a}$	0.56
	Percieved Consumer Effectiveness								
	Low			Median			High		
	N	Mean	*SD*	*N*	Mean	*SD*	*N*	Mean	*SD*
Variables									
Kitchen Bahaviors	80	2.65 $_{b}$	1.33	98	2.78 $_{b}$	1.27	95	3.21 $_{a}$	0.85
Bathroom Bahaviors	79	2.04 $_{b}$	0.67	98	2.16 $_{ab}$	0.67	95	2.38 $_{a}$	0.64
Purchasing Behaviors	80	3.25 $_{b}$	0.56	98	3.46 $_{b}$	0.66	95	3.94 $_{a}$	0.78
Investment	80	0.49 $_{b}$	0.69	98	0.74 $_{ab}$	0.95	95	0.92 $_{a}$	1.03

Note: Means in a row sharing subscripts are not significant at the .05 level based on a Tukey's post hoc tes

Consumers who felt that the 2011 drought was better than previous Texas droughts were significantly younger and had lived in Texas significantly less time than those who thought the 2011 drought was worse (Table 15). Those who thought the drought was worse or about the same compared to previous droughts had significantly smaller households (Table 15). People who thought the drought was about the same participated in water conservation behaviors in the kitchen and invested in water efficient appliances significantly less than those who thought the 2011 drought was better than previous droughts (Table 15). Participants who were concerned about their local water resources were significantly older than those who were neutral, and people who were neutral about the continued availability of their local water resources were from significantly larger households (Table 15). Concern about local water resources was connected to a significantly larger amount of water conservation via purchasing behaviors and investments in water efficient appliances (Table 15).

Table 15. Post Hoc Tukey Results for Awareness and Concern Related the 2011 Texas Drought.

Mean of Variables as a Function of Awareness and Concern

	Drought Severity								
	Better			Same			Worse		
	N	Mean	*SD*	*N*	Mean	*SD*	*N*	Mean	*SD*
Variables									
Age	19	4.47 $_{ab}$	1.43	55	4.45 $_{b}$	1.73	199	5.15 $_{a}$	1.34
Household Size	19	7.58 $_{a}$	21.93	55	2.84 $_{b}$	1.41	196	2.62 $_{b}$	1.40
Years Lived in Texas	19	3.63 $_{ab}$	0.68	55	3.27 $_{b}$	1.08	199	3.64 $_{a}$	0.74
Kitchen Behaviors	19	3.37 $_{a}$	1.30	55	2.62 $_{b}$	1.24	199	2.92 $_{ab}$	1.14
Investment	19	1.11 $_{a}$	1.29	55	0.51 $_{b}$	0.84	199	0.75 $_{ab}$	0.90
Investment-Incentive	19	0.68 $_{a}$	0.75	55	0.33 $_{b}$	0.55	199	0.49 $_{ab}$	0.55
	Local Water Supply Concern								
	Unconcedrned			Neutral			Concerned		
	N	Mean	*SD*	*N*	Mean	*SD*	*N*	Mean	*SD*
Variables									
Age	46	4.67 $_{ab}$	1.43	56	4.59 $_{b}$	1.50	171	5.16 $_{a}$	1.43
Household Age	46	3.15 $_{b}$	1.40	56	4.09 $_{a}$	1.83	171	3.16 $_{b}$	1.38
Purchasing Behaviors	46	3.46 $_{ab}$	0.72	56	3.34 $_{b}$	0.79	171	3.67 $_{a}$	0.70
Investment	46	0.70 $_{ab}$	0.99	56	0.41 $_{b}$	0.65	171	0.84 $_{a}$	0.96
Investment-Date	46	0.52 $_{ab}$	0.66	56	0.32 $_{a}$	0.51	171	0.59 $_{b}$	0.68
Investment-Incentive	46	0.48 $_{ab}$	0.59	56	0.30 $_{b}$	0.50	171	0.52 $_{a}$	0.58

Note: Means in a row sharing subscripts are not significantly different at the .05 level based on a Tukey's post hoc test.

Discussion

Household characteristics do not appear to play a large role in consumer water use or conservation; most notably there was no significant difference in self-reported water use between household that pay for their water and households that do not pay, despite significant differences in certain water use frequencies. The only environmental attitude that was significantly different among household types, was that those who pay for their water agree significantly more that environmental policies should not cost them money

than those households that do not have a water bill. This is not surprising, as having to pay for water may make a person less willing to pay for additional bills, especially environmental policies that could potentially charge them for additional water use. Respondents who own their residencies and have yards were more aware of the severity of the 2011 Texas drought, likely the result of these consumers also being older, having more education, and having lived in Texas longer. Those who own their residencies and have yards are also likely to be more aware of the drought due to restrictions placed on lawn watering, which would have a bigger impact on this group's daily water use routine more than any other.

While water conservations in the home varied among those with different levels of concern, perceived consumer effectiveness and awareness, water use and conservation outside of the home i.e. lawn behaviors did not vary amongst different groups. This is potentially a sign the lawn behaviors are overlooked as part of the water system of a household or are so ingrained as part of household domestic routine that they are more difficult to change. Technological advancements have been made in many home appliances that result in decreased water use, such as new washing machines and dishwashers that are water and energy efficient, however, advancements in lawn care equipment that similarly decrease resource consumption have seemingly gone unnoticed and uninvestigated. A suggestion may be that education on lawn care best practices, such as the ones offered by the International Federation for Home Economics (IFHE) for sustainable resource use for kitchen and laundry routines available at http://www.ifhe.org/, be developed and made available to consumers.

Consumers who perceive that their individual actions have an effect participate in water conservation behaviors significantly more than those who perceive that their individual actions have a low effect on counter acting water scarcity. The level of environmental concern that a person has does not appear to affect their water conservation behaviors, except that they are more likely to invest in water efficient appliances. People with higher levels of environmental concern water their yards for significantly more time, but they are also more likely to invest in xeriscaping and water efficient appliances. These trends indicate that people with greater environmental concern may be more willing or likely to invest in water conservation, but their environmental concern does not lead to a resulting change in behavior. The longer time spent watering the lawn may be representative of a basic lack of awareness of how much water they are using, or potentially is the result of this group's investment in water efficient appliances. Since those with higher environmental concern have more water efficient appliances, they may spend more time watering the lawn figuring it will not result in a net increase in their household water use.

People who perceived the drought to be worse tended to be older and have lived in TX significantly longer than those who thought the 2011 drought was about the same as any other Texas drought. This may be indicative of the fact that people who have had more experience with Texas droughts and have become accustomed to the normal annual weather cycles are more aware of climatic trends in Texas. People who thought the 2011 Texas drought was better than previous TX droughts tend to have larger household sizes, indicating that these respondents may be more focused on family matters than on external concerns. This may also explain why those who felt the 2011 drought was better than

previous TX droughts participated in more water conservation behaviors in the kitchen and invested in more water efficient appliances; larger households may be more conscientious of their water use due to the number of people living in their homes rather than any other motive.

People who were concerned about their local water resource being able to continue to supply water tended to be older and to have invested in more water efficient appliances. In particular those who were more concerned had invested in more water efficient appliances since the beginning of the drought, indicating that concern over water resources due to the 2011 drought in Texas was resulting in an increased investment in water conservation. Age again may indicate that those who have had more experience with droughts are more likely to recognize how dire the 2011 drought was in Texas. Those who were more concerned also considered the amount of water/energy that will be used when making non-appliances purchases significantly more, indicating the level of concern consumers have about their local water resources results in more water conscientious behaviors.

These results indicate that two important driving factors behind consumer water conservation is how effective they feel their individual actions are in conserving water and how concerned they are with the continued availability of their local water resources. Environmental concern does not appear to have much of an effect on consumer behavior. Similarly awareness of the drought does not appear to have resulted in increased water conservation behaviors. Awareness campaigns about water conservation may be ineffective if they do not stress the importance individuals can make and the reasons why people should be concerned about continued water availability.

Conclusion

Implications

Cultivating a general concern for the environment is not as important or effective as promoting an understanding of the specific concerns that arise due water scarcity and drought events when trying to curtail consumer water use. A consumer may be aware of a severe drought event, and still not understand why it is necessary to conserve water or how to do it. Even if consumers are concerned about their water resources, they may still not change their behaviors if they do not think that their individual actions matter. Highlighting the importance that each individual plays in addressing the issue of water scarcity is perhaps the most important and effective means of changing consumer behavior. Household water use is more dependent on the attitudes of the people living in the household than on any other characteristic. Specifically perceived consumer effectiveness impacts consumer water use behaviors, which extend to consumer purchasing behaviors as consumers consider the amount of water that will be required to use and maintain their purchases.

People who are conscientious about the amount of water/energy their purchases will require to use and maintain have a greater sense of perceived consumer effectiveness and a greater level of concern about their local water resources. If consumers are aware that their individual actions can make a difference, they will carry this knowledge over into the individual purchases they make. The impacts of changing consumer water use behavior have the potential to extend far beyond local resource conservation and into global water markets.

Lawns have been identified in the literature as a major source of water use, but are seemingly overlooked by households that otherwise participate in water conservation behaviors. This oversight is likely the result of the importance of the lawn aesthetic in modern culture. Social norms that dictate what a lawn is supposed to look like have been thoroughly engrained into the minds of consumers. Further exacerbating the lack of water conservation in lawn care is the lack of water efficient technology related to lawn care. While most household water uses have been curtailed by advancements in water efficient technologies, technology that would help reduce the amount of water used for lawn care has either been slow to develop and/or to be implemented on a wide scale. Further research into the advancement and current availability of water efficient lawn care technologies needs to be undertaken.

Limitations & Future Research

This study uses the results of an on-line survey and cannot account for all of the diverse economic levels and household types in Texas. Specifically information on the colonias (areas in Texas lacking access to electricity and running water) was not available for use in this study. The data obtained for this research was collected immediately after the height of the 2011 Texas drought, which may have resulted in skewed responses. Data collected on household water use was self-reported, and appears to have resulted in an underestimation or a lack of information for the monthly water use in most households surveyed. This underestimation resulted in a lack of significance between water use in all cases, as regardless of other variables most respondents reported as using below 5 thousand gallons a month or that they did not know how much water they were using per month. An area for future research would be to see how consumers responded to a

similar survey now, after the worse conditions of the drought have subsided. Another aspect of future research should focus on water use and conservation behaviors related to laundering practices in the home, as this study focuses mainly on those in home water use behaviors associated with the kitchen and bathroom areas.

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CHAPTER III

RECOMMENDATIONS FOR POLICY MAKERS

The All Powerful Consumer

Companies spend millions to billions of dollars every year in marketing and advertising campaigns to influence consumer behavior. Consumer behavior may be difficult to understand, predict and change, but it is not impossible. The task set before policy makers is how to influence consumer behavior with a fraction of the budget and resources that many companies have. As climate change (CC) continues to dramatically alter the environment, individual and household behavioral changes will be increasingly necessary. Cultivating water conservation behaviors will be an important step in securing a sustainable water supply for Texas, as the available fresh water supply continues to be stressed by both a growing population and the effects of CC. Texans need to be conserving water regardless of current drought conditions, any water surplus that occurs during wet years needs to be stored for the dry years that will eventually follow. Water conservation needs to become a part of daily routine in Texas, not a reaction to particularly severe droughts. Concern for local water supplies and perceived consumer effectiveness (PCE) have been identified as two attitudes that positively influence the amount of water conservation behaviors participated in by consumers.

Cultivating PCE and Local Water Supply Concern

Targeting a specific concern as opposed to promoting a general concern for the environment adds tangibility and a sense of manageability to the problem. People may be overwhelmed facing the giant task of global water sustainability or combating CC, but being concerned for their local water resources is one specific aspect of a larger problem consumers can manage. It should come as no shock to most Texans that their local water resources are under strain, but the almost yearly droughts and water restrictions that come and go may tamper their resolve to conserve water. The phrase "don't mess with Texas" was coined by the Texas Department of Transportation (TxDOT) as part of the state's anti-littering campaign; its popularity is renowned as it incorporates Texas pride into a campaign to keep the beloved state free of litter (TxDOT, 2013). Such a campaign could be developed for water conservation; a simple catchy slogan used to highlight the importance of caring and concern consumers should have for their local water resources. The slogan would be part of an ad campaign that would demonstrate the need for people to be concerned about their local water resources along with specific actions that they could do help secure these resources by conserving water.

A campaign for local water supply concern could be as easy as promoting programs that already exist, such as WaterSense (EPA, 2013). Water Sense is a partnership program offered by the EPA that specifically promotes consumer water conservation by labeling products and services with a WaterSense label; this label alerts consumers that these products and services are at least 20 percent more water efficient then the alternatives (EPA, 2013). The Water Sense website also provides quick and easy tips for consumers on how to conserve water during their everyday routines, and provides

information about the state if the United States' water resources and the challenges the future holds (EPA, 2013). While the Water Sense partnership program focuses on water resources and sustainability at a national level, similar programs in Texas could focus concern at the state or municipal levels. Campaigns should advertise the need for water conservation and the importance individual actions play in both water conservation and water waste.

Consumers make dozens of choices every day that affect their local water resources, whether they decide to water their lawn, use the dishwasher instead of washing by hand, or simply turn the sink off while they are washing their hands. Behaviors related to consumer purchases also affect their local water resources, such buying drink ware specifically because it is dishwasher safe or investing in a low flow toilet. Providing consumers with water efficient options and information that demonstrates the importance of their choices is essential to changing consumer behavior. A billboard or quick commercial that stated the amount of water used to wash dishes by hand once, and then the amount of water a household used in a year washing the dishes by hand next to a label that was on dishwasher safe kitchen utensils for instance, would stress both the importance of conserving water, how to do it, and the role individual actions played in both. Such devises could be used to promote household water conservation in a variety of ways, with the end goal being not just water conservation but water conservation as the new social norm.

Social norms help people know how to act and behave in everyday situations, it is not surprising then that social norms also play a large role in dictating consumer behavior. While changing social norms takes time and often money, one way that social

norms can be adapted is to educate children about appropriate ways to behave. If taught to behave a certain way at a young age, many children will carry these behaviors into adult hood such as turning off the tap while brushing their teeth. Campaigns aimed at encouraging children to participate in water conservation behaviors may set a new social norm as children take up the behavior and in turn change their parents' behaviors. Many organizations, including the EPA, already offer promotional material to help teach children the importance and practice of water conservation, which could be promulgated by Texas schools and aftercare facilities.

Other useful tactics could involve penalty and rewards for participation in water conservation behaviors or the lack thereof. Many municipalities already offer incentives for the uptake of certain xeriscaping materials, such as drought resistant grass, or water efficient appliances. A system of rewards for water conservation could simply expand on these practices. For instance if a household invests in a Toro XTRA SMART Soil Moisture Sensor, they may be exempt from certain lawn watering restrictions or if a household has a certain type or number of water efficient appliances they get a discount of their water bill or even just a sign they can put up telling the neighborhood that they are a proud Texas water warrior. Penalties for over water use of lack of water conservation could include neighborhood water monitors, similar to the neighborhood watch who simply give you the evil eye when you water you lawn in the middle of the day. Additionally, the advertising of success stories or how much water specific practices have saved could enhance the adoption of water conservation behaviors. People may really feel they have made a difference and can continue to do so if they have an

example of how individual actions have reduced the yearly water use in a specific location.

The above suggestions for water conservation campaigns are based on the results of the previous chapters, and are meant to help policy makers faced with the task of regulating water use and demand. These suggestions are by no means exhaustive or all inclusive, but provide a way to integrate the above research. Consumer behavior is complex and can be hard to change, but it is an essential part of any campaign or policy that hopes to bring about water sustainability or even just reduced water use.

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APPENDIX A

SURVEY

Drought

Q134 This study is looking at your use of water and water conservation techniques. Your participation is important because your responses will provide significant practical implications for educators, regulators and manufacturers. In accordance with Institutional Review Board human subject policies at Texas State University, all data obtained from participants will be kept confidential and will be used for research purposes only, without identifying individual respondents. You must be 18 years or older to participate and your participation in this research study is completely voluntary. By completing the survey, you are providing your consent to participate in this study. If you have questions about participants' rights or other related concerns, you may contact the chair of Texas State University's Institutional Review Board, Dr. Jon Lasser, (512) 245-2314. If you have any other questions regarding this study, you may contact the main investigators in the Department of Family & Consumer Sciences at Texas State University, Dr. Gwendolyn Hustvedt, at 512-245-4689, gh21@txstate.edu or in the Department of Biology at Texas State University, Masters Student Erin Dascher, at 267-242-4627, edd1@txstate.edu

Q136 I have read and understood the above consent form and desire of my own free will to participate in this study.

- ❍ Yes (1)
- ❍ No (2)

If No Is Selected, Then Skip To End of Survey

Q144 Please tell us some general things about yourself and your home.

Q82 Think about purchasing responsibilities for the household (utility bills, grocery shopping, etc.), would you say that:

- ❍ You have primary responsibility for these decisions (1)
- ❍ You share responsibilities for these decisions (2)
- ❍ You have no responsibility for these decisions (3)

Q3 How do you describe your gender?

- Male (1)
- Female (2)

Q1 How old are you?

- under 18 (1)
- 18-24 (2)
- 25-34 (3)
- 35-44 (4)
- 45-54 (5)
- 55-64 (6)
- 65-74 (7)
- 75-84 (8)
- 85 or older (9)

Q4 How many people live in your household (including yourself)?

Q18 What is your zip code?

Q74 What is the highest level of education you have completed?

- Did not graduate from High School (1)
- High School Graduate (2)
- Some Post-Secondary Education (3)
- Bachelor's Degree (BA) (4)
- Post Graduate Degree (Masters or PhD) (5)

Q76 Which of these ranges best reflects the approximate combined annual income of everyone in the household, after tax?

- ❍ $1-14,800 (1)
- ❍ $14,801-22,200 (2)
- ❍ $22,201-29,100 (3)
- ❍ $29,101-35,200 (4)
- ❍ $35,201-41,300 (5)
- ❍ $41,301-47,500 (6)
- ❍ $47,501-54,700 (7)
- ❍ $54,701-62,900 (8)
- ❍ $62,901-73,500 (9)
- ❍ $73,501-91,700 (10)
- ❍ $91,701-119,200 (11)
- ❍ more than $119,200 (12)
- ❍ Don't know (13)

Q8 Do you and/or another member of your household own your current primary residence?

- ❍ Yes (1)
- ❍ No (2)
- ❍ Don't Know (3)

Q7 Is your primary residence?

- ❍ An apartment in a building with less than 12 apartments in total (1)
- ❍ An apartment building with more than 12 apartments (2)
- ❍ A detached house (3)
- ❍ A semi-detached/terraced house (4)
- ❍ Other (specify) (5) _____

Q83 What is the approximate size of your primary residence in square feet? (Please Estimate)

- ❍ less than 270 ft2 (1)
- ❍ 270 ft2 - 540 ft2 (2)
- ❍ 541 ft2 - 1,070 ft2 (3)
- ❍ 1,071 ft2 - 1,610 ft2 (4)
- ❍ 1,611 ft2 - 2,150 ft2 (5)
- ❍ More than 2,150 ft2 (6)

Q2 Do you have a yard/garden?

- ❍ yes (1)
- ❍ no (2)

Answer If Do you have a yard/garden? yes Is Selected

Q84 What is the approximate size of your yard or garden in square feet? (Please Estimate)

- ❍ Less than 500 ft2 (1)
- ❍ 501 ft2 - 2,000 ft2 (2)
- ❍ 2,001 ft2 to 5,000 ft2 (3)
- ❍ 5,001 ft2 - 15,000 ft2 (4)
- ❍ 15,001 ft2 - 25,000 ft2 (5)
- ❍ 25,001 ft2 - 45,000 ft2 (6)
- ❍ More than 1 acre (7)

Answer If What is the approximate size of your yard or garden in sq... More than 1 acre Is Selected

Q20 How many acres is your yard(s) in total? (Please Estimate)

- 0-1acers (1)
- 1-5acers (2)
- 5-10acers (3)
- 10-20acers (4)
- 20-50acers (5)
- 50-100acers (6)
- 100-200acers (7)
- more than 200 acres (8)

Q85 How would you best describe the area in which you live?

- Isolated dwelling (not in town or village) (1)
- Rural (2)
- Suburban (fringes of major city) (3)
- Urban (4)

Q87 Approximately how long ago was your primary residence constructed?

- Less than 5 years ago (1)
- Between 5 and 15 years ago (2)
- Between 16 and 30 years ago (3)
- Between 31 and 50 years ago (4)
- Between 51 and 80 years ago (5)
- More than 80 years ago (6)
- Don't Know (7)

Q86 Approximately how many years have you lived in your primary residence?

- Less than 2 years (1)
- 2-5 years (2)
- 6-15 years (3)
- More than 15 years (4)

Q135 Approximately how many years have you lived in Texas?

- ❍ Less than 2 years (1)
- ❍ 2-5 years (2)
- ❍ 6-15 years (3)
- ❍ More than 15 years (4)

Q9 What types of appliances/fixtures are in your home? (choose all that apply)

- ❑ Dishwasher (1)
- ❑ Top loading clothes washer (2)
- ❑ Front loading clothes washer (3)
- ❑ Clothes dryer (4)
- ❑ Microwave (5)
- ❑ Air conditioner (6)
- ❑ Low-flow toilet (7)
- ❑ Regular toilet (8)
- ❑ Low flow shower head (9)
- ❑ Normal shower head (10)
- ❑ Computer (11)
- ❑ Oven/stove (12)
- ❑ Fireplace (13)
- ❑ Refrigerator (14)
- ❑ Television (15)

Q10 How many of each of the following does your house have?

_____ Full baths (1)
_____ half baths (2)
_____ shower stalls (3)
_____ tubs (4)
_____ sinks (5)

Q15 How often do you experience the following in your home?

	Never (1)	Rarely (2)	Sometimes (3)	Very Often (4)	Always (5)	Don't Know (6)
Drought conditions. (1)	❍	❍	❍	❍	❍	❍
Limitations on water use due to drought conditions (2)	❍	❍	❍	❍	❍	❍

Q143 You have told us that you have a yard. We are interested to learn a bit more about your yard and how you manage the landscape around your home.

Q16 What type of features does your yard have?

- ❑ vegetable garden (1)
- ❑ fruit trees (2)
- ❑ flower garden (3)
- ❑ swimming pool (4)
- ❑ naturally occurring pond (5)
- ❑ man-made pond (6)
- ❑ running fountain (7)
- ❑ fountain that is currently not flowing (8)
- ❑ playground (9)
- ❑ horseshoe pit (10)
- ❑ drought resistant plants (11)
- ❑ drought resistant grass (12)
- ❑ areas of no grass (13)
- ❑ xeriscaped areas (14)
- ❑ gravel (15)
- ❑ stones (16)
- ❑ porch/deck area (17)
- ❑ sand (18)
- ❑ crops (19)
- ❑ shrubs/bushes (20)
- ❑ grass (22)
- ❑ other (please describe) (21) _____

Q14 What color is your lawn?

- ❍ green (1)
- ❍ yellow green (2)
- ❍ grey (3)
- ❍ yellow (4)
- ❍ brown (5)
- ❍ N/A (6)

Q15 What color is your neighbor's lawn?

- ❍ green (1)
- ❍ yellow green (2)
- ❍ grey (3)
- ❍ yellow (4)
- ❍ brown (5)
- ❍ N/A (6)

Q22 Rank the following lawns based on attractiveness with 1 being the least attractive and 4 being the most attractive.

_____ Image:My organic lawn1 (wince) (1)
_____ Image:Grassland (wince) (2)
_____ Image:Native plants drought resistant garden (wince) (3)
_____ Image:Chem lawn (wince) (4)

Q21 Tell us about watering your lawn (as opposed to other areas on your property such as a garden).

	Never (1)	Once a Month (2)	2-3 Times a Month (3)	Once a Week (4)	2-3 Times a Week (5)	Daily (6)	Multiple times a day (7)	Don't Know (8)
How often does your household water your lawn? (1)	❍	❍	❍	❍	❍	❍	❍	❍
What about your neighbors? (2)	❍	❍	❍	❍	❍	❍	❍	❍

If You - Never Is Selected, Then Skip To Tell us a bit about watering habits I...

Q24 Tell us more about the lawn watering habits of your household.

	hose (1)	buckets (2)	sprinkler system (3)	grey water (4)	N/A (5)
How do you water your lawn? (select all that apply) (1)	❑	❑	❑	❑	❑

Q25 Tell us more about your lawn watering habits.

	0-10 min (1)	10-30 min (2)	30-60 min (3)	1-2hours (4)	Longer than 2 hours (5)	N/A (6)
How long does it take to water your lawn? (1)	❍	❍	❍	❍	❍	❍

Q97 Click to write the question text

	early morning (1)	10am - 12pm (2)	12pm - 2pm (3)	2pm - 4pm (4)	4pm - 7pm (5)	8pm - 10pm (6)	N/A (7)
What times of day is water your lawn? (select all that apply) (1)	❑	❑	❑	❑	❑	❑	❑

Q141 Please tell us something about the source of water for your home.

Q120 Where does the water for your primary residence come from? (Select All)

- ❑ Own well (1)
- ❑ River/lake/stream/creek (2)
- ❑ Rain catchment system (4)
- ❑ Municipality water supply (5)
- ❑ Private water company (6)
- ❑ Don't know (3)

If Don't know Is Selected, Then Skip To End of Block If Rain catchment system Is Selected, Then Skip To End of Block

Q121 Is your household charged for water consumption in your primary residence?

- ❍ Yes (1)
- ❍ No (2)

If No Is Selected, Then Skip To how much water do you use on average?

Answer If Where does the water for your primary residence come from? Own well Is Not Selected

Q122 How is the household charged for consumption?

- ❍ flat rate (e.g. lump sum included in charges or rent) (1)
- ❍ charged according to how much water is used (e.g. via a water meter) (2)

Answer If How is the household charged for consumption? charged according to how much water is used (e.g. via a water meter) Is Selected

Q123 Is the water metered just for your home or do you share it?

- ❍ own meter (1)
- ❍ shared meter (2)

Q124 Approximately what is the total cost of your average monthly water bill for your primary residence?

- ❍ Below $15 (1)
- ❍ $15-$29 (2)
- ❍ $30-$59 (3)
- ❍ $60-$89 (4)
- ❍ $90-$119 (5)
- ❍ Above $120 (6)

Q125 Please estimate how much water (in thousand gallons) your household uses on average?

	0-3 thousand gallons (1)	3-5 thousand gallons (2)	5-8 thousand gallons (3)	8-12 thousand gallons (4)	12-15 thousand gallons (5)	15-20 thousand gallons (6)	20-25 thousand gallons (7)	25-30 thousand gallons (8)	More than 30 thousand gallons (9)	Can't guess (10)
per month (1)	❍	❍	❍	❍	❍	❍	❍	❍	❍	❍
per hot/dry months (2)	❍	❍	❍	❍	❍	❍	❍	❍	❍	❍
per year (3)	❍	❍	❍	❍	❍	❍	❍	❍	❍	❍

Answer If Where does the water for your primary residence come from? Private water company Is Selected

Q126 What is the name of your water supply company?

Answer If Where does the water for your primary residence come from? Own well Is Selected

Q127 What aquifer does your well draw water from?

- ❍ Edwards Aquifer (1)
- ❍ Carrizo-Wilcox Aquifer (2)
- ❍ Gulf Coast Aquifer (3)
- ❍ Ogallala Aquifer (4)
- ❍ Hueco-Bolson Aquifer (5)
- ❍ Trinity Aquifer (6)
- ❍ Other (7) _____
- ❍ Not Sure (8)

Answer If Where does the water for your primary residence come from? Municipality water supply Is Selected And Where does the water for your primary residence come from? Private water company Is Selected

Q128 Where does your water supply company get the water sold to your primary residence?

- ❍ Water treatment plant (1)
- ❍ River/creek (2)
- ❍ Lake/Reservoir (3)
- ❍ Artesian spring (4)
- ❍ Aquifer (5)
- ❍ Other (6) _____
- ❍ Not Sure (7)

Answer If Where does your water supply company get the water sold t... Artesian spring Is Selected And Where does your water supply company get the water sold t... Aquifer Is Selected

Q129 What aquifer is the source of water for your water supply company?

- ❍ Edwards Aquifer (1)
- ❍ Carrizo-Wilcox Aquifer (2)
- ❍ Gulf Coast Aquifer (3)
- ❍ Ogallala Aquifer (4)
- ❍ Hueco-Bolson Aquifer (5)
- ❍ Trinity Aquifer (6)
- ❍ Other (7) _____
- ❍ Not Sure (8)

Q140 We are interested in some of the behaviors and attitudes that you might have related to water in your home.

Q12 How many times a week does someone in your household do each of the following?

_____ Shower (1)
_____ Take a bath (2)
_____ Wash dishes (3)

Q95 For each of the following categories, how often does your household choose to use the products listed instead, rather than the alternatives?

	Never (1)	Occasionally (2)	Often (3)	Always (4)	Don't Have This Appliance (5)
Dishwasher (instead of by hand) (1)	❍	❍	❍	❍	❍
Clothes Dryer (instead of clothes line) (2)	❍	❍	❍	❍	❍
Microwave (instead of stove/oven) (3)	❍	❍	❍	❍	❍

Q27 How often do you personally do the following in your daily life?

	Never (1)	Occasionally (2)	Often (3)	Always (4)	Not Applicable (5)
Turn off the water while brushing teeth (1)	❍	❍	❍	❍	❍
Turn off water while washing dishes (2)	❍	❍	❍	❍	❍
Turn off the water while washing hands (3)	❍	❍	❍	❍	❍
Take shower instead of bath specifically to save water (4)	❍	❍	❍	❍	❍
Plug the sink when washing the dishes (5)	❍	❍	❍	❍	❍
Adjust the toilet because it is running (6)	❍	❍	❍	❍	❍

Answer If What types of appliances/fixtures are in your home? (choo... Dishwasher Is Selected

Q30 How Often do you rinse or pre-wash your dishes before putting them in the dishwasher?

- ❍ Never (1)
- ❍ Occasionally (2)
- ❍ Often (3)
- ❍ Always (4)

Q99 Do you drink tap water for your normal household consumption?

	Yes (1)	No (2)
Do you drink tap water for your normal household consumption (1)	❍	❍
Do you filter your tap water? (2)	❍	❍
Are you satisfied with the quality of your drinking water? (3)	❍	❍

Q69 In your tap water, what is of the most concern to you?

- ❍ Taste (1)
- ❍ Concern about health impacts (2)
- ❍ Other (specify) (3) _____
- ❍ Not concerned (4)

Q100 Has your satisfaction with the quality of your tap water changed within the last two years?

- ❍ Yes (1)
- ❍ No (2)

Answer If In your tap water, what is of the most concern to you? Not concerned Is Not Selected

Q71 What is the maximum percentage increase you would be willing to pay to improve the quality of your tap water, holding water consumption constant?

- ❍ Nothing (1)
- ❍ Less than 5% (2)
- ❍ Between 5% and 15% (3)
- ❍ Between 16% and 30% (4)
- ❍ More than 30% (5)

Q31 We are interested in your perceptions of the current conditions here in Texas.

	Much Worse (1)	Worse (2)	Somewhat Worse (3)	About the Same (4)	Somewhat Better (5)	Better (6)	Much Better (7)
How bad is this drought compared to previous droughts in Texas? (1)	❍	❍	❍	❍	❍	❍	❍
How bad are the drought conditions in other states compared to the drought in Texas? (2)	❍	❍	❍	❍	❍	❍	❍
How bad are the drought conditions in other parts of the world compared to the drought in Texas? (3)	❍	❍	❍	❍	❍	❍	❍

Q35 When did the current drought in Texas start?

- May 2008 (4)
- September 2009 (5)
- October 2010 (1)
- December 2011 (2)
- June 2011 (3)

Q34 What system of measurement does the U.S. use to signify drought intensity in a region?

- D0-D4 (1)
- Moderate-extreme (2)
- Colors (green-red) (3)
- Numbering (1-5) (4)
- Couldn't Guess (5)

Q33 The U.S. uses a measuring system of D0 through D4 to denote the intensity of drought in a region. The scale ranges from D0 indicating an abnormally dry season and D4 indicating exceptional drought intensity. Knowing this please indicate the current intensity of the drought in your area.

- D0 (1)
- D1 (2)
- D2 (3)
- D3 (4)
- D4 (5)
- There is not currently a drought in my area (6)

If There is not currently a dr... Is Selected, Then Skip To Does your area/municipality have a wa...

Q55 Are there currently any drought restrictions in your area?

- Yes (1)
- No (2)
- Don't Know (3)

Q39 How effective is your local municipality in handling the current drought conditions?

- ❍ Very Ineffective (1)
- ❍ Ineffective (2)
- ❍ Somewhat Ineffective (3)
- ❍ Neither Effective nor Ineffective (4)
- ❍ Somewhat Effective (5)
- ❍ Effective (6)
- ❍ Very Effective (7)

Q40 What could your local municipality be doing to improve their water conservation programs or handling of the drought?

Q36 Does your area/municipality have a water conservation program?

- ❍ Yes (1)
- ❍ No (2)
- ❍ Don't Know (3)

Q37 Are there any incentives offered in your area for any of the following?

- ❑ Xeriscaping (1)
- ❑ Low-flow appliances (2)
- ❑ Reduced water usage (3)
- ❑ None (4)
- ❑ Don't know (5)

Q41 How concerned are you about your local water resources being able to continue providing water to your area?

- ❍ very concerned (1)
- ❍ moderately concerned (2)
- ❍ somewhat concerned (3)
- ❍ neutral (4)
- ❍ somewhat unconcerned (5)
- ❍ moderately unconcerned (6)
- ❍ very unconcerned (7)

Q42 Give any and all reasons you feel are responsible or have contributed to the current drought in Texas (choose all that apply)

- ❑ global warming/climate change (1)
- ❑ stress placed on local water supplies by burgeoning populations (2)
- ❑ water pollution (3)
- ❑ farming practices (4)
- ❑ seasonal warm weather (5)
- ❑ God (6)
- ❑ water policies/litigation (7)
- ❑ cattle ranching (8)
- ❑ La Nina (9)
- ❑ El Nino (10)
- ❑ water management (11)
- ❑ lack of water conservation practices in your local area (12)
- ❑ weather patterns (13)
- ❑ human behavior (14)
- ❑ human attitudes toward water availability (15)
- ❑ lack of traditional habitats (16)
- ❑ other (17) _____

Q43 At what level are your local water resources (lakes, stream, aquifers, etc.)?

- ❍ Very Low (1)
- ❍ Low (2)
- ❍ At Usual Levels (3)
- ❍ High (4)
- ❍ Very High (5)

Q44 When do you think the current drought in Texas will end?

- ❍ this year (6)
- ❍ next year (4)
- ❍ within the next two to three years (2)
- ❍ within the next four to seven years (5)
- ❍ other (7) _____
- ❍ not sure (3)

Q45 What is your biggest concern about the current drought in Texas?

Q142 Finally, please share a few more things with us about several general issues related to water and your home.

Q48 Has anyone expressed concern to you about any of the following? (choose all that apply)

- ❑ current drought conditions (1)
- ❑ lack of water conservation practices/attitudes (2)
- ❑ the effect of water conservation practices/attitudes (3)
- ❑ water pollution (4)
- ❑ water limits (5)
- ❑ water availability (6)
- ❑ no one has expressed concern to me about any of these (7)

Q49 Do your neighbors waste water?

- ❍ Yes (1)
- ❍ No (2)
- ❍ Don't Know (3)

Q51 Has your household invested in the following appliances/devices in your current primary residence? (choose all that apply)

- ❑ Water efficient washing machine (1)
- ❑ Low volume or dual flush toilets (2)
- ❑ Water flow restrictor taps/low flow shower head (3)
- ❑ Water tank to collect rain water (4)
- ❑ Water purifier for drinking water (5)
- ❑ None of these (6)

If None of these Is Selected, Then Skip To To what extent do you agree with each...

Q23 For which of these has your household invested in since October 2010?

Q38 For which of the following has the household benefitted from government support to make this investment (for instance grants and incentives)?

Q94 To what extent do you agree with each of the following statements?

	Strongly Disagree (1)	Disagree (2)	Neither Agree nor Disagree (3)	Agree (4)	Strongly Agree (5)
Environmental impacts are frequently overstated (1)	❍	❍	❍	❍	❍
Environmental issues should be dealt with primarily by future generations (2)	❍	❍	❍	❍	❍
Environmental issues will be resolved primarily through technological progress (3)	❍	❍	❍	❍	❍
Policies introduced by the government to address environmental issues should not cost me money (4)	❍	❍	❍	❍	❍
Each Individual can contribute to a better environment (5)	❍	❍	❍	❍	❍
My own personal actions can have an effect on current	❍	❍	❍	❍	❍

and/or future drought conditions (6)					

Q56 How important are the following factors in encouraging you to reduce your water consumption?

	Not at all Important (1)	Very Unimportant (2)	Somewhat Unimportant (3)	Neutral (4)	Somewhat Important (5)	Very Important (6)	Extremely Important (7)
Practical information on things you can do to save water at home (1)	❍	❍	❍	❍	❍	❍	❍
Money Savings (2)	❍	❍	❍	❍	❍	❍	❍
Clear importance of the environmental benefits of saving water (3)	❍	❍	❍	❍	❍	❍	❍
Availability of water-efficient products (4)	❍	❍	❍	❍	❍	❍	❍
Lower cost of water-efficient equipment (5)	❍	❍	❍	❍	❍	❍	❍
Mandatory water restrictions (6)	❍	❍	❍	❍	❍	❍	❍

Q67 To what extent do you agree with each of the following?

	Strongly Disagree (1)	Disagree (2)	Neither Agree nor Disagree (3)	Agree (4)	Strongly Agree (5)
People should consider the amount of water and/or energy that will be consumed to maintain the things they purchase (1)	❍	❍	❍	❍	❍
I purposefully select products that let me conserve water and/or energy (2)	❍	❍	❍	❍	❍
I try to limit my use of water and/or energy when performing household tasks (3)	❍	❍	❍	❍	❍
People should consider the amount of water that will be consumed when they buy plants/landscaping (4)	❍	❍	❍	❍	❍
I purposefully select plants/landscaping that allow me to conserve water (5)	❍	❍	❍	❍	❍
People should consider the amount of water and energy that will be required to maintain the clothes they purchase (6)	❍	❍	❍	❍	❍

I purposefully select clothing that allows me to conserve water and/or energy (7)	❍	❍	❍	❍	❍

Q139 Thank you for your participation in our survey. Your thoughtful consideration of these topics will help cities and policy makers better respond to your concerns and opinions about the water supply in Texas.

APPENDIX B

IRB EXEMPTION

Exemption Request EXP2011Y9276 - Approval

AVPR IRB <ospirb@txstate.edu> Fri, Sep 23, 2011 at 1:10 PM

To: erindascher@gmail.com

DO NOT REPLY TO THIS MESSAGE. This email message is generated by the IRB online application program.

Based on the information in IRB Exemption Request EXP2011Y9276 which you submitted on 09/17/11 18:07:36, your project is exempt from full or expedited review by the Texas State Institutional Review Board.

If you have questions, please submit an IRB Inquiry form:

http://www.txstate.edu/research/irb/irb_inquiry.html

Comments:

No comments.

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Institutional Review Board
Office of Research Compliance
Texas State University-San Marcos
(ph) 512/245-2314 / (fax) 512/245-3847 / ospirb@txstate.edu / JCK 489
601 University Drive, San Marcos, TX 78666
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APPENDIX C

ANALYSIS OF VARIANCE TABLES

Table 1. ANOVA Results of Demographics Variables by Clusters.

One-Way Analysis of Variance for Clusters				
Variable and source	*df*	*SS*	*MS*	*F*
Age				
Between groups	3	10.70	3.66	1.72
Within groups	269	581.62	2.12	
Education				
Between groups	3	8.53	2.84	3.07 *
Within groups	269	249.39	0.93	
Income				
Between groups	3	136.77	45.59	4.01 *
Within groups	269	3057.46	11.37	
Residence Age				
Between groups	3	18.97	6.32	2.76 *
Within groups	269	617.28	2.30	
Residence Size				
Between groups	3	16.48	5.50	3.46 *
Within groups	269	426.99	1.59	
Years lived in home				
Between groups	3	13.04	4.35	4.24 *
Within groups	269	282.64	1.05	
Years Lived in Texas				
Between groups	3	1.41	0.47	0.68
Within groups	269	185.59	0.69	

* $p < .05$.

Table 2. ANOVA Results for Purchasing Attitudes by Clusters.

One-Way Analysis of Variance for Clusters				
Variable and source	*df*	*SS*	*MS*	*F*
I purposefully select clothing that allow me to conserve water and/or energy				
Between groups	3	1.21	0.40	0.34
Within groups	269	316.55	1.18	
I purposefully select plants/landscapping that allow me to conserve water				
Between groups	3	4.13	1.38	1.62
Within groups	269	228.58	0.85	
I purposefully select products that allow me to conserve water and/or energy				
Between groups	3	9.31	3.10	3.18 *
Within groups	269	262.07	0.97	
I try to limit my use of water and/or energy when performing household tasks				
Between groups	3	6.15	2.05	4.16 *
Within groups	269	132.56	0.49	
People should consider the amount of water and energy that will be required to maintain the clothes				
Between groups	3	8.91	2.97	3.48 *
Within groups	269	229.62	0.85	
People should consider the amount of water that will be consumed when they purchase plants/landscapping				
Between groups	3	10.04	3.35	5.87 *
Within groups	269	153.35	0.57	
People should consider the amount of water and energy that will be consumed to maintain the products they purchase				
Between groups	3	13.80	4.60	6.89 *
Within groups	269	179.67	0.67	

* $p < .05$.

Table 3. ANOVA Results for Environmental Attitudes by Clusters.

One-Way Analysis of Variance for Clusters				
Variable and source	*df*	*SS*	*MS*	*F*
Each individual can contribute to a better environment				
Between groups	3	12.70	4.23	7.63 *
Within groups	269	149.35	0.56	
Environmental impacts are frequently overstated				
Between groups	3	76.33	25.44	27.86 *
Within groups	269	245.62	0.91	
Environmental issues should be dealt with primarily by future generations				
Between groups	3	29.36	9.79	9.01 *
Within groups	269	292.20	1.09	
[illegible] primarily through technological progress				
Between groups	3	1.74	0.58	0.69
Within groups	269	224.18	0.83	
My own personal actions can have an effect on current and/or future drought conditions				
Between groups	3	17.92	5.97	7.77 *
Within groups	269	206.64	0.77	
Policies intriduced by the government to address environmental issues should not cost me money				
Between groups	3	0.90	0.30	0.34
Within groups	269	238.42	0.89	

* $p < .05$.

Table 4. ANOVA Results for Drought Precipitation by Clusters.

One-Way Analysis of Variance for Drought Preceptions by Clusters.

Variable and source	*df*	*SS*	*MS*	*F*
compared to prvious Texas droughts				
Between groups	3	20.96	6.99	3.92 *
Within groups	269	480.10	1.79	
Drought Severity				
Between groups	3	18.49	6.16	0.19
Within groups	269	783.74	2.91	
Local Water Supply concern				
Between groups	3	36.98	12.33	5.12 *
Within groups	269	647.93	2.41	
Municipality effectiveness				
Between groups	3	13.78	4.59	2.24
Within groups	224	458.90	2.05	

* $p < .05$.

Table 5. ANOVA Results for Demographics by Yard/Ownership Groups.

One-Way Analysis of Variance for Yard/Ownership Groups				
Variable and source	*df*	*SS*	*MS*	*F*
Age				
Between groups	3	41.77	13.92	6.94 ***
Within groups	269	539.86	2.01	
Education				
Between groups	3	9.79	3.26	3.54 *
Within groups	269	248.13	0.92	
Income				
Between groups	3	274.11	91.37	8.42 ***
Within groups	269	2920.12	10.86	
Household Size				
Between groups	3	57.27	19.09	0.53
Within groups	266	9517.70	35.78	
Water Quantity per Month				
Between groups	3	79.84	26.61	1.78
Within groups	236	3534.82	14.98	
Residence Size				
Between groups	3	100.52	33.51	26.28 ***
Within groups	269	342.95	1.28	
Home Age				
Between groups	3	41.23	13.74	6.21 ***
Within groups	269	595.02	2.21	
Years Lived in Home				
Between groups	3	81.17	27.06	33.93 ***
Within groups	269	214.51	0.80	
Years Lived in Texas				
Between groups	3	15.01	5.00	7.82 ***
Within groups	266	171.99	0.64	

* p-value < .05. ** p-value < .01. *** p-value <.001.

Table 6. ANOVA Results for Household Characteristics by Yard/Ownership Groups

One-Way Analysis of Variance for Yard/Ownership Groups.

Variable and source	*df*	*SS*	*MS*	*F*
Number of Full Baths				
Between groups	3	37.43	12.48	3.54 *
Within groups	269	947.85	3.52	
Number of Half Baths				
Between groups	3	13.13	4.38	2.15
Within groups	269	546.36	2.03	
Number of Shower Stalls				
Between groups	3	27.46	9.15	2.07
Within groups	269	1189.07	4.42	
Number of Tubs				
Between groups	3	36.32	12.11	2.65 *
Within groups	269	1230.35	4.57	
Number of Sinks				
Between groups	3	133.41	44.47	8.80 ***
Within groups	269	1360.17	5.06	
Showers per Week				
Between groups	3	34.02	11.34	0.54
Within groups	269	5693.08	21.16	
Baths per Week				
Between groups	3	9.89	3.30	0.23
Within groups	269	3834.44	14.25	
Dishwashing Episodes per Week				
Between groups	3	27.46	9.15	2.07
Within groups	269	1189.07	4.42	

* p-value < .05. ** p-value < .01. *** p-value <.001.

Table 7. ANOVA Results for Water Conservation Behaviors by Yard/Ownership Groups.

One-Way Analysis of Variance for Yard/Ownership Groups				
Variable and source	*df*	*SS*	*MS*	*F*
Kitchen Water Behaviors				
Between groups	3	44.75	14.92	0.01 *
Within groups	269	1117.24	4.15	
Bathroom Water Behaviors				
Between groups	3	65.13	21.71	0.07
Within groups	269	2440.86	9.07	
Purchasing Attitudes				
Between groups	3	358.01	119.34	5.66 **
Within groups	269	5667.31	21.07	
Investment				
Between groups	2	7.91	3.96	4.77 **
Within groups	270	224.03	0.83	
Investment-Date				
Between groups	2	3.06	1.53	3.72 *
Within groups	270	111.04	0.41	
Investment-Incentive				
Between groups	2	1.99	1.00	3.12 *
Within groups	270	86.00	0.32	

* p-value < .05. ** p-value < .01. *** p-value <.001.

Table 8. ANOVA Results for Attitudes, Awareness, & Concern by Yard/Ownership Groups.

One-Way Analysis of Variance for Yard/Ownership Groups				
Variable and source	*df*	*SS*	*MS*	*F*
Environ1				
Between groups	3	8.23	2.74	2.35 *
Within groups	269	313.71	1.17	
Environ2				
Between groups	3	5.43	1.81	1.54
Within groups	269	316.13	1.18	
Environ3				
Between groups	3	1.99	0.66	0.80
Within groups	269	223.93	0.83	
Environ4				
Between groups	3	2.08	0.69	0.79
Within groups	224	237.24	0.88	
Envrion5				
Between groups	3	3.05	1.02	1.72
Within groups	269	159.01	0.59	
Environ6				
Between groups	3	4.56	1.51	1.86
Within groups	269	219.99	0.82	
Drought Severity				
Between groups	3	18.45	6.15	3.43 *
Within groups	269	482.61	1.80	
Local Water Supply				
Between groups	3	9.03	3.01	1.20
Within groups	269	675.88	2.51	

* p-value < .05. ** p-value < .01. *** p-value <.001.

Table 9. ANOVA Results for Demographics by Perceived Consumer Effectiveness.

One-Way Analysis of Variance for Perceived Consumer Effectiveness				
Variable and source	*df*	*SS*	*MS*	*F*
Age				
Between groups	2	0.36	0.18	0.08
Within groups	270	581.28	2.15	
Education				
Between groups	2	0.28	0.14	0.15
Within groups	270	257.64	0.95	
Income				
Between groups	2	0.67	0.33	0.03
Within groups	270	3193.56	11.83	
Household Size				
Between groups	2	76.45	38.23	1.08
Within groups	267	9498.51	35.58	
Residence Age				
Between groups	2	2.02	1.01	0.43
Within groups	270	634.22	2.35	
Residence Size				
Between groups	2	5.98	2.99	1.84
Within groups	270	437.50	1.62	
Yard Size				
Between groups	2	7.97	3.98	1.14
Within groups	217	761.74	3.51	
Years lived in home				
Between groups	2	1.31	0.66	0.60
Within groups	270	294.36	1.09	
Years Lived in Texas				
Between groups	2	0.12	0.06	0.09
Within groups	270	186.88	0.69	
Monthly Water Cost				
Between groups	2	0.07	0.04	0.03
Within groups	211	250.79	1.19	
Water Quantity Per Month				
Between groups	2	70.76	35.38	2.37
Within groups	237	3543.89	14.95	

* $p < .05$.

Table 10. ANOVA Results for Demographics by Environmental Concern.

One-Way Analysis of Variance for Environmental Concern				
Variable and source	*df*	*SS*	*MS*	*F*
Age				
Between groups	2	3.97	1.99	0.93
Within groups	270	577.66	2.14	
Education				
Between groups	2	1.66	0.83	0.88
Within groups	270	256.26	0.95	
Income				
Between groups	2	28.47	14.24	1.21
Within groups	270	3165.76	11.73	
Household Size				
Between groups	2	91.74	45.87	1.29
Within groups	267	9483.23	35.52	
Residence Age				
Between groups	2	4.75	2.37	1.02
Within groups	270	631.50	2.34	
Residence Size				
Between groups	2	5.84	2.92	1.80
Within groups	270	437.64	1.62	
Yard Size				
Between groups	2	7.39	3.70	1.05
Within groups	217	762.32	3.51	
Years Lived in Home				
Between groups	2	2.20	1.10	1.01
Within groups	270	293.48	1.09	
Years Lived in Texas				
Between groups	2	0.83	0.42	0.60
Within groups	270	186.17	0.69	
Monthly Water Cost				
Between groups	2	1.24	0.62	0.52
Within groups	211	249.62	1.18	
Water Quantity Per Month				
Between groups	2	34.88	17.44	1.15
Within groups	237	3579.77	15.11	

* $p < .05$.

Table 11. ANOVA Results for Demographics by Drought Severity.

One-Way Analysis of Variance for Drought Severity				
Variable and source	*df*	*SS*	*MS*	*F*
Age				
Between groups	2	25.78	12.89	6.26
Within groups	270	555.85	2.06	
Education				
Between groups	2	2.66	1.33	1.41
Within groups	270	255.26	0.95	
Income				
Between groups	2	17.80	8.90	0.76 **
Within groups	270	3176.43	11.77	
Household Size				
Between groups	2	428.51	214.25	6.25 **
Within groups	267	9146.46	34.26	
Residence Age				
Between groups	2	3.67	1.83	0.78
Within groups	270	632.57	2.34	
Residence Size				
Between groups	2	4.09	2.05	1.26
Within groups	270	439.38	1.63	
Yard Size				
Between groups	2	7.01	3.50	1.00
Within groups	217	762.70	3.52	
Years Lived in Home				
Between groups	2	3.47	1.73	1.60
Within groups	270	292.21	1.08	
Years Lived in Texas				
Between groups	2	6.00	2.99	4.47 *
Within groups	270	181.00	0.67	
Monthly Water Cost				
Between groups	2	4.55	2.27	1.95
Within groups	211	246.31	1.17	
Water Quantity Per Month				
Between groups	2	89.08	44.54	2.99
Within groups	237	3525.57	14.88	

* $p < .05$. **$p < .01$.

Table 12. ANOVA Results for Demographics by Local Water Supply Concern.

One-Way Analysis of Variance for Local Water Supply Concern				
Variable and source	*df*	*SS*	*MS*	*F*
Age				
Between groups	2	18.56	9.28	4.45 *
Within groups	270	563.08	2.09	
Education				
Between groups	2	1.35	4.77	0.71
Within groups	270	256.57	35.83	
Income				
Between groups	2	14.18	7.09	0.60
Within groups	270	3180.05	11.78	
Household Size				
Between groups	2	9.54	4.77	1.33
Within groups	267	9565.43	35.83	
Residence Age				
Between groups	2	38.34	19.17	8.66 ***
Within groups	270	597.90	2.21	
Residence Size				
Between groups	2	2.82	1.41	0.86
Within groups	270	440.66	1.63	
Yard Size				
Between groups	2	20.14	10.07	2.92
Within groups	217	749.57	3.45	
Years Lived in Home				
Between groups	2	2.18	1.09	1.00
Within groups	270	293.50	1.09	
Years Lived in Texas				
Between groups	2	3.82	1.91	2.81
Within groups	270	183.18	0.68	
Monthly Water Cost				
Between groups	2	0.49	0.24	0.21
Within groups	211	250.37	1.19	
Water Quantity Per Month				
Between groups	2	20.78	10.39	0.69
Within groups	237	3593.88	15.16	

* $p < .05$. ** $p < .01$. *** $p < .001$.

Table 13. ANOVA Results for Water Conservation Behaviors by Perceived Consumer Effectiveness.

One-Way Analysis of Variance for Perceived Consumer Effectiveness				
Variable and source	*df*	*SS*	*MS*	*F*
Watering Frequency				
Between groups	2	2.90	1.49	0.47
Within groups	217	685.74	3.16	
Watering Duration				
Between groups	2	2.00	1.00	0.39
Within groups	217	562.59	2.59	
Bathroom Behavior				
Between groups	2	5.25	2.62	6.05 **
Within groups	269	116.63	0.43	
Kitchen Behavior				
Between groups	2	15.65	7.83	5.79 **
Within groups	270	365.05	1.35	
Purchasing Behavior				
Between groups	2	22.17	11.09	23.95 ***
Within groups	270	124.96	0.46	
Investment				
Between groups	2	8.01	4.00	4.83 **
Within groups	270	223.94	0.83	
Investment-Date				
Between groups	2	1.89	0.95	2.28
Within groups	270	112.21	0.42	
Investment-Incentive				
Between groups	2	1.76	0.88	2.75
Within groups	270	86.23	0.32	

* $p < .05$. ** $p < .01$. *** $p < .001$.

Table 14. ANOVA Results for Water Conservation Behaviors by Environmental Concern.

One-Way Analysis of Variance for Environmental Concern				
Variable and source	*df*	*SS*	*MS*	*F*
Watering Frequency				
Between groups	2	9.56	4.78	1.53
Within groups	217	679.17	3.13	
Watering Duration				
Between groups	2	16.92	8.46	3.35 *
Within groups	217	547.68	2.52	
Bathroom Behavior				
Between groups	2	0.93	0.46	1.03
Within groups	269	120.95	0.45	
Kitchen Behavior				
Between groups	2	2.74	1.37	0.98
Within groups	270	377.96	1.40	
Purchasing Behavior				
Between groups	2	1.93	0.97	1.80
Within groups	270	145.19	0.54	
Investment				
Between groups	2	8.98	4.49	5.44 **
Within groups	270	222.96	0.83	
Investment - Date				
Between groups	2	3.11	1.56	3.78 *
Within groups	270	110.98	0.41	
Investment - Incentive				
Between groups	2	2.44	1.22	3.85 *
Within groups	270	85.55	0.32	

* $p < .05$. ** $p < .01$. *** $p < .001$.

Table 15. ANOVA Results for Water Conservation Behaviors by Drought Severity

One-Way Analysis of Variance for Drought Severity

Variable and source	*df*	*SS*	*MS*	*F*
Watering Frequency				
Between groups	2	4.93	2.47	0.78
Within groups	217	683.80	3.15	
Watering Duration				
Between groups	2	10.08	5.04	1.97
Within groups	217	554.51	2.56	
Bathroom Behavior				
Between groups	2	2.60	1.30	2.93
Within groups	269	119.28	0.44	
Kitchen Behavior				
Between groups	2	8.59	4.29	3.12 *
Within groups	270	372.12	1.38	
Purchasing Behavior				
Between groups	2	0.83	0.42	0.77
Within groups	270	146.30	0.54	
Investment				
Between groups	2	5.47	2.38	3.26 *
Within groups	270	226.47	0.84	
Investment - Date				
Between groups	2	2.07	1.03	2.49
Within groups	270	112.03	0.42	
Investment - Incentive				
Between groups	2	2.05	1.03	3.22 *
Within groups	270	85.93	0.32	

* $p < .05$.

Table 16. ANOVA Results for Water Concervation Behaviors by Local Water Supply Concern.

One-Way Analysis of Variance for Local Water Supply Concern				
Variable and source	*df*	*SS*	*MS*	*F*
Xeri-scapping				
Between groups	2	0.40	0.20	1.04
Within groups	217	41.35	0.19	
Watering Frequency				
Between groups	2	1.00	0.50	0.16
Within groups	217	687.73	3.17	
Watering Duration				
Between groups	2	1.44	0.72	0.28
Within groups	217	563.15	2.60	
Bathroom Behavior				
Between groups	2	1.95	0.98	2.19
Within groups	269	119.93	0.45	
Kitchen Behavior				
Between groups	2	1.85	0.93	0.66
Within groups	270	378.85	1.40	
Purchasing Behavior				
Between groups	2	5.16	2.58	4.91 **
Within groups	270	141.97	0.53	
Investment				
Between groups	2	7.91	3.96	4.77 **
Within groups	270	224.03	0.83	
Investment-Date				
Between groups	2	3.06	1.53	3.72 *
Within groups	270	111.04	0.41	
Investment-Incentive				
Between groups	2	1.99	1.00	3.12 *
Within groups	270	86.00	0.32	

* $p < .05$. ** $p < .01$.

VITA

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