A Comparison of Los Angeles and Phoenix Homeowners' Attitudes and Behaviors towards Outdoor Water Conservation

by

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A Thesis Presented in Partial Fulfillment
of the Requirements for the Degree of
Master of Science

Approved July 2016 by the
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ARIZONA STATE UNIVERSITY

August 2016

ABSTRACT

Los Angeles, California and Phoenix, Arizona are two naturally water-scarce regions that rely on imported water to meet their local water needs. Both areas have been experiencing an ongoing drought that has negatively affected their local water supply. Populations in both cities continue to grow, increasing overall demand for water as the supply decreases. Water conservation is important for the sustainability of each town. However, the methods utilized to conserve residential water in the two areas differ drastically; Los Angeles has implemented involuntary water rationing and Phoenix has not.

The widespread effectiveness of involuntary restrictions makes them a popular management scheme. Despite their immediate effectiveness, little is known about how involuntary restrictions affect attitudinal precursors towards the behavior in question and thus, whether or not the restrictions are potentially helpful or harmful to lasting behavior change. This study adapted the Theory of Planned Behavior to survey 361 homeowners in Los Angeles and Phoenix to examine how involuntary water restrictions shape attitudinal precursors to outdoor water conservation.

This study found that when involuntary water restrictions are present, residents feel less in control of their outdoor water use. However, in the presence of involuntary water restrictions, stronger social norms and stronger support for policy prescriptions over outdoor water use were found. The favorable societal support towards water conservation, conceptualized as social norms and policy attitudes, in the presence of involuntary water restrictions is potentially promising for lasting behavior change.

ACKNOWLEDGMENTS

I owe a great deal of gratitude to my husband who has always encouraged me to seek knowledge and challenge myself. Without him, I can't imagine I would have been brave enough (or foolish enough) to pursue a graduate degree.

A special thank you is in order for my friends who have listened to me whine along the way. Danielle Chipman was a great comfort and always empathetic to the process.

I am thankful for my committee who helped me design and execute this study. Sonja Klinsky gave me abundant encouragement and positive affirmations that were desperately needed along the way. Sonja made me constantly stretch and exercise my brain. Kevin Dooley empowered me to pursue the direction I wanted to go and not be intimidated by a large data set. Kelli Larson helped me understand what I truly wanted to ask people, as I designed my survey. Thank you all for your dedicated support.

Lastly, gratitude is given to Arizona State University's Graduate and Professional Student Association for financially funding a portion of this research study through the Graduate Research Support Program grant.

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INTRODUCTION

Freshwater is essential for the survival of any population. In the United States, city, state, and federal governments all contribute to the provision, distribution, and treatment of water sources for residents in urban areas. Sometimes water naturally reaches a city through freshwater systems, such as rivers, lakes, and tapped underground reservoirs. However, when the amount of local water is not enough or not of sufficient quality to sustain a population, humans have historically altered their natural environment to engineer the transport of non-local freshwater sources to their towns. The allocation and investment of human capital can transport freshwater from far away sources in order to sustain populations much greater than what the local natural environment would have been able to sustain by itself. Currently, humans "capture and consume about 54% of the world's freshwater supplies, and that figure is expected to go up to 70% by 2025" (Hirt, Gustafson, and Larson, 2008).

Densely populated, fast growing, urban areas that receive little annual rainfall and exist in arid environments are typically heavily dependent on imported water sources for their freshwater. In the U.S., this is the case for both Southern California and much of Arizona. Specifically, the cities of Los Angeles, California and Phoenix, Arizona rely heavily on imported freshwater for essential survival requirements, such as: drinking water, water for growing and cleaning food, water for sanitary purposes, as well as for non-essential survival requirements, such as: non-native irrigated lawns, stretches of turf for recreation and tourism, or displays or fountains that utilize water for aesthetic and commercial purposes.

In these arid urban areas, the conservation of water use is critically important. This is because, in each area, based on the natural water supply available, approximately only 10% of the total current populations could be sustained by these natural water resources (Kenny, 2009). Therefore, each city must rely heavily upon imported water sources to sustain their large, growing populations. Unlike Los Angeles, Phoenix has halted the majority of groundwater pumping and banks additional water underground, yielding a surplus water supply that, reported, could sustain the current population 100 years into the future (City of Phoenix, 2016). Los Angeles relies heavily on snowmelt to refill their water reservoirs, so under prolonged drought conditions, their supply quickly dwindles (Union of Concerned Scientists, 2015). These two different water management schemes have lead to different levels of water security for residents. As a result, to combat the ongoing drought in the Southwest of the United States, the state of California has implemented mandatory water restrictions, whereas the state of Arizona, has not.

One specific area of water conservation in urban areas that has garnered much attention is the use of water by homeowners, especially for outdoor, landscaping purposes. The presence of yards that are hosts to green lawns and non-native plant species suggest that there is room for conservation of outdoor water use within residential households. By examining this specific topic in the context of water conservation, I might be able to provide general lessons concerning water conservation applicable to both public and private realms.

Outdoor water use accounts for the vast majority of residential water use. In California, residential water use is responsible for over half of all urban water consumption, with single family residences using about 52% and multi-family residences

using another 14% of the total water supply (DeOreo et al., 2011). In Los Angeles County, about 70% of residential water use is attributed to outdoor landscaping. Furthermore, in California, it has been suggested that residential outdoor water use could be reduced by about 25-40% based on practicing best water management techniques and updating irrigation systems to the best available technology (Gleik et al., 2003). In Arizona, in Maricopa County, urban water use accounts for about half of all water use; although, this number has been continuing to grow (Hirt, Gustafson, and Larson, 2008). In Phoenix, about half of all residential water use can be attributed to single-family residential homes, and of that water use, about 74% goes to outdoor landscaping (Balling Jr and Gober, 2006). In a study by Wentz and Gober, they discovered four main drivers of residential water use, they included: household size, lot size, presence of a pool, and the amount of landscaping that requires water inputs (2007). Of these four main factors that determine residential water use, three of the four are related to outdoor water use, again pointing to the importance of considering outdoor water use. Furthermore, considering that landscaping is non-essential for survival, one could reason that there is room for conservation regarding the amount of residential water used outdoors.

Despite this likely excessive use of water for residential landscaping, homeowners typically have significant control of the amount of water they use for their yards. When you own the property you live on, you can manipulate the vegetation on it as you see fit, with the exception of possible regulations from being a part of a homeowner's association. Yet preferences for certain styles of landscaping, social norms to fit in with the rest of the neighborhood, and in some places, mandatory water restrictions, tell us otherwise. These factors can affect our sense of self-efficacy and control over our yard.

Furthermore, making significant changes to our yard may seem overwhelming and individuals may not feel confident in their ability to plan, execute, and afford such changes.

So what happens when someone is told that they must change the way they have been managing their yards? In California, as a response to the ongoing drought, mandatory water rationing was implemented in August 2008 and restrictions have been ratchetted-up over time. Currently, in Los Angeles, there are multiple outdoor water restrictions that detail how, when, and how much water may be used by residents on their yard. Conversely, in Phoenix, there are no specific regulations on how, when, or how much water may be used by residents on their yard as a response to the ongoing drought. Thus, I can use these two cities as a natural environment to explore how mandatory restrictions change homeowners' attitudinal precursors towards residential water conservation behavior and management. Understanding how a mandated behavior change influences a person's attitudes towards these behaviors can help us postulate what types of behavior changes are more likely to endure, if the current water restrictions are repealed. This study is particularly timely, as California rescinded the state-wide mandated for water restrictions, effective June 2016; allowing local water management districts instead to implement water use restrictions (Stevens, 2016). So far, the water restrictions in city Los Angeles have not yet changed (Los Angeles Department of Water and Power, 2016).

Theories of human behavior tell us that there are often multiple factors influencing our behaviors. Much research suggests that behavioral intentions are the one of the best predictors of our behaviors, specifically when the behavior in question is

within in our own volitional control (Ajzen, 2002). The Theory of Planned Behavior, which focuses on how attitudes towards the behavior, social norms, and our perceived self-efficacy and control over an action, along with our actual realized amount of control over an action, have been found to be strong predictors of our behavioral intentions (Armitage and Connor, 2001). The Theory of Planned Behavior, specifically with its focus on perceived self-efficacy and control over an action, can be especially helpful in understanding intentions when an action is not under complete volitional control (i.e., when social norms or government regulations make a person feel like they must behave in a certain way).

Therefore, this thesis examines the following broad question:

How do different governance approaches (i.e. water rationing versus no water rationing) effect homeowners' attitudes and behaviors towards outdoor water conservation?

More specifically, I address the following research questions:

- *How do different governance approaches affect homeowners' feelings of self-efficacy and controllability towards outdoor water conservation?*
- *How do different governance approaches affect homeowners' attitude evaluations (i.e., policy attitudes) towards outdoor water conservation?*
- *How do different governance approaches affect homeowners' normative expectations towards other people (i.e., social norms) towards outdoor water conservation?*
- *How do different governance approaches affect homeowners' behavioral intentions towards outdoor water conservation?*

In order to understand how outdoor water regulations affect attitudinal precursors to behavior, this study utilized the Theory of Planned Behavior to shape and guide the development of survey questions to assess differences between Los Angeles and Phoenix residents towards outdoor water use and management. Because it was believed that perceptions of self-efficacy and controllability are the most likely characteristics of the model be influenced by an external force, such as a regulation, these concepts were the focus of understanding the differences between the two cities. Data was collected through an online survey and analyzed using SPSS software.

Knowledge gleaned from this study can be used to influence policy-makers in other arid regions experiencing ongoing drought conditions with increasing populations and a scarce water supply. Specifically, this study will provide the Phoenix area with highly valuable information about how mandatory water rationing might affect residents' attitudinal precursors to outdoor water conservation, should they consider implementing these types of involuntary restrictions. Additionally, this study can give Los Angeles water managers information about current attitudes towards the water restrictions as they contemplate how best to move forward with their newfound power to regulate outdoor water use.

In order to best understand the reasoning behind the choices made to develop this study, I will guide the reader through this process in the remaining chapters. In Chapter 2, I review the current literature and attempt to answer the proposed research questions based on current evidence; the gaps found in the literature guided the development of the survey questions. In Chapter 3, I explain the choices made and factors that shaped my

research design. In Chapter 4, I present the data results and significant findings. In Chapter 5, I provide a discussion on my conclusions.

LITERATURE REVIEW

In this chapter, I examine the current literature in an attempt to answer my research questions proposed in Chapter 1. I will identify gaps in the literature that might impede me from being able to answer my research question. These gaps will guide the development of the research design employed in this study. In order to do this, I will first examine the importance of freshwater to humanity. I will make a case for looking at the demand side of water use, and furthermore, why outdoor water use is crucial for understanding residential demand. Additionally, I will investigate different ways of managing water use through different policy prescriptions. Then I will shift to the literature surrounding human behavior and behavior change. I will connect the dots between water management and human behavior to make a case for why I should utilize the research design associated with this research process, as discussed in the following chapter on Methods.

Freshwater: Use and Management

Freshwater is essential to the survival of the human race. Freshwater makes up only 2.5% of all water on Earth. Of the water available on Earth, only 0.01% of that water is both fresh and accessible (i.e., not locked up in glaciers, groundwater, permafrost) (Gleick, 1996). Currently, humans "capture and consume about 54% of the world's freshwater supplies" (Hirt, Gustafson, and Larson, 2008). In the Southwestern United States, this figure is even higher; it is estimated that humans appropriate 76% of the freshwater resources in the Southwestern United States (Sabo et al., 2010). Still today, "over 1 billion people worldwide lack access to safe drinking water" and "2.4 billion lack access to water for sanitation purposes" (Gleick, 2003). The increasing

effects of climate change, further threaten access to clean and safe freshwater, especially in the Southwest United States (McDonald, 2010).

Currently, humans use water for both essential and non-essential uses. Essential uses of water include sanitation, production of food, cleaning of food, drinking water and producing goods for survival. Non-essential uses of water include unnecessary overproduction of food and goods, growing non-native aesthetic crops (e.g., turf, non-native water intensive plants), and water used for recreational purposes. Considering that turf is the most produced crop in the United States and accounts for three times the amount of area of the next largest crop, corn, (DPRA, 1999 as cited by Milesi et al., 2005), I can infer that there is room for improvement in regards to water conservation in the landscaping of the United States.

This scarce resource is the cause for much human conflict and investment. Through collective action, humans have built hard infrastructure to move and manipulate water ways for their own survival. This is seen through government-funded aqueducts, pipelines, dams, and reservoirs (Gleick, 2003). This push for the construction of hard infrastructure can be seen across the arid regions of North America (Gleick, 2003). A popular new concept in water management, is the focus on the "soft path" (i.e., soft infrastructure, such as behavior changes) as opposed to a "hard path" (i.e., hard infrastructure, such as dams, canals, etc.) This "soft path" incorporates the idea of attempting to use current water resources more efficiently (Gleick, 2003). For example, soft pathways include: incentivizing, encouraging, or regulating water conservation behaviors.

Using water efficiently is especially important in arid environments that receive little rainfall. Arid environments such as the Los Angeles, California area and Phoenix, Arizona area rely heavily on imported water. The average annual precipitation is low; 17 inches per year in Los Angeles and 8.3 inches per year in Phoenix (Los Angeles: Geography and Climate, 2006, Phoenix: Geography and Climate, 2006). The residential sector is becoming an increasingly large user of the domestic water supply, especially in these arid environments (Hirt, Gustafson, and Larson, 2008). In both Los Angeles and Phoenix, residential water use is responsible for about half of all urban water use (DeOreo et al., 2011; Balling Jr and Gober, 2007), and approximately 70% and 74% of this total residential water use can be attributed to outdoor landscaping in Los Angeles and Phoenix, respectively (Los Angeles County Waterworks Districts, 2016; Balling Jr and Gober, 2007). Ongoing droughts and climate change threaten already scarce water resources in both Los Angeles and Phoenix (McDonald, 2010; US Drought Monitor, 2016a; US Drought Monitor, 2016b).

When facing a water shortage, there are multiple ways to address the problem of scarcity. Water shortages can be approached from the supply side, demand side, or both. Because climate change is expected to increase the severity and longevity of the current drought situation, trying to approach water insecurity in the Southwestern U.S. from the supply side (i.e., building more dams and reservoirs) seems ineffective; instead decreasing the amount of water used in urban landscaping seems to be a smarter and significant way to increase local water supplies (McDonald, 2010). Therefore, this study focuses on the demand side.

On the demand side, there are three main ways to approach urban water conservation. These include: 1) voluntary actions (e.g., rebates, educational programs); 2) involuntary restrictions (e.g., regulations on when and how you can use water and mandatory technology standards); and 3) market-based pricing (i.e., raising the price of water to reflect scarcity and demand) (Olmstead and Stavins, 2009). Furthermore, water use can be categorized as non-discretionary and discretionary. Non-discretionary water use involves much of a household's indoor water use for their daily consumption and sanitization purposes, including washing and cleaning of food and laundry. Discretionary water use can be thought of as water used for non-essential purposes such as irrigation and pools (Willis, et al., 2010). Studies have found that people are willing and feel capable to cut back on their outdoor water use (i.e., discretionary water use) but this desire does not always translate into action (Randolph and Troy, 2008; Dolnicar and Hurlimann, 2010).

Each water management scheme includes trade-offs. Voluntary restrictions typically come with no enforcement costs due to their voluntary nature, although successfully implementing the scheme may have a significant cost (e.g., marketing and communication costs to promote a voluntary behavior change). Involuntary restrictions tend to come with high monitoring and enforcement costs and may also have a significant implementation cost (e.g., accumulating the political will to create and pass new policy measures) (Olmstead and Stavin, 2009). In theory, market-based pricing of water can be another way to reduce demand that often comes without enforcement costs, but may also have a significant implementation cost (i.e., any price change in the cost of water is a political act). Involuntary restrictions and market-based pricing are two very attractive

methods for managing water due to their low enforcement costs. However, traditionally, water managers have shied away from market-based pricing methods for managing water because studies have shown that market-based pricing of water can result in the majority of the burden of water conservation to falling on low-income residents; this is because low-income residents are the most sensitive to price increases in the cost of residential water (Renwick and Archibald, 1998; Mansur and Olmstead, 2012).

It can be difficult to find the right combination of water management schemes for a population. Water managers must be open to experimentation to understand how certain policies will influence behavior and whether those behaviors will endure in their local area. Furthermore, they should be sensitive to their demographic population to make sure that water cut-backs are equitable among the community. Water demand is relatively inelastic, since people don't entirely respond to price signals (Willis et al., 2010). Additionally, in order for market-based pricing to be effective, there must be a high frequency of feedback regarding the true cost of the supply and a perfect understanding of the demand in the area (Jorgensen, Graymore, & O'toole, 2009); this requirement is largely unrealistic. Therefore, "water managers traditionally have maintained that consumers do not respond to price signals, so demand management has occurred most frequently through restrictions on specific water uses and requirements for the adoption of specific technologies," (Olmstead, Hanemann, and Stavins, 2007). Avoidance of market-based pricing of water, from a policy-maker, may be due to equity concerns since price increases for urban water use result in the biggest water use cutbacks implemented by low-income households (Olmstead and Stavins, 2009).

Voluntary and involuntary restrictions have proven to be effective for reducing outdoor water use (Hall, 2009, Mini, Hogue, Pincetl, 2014). However, involuntary restrictions may only reduce demand in the short run, while the involuntary restrictions are in place. Therefore, long-term behavior change resulting from involuntary restrictions must convey or connect with a sense of personal responsibility, institutional trust, or positive environmental values, in order to truly instill change (Jorgensen, Graymore, & O'toole, 2009). Researchers found that residents must believe that others in the local community are also trying to conserve water use and water managers are accountable (i.e., honest about how water is being used), strategic (i.e., using water wisely throughout the community), and equitable (i.e., distributing water cut-backs evenly throughout the community) (Jorgensen, Graymore, & O'toole, 2009). Therefore, it is important that water managers experiment and try to empathize and instill trust in their local community as they work to put water management schemes together.

Residential Water Conservation

Because outdoor water use constitutes about 70% of a household's water use for detached housing units in the Southwest of the US (Mayer and DeOreo, 1999), outdoor water use is where the most potential for water conservation resides for residential dwellers in a detached housing unit (Randolph and Troy, 2008). This discretionary water use, within detached housing units, is the target of this study. Additionally, most voluntary and involuntary water management schemes focus on outdoor water use because outdoor water use constitutes the majority of residential water use. Outdoor water use accounts for about 70% of total residential water use in arid environments (Los Angeles County Waterworks Districts, 2016; Balling Jr and Gober, 2007). Furthermore,

residents are more willing to curtail outdoor water use, as opposed to indoor water use (Sadalla et al., 2014)

Residential Water Conservation in Los Angeles

Los Angeles has been trying multiple methods to promote residential water conservation. Los Angeles currently has a two-tier pricing system for their water supply, however, economists argue that this two-tier system does not sufficiently reflect the true scarcity of the water supply and is therefore inadequate at promoting the right levels of conservation (Pincetl & Hogue, 2015). In practice, market-based water restrictions are hard to implement, although economists argue that they are the most efficient approach to water conservation (i.e., market-based approaches lead to the least amount of economic dead-weight loss of social welfare) (Mansur and Olmstead, 2012). However, Los Angeles has taken a predominantly command-and-control response to water conservation that relies on outdoor water use restrictions and requirement of specific technologies (Mini, Hogue, Pincetl, 2014).

Due to their dwindling water supply, the city of Los Angeles has implemented involuntary water restrictions of increasing severity since 2007. In the summer of 2007, Los Angeles attempted to increase local water conservation by asking for voluntary cutbacks from residents. In August 2008, restrictions were placed on residential outdoor water use. These restrictions included: no irrigating between the hours of 9AM – 4PM, no irrigation during or after rainfall events, watering limits of 15 minutes per section and a limit on daily watering cycles for sprinkler use, and a requirement to fix water leaks in a timely manner. In June 2009, additional restrictions were placed, limiting outdoor

watering to only two days per week in most cities[1], increased restrictions on sprinkler use, including duration and frequency, and the implementation of price conservation measures, such as tiered pricing (Mini, Hogue, Pincetl, 2014a). In January 2014, California declared an emergency state of drought (Brown, 2014). In April 2015, the Governor of California asked the state to reduce its total water use by 25% of 2013 consumption levels. Furthermore, the executive order outlines specific water use restrictions and sanctioned the use of graduated financial penalties (e.g., fines up to $500/day) for the misuse of water under those guidelines (Brown, 2015).

Residential Water Conservation in Phoenix

In contrast to Los Angeles, Phoenix has a much more secure water supply. Phoenix has aggressively been storing water underground as a sort of bank to combat water shortages (City of Phoenix, 2016). Water pricing is managed at a state level in Arizona, so private water distributers have not had pricing manipulation as an option for demand management (Larson, Gustafson, and Hirt, 2009). Additionally, the Phoenix area is known for implementing a progressive groundwater management plan in 1980, meant to stop all groundwater pumping by 2025 (Larson, Gustafson, and Hirt, 2009). Additional water conservation measures, such as strict plumbing codes, have helped Phoenix save water as they develop and expand. Today, Phoenix has no involuntary water restrictions meant to cope with drought, despite a similar drought conditions to Los Angeles.

Understanding Individual Household Demand

I have just discussed the importance of freshwater to humanity and different ways water managers try to provide sustainable supplies of water for local populations. By

[1] Los Angeles is an exception to this rule; they are only limited to three days a week as opposed to two.

now, the reader should have a better understanding of what types of management schemes might work for different populations. However, it is still important to understand what factors tend to influence individual household demand of freshwater. I will now take a look at some of the variables affecting human behavior, in general and with regard to freshwater consumption. A summary of the main findings of effects on residential water consumption is presented in Table 1.

Contextual settings affect individual consumption of freshwater; this includes variables such as climatic variability and infrastructure. The need for outdoor water use tends to be higher in more arid environments. For example, in Phoenix, due to the high temperatures and low amount of rainfall, outdoor water use constitutes about 74% of a household's water consumption (Mayer and DeOreo 1999). Household affluence and the size of one's home affect water consumption. In a study by Harlan et al. that examined water use in single-family homes in Phoenix, AZ, total household income was found to have a "positive, significant effect on consumption that was mediated by house size. Irrigable lot size and landscape type also had significant effects on consumption;" although their study did not find attitudes correlated to consumption (2007). Another study similarly found that the amount of people in a household increases overall household water use (Jorgensen, Graymore, & O'toole, 2009).

It is known that social norms play a significant role in influencing outdoor lawn choices, and affect outdoor water consumption. In a study by Sisser et al., researchers found that 88% of homeowners interviewed mentioned a social norm that influenced their lawn design (2016). Additionally, multiple studies have found that people tend to design their yard based on aesthetics, functionality, and recreation (Larson et al., 2015; Blaine et

al., 2012); there is a strong preference for green turfs that are nicely manicured with little to no weeds (Larson et al., 2015; Larson and Brumand, 2015). In Phoenix, AZ, researchers have also highlighted that long-term residents in the area tend to prefer higher-water-using-landscape designs over xeriscape designs; the researchers found no link between higher environmental values and a desire for low-water-use-landscape (Yabiku, Casagrande, Farley-Metzger, 2007). People also tend to perceive their lawns as a type of social status symbol and feel a desire to fit in with the neighbors (Blaine et al., 2012). Corral-Verdugo et al. examined the role that trust plays in outdoor water use and found that when homeowners believe their neighbors are wasting water, they are more likely to use more water themselves (2002). Similarly, it has been discovered that is there is a lack of trust in the water authority that supplies or regulates water, people are more likely to waste water (Jorgensen, Graymore, & O'toole, 2009).

Technology also plays a significant role in how much water is used in a household. It is easy to understand how a more water efficient device would use less water to perform the same task, such as low flow toilets and showerheads. However, whether or not water efficient technologies do indeed promote overall water savings is trickier to understand. Campbell, Johnson and Larson provide a discussion on “offsetting behaviors” in humans. Sometimes when humans are presented with a more efficient method of consumption, they end up consuming more of a good because of the perceived savings (2004). In the absence of this offsetting behavior, more efficient technology leads to reductions in water use (Willis et al., 2013). Additionally, researchers have found when you have a higher feedback frequency regarding your ongoing total water

consumption, water use is more likely to go down (Willis et al., 2013). It seems that technology combined with information can reduce overall water consumption.

Personal values have some effect on individual water consumption, however the research findings are still mixed. While studies have not consistently linked higher environmental values with lower water use yards, one study by Syme et al. linked positive garden attitudes and environmental attitudes with more outdoor water use (2004). Because of mixed findings regarding the role of environmental attitudes on outdoor water use, the relationship is unclear. However, it seems that individuals who receive higher amounts of enjoyment from outdoor gardening are more likely to use more water outdoors (Syme et al. 2004). Syme, Seligman, and Thomas have found that households that view their outdoor landscaping as contributing higher to their overall resale value of their home are more likely to use more water outdoors. Additionally, they found that the amount of recreational value that a household gets out of their yard is also a positive predictor of outdoor water use (1990-1991). These studies suggest that attitudes do indeed play a role on outdoor water use; the challenge is figuring out which attitudes are correlated to outdoor water use.

Furthermore, different human behaviors have varying degrees of volitional control associated with them based on internal variables. When one consider's the factors that affect a type of action (i.e., outdoor water conservation), one should also consider the amount of control an individual has over the action. As described earlier, different variables are known to affect household water consumption and can change the feelings of control a household has over those actions. For example, individuals with a large household and large outdoor lot may feel like they have to use more water to maintain

their larger lot and maintain neighborhood social norms. Individuals with higher levels of income may feel like they need to be display affluence in their yard with decorative displays of water, such as fountains or elaborate pools. The current literature on perceptions of self-efficacy and controllability can help us understand resource consumption when resource usage feels driven by external drivers outside of an individual's own control (Ajzen, 1985). This will be discussed in more detail using examples in this chapter.

Factor	Effect	Relationship
Climatic environment	Higher aridity increases outdoor water use (Mayer and DeOreo, 1999)	Positive
Household income	Higher incomes lead to increased water use (Harlan et al., 2007)	Positive
Home size	Larger home size, specifically irrigable lot size, lead to increased water use (Harlan et al., 2007)	Positive
Trust	People who believe that their neighbors are conserving water and have faith that local water managers are responsibly managing water are more likely to conserve water use (Corral-Verdugo et al, 2002; Jorgensen, Graymore, & O'toole, 2009)	Negative
Technology	Water efficient technology may lead to water savings – depends on offsetting behaviors & feedback frequency (Campbell, Johnson and Larson, 2004; Willis et al., 2013)	Uncertain
Environmental attitudes	Environmental attitudes are not always linked with lower water use; gardening habits, perceptions of recreation and resale value may increase water use (Syme, Seligman, and Thomas 1990-1991; Syme et al. 2004)	Uncertain
Social norms	88% of homeowners influence by social norms in yard design; desire to fit in with neighbors (Blaine et al., 2012; Sisser et al., 2016)	Uncertain

Table 1 – Summary of main factors that influence residential demand of water use

Perceptions of Self-efficacy and Control

Perceptions of self-efficacy and controllability are known to affect human behavior. Self-efficacy can be thought of an individual's confidence that they can

successfully plan for and execute an action (Bandura, 1994). Controllability can be thought of as how much of the behavior is actually under the control of the individual (Ajzen, 2002). Perceived self-efficacy is closely linked to self-esteem and can affect an individual's motivation to attempt to perform a behavior (Meinhold and Malkus, 2005). Bandura believed that individuals make self-appraisals about their ability to successfully perform a behavior, and these appraisals are linked to how much effort they put into attempting to perform the behavior (Bandura, 1984). When people have higher levels of perceived self-efficacy regarding a task, they tend to work harder and are more resilient to set-backs or failures (Bandura, 2006). In contrast, low self-efficacy can make a person feel like they have no control over performing the behavior and halt intentions to perform the behavior; in this way, the two characteristics are linked. Furthermore, because perceptions of self-efficacy revolve around how much confidence an individual has in their ability to successfully perform and execute an action, measurements of self-efficacy should be done in a graduated fashion (Bandura, 2006).

Perceptions of self-efficacy and controllability affect each other. For example, consider planning a trip to the movies see the release of a new movie. You have high confidence in your ability to: 1) find out when and where you can see the desired movie; 2) get yourself to the movie theatre with ample time to see the movie; and 3) pay for the movie. You could say you have a high perception of self-efficacy regarding going to the movie theatre to see a new movie. You plan and execute items 1 and 2, however, when you arrive at the movie theatre, you find out that the showing has been sold out and there are no tickets left. You can no longer see the desired movie at the time and place you

planned. This action was out of your control. You realize you have very little control over the actual amount of movie tickets available at any given time.

How much control does a person really have? It has been established that household size, location, and infrastructure affect water consumption (Harlen et al., 2007; Mayer and DeOreo, 1998; Campbell, Johnson and Larson, 2004; Willis et al., 2013). Arguably, a person can choose where they live and the characteristics of their home. However, once a person or persons are established in a home, there are significant costs to moving or even changing existing infrastructure. These costs may act as barriers that reduce a person's sense of control over their living situation. Personal values are often deeply rooted in cultural upbringing and may be difficult to change. Therefore, it is important to be sensitive to what might cause households to feel less in control of their actions, when trying to understand household water use.

Tying It Together: Involuntary Restrictions, Human Behavior, and Water Consumption

In order to assess the role that involuntary regulations have on water conservation behaviors, I need a model of human behavior that has previously worked well for conservation behaviors and can incorporate the role of an external force, such as an involuntary regulation. When I consider the function of a regulation, which is meant to control and shape behaviors in a particular fashion, it seems reasonable that I should look into how this changes our feelings of perceived control. Perceived control can be thought of as a combination of perceived self-efficacy and control over the action, or controllability; this is often referred to as "perceived behavioral control" in the literature (Ajzen, 2002).

The Theory of Planned Behavior has been previously successful in examining pro-environmental behaviors (Ajzen, 2002) and furthermore, has had success in predicting intentions to conserve water (Lam, 2006; Trumbo and O'Keefe, 2001). Additionally, the theory accounts for how our feelings of control are shaped by the actual amount of control a person has over the behavior; this is often called "actual behavior control" in the literature (Ajzen, 2002). I will now discuss how this theory first emerged and how it has been used to explain human behavior, specifically in the context of complying with involuntary regulations.

The Theory of Planned Behavior

The Theory of Planned Behavior first emerged in the literature as the Theory of Reasoned Action. The theory of reasoned action was developed by Ajzen and Fishbein in 1975 and has been "widely used as model for the prediction of behavioral intentions and/or behaviors," (Madden, Ellen, and Ajzen, 1992). The Theory of Reasoned Action "posits that behavioral intentions, which are the immediate antecedents to behavior, are a function of salient information or beliefs about the likelihood that performing a particular behavior will lead to a specific outcome." The Theory of Reasoned Action however, only works under conditions where the person has complete volitional control over their actions, meaning there are no internal or external barriers that may prevent them from successfully executing the action. Ajzen and Fishbein soon realized that many human behaviors are not under complete volitional control and revised their model into the Theory of Planned Behavior in order to account for this discovery.

The Theory of Planned Behavior, presented in Figure 1, took a similar form to the Theory of Reasoned Action. Both theories describe behavioral intentions to being a

function of attitudes toward the behavior and subjective norms about the behavior (Ajzen, 1985). However, understanding that many human actions are not under complete volitional control, the question arose of how much control an individual actually has over completing an action. Ajzen thought of behaviors such as quitting smoking or drinking and weight lost and understood that intentions could not fully predict behavior without accounting for the actual amount of control an individual has over the situation (Ajzen, 1985). Ajzen realized that perceptions of self-efficacy and the controllability of the target behavior, and the actual amount of realized control the individual have over the behavior, had been left out of the equation. The Theory of Planned Behavior added in another variable that influenced behavioral intentions, he called this "perceived behavioral control," which is made up of perceptions self-efficacy and the amount of perceived control an individual has over the behavior (Madden, Ellen, and Ajzen, 1992; Ajzen, 2002).

The Theory of Planned Behavior, then looks like this:

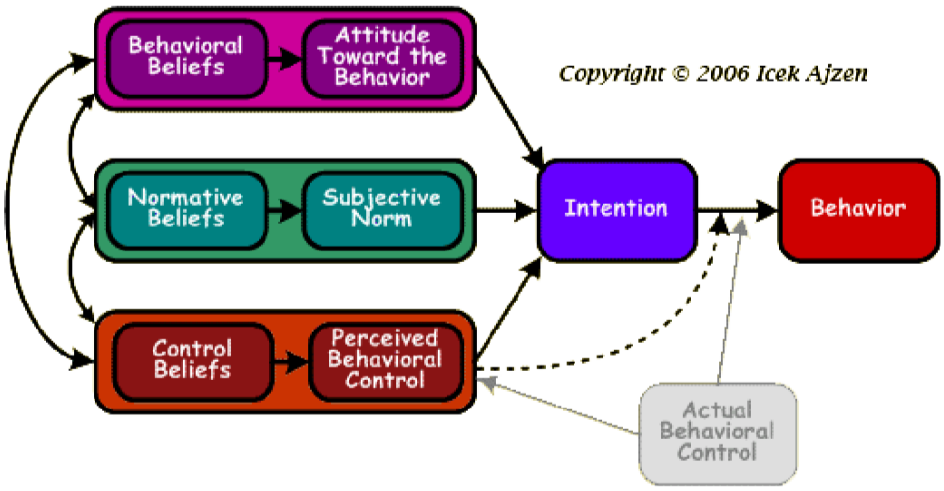


Figure 1: Theory of Planned Behavior (Ajzen, 2006)

The Theory of Planned Behavior and Involuntary Regulations

The Theory of Planned Behavior has been used in multiple studies to examine personal intention to comply with involuntary regulations. Multiple researchers have successfully used the theory to explain driver's speeding intentions and self-reported speeding behavior (Elliott, Armitage, and Baughan 2007; Warner and Aberg, 2006). Şimşekoğlu and Lajunen used the Theory of Planned Behavior to explain seat-belt use by passengers in the front seat of a car; their study showed that attitudes and social norms predicted seat belt behavior (2008).

Similarly, in a study that examined truck driver's behavior on the road (e.g., signaling before changing lanes, following traffic signs, not driving drunk, etc.) and compliance with truck-driving regulations (e.g., following the speed limit, having the correct operator's license for your vehicle, not overloading your vehicle), the Theory of Planned Behavior was utilized. The researchers found that intentions, attitudes, and social norms affected the truck driver's driving behavior and could explain whether the truck drivers obeyed the rules of the road or not. For example, truck drivers who expressed the intention to signal before changing lanes, were more likely to actually signal before changing lanes. However, when it came to compliance with truck-driving regulations, it was found that perceived behavioral control was the largest direct influence on compliance behavior. Truck drivers who felt more in control of their work, were more likely to obey the regulations (Poulter et al., 2008). Drawing from the study by Poutler et al. and others, it seems that perceived behavioral control would directly influence

household compliance with regulations on outdoor water use. Intentions, attitudes, and social norms can help us in understanding individual desires to conserve water, outside of compliance with involuntary regulations.

Filling the Gaps

I have now described some ways in which behavioral beliefs, normative beliefs (i.e., social norms), control beliefs, and external regulations can affect outdoor water conservation. Additionally, it is well understood that intentions are good predictors of behavior, when mediating for the actual amount of control, or "actual behavioral control," an individual has over the behavior (Ajzen, 1985). How might this knowledge be used to fill a current gap in the literature? I can utilize this model to build a basis for understanding what variables might be the most important in understanding how outdoor water rationing (an external effect on the actual amount of control over a behavior) affects attitudinal precursors to the behaviors, as described in this study.

The novelty of my research design is that it focuses on the attitudes experienced by homeowners in their attitudinal precursors under the presence of involuntary water restrictions. Many studies have assessed the effectiveness of involuntary restrictions (Abrahamse et al., 2005; Poulter et al., 2008) and the role of residential water use (Cooper, Rose and Crase, 2011; Olmstead and Stavins, 2009) and found positive results indicating the effectiveness of involuntary regulations in reducing urban water consumption. However, information on how these involuntary water restrictions make people feel has not been adequately explored. Do involuntary restrictions breed distrust from households in the management and security of the water supply? Do they bring the community together, making neighbors feel like they are all contributing to a common

cause? What long-term effects on water conservation do involuntary water restrictions elicit?

Therefore, I propose that in order to better understand outdoor water use and conservation in arid regions that are experiencing an ongoing drought, I need to also understand how implementing involuntary water rationing affects people's attitudinal precursors towards outdoor water conservation. While the literature supports the immediate effectiveness of involuntary regulations, little is known about how these involuntary regulations shape attitudes towards conservation, which could have dramatic effects on long-term conservation when involuntary regulations are rescinded. Drawing on the Theory of Planned Behavior's model for human behavior, and synthesizing current work that has been done using this model to better understand involuntary regulations, I propose the following research question:

How do different governance approaches (i.e. water rationing versus no water rationing) effect homeowners' attitudes and behaviors towards outdoor water conservation?

I will therefore evaluate the following constructs, which are important precursors to water conservation behavior:

1. Self-efficacy and controllability for towards outdoor water conservation
2. Attitudes toward outdoor demand-management policies, especially restrictions
3. Social norms regarding outdoor water conservation
4. Behavioral intentions to conserve water use

These questions will be assessed in two different cities, one with involuntary water rationing in place and another without: Los Angeles, CA and Phoenix, AZ respectively. Comparisons will be drawn between the two cities to better understand the

effect of water rationing on outdoor water conservation beliefs and behaviors. An expansion on the Methodology of this research design follows in the next chapter.

RESEARCH METHODS

This study was conducted in order to understand the effects of involuntary water rationing on homeowners' attitudes and behaviors towards outdoor water conservation. A comparative study was conducted between Los Angeles, California, and Phoenix, Arizona, where there are involuntary water restrictions and no involuntary water restrictions, respectively. The study locations were chosen based on current policy prescriptions in place (i.e., involuntary restrictions and no involuntary restrictions) and relatively arid climatic environments that rely heavily on imported water and have recently experienced periods of prolonged drought. Because differences between the cities do exist, demographic and landscape variables were collected to potentially explain the differences and additional trends that may exist, independent of location.

Specifically, in order to assess attitudes and behaviors, this study measures:

1. Perceived behavioral control beliefs, broken down into perceptions of self-efficacy and controllability
    a. Self-efficacy of compliance with outdoor water restrictions, as a function of average weekly time available and as a function of knowledge, skills and irrigation system know-how
    b. Controllability over outdoor water use
2. Normative beliefs about water personal water conservation efforts and the efforts of others
3. Attitude beliefs towards outdoor water conservation, current local water security, different types of water restrictions, personal responsibility
4. Behavioral intentions towards outdoor water conservation methods

A review of the key constructs utilized in this study is presented in the following table, Table 2.

Key Construct	Definition	Source
Perceived self-efficacy	"Beliefs in one's capabilities to organize and execute the courses of action required to produce given levels of attainments"	Bandura, 1998, pg 624
controllability	"Beliefs about the extent to which performing the behavior is up to the actor"	Ajzen, 2002
Perceived behavioral control	"Perceived control over performance of a behavior"	Ajzen, 2002
behavioral beliefs or “attitudes towards the behavior”	"Beliefs about the likely consequences or other attributes of the of the behavior"	Ajzen, 2002
normative beliefs	"Beliefs about the normative expectations of other people"	Ajzen, 2002
control beliefs	"Beliefs about the presence of factors that may further or hinder performance of the behavior"	Ajzen, 2002
Volitional control	Matter of degree of control over a behavior	Ajzen, 2002

Table 2 - Summary of key constructs and their definitions.

These features were assessed using an online survey platform, Qualtrics, and distributed to multiple survey takers through a research panel company, called Research Now, with the intention of collecting approximately 360 completed surveys, split evenly between Los Angeles, CA and Phoenix, AZ. In the end, there were n=179 in Los Angeles and n=182 in Phoenix completed surveys for a total sample size equal to n=361 completed surveys. The survey data was analyzed using SPSS software.

The focus of this study was understand differences in attitudes and beliefs between the two cities, specifically as this relates to differences in perceptions of self-efficacy and control over their outdoor water use. Between the two drought-striken, water-scarce regions, differences between how the water supply is acquired and used

(i.e., how much of the current water supply is saved or "banked" for the future) have led to significant differences between the way the two cities manage outdoor water use. Specifically, this is seen by the presence of involuntary water restrictions in Los Angeles and no involuntary water restrictions, in response to the drought conditions, in Phoenix. From the literature review presented in Chapter 2, it is known that there are multiple variables that affect human behavior, and the Theory of Planned Behavior has been widely used in similarly complex contexts. Accordingly, I decided to use this as a model to understand attitudes and behaviors in the context of this study. In addition to considering the role of self-efficacy and controllability, the Theory of Planned Behavior, also examines social norms, attitudes towards the behavior (conceptualized as policy attitudes), and behavioral intentions. Therefore, all of these described concepts are evaluated in this study.

In order to identify the exact differences in regulatory context between the two cities this study started with a policy analysis of water regulations in Phoenix and Los Angeles. Through analyzing the outdoor water restrictions in place in Los Angeles, it was apparent that current household irrigation system technology would be relevant to the ease of compliance; therefore, consideration of household irrigation systems became essential to the survey development. Once this background information was collected, further research was done into how best to construct a survey questionnaire for the concepts that were desired to be assessed in this study. A survey pilot was conducted prior to launching the survey.

My survey relied on the construction of multiple concepts, including: self-efficacy, controllability, social norms, policy attitudes, and behavioral intentions. These

concepts were constructed out of composite, related survey questions. In order to justify use of these composite concepts, the internal reliability and validity of the concepts were tested prior to data analysis. Once these concepts were justified, then hypothesis testing of the data could begin. This chapter will guide you through the process taken to accomplish this research design, as described above. Finer details will also be described. The following chapters, 4 and 5, on Results and Discussion, respectively, will continue this story by reporting and discussing the relevant findings from this research methodology.

Comparative Policy Analysis of Outdoor Water Restrictions

In order to understand what external rules were affecting attitudes and behaviors between the two case study cities, a comparison of the outdoor water use rules for the cities was conducted. Rules were focused in scope by all applicable state and city rules; HOA rules were excluded from examination, as it would be impractical to uncover any and all HOA rules throughout the two cities. Rules regarding outdoor water use for commercial purposes were excluded, as this study focuses on homeowners. Rules about residential outdoor water use were then simplified into easy-to-understand language and form the basis of the different measures of self-efficacy and controllability assessed in this study. Simplification of the language of the rules was necessary in order to make the survey more accessible to both residents in Los Angeles and Phoenix, where the surveys would be distributed. Rules were then narrowed down by ignoring any outdoor water use rules that also existed in Phoenix.

The restrictions on outdoor water use that exist in Los Angeles, and not in Phoenix, and were chosen for inclusion in this survey assessment, include:

1. Limits on the amount of days that one can water their yard;
2. Limits on the time of day that one can water their yard;
3. Restrictions on watering the yard during and immediately after rainfall events;
4. Restrictions on the amount of water used per watering interval;
5. Requirements to fix water leaks on the property within a timely manner.

Rationale for Assessing Irrigation Systems

Additionally, this survey chose to assess the capabilities of and the ease of operating the current irrigation system in place for each household. Because this research design has a focus on self-efficacy, it was important to understand how people planned for and executed the watering of their yards. Automated systems are very popular household methods for irrigating yards. Therefore, it was important to understand the role of household irrigation systems in the context of outdoor water use.

When attempting to understand self-efficacy in regards to outdoor water use, it is necessary to understand what variables make the planning and execution of a task more or less difficult. It was determined that the capabilities and ease of operation of the current household irrigation system would likely be an explanatory factor for how difficult a person found compliance with the outdoor water rules or for reducing their overall water use in the yard, in general. For example, if a person has an automatic irrigation system that they know how to use and the irrigation system has the capabilities to limit how much water is used and when, then it should be relatively easy to comply with the outdoor water restrictions. However, if a person does not know how to operate their automatic irrigation system, compliance becomes more difficult because there is a knowledge barrier. If a person knows how to operate their irrigation system, but the

system is not sophisticated enough to control for these restrictions, compliance again becomes more difficult. If a person has no automatic irrigation system and instead relies on human labor to water the yard, then their ability to comply with these restrictions is limited to the availability that is in that person's schedule to make these adjustments and knowledge of how to comply.

Each household's relationship with their irrigation system, including their knowledge of how to use it and the capabilities that the system has, is important to understanding how the homeowner behaves in regards to outdoor water use and management. Therefore, questions related to the use of and capabilities of household irrigation systems appear throughout the survey when attempting to understanding the concepts assessed.

Assessment of Main Concepts

The survey was first constructed in a word document. This allowed for ease of editing as the desired survey concepts were developed and refined. Additionally, all survey questions were tested by homeowner volunteers in the state of California or Arizona prior to finalizing the survey and building it on an online platform through Qualtrics. This section will explain how the scale was built, how each concept was built, and how the survey flow was determined. Copies of the surveys, as distributed to Los Angles and Phoenix residents can be found in the appendix (Appendix B and C, respectively). Once I have discussed how different attitudes and behaviors were assessed in the survey, I will move on to how the survey sample was recruited and the composite survey concepts were justified.

Scale Development

Most of the survey response options utilized a 5-point likert scale that asked about how much the individual agreed or disagreed with the given statement. Response options included: 1) strongly disagree; 2) somewhat disagree; 3) neutral, neither agree or disagree; 4) somewhat agree; and 5) strongly agree. Additionally, a "don't know" response option was available and respondents were allowed to skip the question if they desired unless otherwise specified. If a different set of response options was utilized for the response option set, it is specified herein.

Assessing Self-efficacy

Perceptions on self-efficacy were assessed in order to answer the following research question:

How do different governance approaches affect homeowners' feelings of self-efficacy and controllability towards conserving outdoor water use?

The construction of the self-efficacy concept, as presented in this research design, was influenced by Ajzen's work, as discussed in the literature review (Ajzen, 2002). Ajzen has published a "how-to construct a questionnaire" for the concept of self-efficacy and controllability that was utilized in the building of these concepts (Ajzen, 2002). To assess perceptions of self-efficacy, a series of questions that read as "I can easily…" were used to understand residents' levels of confidence for completing an action, as recommended by Ajzen (2002.) Exact wording of questions can be found in the Appendix.

In order to assess the different measures of self-efficacy under different conditions, two prominent frames of reference were used to assess the difficulty of

different outdoor water use actions. These two frames of thinking for self-efficacy of outdoor water use behaviors were determined to be the average amount of free time available in someone's weekly schedule and their general knowledge and skills, including knowledge of how-to operate the current household irrigation system. In the following chapters these concepts are referred to as 1) "self-efficacy (time)" and 2) "self-efficacy (capacity)," respectively. These prominent frames were chosen to frame the self-efficacy questions because they appeared to be the two main themes that would affect the ease or difficulty of compliance with the assessed outdoor water use restrictions.

Time is an important concept in trying to understand self-efficacy as it relates to outdoor water use and management, hence the development of the concept "Self-efficacy (time)." Consider the outdoor water use rule in Los Angeles that states the residents must only irrigate their yards before 9AM or after 4PM. A homeowner may accept that they could irrigate their yards during this time-frame, however, if they manually water their yards and are not available during that time frame to take care of yard-duties, they may find compliance with this rule difficult. This example also highlights why it is so important to consider household irrigation systems, and know-how of how to operate these systems in this study. Perhaps, this same person who is not available during that time frame has an automated watering system that they know how to operate. When they do have free time, they can adjust the settings on their irrigation system and then compliance becomes easier, as it is automated by technology.

It was determined the household's current irrigation infrastructure and knowledge of how to use it, would likely be one of the main explanatory variables in explaining the perceived ease or difficulty of managing outdoor water use. This is highlighted in the

latter part of the example presented in the previous paragraph and touched upon in the following paragraph. Furthermore, I determined that ease of compliance with some of these rules is also highly dependent on the knowledge and skills that a person has. Hence, these concepts were combined into idea, "Self-efficacy (capacity)." If someone knows how to detect and fix leaks, then compliance with fixing leaks in a timely manner becomes easier than if someone does not know how to detect or fix leaks, ceteris paribus.

The difficulty of operating the existing irrigation system can also potentially create barriers that increase the difficulty of complying with the desired behavior. Hence, the self-efficacy concepts for both time and capacity touch upon scenarios that reference the household irrigation system. Imagine that the desired outcome is to turn off your irrigation system during a rainfall event and postpone future watering for a short period after a rainfall event. Perhaps there is an automatic irrigation system for the yard and someone has the time, knowledge, and capabilities to adjust it in response to rainfall. However, if the irrigation system can only be adjusted by going outside to an outdoor panel while it is currently raining, this may present as an additional level of difficulty in successfully executing the desired behavior, despite having the intent to comply with the behavior.

I recognize that the concepts "Self-efficacy (time)" and "Self-efficacy (capacity)" are closely related. This is intentional and due to the fact that they both assess self-efficacy as the core concept. However, the distinction between these two concepts is to encourage the survey-taker to adopt a different point of view, based on either 1) time or 2) knowledge, skills, and know-how when answering the survey questions.

Assessing Controllability

Perceptions on controllability were assessed in order to answer the following research question:

How do different governance approaches affect homeowners' feelings of self-efficacy and controllability towards conserving outdoor water use?

The concept of controllability was adapted from Ajzen's research on the Theory of Planned Behavior (Ajzen, 2002). This concept, controllability, was described in greater detail in the literature review conducted in Chapter 2. Additionally, Ajzen provides a "how-to construct a questionnaire" guide that describes how-to assess perceptions of control (Ajzen, 2002); this guide was followed in constructing the controllability questions. In order to assess controllability, statements such as "I can…" "I am in control…" and "…is determined by me," were used to understand residents' perceptions of control over their outdoor water use (Ajzen, 2002). Exact wording of questions can be found in the Appendix.

In order to assess how outdoor water use rules affect the amount of control that homeowners feel they have over their outdoor water use behaviors, survey questions were constructed that gauged how much "in control" a person felt. Three behaviors were used to assess levels of control. These include: 1) ability to control how much water you use on your yard; 2) ability to control how often you water your yard; and 3) ability to control when you water your yard. All three aspects of behavior assessed the perceived amount of individual control that residents have over restrictions in place in Los Angeles. Questions were adapted from Ajzen's work and included the following phrases: "I can…" "I am in control…" or "…is determined by me," (Ajzen, 2002).

Assessing Social Norms

Social norms were assessed in order to answer the following research question:

How do different governance approaches affect homeowners' normative expectations towards other people (i.e. social norms) in the local community?

In order to gauge the amount of perceived influence of social norms on outdoor water use behaviors, four questions were developed. These questions asked about aspects of perceived external social pressure (e.g. "my neighbors/friends/family/ think…" and "how my neighbors view my…" and internal social pressure (e.g., "I think my neighbors should…"). Exact wording of the questions used can be found in the Appendix.

Assessing Policy Attitudes

Policy attitudes were assessed in order to answer the following research question:

How do different governance approaches affect homeowners' attitude evaluations (i.e., policy attitudes) towards conserving outdoor water use?

One matrix style question with seven different components was used to assess how much residents would oppose or support different types of government policies meant to restrict and influence outdoor water use. All six of the seven government policies assessed are currently being exercised in Los Angeles and not in Phoenix, with the exception of "education programs to promote water conservation." For the Los Angeles survey, I assessed how much residents currently do or do not support the following conditions and for the Phoenix survey I assessed how much residents thought they might or might not support the following conditions. The government policies assessed included explicit restrictions and conditions that residents must follow, government subsidies for particular water conservation tools, and government

educational programs that promote water conservation. Exact wording of questions can be found in the Appendix.

In order to gain additional contextual understanding of people's attitudes towards the different types of government policies, another two questions assessed whether or not the participant thought that their city and state governments were managing the current water supplies effectively. If someone strongly opposed multiple different government policies, a disbelief that the city government and or state government was doing an effective job of managing current water supplies effectively could potentially explain this disbelief and vice versa.

Assessing Behavioral Intentions

Policy attitudes were assessed in order to answer the following research question:

How do different governance approaches affect homeowners' behavioral intentions to conserve outdoor water use?

Because actual behavior could not be assessed in this research, behavioral intentions were assessed instead, as behavioral intentions are direct antecedents to behaviors (Ajzen, 2002). A series of four questions were developed to assess behavioral intentions. These questions focused on assessing intent to engage in behaviors that are being regulated in Los Angeles. Behavioral intentions assessed included: 1) trying to limit how much water is used on the yard; 2) trying to water the yard in the early morning or later evening only; 3) trying to avoid watering yard for a short period in response to rainfall events; and 4) trying to fix outdoor water leaks quickly. Questions were developed according to Ajzen's guide and included the phrasing, "I try…" as instructed by Ajzen (2002). Exact wording of questions can be found in the Appendix.

Descriptive Beliefs Between Cities

I will now explain some of the additional descriptive beliefs that were assessed between the two cities, in order to understand differences between the cities that might help explain findings around the key constructs assessed in this study.

Assessing Costs and Benefits of Reducing Outdoor Water Use

Three questions were used to understand the respondent's perception of the required costs and benefits to conserving outdoor water use. One question asked the respondent about their belief that reducing the amount of water they currently use on their yard would require significant initial changes to their yard set-up, another question asked this same question but inquired about the financial cost of doing so. Another question assessed whether or not the respondent thought that reducing the amount of water they use on their yard would yield monthly savings on their water bill.

Assessing Individual Responsibility

One survey question was utilized to assess personal feelings of responsibility regarding total outdoor water use. This was to determine how much responsibility, if any, a person felt for the total amount of water they used on their yard. Understanding feelings of responsibility for outdoor water use is important because a lack of personal responsibility for using a natural resource could explain a lack of trying to engage in outdoor water conservation behaviors or a lack of trying to comply with restrictions on outdoor water use.

Assessing Social Responsibility

Two questions were used to understand which group of actors' water use reductions could have the biggest impact on water supplies; one question assessed the

city level and another assessed the state level. Respondents were given the option to select one of the following response options: residential households, farmers, tourists, industry, golf courses, city government, state government, and other (with a fill in the blank option). Response options were randomized for each survey participant to avoid a selection bias of the first response option.

Assessing Perceptions of the Water Supply

Three questions were utilized to assess perceptions of the current state of the water supply. One question asked individuals about whether or not they believed their city is currently experiencing a drought. Additionally, this question could also be used to assess those who are knowledgeable about the current drought and those who are not. Another question asked about whether or not the respondent believes that the government is currently managing their water supplies effectively at both the city and state level. Together these questions assessed individual perceptions of how well the city and state are doing and provide additional clarity to the set of policy attitudes questions that were also asked. For example, if strong opposition was seen in Los Angeles toward many of the water rationing measures, this might be influenced by lack of a belief that the city and state governments are managing their water supplies effectively.

Los Angeles Contextual Questions

In order to better understand respondent's answers, two survey questions were added to the Los Angeles survey that were not added to the Phoenix survey because they contextually did not make sense for the Phoenix residents. These questions assessed whether or not the individual respondent believed that 1) Los Angeles enforces their

prescribed outdoor water use restrictions and 2) whether or not the individual respondent tries to comply with the prescribed city restrictions on outdoor water use.

If there were no differences in perceptions regarding outdoor water use and management, then a lack of belief that the city enforces their restrictions and or a lack of effort to comply with the outdoor water use restrictions could explain these differences.

Landscape Demographics

A series of questions were developed in order to gain a better understanding of the current setup of an individual's yard and what changes they have made to their yard in the past. The following types of question were asked: are you the primary decision-maker for the household, is this your primary residence, are you part of an HOA, is there a pool in your yard, what changes have you already made to you yard, what is your primary method of watering your yard, what irrigation infrastructure do you have in place? These questions deviated from the agree/disagree, 5-point likert scale as explained above. These questions were meant to provide clarity for responses to other questions in the survey.

Population Demographics

A series of standard demographic questions were asked in the survey. This was done to 1) better understand the sample population; 2) control the racial demographic and sample population; and 3) determine if there are any trends in the survey responses that are correlated with demographic variables. Demographic questions included: current zip code, length respondent has lived in home, how many people regularly live in the home, how many are under the age of 18, highest level of completed education, annual household income, gender and political orientation.

Survey flow

The flow of the survey was carefully determined. The survey started with a consent process and the necessary screen out questions, including: are you 18 years of age and are you a current homeowner in the respective city. Next came the racial demographic question so that if the racial quota for the survey had already been met, respondents would be screened out before spending their time answering additional survey questions.

Next the survey transitioned to the questions that assessed the current state of one's yard. These were chosen to go early on in the survey, as these questions did not require much thinking. They were meant to get the respondent acclimated to and invested in the survey. Following this were the two questions that assessed the current state of the city's water supplies.

Then came the controllability questions followed by the self-efficacy questions. These questions were deliberately placed early on in the survey since they required the most mental effort and were the crux of this survey assessment. I did not want survey takers to be experiencing any form of mental fatigue while answering these questions. Additionally, I did not want to start the survey with these questions, as they could be off-putting since they required mental effort, therefore they came after the survey respondent had already invested some time and effort into the survey.

Next came the questions that assessed the costs and benefits of reducing outdoor water use. Then came the questions about normative value beliefs followed by the questions about behavioral intentions and then personal responsibility. All of the

questions thus far are about beliefs that an individual has about themselves or pressure they feel from others. Then the survey transitioned into beliefs about external forces.

For the Los Angeles survey takers, the two questions specific to the Los Angeles survey came next; these questions were about trying to comply with Los Angeles restrictions and whether or not they believed that Los Angeles' water restrictions were enforced. Then, for both cities taking the survey, came the questions about policy attitudes. These were followed by the questions that assessed social responsibility. These questions were followed by the questions about the current state of the water supplies. Lastly, the survey ended with the remaining demographic variables (racial demographics were were assessed at the beginning of the survey, so participants could be screened out once a racial quota was met). A copy of the specific language used in the surveys can be found in the Appendix.

Survey Piloting

As mentioned earlier, the survey was first created in a word document. This allowed for editing ease as feedback came in through the piloting stage. As survey questions were developed and flow determined, the survey was piloted. The survey was piloted multiple times throughout the questionnaire development stage to make sure that the questions were logical to a survey-taker. It should be noted that there were two different versions of the survey, with language tailored to the respective city and state that the survey was disseminated in. Once the questions and flow were finalized, the survey was transited to an online platform, hosted by Qualtrics. Qualtrics was chosen as the survey provider due to their user-friendly but sophisticated platform.

Sample Recruitment

The ideal sample size was determined to be approximately 360 completed surveys, split between the two cities being analyzed. This sample size was in part decided based upon available funding to collect the survey. This research design had a budget of about $2,000 to spend on collecting completed surveys. I worked with a research firm, called Research Now, to collect completed surveys. Using the budget allowance, it was determined that I could collect 360 completed surveys total. This budget allowance also included financial payments made to each completed survey-taker. Research Now facilitated payment to each completed survey-taker in the amount of approximately $3.00 per completed survey.

It was decided that in order to have a representative sample of each city, it was important to try to collect completed surveys based on the actual racial demographic make-up of the cities. Therefore, racial controls were put in place when developing the city to screen out survey participants once a racial quota was met for each city. The research firm that I partnered with was able to help facilitate this by strategic solicitation. Census data from the most recent year available was utilized to construct the desired demographic profile for each city's survey sample. It should be noted that there were complications in reaching the desired Hispanic/Latino/Spanish quota for Phoenix and in the end, additional White/Anglo surveys were collected, in Phoenix, to account for this discrepancy. The completed survey demographics are presented in Chapter 4: Results.

It was also important that our survey population meet two other characteristics, including: 1) being a current homeowner in the city assessed and 2) being over the age of 18. Research Now was able to target potential survey takers registered in their online

database of survey panelists that fit the desired profile. It was important that the survey-taker be a current homeowner in the city being assessed, because that was one of the requirements of the research design. The choice was made to target homeowners in general, with no discrimination between single-family or multi-family households; although information on family size would be collected to understand how many water users are in the home. The distinction between homeowner and renter was purposeful for two main reasons: 1) homeowners have more power in making decisions regarding property and landscaping options than renters; and 2) homeowners have more incentive to invest in efficient upgrades regarding property and landscaping options. The first element is important to the assessment of self-efficacy and control and the second element is important in regards to making yard management improvements to conserve outdoor water use. The age requirement was set to 18 years or older so that the survey-taker could legally consent to participating in the research process. Through required-to-answer screening questions embedded in the survey, I was able to verify that each survey respondent that completed a survey was both a current homeowner in the respective city of interest and over the age of 18, in order to provide consent to the research process.

Concept Justification

In order to justify the use of composite concepts built in this survey, internal validity and reliability of the concepts was tested. In order to test the internal validity, a factor analysis of the concepts was run. A Cronbach's Alpha test was run to test the internal reliability of the concepts used.

Internal Validity

In this survey, multiple survey questions were utilized to test for particular concepts. These concepts included: self-efficacy (time), self-efficacy (capacity), controllability, social norms, policy attitudes, and behavioral intentions. In order to justify making a composite variable based on these concepts for the purposes of a statistical analysis, the internal validity of these concepts was tested. A factor analysis was run on these concepts to determine loading values. These concepts were supported based on the factor analysis; there were six distinct sets of loading variables distributed among the six main concepts.

Internal Reliability

Furthermore, in order to support the use of the concepts utilized in this study, the internal reliability of the concepts was tested using a Cronbach's Alpha test. There was strong internal reliability between the questions that composed a concept, which each concept testing greater than or equal to 0.718, as shown in Table 3.

Assessment of Internal Reliability of Concepts		
Concepts	**N of items**	**Cronbach's Alpha**
Controllability	3	0.906
Social Norms	4	0.718
Behavioral Intentions	4	0.775
Policy Attitudes	6	0.860
Self-efficacy (free time)	4	0.884
Self-efficacy (capacity)	7	0.904

Table 3: Internal reliability test of concepts used in study

Hypothesis Testing

The hypotheses presented in this research design were evaluated using a Mann Whitney U test run through SPSS software. I evaluated whether or not there were any differences in the data between the two cities using this test. Bonferroni's correction was

applied to the alpha value to account for the testing of multiple hypotheses. Mann Whitney U tests were run on the secondary hypotheses; these were the hypotheses not related to the composite concepts built in this study. A full presentation of the hypothesis and presentation of the results can be found in the following chapter, Results.

Correlations

Correlations of the main concepts were analyzed using a Spearman Rho's test in SPSS. This test was run in order to evaluate the relationships between concepts. A presentation of the results can be found in the following chapter, Results.

Summary Statistics

Basic descriptive statistics and frequencies were run on all questions in the survey using SPSS software. This was conducted for multiple reasons, including: noticing trends and quality control. This data was particularly helpful in evaluating demographic trends of survey-takers, such as: gender identification, political orientation, highest completed education level, income level, etc.

Evaluation of Results

Once all the data was collected and analyzed, then I could begin trying to make sense of the results. In Chapter 5, Discussion, I begin the discussion of what the data might be telling us, elaborating on the findings presented in Chapter 4.

RESULTS

The purpose of the research design was to investigate how involuntary outdoor water restrictions affect attitudes towards residential outdoor water use and management. In order to accomplish this, a survey was developed to assess attitudes and behaviors towards outdoor water use and management. These attitudes and behaviors included: perceptions of self-efficacy, perceptions of controllability, social norms, policy attitudes (i.e., attitudes towards different policies that regulate and promote outdoor water conservation) and behavioral intentions. Additional clarifying information was collected, such as: population and landscape demographics, personal beliefs about the current water situation, supply, and management, feelings of responsibility towards outdoor water use, expectations about the outcomes of reducing the amount of water used outdoors.

This study sampled 361 unique detached housing-unit residents from both Los Angeles, California and Phoenix, Arizona (n=179, n=182, respectively). The data was collected through an online survey powered by Qualtrics and distributed to survey-takers through a research panel firm, called Research Now. Population demographics of the survey were controlled, as best as possible, to match city demographics. Survey-takers had to be a homeowner and current resident in one of the two cities to be eligible to participate in the research process. Additionally, people under the age of 18 were screened out of the survey, as they could not legally consent to the research process.

For the rest of this chapter I will elaborate on the findings of this research. In this chapter, I will discuss the study population demographics, including summary landscape features of the sample population, drought beliefs, water supply beliefs, beliefs about how effectively the water supply is managed, feelings of personal responsibility, and

beliefs about outcomes associated with reducing outdoor water use. Additionally, this chapter will report findings on the following main concepts assessed in this study: perceptions of self-efficacy, perceptions of controllability, social norms, policy attitudes, and behavioral intentions.

In this chapter, I will present the findings of the data analysis and in the following Discussion chapter, I will elaborate on what these findings mean. Furthermore, in the Discussion chapter I will link the supported hypotheses and data findings back to the main research questions and have a discussion on what the data means in this context.

Description of the Sample

The target sample size was approximately 180 completed survey responses from each city: Los Angeles, California and Phoenix, Arizona. Both sample sizes were very close to this target, with 179 completed surveys in Los Angeles and 182 completed surveys in Phoenix collected. Each sample size attempted to control for racial demographics to match the actual racial demographics of the study city. In Phoenix, however, the target population for "Hispanic/Latino/Spanish" was not met and ultimately, extra "White/Anglo" survey responses were collected, since the latter was the most abundant racial population in Phoenix. Aside from the discrepancy mentioned in the Phoenix samples, the remaining samples collected very closely matched the actual racial demographics in the respective cities. These results are presented in Table 4.

Racial Demographics						
	Los Angeles			Phoenix		
	Frequency	Percentage of Survey-takers	Percentage of Actual Residents	Frequency	Percentage of Survey-takers	Percentage of Actual Residents
White/Anglo	51	28.5	28.6	129	70.9	44.9
Hispanic/Latino/Spanish	86	48.0	48.6	28	15.4	41.2
Black/African American	15	8.4	8.6	12	6.6	6.4
Asian/Asian American	21	11.7	11.5	6	3.3	3.6
Native American/ American Indian	1	0.6	0.2	3	1.6	1.6
Other	5	2.8	2.6	4	2.2	2.3
Total	179	100	100	182	100	100

Table 4: Racial demographics of survey-takers, in Los Angeles and Phoenix, compared to actual city racial demographics.

Additional demographic information was collected on the study population, including highest level of completed education, total combined household income before 2015 taxes, political orientation and gender. These results are presented in Tables 5-8.

Highest level of education completed				
	Los Angeles		Phoenix	
	Frequency	Percentage	Frequency	Percentage
Less than HS	3	1.7	2	1.1
HS degree	16	8.9	17	9.3
Some college	46	25.7	47	25.8
2 year college degree	14	7.8	27	14.8
4 year college degree	66	36.9	55	30.2
Post grad degree	34	19.0	33	18.1
Total	179	100.0	181	99.5

Table 5: Highest level of education completed by survey-takers in Los Angeles and Phoenix.

Total Household Combined Income, before taxes, 2015				
	Los Angeles		Phoenix	
	Frequency	Percentage	Frequency	Percentage
Under 15,000	1	0.6	0	0.0
15,000-29,999	5	2.8	12	6.6
30,000-49,999	25	14.0	27	14.8
50,000-74,999	35	19.6	43	23.6
75,000-99,999	35	19.6	31	17.0
100,000-149,999	48	26.8	39	21.4
More than 150,000	23	12.8	22	12.1
Don't know	7	3.9	8	4.4
Total	179	100.0	182	100.0

Table 6: Total household combined income, before taxes, 2015, of survey-takers in Los Angeles and Phoenix.

Polical Orientation				
	Los Angeles		Phoenix	
	Frequency	Percentage	Frequency	Percentage
Very conservative	13	7.3	14	7.7
Conservative	30	16.8	44	24.2
Slightly conservative	17	9.5	20	11.0
Moderate	61	34.1	42	23.1
Slightly Liberal	11	6.1	17	9.3
Liberal	31	17.3	19	10.4
Very liberal	5	2.8	8	4.4
Don't know	10	5.6	18	9.9
Total	179	100.0	182	100.0

Table 7: Political orientation of survey-takers in Los Angeles and Phoenix.

Gender Identification				
	Los Angeles		Phoenix	
	Frequency	Percentage	Frequency	Percentage
Male	71	39.7	61	33.5
Female	107	59.8	120	65.9
Prefer not to answer	1	0.6	1	0.5
Total	179	100.0	182	100.0

Table 8: Gender identification of survey-takers in Los Angeles and Phoenix.

There were no stark differences between the highest level of education completed or total combined household income between the two cities, as depicted in Tables 5 and 6, respectively. Furthermore, the gender breakdown of survey takers between the two

populations was roughly the same, as depicted in Table 8. In Table 7, however, it was noticed that the political orientation of the two cities was slightly different. Phoenix-area survey-takers tended to identify as more conservative than Los Angeles-area survey-takers, who tended to identify as more liberal.

Landscape demographics

In order to best understand the survey responses associated with the tested hypotheses, it was also deemed necessary to understand what types of yard features and methods of watering were being utilized by residents in Los Angeles and Phoenix. The standard demographics (i.e., race, gender, income level, education level) did not yield many differences in the populations between the cities, with the notable exception of political orientation. However, when I look at some of the landscape descriptive features between the two cities, presented in Table 9, it is clear that there are significant differences. For example, Phoenix homeowners are much more likely to be a part of a homeowner's association. 59.5% of the Phoenix population survey reported being a part of a homeowner's association whereas only 30.2% of survey-takers in Los Angeles reported being a part of a homeowner's association. Rates of having a pool are also a little higher in Phoenix, as opposed to Los Angeles (39.6% as opposed to 24.6%, respectively).

There also appears to be a stronger culture of conservative watering methods in Phoenix as opposed to Los Angeles. When I look at the reported methods utilized to water the yards between the two cities, reported in Figure 10, it is apparent that conservative watering techniques (i.e., drip irrigation) are more popular in Phoenix. Additionally, residents in Los Angeles, are more likely to engage in methods of watering

their yard that are traditionally less efficient in regards to water application, such as: sprinklers on the ground; sprinklers on a hose; handheld hoses; water cans, jugs, or containers. This will be discussed more in the following chapter, Discussion

Yard Features

Yard Features				
	Los Angeles		Phoenix	
	% Yes	% No	% Yes	% No
Part of an HOA	30.2	67.6	59.9	39.0
Have a pool	24.6	75.4	39.6	60.4

Table 9: Summary of yard features (HOA and pool presence) in Los Angeles and Phoenix

Methods of Watering

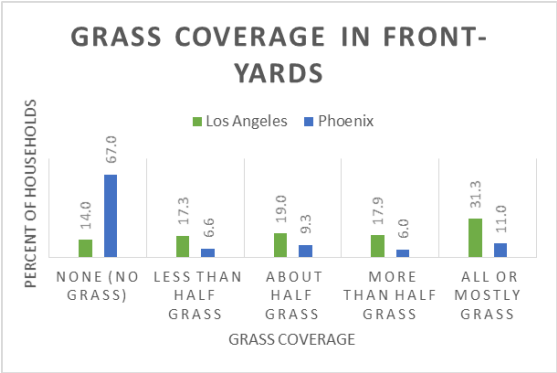
Which methods are used water your yard? (select all that apply)		
	Los Angeles	Phoenix
	Percent Contribution	Percent Contribution
Drip irrigation	11.2	60.4
Sprinklers on the ground	65.9	48.9
Sprinklers on a hose	15.1	8.2
A hose (handheld that you	47.5	39.5
Water can, jug, or container	26.8	20.9
Flood irrigation	2.8	2.2
Other	2.8	2.2

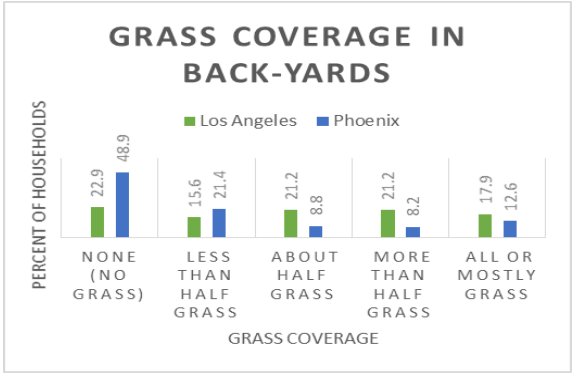
Table 10: Reporting of which methods are utilized to water yards in Los Angeles and Phoenix

Grass Coverage in Yards

Residents in Phoenix were much more likely to report that they no grass in either their front- or back-yard. Residents in Los Angeles were much more likely to report that they had at least half of their front- or back-yards covered in grass. These findings

regarding grass coverage in front- and back-yards, as shown in Figures 2 and 3, perpetuate the speculation that there is a stronger water conservation culture in regards to landscaping in Phoenix, as opposed to Los Angeles.





Figures 2 and 3: Grass coverage in front-yards and back-yards, respectively, between Los Angeles and Phoenix survey-takers.

Descriptive Beliefs of Sample

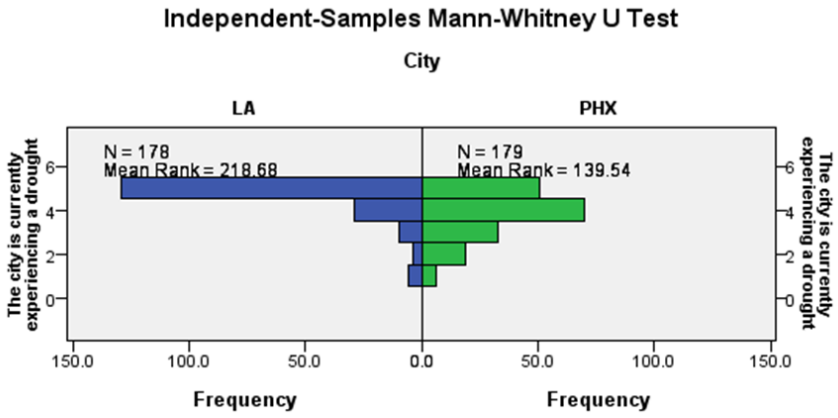
It was believed that some basic beliefs about the current state of the water situation (i.e., drought belief, beliefs about water supply and management, feelings of personal responsibility, outcomes of reducing water) would be different between the two cities. Mann Whitney U Tests were run on each of these descriptive beliefs to evaluate if there was a significant difference between the two cities. These values are reported in Table 8. Therefore, the following descriptive beliefs between the two cities were assessed:

1. Perceptions of whether or not the city is currently experiencing a drought,
2. Perceptions of whether or not the city has an adequate supply of water,
3. Perceptions of how well the city is currently managing water supplies,
4. Perceptions of how well the state is currently managing water supplies,

5. Feelings of personality responsibility towards outdoor water use,
6. Perceptions of whether reducing outdoor water use would require significant initial costs,
7. Perceptions of whether reducing outdoor water use would require significant initial changes to the yard,
8. Perceptions of whether reducing outdoor water use would result in significant savings on a residential monthly water bill.

Drought Beliefs

Residents in Los Angeles were more likely to believe that their city was currently experiencing a drought, as opposed to residents in Phoenix (p-value=0.000), as shown in Figure 4. Despite the fact that both cities have been experiencing an ongoing drought, as classified by the U.S. Drought Monitor, it is believed that residents in Los Angeles were more aware of the ongoing drought conditions because they were experiencing state-mandated water restrictions. It is also likely that the social messaging about drought conditions throughout the state helped raise awareness in Los Angeles residents.



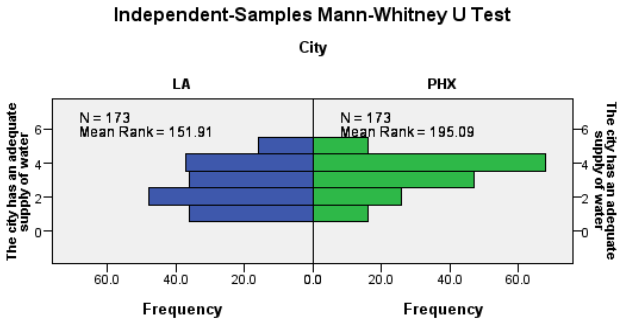
Total N	357
Mann-Whitney U	8,868.500
Wilcoxon W	24,978.500
Test Statistic	8,868.500
Standard Error	898.050
Standardized Test Statistic	-7.864
Asymptotic Sig. (2-sided test)	.000

Figure 4: Mann Whitney U Test results regarding beliefs about whether or not a resident thought their city is currently experiencing a drought, between Los Angeles and Phoenix.

Water Supply Beliefs

Residents in Phoenix were more likely to believe that their city currently had an adequate supply of water (p-value = 0.000), as shown in Figure 5. It is known that the presence of the water rationing in California was associated with skepticism among the residents in Los Angeles regarding the current water supply. However, the City of Phoenix public touts that they have enough of a water reserve to support their current population up to 100 years in the future (City of Phoenix, 2016). It is unknown whether public messaging or drought awareness was responsible for the belief in a more adequate

water supply in Phoenix, as opposed to Los Angeles, in the context of this study. Because drought beliefs and adequate water supply beliefs are negatively correlated with each other, it likely that drought beliefs affected adequate water supply beliefs, however, adequate water supply beliefs might also have been affected by public messaging. This is an important area for future researchers to investigate.



Total N	346
Mann-Whitney U	18,700.000
Wilcoxon W	33,751.000
Test Statistic	18,700.000
Standard Error	904.008
Standardized Test Statistic	4.132
Asymptotic Sig. (2-sided test)	.000

Figure 5: Mann Whitney U Test results regarding beliefs about whether or not a resident thought their city currently has an adequate supply of water, between Los Angeles and Phoenix.

Water Management and Responsibility Beliefs

There were no significant differences between the two cities, regarding beliefs about how the city and the state were currently managing the water supply or about personal responsibility over the amount of outdoor water used.

Costs, Changes, & Savings Beliefs

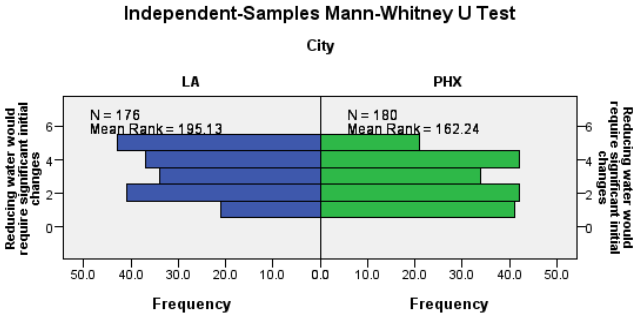
Residents in Phoenix were more likely to disagree that reducing the amount of water they currently use on their yards would require significant initial costs (p-value = 0.002), as shown in Figure 6. It is believed that two things may have been going on here. First, based on the yard characteristics collected between Phoenix and Los Angeles, residents in Phoenix were much more likely to have drip irrigation installed than people in Los Angeles; therefore, this might suggest that people in Phoenix were more likely to have newer and/or more sophisticated yard infrastructure or xeriscape yards already in place. Second, it seems possible that more people in Los Angeles have been recently changing their yard infrastructure as a result of the involuntary water restrictions – therefore, initial costs may be at the forefront of their mind, making them more likely to agree with this statement.

Just as residents in Los Angeles were more likely to believe that reducing the amount of water they currently use on their yards would require significant initial costs, they were also more likely to agree with the statement that it would also require significant initial changes to their yard (p-value = 0.002), as shown in Figure 7. The reasoning behind this belief is assumed to be the same as the reasoning behind the Beliefs About Costs.

Residents in Los Angeles were also more likely to believe that reducing the amount of water they currently use on their yards would result in significant savings on their monthly water bill (p-value = 0.000), as shown in Figure 8. It is proposed that residents held this belief because they have been forced to make cutbacks on their water

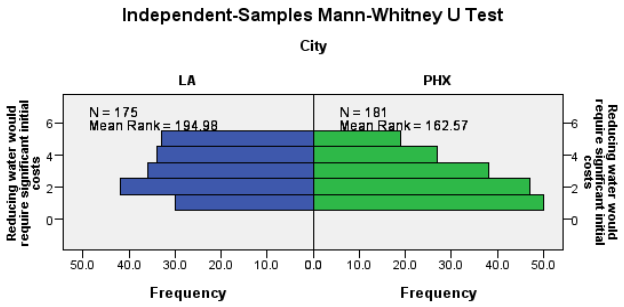
use and have likely seen recent savings. Having seen recent savings, this belief was more likely to be prominent on the minds of residents in Los Angeles.

A summary of the differences in the descriptive beliefs between Los Angeles and Phoenix is presented in Table 11.



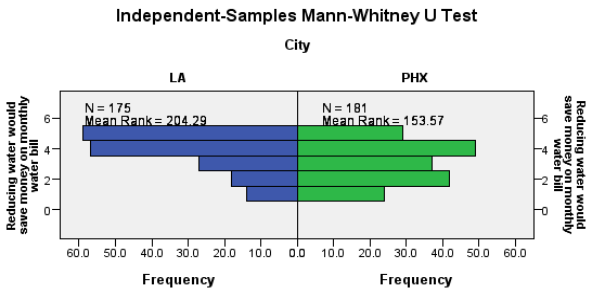
Total N	356
Mann-Whitney U	12,913.000
Wilcoxon W	29,203.000
Test Statistic	12,913.000
Standard Error	950.379
Standardized Test Statistic	-3.080
Asymptotic Sig. (2-sided test)	.002

Figure 6: Mann Whitney U Test results regarding beliefs about whether or not reducing the amount of water used on your yard would require significant initial changes, between Los Angeles and Phoenix.



Total N	356
Mann-Whitney U	12,953.500
Wilcoxon W	29,424.500
Test Statistic	12,953.500
Standard Error	949.094
Standardized Test Statistic	-3.039
Asymptotic Sig. (2-sided test)	.002

Figure 7: Mann Whitney U Test results regarding beliefs about whether or not reducing the amount of water used on your yard would require significant initial costs, between Los Angeles and Phoenix.



Total N	356
Mann-Whitney U	11,324.500
Wilcoxon W	27,795.500
Test Statistic	11,324.500
Standard Error	944.509
Standardized Test Statistic	-4.778
Asymptotic Sig. (2-sided test)	.000

Figure 8: Mann Whitney U Test results regarding beliefs about whether or not reducing the amount of water used on your yard would yield significant savings on your monthly water bill, between Los Angeles and Phoenix.

Descriptive Beliefs - Differences Between Populations		
Belief	**P-value**	**Finding**
The city is currently experiencing a drought	0.000	Belief is stronger in Los Angeles
The city has an adequate supply of water	0.000	Belief is stronger in Phoenix
The city is currently managing water supplies effectively	0.316	No significant difference between cities
The state is currently managing water supplies effectively	0.226	No significant difference between cities
Feelings of personal responsibility towards water used on yard	0.860	No significant difference between cities
Reducing water would require significant initial costs	0.002	Belief is stronger in Los Angeles
Reducing water would require significant initial changes	0.002	Belief is stronger in Los Angeles
Reducing water would save money on monthly water bill	0.000	Belief is stronger in Los Angeles

Table 11: Summary p-value reporting and subsequent findings from the Mann Whitney U Tests run between the two cities based on the descriptive beliefs identified.

Los Angeles Contextual Beliefs

Additionally, it seemed prudent to understand whether or not Los Angeles residents believed 1) that the state-mandated outdoor water restrictions were being enforced; and 2) whether or not residents were attempting to comply with those restrictions. Therefore, two additional questions were used to assess these beliefs in the Los Angeles survey population only.

There were strong beliefs among Los Angeles residents that Los Angeles did enforce outdoor water restrictions. 70.4% of respondents in Los Angeles reported that they either "strongly agree" or "somewhat agree" with the statement that Los Angeles enforces their outdoor water restrictions that are currently in place; this is shown in Figure 9. Additionally, residents in Los Angeles reported their intent to comply with the outdoor water restrictions. 88.8% of Los Angeles residents reported that they either "strongly agree" or "somewhat agree" with the statement "I try to comply with outdoor water restrictions;" these results are shown in Figure 10.

Figure 9: Beliefs regarding whether or not individuals in Los Angeles believe that the outdoor water restrictions are enforced

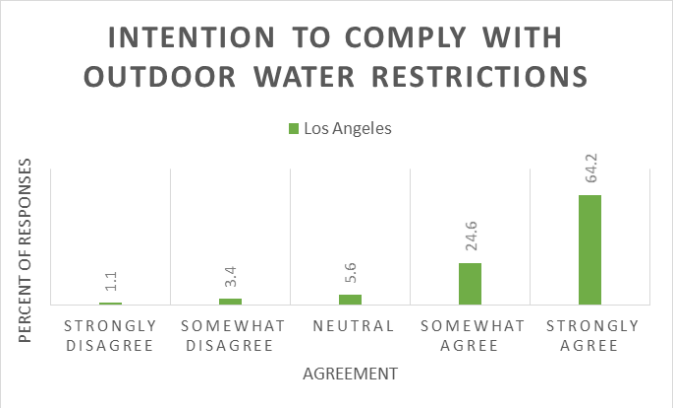


Figure 10: Beliefs regarding whether or not individuals in Los Angeles have the intention to comply with outdoor water restrictions

Main Hypotheses

In Chapter 1, the main research questions that guide this study were presented. In Chapters 2 and 3, I built the case and logical reasoning for how to go about answering these research questions and ultimately how I might test these questions through the construction of multiple hypotheses. The hypotheses tested in this research design were as follows:

$H1\_A_{null}$: Self-efficacy (time) of outdoor water use between the two cities will not be different.

$H1\_A_{alternate}$: Self-efficacy (time) of outdoor water use between the two cities will be different.

$H1\_B_{null}$: Self-efficacy (capacity) of outdoor water use between the two cities will not be different.

$H1\_B_{alternate}$: Self-efficacy (capacity) of outdoor water use between the two cities will be different.

$H2_{null}$: Controllability over outdoor water use between the two cities will not be different.

$H2_{alternate}$: Controllability over outdoor water use between the two cities will be different.

$H3_{null}$: Social norms towards outdoor water use between the two cities will not be different.

$H3_{alternate}$: Social norms towards outdoor water use between the two cities will be different.

$H4_{null}$: Policy attitudes towards outdoor water use restrictions between the two cities will not be different.

$H4_{alternate}$: Policy attitudes towards outdoor water use restrictions between the two cities will be different.

$H5_{null}$: Behavioral intentions to conserve water through outdoor water use between the two cities will not be different.

$H5_{alternate}$: Behavioral intentions to conserve water through outdoor water use between the two cities will be different.

Due to the limits of statistics, I can only test for differences between the two cities, in regards to our hypotheses construction. Therefore, each hypothesis has both a null and alternative hypothesis. The null hypothesis is that there is no difference and the alternative hypothesis is that there is a difference. When analyzing the data, I will either decide to accept or reject the null hypothesis that says there is no difference. If I reject the null hypothesis then I am saying that there is a difference between the two cities; this then would support my alternate hypothesis. Then from analyzing the data, I can infer which concepts might be higher or lower between the two cities.

The hypotheses were tested using a Mann Whitney U Test run using SPSS software. The alpha value was modified using a Bonferroni correction, to account for a total of 6 null hypotheses (alpha = 0.05/6).

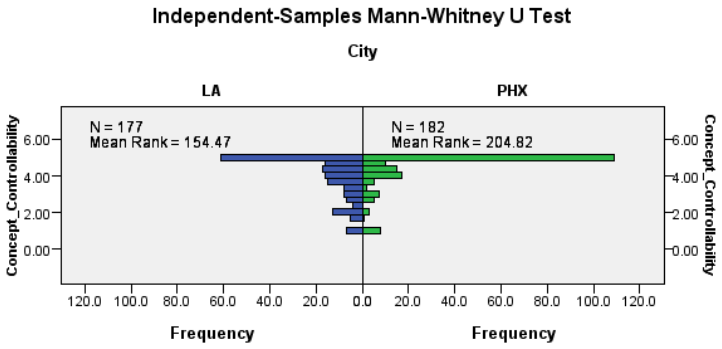
Self-efficacy

In this study, self-efficacy was evaluated using two distinct frames of reference, these were: time and capacity. The "time" frame of reference was meant to prompt survey-takers to consider the average amount of free time they have available, based on their weekly schedules. The "capacity" frame of reference was meant to prompt survey-takers to consider their current knowledge and skills, including their know-how to operate their current irrigation system. Then, under the umbrella of these two frames of reference, multiple survey questions were developed to assess perceptions of self-efficacy. A series of statements regarding the ability to manage outdoor water use were assessed using the phrasing such as "I can." Four questions were used to assess the time perspective and seven questions were used to assess the capacity perspective. No significant differences between the self-efficacy concepts were found between the two cities.

Controllability

In this study, three survey questions were developed to test for perceptions of control over outdoor water use and management. These questions asked about individual outdoor water use and management, within the household, and used phrasing such as, "I can choose," "I am in control," and "is determined by me," to build the overall concept of controllability. There was found to a statistically significant difference between perceptions of controllability between the two cities (p-value = 0.000); this means that

there was a difference in the perceptions of controllability over outdoor water use and management between the two cities. Furthermore, based on the reported mean ranks between the cities, as presented in Figure 11, it is apparent the perceptions of controllability were stronger in Phoenix than in Los Angeles.



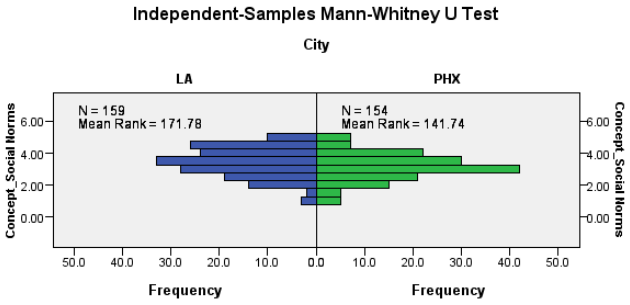
Total N	359
Mann-Whitney U	20,625.000
Wilcoxon W	37,278.000
Test Statistic	20,625.000
Standard Error	928.196
Standardized Test Statistic	4.868
Asymptotic Sig. (2-sided test)	.000

Figure 11: Mann Whitney U test values for Controllability concept, measured between Los Angeles and Phoenix.

Social Norms

In this study, four questions were used to assess attitudes about social norms between the two cities. Statements about outdoor water use and management were drafted using phrasing such as, “My friends and family think…” “My neighbors should…” “How my neighbors view…” to understand social norms. There was found to a statistically significant difference between perceptions of social norms between the two

cities (p-value = 0.003); this means that were was a significant difference in the attitudes regarding social norms of outdoor water use between the two cities. Furthermore, based on the reported mean ranks between the cities, as presented in Figure 12, it is apparent the perceptions of social norms were stronger in Los Angeles than in Phoenix.



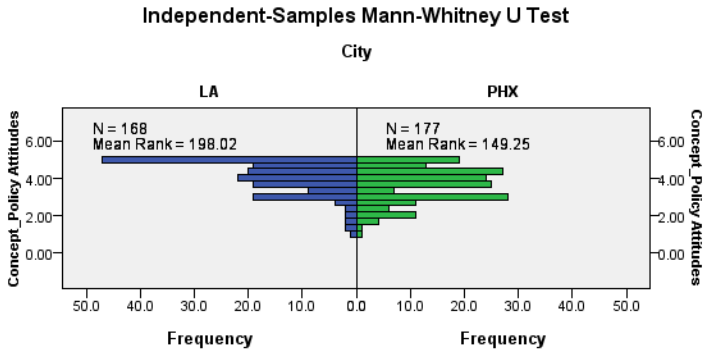
Total N	313
Mann-Whitney U	9,893.000
Wilcoxon W	21,828.000
Test Statistic	9,893.000
Standard Error	797.236
Standardized Test Statistic	-2.948
Asymptotic Sig. (2-sided test)	.003

Figure 12: Mann Whitney U test values for Social Norms concept, measured between Los Angeles and Phoenix.

Policy Attitudes

In this study, a series of questions were asked that assessed how much a resident might support or oppose different types of government policy prescriptions, meant to conserve outdoor water use. The policy prescriptions assessed in this concept included, restrictions and limits on outdoor water use, rebates meant to conserve outdoor water use, and educational programs that promoted water conservation. There was found to a statistically significant difference between policy attitudes in the two cities (p-value =

0.000); this means that between the two cities, there were significantly different attitudes towards policy prescriptions meant to regulate outdoor water use and promote water conservation. Furthermore, based on the reported mean ranks between the cities, as presented in Figure 13, it is apparent the perceptions towards different policy prescriptions meant to conserve water were more favorable in Los Angeles than in Phoenix.



Total N	345
Mann-Whitney U	10,664.000
Wilcoxon W	26,417.000
Test Statistic	10,664.000
Standard Error	922.131
Standardized Test Statistic	-4.559
Asymptotic Sig. (2-sided test)	.000

Figure 13: Mann Whitney U test values for Policy Attitudes concept, measured between Los Angeles and Phoenix.

Behavioral Intentions

A set of four questions were utilized to assess behavioral intentions between the two cities. These questions assessed individual intentions to engage in outdoor water use and management behaviors; these questions used phrasing such as, “I try” in relation to

the behaviors. There was no statistical difference between the two cities. Therefore, behavioral intentions towards outdoor water use and management between the cities are not significantly different.

A summary of the main hypotheses assessed and decisions made regarding significance are presented in Table 12.

Main Hypotheses		
Concepts	**P-value**	**Decision**
Self-efficacy (time)	0.224	Retain null hypothesis
Self-efficacy (capacity)	0.534	Retain null hypothesis
Controllability	0.000	Reject null hypothesis
Social norms	0.003	Reject null hypothesis
Policy attitudes	0.000	Reject null hypothesis
Behavioral intentions	0.079	Retain null hypothesis
The significance level is 0.01		
Adjusted alpha of .008333, based on Bonferroni's correction		

Table 12: Summary reporting of the P-values of the main hypotheses of the study. The null hypothesis was that there were no differences between the two cities.

Correlation of Main Concepts

A correlation of the concepts utilized in the main hypotheses was run using a Spearman's Rho correlation. Statistically significant correlations between multiple concepts were found and are reported in Table 13.

The self-efficacy concepts, time and capacity were both highly correlated with each other (0.708 Rho value); this is likely due to the fact that the questions developed to assess self-efficacy, from a time and capacity perspective, had significant wording overlapping, even though the sets of questions were premised with distinctly different frames of reference.

Additionally, there was a strong correlation between both self-efficacy concepts, both time and capacity, and behavioral intentions (0.514 and 0.465, respectively). These

sets of survey questions also had significant overlap, however the self-efficacy questions started off with “I can…” and the behavioral intention questions started off with “I try…” It is possible that some survey-respondents did not conceptualize a strong difference between what they can do and what they try to do. However, it is also possible that feelings about what survey-respondents feel that they can do might lead to what they try to do. Based on the literature surrounding self-efficacy, people are more likely to try to do behaviors that they believe that they can accomplish (Ajzen, 2002).

Behavioral intentions, self-efficacy (time), and self-efficacy (capacity) were all correlated with policy attitudes (Rho values = 0.430, 0.306, 0.273, respectively). As discussed, the literature supports the idea that people are more likely to try to do behaviors that they believe they can accomplish (Ajzen, 2002). It is also possible that people are more likely to support policy prescriptions that they believe they can comply with. It seems logical that a person would not support a policy prescription that they believed to be too difficult to comply with, as this would likely create legal or financial hardship on the individual. This additional hardship would likely form a positive feedback loop increasing the perceived difficulty of compliance, and further decreasing self-efficacy, which would negatively affect behavioral intentions.

Controllability was correlated with both self-efficacy concepts, capacity and time, and behavioral intentions (Rho values = 0.272, 0.271, 0.128, respectively). The literature tells us that when people have a high perception of control over an action, this both strengthens the likelihood of the person trying the action and increases the amount of effort an individual is likely to exert to execute the action (Ajzen, 2002). These findings, then, make sense; it seems logical that with a higher amount of perceived control over a

behavior, a person would likely try harder to complete the behavior, and that this would likely positively influence perceptions of self-efficacy. Together, the higher perceptions of control and self-efficacy would translate into higher behavioral intentions.

Policy attitudes and social norms were correlated with each other (Rho value = 0.289). It is unclear whether stronger social norms lead to stronger policy attitudes or other way around. Behavioral intentions were also weakly correlated with social norms (Rho value = 0.113). There is not a clear explanation for these results. These would both be great areas for future researchers to attempt to better understand what is happening here.

Based on a reflection of the data findings, it was posited that there may be a significant relationship between drought beliefs in the city and beliefs about the water supply. Therefore, an additionally correlation was run between these two beliefs. It was found that these two beliefs were negatively correlated (Rho value = -0.387).

Summary of Statistically Significant Correlations		
Item 1	**Item 2**	**Spearman's Rho**
Self-efficacy (time)	Self-efficacy (capacity)	.708**
Self-efficacy (time)	Behavioral Intentions	.514**
Self-efficacy (capacity)	Behavioral Intentions	.465**
Behavioral Intentions	Policy Attitudes	.430**
Self-efficacy (time)	Policy Attitudes	.306**
Policy Attitudes	Social Norms	.289**
Self-efficacy (capacity)	Policy Attitudes	.273**
Self-efficacy (capacity)	Controllability	.272**
Self-efficacy (time)	Controllability	.271**
Controllability	Behavioral Intentions	.128*
Behavioral Intentions	Social Norms	.113*
Drought Beliefs	Water Supply Beliefs	-0.387**
** Correlation is significant at the 0.01 level (2-tailed).		
* Correlation is significant at the 0.05 level (2-tailed).		

Table 13: Summary reporting of statistically significant Spearman's Rho coefficient findings of concepts utilized in study

Summary

I will now synthesize the findings presented in this chapter, before turning to a more robust discussion of the results in next Chapter 5: Discussion. First, it appears that I collected a relatively representative sample populations between the two cities. There are notable differences seen in regards to political orientation between the two cities; Los Angeles is more liberal than Phoenix, which is more conservative. Additionally, current landscapes assessed between the two sample populations tend to depict that Phoenicians are currently utilizing more conservative watering methods on their yards; that is to say, that Phoenicians are using technology that tends to be more efficient at distributing water

to plants. This tends to convey that there might be a greater culture of conservation, in regards to outdoor water use, in Phoenix, as opposed to Los Angeles.

Additionally there were some significant differences in beliefs about the current water situation between the two cities, these findings are summarized in Table 11. Furthermore, there were differences found between the cities in regards to beliefs about the outcomes of reducing outdoor water use. In Los Angeles, residents were more likely to report that their city was currently experiencing a drought. In Phoenix, residents were more likely to report that their city currently had an adequate supply of water. In Los Angeles, residents were more likely to believe that reducing the amount of water they use on their yards would: 1) require significant initial costs; 2) require significant initial changes; and 3) yield significant savings on their monthly water bill.

I discovered that in Los Angeles, most residents indicated that they believed that the involuntary water restrictions were being enforced (70.4% strongly or somewhat agreed) and most residents indicated that they were attempting to comply with the water restrictions (88.8% strongly or somewhat agreed), as shown in Figures 9 and 10, respectively. These were important findings, because they let us know that our independent variable, involuntary water restrictions in the city of Los Angeles, was being perceived relatively consistently among the sample population in Los Angeles.

The concepts assessed in this study were validated and deemed to be reliable, through a factor analysis and Cronbach's alpha test. This allowed me to proceed with confidence in evaluating the concepts with a Mann Whitney U test, to assess differences between the two cities. Significant differences between the two cities were presented in Table 12. Perceptions of controllability over outdoor water use and management was

found to be higher in Phoenix, as opposed to Los Angeles. This was finding was expected, due to the lack of involuntary water restrictions in Phoenix. However, it is interesting that Phoenix had much higher rates of HOAs among the residential households (59.5% of households belonged to HOAs in Phoenix and 30.2% of households belong to HOAs in Los Angeles) and still had a greater sense of controllability.

Furthermore, I found that there were stronger social norms and stronger policy attitudes (i.e., residents had a more favorable opinion towards different types of policy prescriptions meant to conserve outdoor water use) in Los Angeles, as opposed to Phoenix. It appears that there was a stronger societal support for the conservation of outdoor water and more favorable opinions towards government actions meant to encourage water conservation in the city of Los Angeles. Social norms and policy attitudes were also found to be correlated with each other; these concepts likely help to reinforce each other.

There were no distinctive differences in regards to self-efficacy (time) or (capacity) found between the two cities. Additionally, no significant differences were found between behavioral intentions among the two cities. It was discovered that belief in drought has a moderating effect on self-efficacy (time) and behavioral intentions. It is suggested that strong beliefs in drought may make people feel like their limited contributions to conserve water cannot create a significant impact and thus result in a lack of behavioral intentions, which would likely translate into observing less conservation behaviors.

In the next chapter, I will elaborate on what these findings mean in relationship to our original research question: How do involuntary water restrictions shape homeowners' attitudes and behaviors towards outdoor water use and management? Additionally, I will discuss the relevance of these findings to homeowners, academics, and policymakers. Lastly, in the next chapter I will discuss some of the limitations of this study and areas for future research.

DISCUSSION AND CONCLUSION

Freshwater is essential to the survival of the human race and yet only 0.01% the world's total water resources are accessible to humanity (Gleick, 1996). Humans use freshwater for both essential and non-essential purposes, from drinking-water and sanitization to growing vast amounts of green spaces and decorative water displays. In urban areas, residential households consume about 50% of the freshwater supply (DeOreo et al., 2011); of that figure, about 70% of residential water use is attributed to outdoor landscaping *(*Los Angeles County Waterworks Districts, 2016; Balling Jr and Gober, 2007). In the arid Southwest of the United States, climatic changes, such as prolonged droughts, along with population increases, threaten the already limited freshwater supply for many urban areas and pronounce the need for conservation of our limited freshwater supplies.

There are three management schemes that have historically been used by the government to encourage residential water consumption, these are: market-based pricing methods, voluntary water restrictions, and involuntary water restrictions. Of these, the latter two are most frequently used to encourage residential water consumption. Voluntary water restrictions allow residents to opt in and out of behavior changes as they see fit. Involuntary water restrictions, however, mandate behavior changes.

So what happens when people are told that they must change their behaviors? Very little is currently know about how involuntary water restrictions affect attitudinal precursors to the behavior. Furthermore, what happens when the involuntary water restrictions are lifted? Does the behavior change endure? Understanding how involuntary

water restrictions shape and change attitudinal precursors to the behavior can help us infer if these resulting behavior changes are likely to last.

This final chapter, I will attempt to provide an answer to the following question: *How do different governance approaches (i.e. water rationing versus no water rationing) effect homeowners' attitudes and behaviors towards outdoor water conservation?*

More specifically, I can ask:

- *How do different governance approaches affect homeowners' feelings of self-efficacy and controllability for conserving outdoor water use?*
- *How do different governance approaches affect homeowners' normative expectations towards other people (i.e. social norms) in the local community?*
- *How do different governance approaches affect homeowners' attitude evaluations (i.e. policy attitudes) towards conserving outdoor water use?*
- *How do different governance approaches affect homeowners' behavioral intentions to conserve outdoor water use?*

In the rest of this chapter, I will summarize the findings around demographic and yard characteristics of the sample population and the main concepts (i.e. self-efficacy, controllability, social norms, policy attitudes, and behavioral intentions) utilized in this study. I will tie these back findings to the larger research questions. I will then discuss the implications of these findings to society. Following this, I elaborate on some of the limitations of this study. I will close this chapter by talking about areas for future research.

Discussion of Demographic Influence

This study had a racially representative sample of residents from both Los Angeles and Phoenix. Additionally, education levels, income levels, and gender identification between residents in both cities were comparable. However, there was a notable difference in the political orientation of the residents in the two cities. Los Angeles residents were notably more liberal than Phoenix residents. The more liberal orientation of Los Angeles residents may be able to explain some of the findings highlighted in this study and more rigorous statistical analysis is recommended for future research.

It makes sense that we would see more acceptance of different government regulations towards outdoor water use among a more liberal population. Therefore, I ponder how much of the policy attitudes concept was influenced by political orientation. Additionally, it was also seen in Los Angeles, that social norms (which are positively correlated with policy attitudes) were significantly higher among the more liberal city. How much of the social norms concept might also be connected to political orientation?

Discussion of Yard Characteristics

I argued that there appears to be a stronger culture towards water conservation in the city of Phoenix residents as supported by the yard characteristics seen in Phoenix residents, as opposed to Los Angeles. Residents in Phoenix were more likely to have drip irrigation installed and less likely to have inefficient watering methods in their yard (i.e., sprinklers, hose, watering can), than residents in Los Angeles.

Considering some of the descriptive belief differences between the two cities, these differing yard characteristics may offer an explanation. In Los Angeles, residents

were more likely to report that reducing the amount of water they use on their yard would: 1) require significant initial costs; 2) require significant initial changes; and 3) yield significant initial savings on their monthly water bill. Reflecting on the fact that Phoenix residents were more likely to have conservative watering methods already in place in their yard (i.e., drip irrigation), it makes sense that Phoenix residents would think that reductions in their total outdoor water use would not be expensive, not require many changes, or yield significant savings on their monthly water bill. Los Angeles residents, who appeared to be using more water inefficient techniques, would likely require investments in new technology which would yield significant changes and changes to their yard. Furthermore, since Los Angeles residents had more room to improve their current outdoor watering infrastructure, it seems reasonable that residents in Los Angeles would be more likely to see higher savings on their monthly water bills.

Discussion of Main Concepts

Self-efficacy

Two different types of self-efficacy were assessed in this study. These were: self-efficacy of residential outdoor water use and management based on: 1) average amount of free-time typically available in a week; and 2) current skills and knowledge, including the ability to currently operate the existing irrigation system setup in the yard. These concepts were called self-efficacy (time) and self-efficacy (capacity), respectively. There were no statistically significant findings between the two cities in regards to self-efficacy (time) and self-efficacy (capacity). Residents in both cities seem to have similar self-efficacy towards their outdoor water use and management in regards to their time and capacity, as discussed here.

It was originally thought that residents in Los Angeles, where they were required to engage in reducing their outdoor water use, would report having higher perceptions of self-efficacy and greater intentions to engage in outdoor water conservation behaviors. This rationale was based on the idea that actions become easier to perform over time, as someone practices the action multiple times, their overall confidence that they can perform the action increases. The literature tells us that people's behavior is positively influenced their confidence in being able to perform the behavior (Madden, Ellen, and Ajzen, 1992). This is supported by the correlations found between self-efficacy (time) and (capacity) with behavioral intentions (Rho value = 0.514 and 0.465, respectively).

Therefore, because residents in Los Angeles have been coerced (by the presence of a prescriptive regulation with threat of fine) to engage in outdoor water conservation, they would then feel more capable of executing this action (i.e., outdoor water conservation) after performing this action multiple times. However, this belief was not supported in the findings. In fact, there were no significant differences between perceptions of self-efficacy or behavioral intentions among the two cities.

Was it possible that people in Los Angeles did not feel like they had to comply with the outdoor water restrictions? To answer this, I assessed whether or not people in Los Angeles felt that the involuntary water restrictions were 1) being enforced and 2) whether or not residents were trying to comply with the restrictions. Residents reported belief that Los Angeles does enforce their outdoor water restrictions (70.4% in agreeance) and that they were attempting to comply with the outdoor water restrictions (88.8% in agreeance). This study could not find any direct effects of involuntary water restrictions shaping perceptions of self-efficacy.

Controllability

While self-efficacy did not directly change under the influence of involuntary restrictions, controllability did. Perceptions of control over outdoor water use were higher in Phoenix than Los Angeles. From the literature, it is known that self-efficacy and controllability are very closely related and thus tend to affect each other. Self-efficacy is about our confidence to plan and execute the performance of a particular behavior, while controllability is about how much of the behavior is seen as being influenced by own actions, or under our control (Ajzen, 2002). In Los Angeles, residents may have felt capable of watering their yard seven days a week, however, involuntary water restrictions in the city dictated that they were only allowed to water their yard three days a week. Therefore, how often they could water their yard was not fully in their control. Residents in Phoenix, however, are allowed to water their yards any day of the week, it is therefore, not surprising, that Phoenix residents reported higher levels of control over their outdoor water use.

It is challenging to make further assumptions about how controllability affected resident's behaviors because there were no significant differences in the behavioral intentions among the cities. From the landscape demographics in Chapter 4, it is apparent from that homes in Phoenix were more likely to have more efficient irrigation technology in their yards (60.4% of Phoenix households report using drip irrigation, as opposed to only 11.2% in Los Angeles), however, I cannot conclude these features are a result of their feelings of control. Additionally, the irrigation seen in Los Angeles could have been installed prior to the involuntary water restrictions, when the residents had more control. Furthermore, it is entirely possible that homes in Phoenix were more likely to be

constructed with more efficient irrigation technology, since the Phoenix city area developed much later than the Los Angeles city area.

Social Norms

Perceptions of social norms were significantly different between the two cities. The social norms around outdoor water use were stronger in Los Angeles, as opposed to Phoenix. Let's consider what might have caused this and what this might say about involuntary water restrictions and controllability.

One possible explanation for the higher social norms in Los Angeles, is that the prescriptive regulations made people feel like their whole neighborhood needed to, and was trying to, conserve water. Feeling like your immediate neighbors are actively working to conserve water, could encourage individuals to try to conserve water themselves. From the literature, it is known that if residents perceive their neighbors as water wasters, they are less likely to conserve water themselves (Corral-Verdugo et al., 2002); therefore, one could extrapolate that seeing neighbors conserving water would likely encourage a person to conserve water themselves.

Furthermore, in Los Angeles, based on the restrictions in place, people were more likely to water their yard at the same time. When you consider the types of outdoor water restrictions put in place in Los Angeles (e.g., restrictions on time of day and based on street number, a restriction of what days you can water your yard) it makes sense that more people were likely watering their yards at the same day and time as their neighbors. When you reduce the window of opportunity for watering, you increase the probability that neighbors will be watering at the same time. For example, people in Los Angeles were told to water their yards before 9AM or after 4PM. Additionally, all odd-numbered,

and even-numbered, houses were restricted to watering their yards only on three specific days per week. If your irrigation system is not completely automated, then when you go outside to water your yard, you would have a much higher chance of seeing your neighbors watering their yards at the same time, whether automated or not (especially if you take advantage of watering each day you are allowed, per week). This visual cue of seeing your neighbors complying with the water restrictions might also increase social cohesion in the city of Los Angeles in regards to outdoor water conservation.

Furthermore, the state of California has had multiple social messaging campaigns, stressing phrases such as, "We are all in this together," and "Save water to show love for your city," (McDonald, 2015; Decker, 2015). After the data was collected, it become apparent that social messaging campaigns could have been one of the factors influencing the presence of stronger social norms in Los Angeles. Unfortunately, this variable was not controlled for in the survey, therefore its effect is unknown.

Policy Attitudes

Attitudes towards different government policies meant to encourage water conservation were more favorable in Los Angeles, as opposed to Phoenix. This was a counterintuitive finding, as it was originally believed that people in Los Angeles would have more discrimination towards what types of policy prescriptions they did and did not like, since they have had past experience with the restrictions. However, our results show the opposite. It seems plausible that strong social norms might have also influenced support for different types of policy prescriptions to conserve water. It is worth mentioning that there was a significant correlation between social norms and policy attitudes, with a reported Spearman Rho coefficient of 0.289.

It is also possible that more favorable policy attitudes led to stronger social norms. Exactly how the relationship between social norms and policy attitudes functions is unclear. It is known that the Los Angeles sample is more liberal than Phoenix sample, based on the reported political orientations of the survey-taker demographics, as shown in Chapter 4. It is also possible that residents heard about the water savings that were being achieved and thus felt like compliance with restrictions was helping the city and state reach their water savings goal; this could have made residents feel more favorable towards different policies. A deeper exploration into the role of social norms and policy attitudes in the context of this study would constitute a valuable study.

Behavioral Intentions

There was no statistically significant finding between the two cities in regards to differing behavioral intentions. Residents in both cities exhibited a similar trend in how they responded in regards to their behavioral intentions to conserve outdoor water use. Despite restrictions on outdoor water use in Los Angeles that intended to conserve residential outdoor water use, there was no visible difference between the intentions of residents to conserve outdoor water use.

Drought Beliefs

When this study was constructed, it was not anticipated how influential drought beliefs would be between the two cities. Both areas have been experiencing prolonged, moderate to severe droughts, as classified by the U.S. Drought Monitor, however how the two areas think about drought differs. This finding suggested that I should look more closely at the data related to drought beliefs, and through this it was discovered that drought beliefs and beliefs about the water supply were negatively correlated (Rho value

= -0.387). This tells us that when a person believes that their city is experiencing a drought, they are more likely to think that their city does not have an adequate water supply. Sure enough, Phoenix residents, who were less aware of the ongoing drought, were more likely to have confidence that their city had an adequate supply of water.

In sum, these findings are only a tip of the iceberg and are presented in Table 14. Furthermore, what do these findings mean for different sector of society? I will discuss what these findings might mean to policy-makers, academics, and the general public next.

Summary of Beliefs Between Cities		
Concept or Belief	**P-Value**	**Finding**
Reducing water would require significant initial costs**	0.002	Stronger beliefs in Los Angeles regarding costs
Reducing water would require significant initial changes**	0.002	Stronger beliefs in Los Angeles regarding changes
Reducing water would save money on monthly water bill**	0.000	Stronger beliefs in Los Angeles regarding savings
Self-efficacy (time)*	0.224	No difference between cities
Self-efficacy (capacity)*	0.534	No difference between cities
Controllability*	0.000	Higher sense of control in Phoenix
Social Norms*	0.003	Stronger social norms in Los Angeles
Policy Attitudes*	0.000	More public policy support in Los Angeles
Behavioral intentions*	0.079	No difference between cities
Drought Beliefs**	0.000	Stronger beliefs in Los Angeles that there is a current drought
Water Supply Beliefs**	0.000	Stronger beliefs in Phoenix about having an adequate water supply

**The significance level is 0.01; Adjusted alpha of .008333, based on Bonferroni's correction*

***The significance level is 0.05*

Table 14 – Summary of Mann Whitney U Tests run on different concepts and beliefs.

Implications

…**To Policy-makers**

These findings suggest that involuntary water restrictions appear to be a good way to promote water conservation. The involuntary water restrictions have been utilized often because they yield results. The restrictions have indeed been effective in the state of California; California has reduced their total water consumption 24% of their 2012 levels due to the mandatory regulations as of May 2016 (Stevens, 2016). Furthermore, it appears that along with being effective in the short-term, the restrictions are associated with strong social norms for water conservation and strong support of public policies meant to encourage water conservation. This is particularly promising for long-term behavior changes in the city.

Recalling the Theory of Planned Behavior, it is known that behavioral intentions are the immediate antecedents of our behaviors (Ajzen, 2002). Furthermore, attitudes towards the behavior, social norms, and perceived behavioral control can explain our behavioral intentions (Ajzen, 2002). Seeing that involuntary water restrictions do not appear to affect self-efficacy (which makes up about half of the concept of perceived behavioral control), and that the restrictions are associated with positive attitudes towards the behavior (i.e., policy attitudes) and social norms, I would predict that behavioral intentions towards outdoor water conservation would likely endure, in the event that involuntary water restrictions are rescinded. This is mainly due to the presence of strong social norms and policy attitudes, which are positively correlated in this context. These concepts would likely create positive feedbacks in society, to continue to encourage outdoor water conservation in the event that involuntary water restrictions are rescinded.

…To Academics

There is still a great deal of work to be done on understanding water governance, specifically involuntary water restrictions. Based on the drought belief findings, I believe that one of the keys to effective governance is related to how that governance is communicated to the public. How does a discussion about the problem (i.e., drought) versus a discussion about the solution (i.e., water conservation) alter perceptions of the water supply? Furthermore, how does that alter behavior? Language can either empower people or enslave people. Therefore, effective conservation relies on a thoughtful consideration of the language used. Academics should be careful to emphasize solutions over problems.

… To the general public

The general public should be aware of the power of their own actions. Through public displays of conservation, they can positively contribute to conservation being the social norm. Through supporting public policy that encourages conservation, significant strides for conservation can be made, whether that is implementing policy itself or creating more social cohesion and support for conservation. When in the public eye, individual choices to conserve water result in more than just those immediate water savings. Small actions of conservation can have subtle influences throughout the community that create ripple effects.

Limitations

The scope of the study is one of the most obvious limitations of this research design. The research design was bound to two different cities, one with water restrictions (i.e., Los Angeles) and one without (i.e., Phoenix). The attitudes and behaviors of the

residents in these two cities may not be representative of the outer lying cities or the state as a whole. Therefore, one must be careful when extrapolating results that might be applied to other cities that are also considered to be similar to either Los Angeles or Phoenix. The design of this research study hoped that these cities would be representative of other cities with similar climates and demographics, however, without having perfect information, it hard to say just how much of this study can be extrapolated to other cities. This study also chose to study homeowners' attitudes and feelings, so one must be careful not to extrapolate these results to condominium dwellers or renters.

The online survey model of this research design was limiting. Survey participants could not elaborate on their answers due to the model of the survey. Therefore, each survey participant either had to choose the answer that most closely fit their own personal thoughts, select "don't know," or decline to answer the question. Additionally, the reasoning behind each choice was not captured due to this model.

Furthermore, a research panel was utilized to complete the required amount of surveys desired. Survey-takers on this panel specifically sign up to take surveys for financial compensation. Therefore, one might assume that their motive is to complete as many surveys as quickly as possible to increase their income in the shortest amount of time as possible. Additionally, pooling survey-takers from this a research panel means that these people tend to enjoy taking surveys or at least enjoy taking surveys for money; these people may not be a true representative sample of the greater public.

Furthermore, how different people conceptualize "drought" was a limitation of this study. This study specifically chose to assess two different cities based on the premise of an ongoing drought and the presence of involuntary water restrictions. It is not

known if "drought" is a well-defined and consistent idea in most people's minds. For the purposes of tracking drought, one can create guidelines for measuring this idea, as done by the U.S. Drought Monitor. This does not mean that the idea of what a drought is and means will be the same in each person's head between the two cities. Furthermore, the idea of what a drought is and means may not even be the same within the cities or within a single household. Los Angeles is an urban city in close proximity to the Pacific Ocean (i.e., the heart of the city is about 15 miles from the coastline). Phoenix is an urban city in the middle of the Sonoran Desert, lacking naturally occurring water sources. One can ponder how these two different cities might affect different perceptions of drought. That is, how does a drought in the desert look different from a drought near the ocean?

Lastly, it is important to remember that this study has only revealed correlations and not causations. There are potentially an unlimited amount of unknown control variables that could have affected the reported results. Because of this, it would be extremely valuable for future research to try to fill in some of the gaps in this research, I will discuss this next.

Future Research

This study was not able to detect any causation, rather only significant correlations between concepts were able to be detected. A follow-up investigation with in-depth qualitative interviews surrounding resident's views on: self-efficacy, controllability, social norms, policy attitudes, and behavioral intentions would likely yield very interesting and complementary results. While this study was able to detect relationships between concepts in particular directions, it would be valuable to

understand individual rationales, from residents, for why these directional relationships were happening.

It would be interesting to further investigate the concept of controllability towards outdoor water use through a series of interviews. In particular, it would be interesting to get rationales for what in particular makes people feel more in control over their outdoor water use. Was the lack of involuntary restrictions in Phoenix what made them feel more in control – or is there something else going on there? Currently, it seems that involuntary water restrictions decrease feelings of control. I think it would be helpful for policy-makers to have more detailed explanations from residents about which types of restrictions have the greatest effects on people's sense of control. What is the role of income levels in control; I think it would be fascinating to do interviews to better understand how the role of a hired helping hand or different forms of irrigation technology change perceptions of control. Does more sophisticated or expensive irrigation infrastructure lead to more control or more confusion? This granular level of detail was not able to be gleaned from the survey questions.

The findings around social norms and policy attitudes, in the context of this study, would be a great area for future research. How do these two relate to one another; do social norms tend to increase support for public policy or does public policy tend to foster social norms? It would be important to also explore the role that social messaging played in regards to these concepts; how does messaging contribute to public policy support and stronger social norms? While involuntary water restrictions are associated with higher levels of social norms and policy support, it is not clear that involuntary water restrictions are the cause of this support.

A better understanding of how "drought" is conceptualized by people would help illuminate some more knowledge on the current findings. How does the way society communicates about drought make individuals feel? Drought beliefs were negatively correlated with beliefs about having an adequate water supply. Which of these is the stronger influence; does drought awareness led to skepticism over the water supply or does abundant water supply influence belief about drought? Additionally, it would be helpful to understand how different environmental settings influence perceptions of drought. Does being near the ocean or in the middle of the desert change one's conceptualization of drought? What other factors might influence perceptions of drought; do age, education, gender, political orientation, religion, or experience with past droughts or environmental disasters shape this idea?

Conclusion

This research study attempted to understand how involuntary water restrictions affect attitudinal precursors to outdoor water use and management, for the purposes of conservation. I have discovered that involuntary water restrictions are associated with feelings of less control over outdoor water use and management. I have also found that involuntary water restrictions are associated with stronger social norms and support towards policy prescriptions that regulate outdoor water use. Involuntary water restrictions were not associated with any effect on self-efficacy or behavioral intentions.

Involuntary water restrictions appear to not only be effective at saving water, but they appear to be associated with greater social cohesion. The mandatory restrictions appear to positively affect social norms towards conservation in the community and public support for conservation measures. These positive influences on attitudes towards

water conservation are particularly promising for enduring behavior change. It is hypothesized that even if the restrictions are rescinded, the social support for water conservation will remain, encouraging continuous water conservation in the community.

This study hinted at the importance of understanding how drought is conceptualized to individuals. It was found that belief in a local drought was negatively correlated with belief in an adequate local water supply. This finding may have implications for the way that water managers communicate about current droughts or the water supply.

Despite the fact that there will always be problems that need addressing and no shortage of future research suggestions, this study was able to uncover some concrete findings. It is my hope that these findings can help advance future conservation measures and encourage others to continue seeking trends and provide their insight.

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APPENDIX A

INSTITUTIONAL REVIEW BOARD APPROVAL

ASU Knowledge Enterprise Development

EXEMPTION GRANTED

Sonja Klinsky
Sustainability, School of
480/727-0834
Sonja.Klinsky@asu.edu

Dear Sonja Klinsky:

On 3/15/2016 the ASU IRB reviewed the following protocol:

Type of Review:	Initial Study
Title:	Perceptions of self-efficacy and controllability regarding outdoor water use: A comparison between Los Angeles and Phoenix homeowners, under different rules for outdoor water use, concerning outdoor water intentions and attitudes
Investigator:	Sonja Klinsky
IRB ID:	STUDY00004078
Funding:	Name: (Unspecified)
Grant Title:	
Grant ID:	
Documents Reviewed:	• Survey and survey instructions, Category: Measures (Survey questions/Interview questions /interview guides/focus group questions); • GPSA Funding Award, Category: Sponsor Attachment; • GPSA Grant Application, Category: Sponsor Attachment; • Consent form, Category: Consent Form; • Protocol, Category: IRB Protocol;

The IRB determined that the protocol is considered exempt pursuant to Federal Regulations 45CFR46 (2) Tests, surveys, interviews, or observation on 3/15/2016.

In conducting this protocol you are required to follow the requirements listed in the INVESTIGATOR MANUAL (HRP-103).

Sincerely,

IRB Administrator

cc: Heather Turrentine
Sonja Klinsky
Heather Turrentine
Kevin Dooley
Kelli Larson

APPENDIX B

SURVEY – LOS ANGELES

Qs

Participation in this research survey is expected to take approximately 10-15 minutes of your time. This survey will assess some of your thoughts about water use and yard management. There are no expected risks to participating in this research. You were selected for participation in this study due to the city you live in and your classification as a homeowner. You may exit the survey at any time or choose not to complete all the questions.

Your explicit consent is necessary in order to participate in this research process. You must be at least 18 years of age to give your consent to participate in research. If you would like a copy of this consent form you may request one and it will be provided to you.

Confidentiality: You will be assigned a code number which will protect your identity. No personal identifying information will be collected or linked to your responses. All data will be kept in secured files under password protection. No one will know what your survey responses were. All research participation is voluntary, and you have the right to withdraw at any time, without prejudice, should you object to the nature of the research. You are entitled to ask questions and to receive an explanation after your participation.

Any questions regarding your rights as a research participant may be directed to Arizona State University's Office of Research Integrity and Assurance at research.integrity@asu.edu or (480) 965-6788.

Any technical questions about this research may be directed to: Heather Turrentine at Heather.Turrentine@asu.edu. Further concerns can be directed to: Dr. Sonja Klinsky at Sonja.Klinsky@asu.edu.

Lastly, you are eligible to receive compensation for participating in this research process. Your compensation will be determined by Research Now! and credited to your account upon completion of the survey. If you consent to participating in the research process, with the terms and conditions as described, please begin the survey now.

In order to consent to this research process, you must be at least 18 years old.

Are you at least 18 years old?

Yes

No

In order to participate in this survey, you must be a current homeowner who lives in the City of Los Angeles, California.

Are you a current homeowner in the City of Los Angeles?

Yes

No

Which do you most closely identify with?

White/Anglo

Hispanic/Latino/Spanish

Black/African American

Asian/Asian American

Native American/ American Indian

Other:

What percent of the year do you live in your home in the City of Los Angeles?

0 25 50 75 100

Percent

Please indicate how much you agree with the following statement:

I am the primary decision-maker in the household regarding outdoor water use.

Strongly disagree	Somewhat disagree	Neither agree or disagree	Somewhat agree	Strongly agree	Don't know

The following questions are about your yard and your ability to water your yard.
Please consider your home in the City of Los Angeles when answering these questions.

Is your house in the City of Los Angeles part of a Homeowner's Association (HOA)?

Yes

No

Don't know

Do you have a pool in your yard?

Yes

No

Don't know

Using the scale below, how much of your yard in the front and back of your home is covered by grass?

	None (no grass)	Less than half grass	About half grass	More than half grass	All or mostly grass	Don't know
Amount of grass in front yard	○	○	○	○	○	○
Amount of grass in back yard	○	○	○	○	○	○

Please select all the ways used to water the **plants, trees, or grass** in your yard.

Drip irrigation

Sprinklers in the ground

Sprinklers on a hose (above the ground)

A hose (hand held or that you move around)

Watering can, jug, or container

Flood irrigation

_____ Other:

Don't know

Which of the water options would you say is used most to water your yard?

How much of your yard is watered with an automatic timer?

None
Some
Most
All
Don't know

What changes have you made to your yard since you have lived in your house? Please select all that apply.

Removed grass
Added grass
Removed trees
Added trees
Removed shrubs
Added shrubs
Removed irrigation system
Installed an irrigation system
Updated or changed an existing irrigation system
Added a pool
Removed a pool
Other:
Don't know

Please indicate how much you agree with the following statements regarding the City of

Los Angeles:

The City of Los Angeles is currently experiencing a drought.

Strongly disagree	Somewhat disagree	Neither agree or disagree	Somewhat agree	Strongly agree	Don't know

The City of Los Angeles has an adequate supply of water.

Strongly disagree	Somewhat disagree	Neither agree or disagree	Somewhat agree	Strongly agree	Don't know

Please indicate how much you agree with the following statements:

The amount of water I use on my yard is determined by me.

Strongly disagree	Somewhat disagree	Neither agree or disagree	Somewhat agree	Strongly agree	Don't know

I can choose how I water my yard.

Strongly disagree	Somewhat disagree	Neither agree or disagree	Somewhat agree	Strongly agree	Don't know

I am in control of when I water my yard.

Strongly disagree	Somewhat disagree	Neither agree or disagree	Somewhat agree	Strongly agree	Don't know

Please indicate how much you agree with the following statements, **based on your typical schedule and the amount of free time you usually have available:**

	Strongly disagree	Somewhat disagree	Neither agree or disagree	Somewhat agree	S
I can easily limit watering my yard to the early morning and late evening**.**	○	○	○	○	
I can easily limit watering my yard to only three days a week.	○	○	○	○	
I can easily stop watering my yard when it rains.	○	○	○	○	

I can make sure that water leaks on my property are fixed quickly.	○	○	○	○

Please indicate how much you agree with the following statements, **using your current knowledge and skills:**

	Strongly disagree	Somewhat disagree	Neither agree or disagree	Somewhat agree	S
I can make sure that water leaks on my property are fixed quickly.	○	○	○	○	
I can reduce the amount of water I currently use to water my yard while still maintaining my current landscape.	○	○	○	○	
I can easily operate my irrigation system to water my yard.	○	○	○	○	

Please indicate how much you agree with the following statements, **based on the current irrigation system at your home:**

	Strongly disagree	Somewhat disagree	Neither agree or disagree	Somewhat agree	S
I can make sure that water leaks on my property are fixed quickly.	○	○	○	○	
I can reduce the amount of water I currently use to water my yard while still maintaining my current landscape.	○	○	○	○	
I can easily stop watering my yard when it rains.	○	○	○	○	
I can easily operate my irrigation system to water my yard.	○	○	○	○	

Please indicate how much you agree with the following statements:

Reducing the amount of water I currently use outdoors would require significant initial changes to my yard.

Strongly	Somewhat	Neither agree or	Somewhat	Strongly agree	Don't know

disagree disagree disagree agree

Reducing the amount of water I currently use outdoors would require significant initial costs.

Strongly disagree | Somewhat disagree | Neither agree or disagree | Somewhat agree | Strongly agree | Don't know

Reducing the amount of water I currently use outdoors would save me a significant amount of money on my monthly water bill.

Strongly disagree | Somewhat disagree | Neither agree or disagree | Somewhat agree | Strongly agree | Don't know

My friends and family think I should conserve water use on my yard.

Strongly disagree | Somewhat disagree | Neither agree or disagree | Somewhat agree | Strongly agree | Don't know

My neighbors should try to conserve how much water they use on their yards.

Strongly disagree | Somewhat disagree | Neither agree or disagree | Somewhat agree | Strongly agree | Don't know

How my neighbors view my yard is important to me.

Strongly disagree | Somewhat disagree | Neither agree or disagree | Somewhat agree | Strongly agree | Don't know

How my neighbors view my outdoor water use is important to me.

Strongly disagree | Somewhat disagree | Neither agree or disagree | Somewhat agree | Strongly agree | Don't know

I try to water my yard during the early morning or late evening.

Strongly disagree | Somewhat disagree | Neither agree or disagree | Somewhat agree | Strongly agree | Don't know

I try to limit how much water I use on my yard.

Strongly disagree	Somewhat disagree	Neither agree or disagree	Somewhat agree	Strongly agree	Don't know

I try to avoid watering my yard when it rains.

Strongly disagree	Somewhat disagree	Neither agree or disagree	Somewhat agree	Strongly agree	Don't know

I try to fix water leaks on my property quickly.

Strongly disagree	Somewhat disagree	Neither agree or disagree	Somewhat agree	Strongly agree	Don't know

I feel personally responsible for the amount of water I use on my yard.

Strongly disagree	Somewhat disagree	Neither agree or disagree	Somewhat agree	Strongly agree	Don't know

Please indicate how much you agree with the following statements regarding the City of Los Angeles:

The City of Los Angeles enforces outdoor water restrictions.

Strongly disagree	Somewhat disagree	Neither agree or disagree	Somewhat agree	Strongly agree	Don't know

I comply with the City of Los Angeles's outdoor water restrictions.

Strongly disagree	Somewhat disagree	Neither agree or disagree	Somewhat agree	Strongly agree	Don't know

Please indicate how much you oppose or support the following government measures being used to reduce water consumption in the City of Los Angeles:

Strongly oppose	Somewhat oppose	Neither oppose or support	Somewhat support	Strongly support	Do kn

Restrictions on what time of day you can water your yard	○	○	○	○	○	(
Limits on how much water you can use to water your yard	○	○	○	○	○	(
Regulations on which days you can water your yard	○	○	○	○	○	(
A rebate to remove grass	○	○	○	○	○	(
A rebate to install a weather-based irrigation system that receives local weather information and adjusts accordingly	○	○	○	○	○	(
Educational programs that promote water conservation	○	○	○	○	○	(

Whose water use reductions could have the biggest impact on the City of Los Angeles's water supply?

City government

Golf courses

Residential households

Industry

State government

Farmers

Other:

Whose water use reductions could have the biggest impact on California's water supply?

Industry

Golf courses

City government

State government

Farmers

Residential households

Other:

Please indicate how much you agree with the following statements:

The City of Los Angeles is currently managing their water supplies effectively.

Strongly disagree	Somewhat disagree	Neither agree or disagree	Somewhat agree	Strongly agree	Don't know

California is currently managing their water supplies effectively.

Strongly disagree	Somewhat disagree	Neither agree or disagree	Somewhat agree	Strongly agree	Don't know

The remaining questions are for statistical purposes. Please consider your home in the City of Los Angeles when answering the following questions. Your answers to all questions are confidential.

What is the zip code of your house?

How many years have you lived in your current house?

Including yourself, how many people regularly live in your house?

None
1
2
3
4
5
6
7
8 or more

How many people living in your house are under the age of 18?

None
1
2
3
4
5 or more

What is the highest level of education you have completed?

Less than high school
High school degree
Some college
2-year college degree (Associate's)
4-year college degree (Bachelor's)
Post graduate degree (Master's, Ph.D., M.D., etc)

For all the people in your household, please choose the category which best describes the total combined income from all sources before taxes in 2015.

Under $15,000
$15,000-$29,999
$30,000-$49,999
$50,000-$74,999
$75,000-$99,999
$100,000–$149,999
More than $150,000
Don't know

Are you:

Male
Female
Prefer not to answer

How would you describe yourself politically?

Very conservative

Conservative

Slightly conservative

Moderate

Slightly liberal

Liberal

Very liberal

Don't know

Powered by Qualtrics

APPENDIX C

SURVEY – PHOENIX

Qs

Participation in this research survey is expected to take approximately 10-15 minutes of your time. This survey will assess some of your thoughts about water use and yard management. There are no expected risks to participating in this research. You were selected for participation in this study due to the city you live in and your classification as a homeowner. You may exit the survey at any time or choose not to complete all the questions.

Your explicit consent is necessary in order to participate in this research process. You must be at least 18 years of age to give your consent to participate in research. If you would like a copy of this consent form you may request one and it will be provided to you.

Confidentiality: You will be assigned a code number which will protect your identity. No personal identifying information will be collected or linked to your responses. All data will be kept in secured files under password protection. No one will know what your survey responses were. All research participation is voluntary and you have the right to withdraw at any time, without prejudice, should you object to the nature of the research. You are entitled to ask questions and to receive an explanation after your participation.

Any questions regarding your rights as a research participant may be directed to Arizona State University's Office of Research Integrity and Assurance at research.integrity@asu.edu or (480) 965-6788.

Any technical questions about this research may be directed to: Heather Turrentine at Heather.Turrentine@asu.edu. Further concerns can be directed to: Dr. Sonja Klinsky at Sonja.Klinsky@asu.edu.

Lastly, you are eligible to receive compensation for participating in this research process. Your compensation will be determined by Research Now! and credited to your account upon completion of the survey. If you consent to participating in the research process, with the terms and conditions as described, please begin the survey now.

In order to consent to this research process, you must be at least 18 years old.

Are you at least 18 years old?

Yes

No

In order to participate in this survey, you must be a current homeowner who lives in the City of Phoenix, Arizona.

Are you a current homeowner in the City of Phoenix?

Yes

No

Which do you most closely identify with?

White/Anglo

Hispanic/Latino/Spanish

Black/African American

Asian/Asian American

Native American/ American Indian

Other:

What percent of the year do you live in your home in the City of Phoenix?

0 25 50 75 100

Percent

Please indicate how much you agree with the following statement:

I am the primary decision-maker in the household regarding outdoor water use.

Strongly Somewhat Neither agree or Somewhat Strongly agree Don't know

disagree disagree disagree agree

The following questions are about your yard and your ability to water your yard. Please consider your home in the City of Phoenix when answering these questions.

Is your house in the City of Phoenix part of a Homeowner's Association (HOA)?

Yes

No

Don't know

Do you have a pool in your yard?

Yes

No

Don't know

Using the scale below, how much of your yard in the front and back of your home is covered by grass?

	None (no grass)	Less than half grass	About half grass	More than half grass	All or mostly grass	Don't know
Amount of grass in front yard	○	○	○	○	○	○
Amount of grass in back yard	○	○	○	○	○	○

Please select all the ways used to water the **plants, trees, or grass** in your yard.

Drip irrigation

Sprinklers in the ground

Sprinklers on a hose (above the ground)

A hose (hand held or that you move around)

Watering can, jug, or container

Flood irrigation

Other:

Don't know

Which of the water options would you say is used most to water your yard?

How much of your yard is watered with an automatic timer?

None

Some

Most

All

Don't know

What changes have you made to your yard since you have lived in your house? Please select all that apply.

Removed grass

Added grass

Removed trees

Added trees

Removed shrubs

Added shrubs

Removed irrigation system

Installed an irrigation system

Updated or changed an existing irrigation system

Added a pool

Removed a pool

Other:

Don't know

Please indicate how much you agree with the following statements regarding the City of

Phoenix:

The City of Phoenix is currently experiencing a drought.

Strongly disagree	Somewhat disagree	Neither agree or disagree	Somewhat agree	Strongly agree	Don't know

The City of Phoenix has an adequate supply of water.

Strongly disagree	Somewhat disagree	Neither agree or disagree	Somewhat agree	Strongly agree	Don't know

Please indicate how much you agree with the following statements:

The amount of water I use on my yard is determined by me.

Strongly disagree	Somewhat disagree	Neither agree or disagree	Somewhat agree	Strongly agree	Don't know

I can choose how I water my yard.

Strongly disagree	Somewhat disagree	Neither agree or disagree	Somewhat agree	Strongly agree	Don't know

I am in control of when I water my yard.

Strongly disagree	Somewhat disagree	Neither agree or disagree	Somewhat agree	Strongly agree	Don't know

Please indicate how much you agree with the following statements, **based on your typical schedule and the amount of free time you usually have available:**

	Strongly disagree	Somewhat disagree	Neither agree or disagree	Somewha agree
I can easily limit watering my yard to the early morning and late evening.	○	○	○	○
I can easily limit watering my yard to only three days a week.	○	○	○	○
I can easily stop watering my yard when it rains.	○	○	○	○

I can make sure that water leaks on my property are fixed quickly.	○	○	○	○

Please indicate how much you agree with the following statements, **using your current knowledge and skills:**

	Strongly disagree	Somewhat disagree	Neither agree or disagree	Somewhat agree	S
I can make sure that water leaks on my property are fixed quickly.	○	○	○	○	
I can reduce the amount of water I currently use to water my yard while still maintaining my current landscape.	○	○	○	○	
I can easily operate my irrigation system to water my yard.	○	○	○	○	

Please indicate how much you agree with the following statements, **based on the current irrigation system at your home:**

	Strongly disagree	Somewhat disagree	Neither agree or disagree	Somewhat agree	S
I can make sure that water leaks on my property are fixed quickly.	○	○	○	○	
I can reduce the amount of water I currently use to water my yard while still maintaining my current landscape.	○	○	○	○	
I can easily stop watering my yard when it rains.	○	○	○	○	
I can easily operate my irrigation system to water my yard.	○	○	○	○	

Please indicate how much you agree with the following statements:

Reducing the amount of water I currently use outdoors would require significant initial changes to my yard.

Strongly	Somewhat	Neither agree or	Somewhat	Strongly agree	Don't know

disagree disagree disagree agree

Reducing the amount of water I currently use outdoors would require significant initial costs.

Strongly disagree | Somewhat disagree | Neither agree or disagree | Somewhat agree | Strongly agree | Don't know

Reducing the amount of water I currently use outdoors would save me a significant amount of money on my monthly water bill.

Strongly disagree | Somewhat disagree | Neither agree or disagree | Somewhat agree | Strongly agree | Don't know

My friends and family think I should conserve water use on my yard.

Strongly disagree | Somewhat disagree | Neither agree or disagree | Somewhat agree | Strongly agree | Don't know

My neighbors should try to conserve how much water they use on their yards.

Strongly disagree | Somewhat disagree | Neither agree or disagree | Somewhat agree | Strongly agree | Don't know

How my neighbors view my yard is important to me.

Strongly disagree | Somewhat disagree | Neither agree or disagree | Somewhat agree | Strongly agree | Don't know

How my neighbors view my outdoor water use is important to me.

Strongly disagree | Somewhat disagree | Neither agree or disagree | Somewhat agree | Strongly agree | Don't know

I try to water my yard during the early morning or late evening.

Strongly disagree | Somewhat disagree | Neither agree or disagree | Somewhat agree | Strongly agree | Don't know

I try to limit how much water I use on my yard.

Strongly disagree	Somewhat disagree	Neither agree or disagree	Somewhat agree	Strongly agree	Don't know

I try to avoid watering my yard when it rains.

Strongly disagree	Somewhat disagree	Neither agree or disagree	Somewhat agree	Strongly agree	Don't know

I try to fix water leaks on my property quickly.

Strongly disagree	Somewhat disagree	Neither agree or disagree	Somewhat agree	Strongly agree	Don't know

I feel personally responsible for the amount of water I use on my yard.

Strongly disagree	Somewhat disagree	Neither agree or disagree	Somewhat agree	Strongly agree	Don't know

Please indicate how much you might oppose or support the following government measures being used to reduce water consumption in the City of Phoenix:

	Strongly oppose	Somewhat oppose	Neither oppose or support	Somewhat support	Strongly support	Do kn
Restrictions on what time of day you can water your yard	○	○	○	○	○	(
Limits on how much water you can use to water your yard	○	○	○	○	○	(
Regulations on which days you can water your yard	○	○	○	○	○	(
A rebate to remove grass	○	○	○	○	○	(
A rebate to install a weather-based irrigation system that receives local weather information and adjusts accordingly	○	○	○	○	○	(
Educational programs that promote water conservation	○	○	○	○	○	(

Whose water use reductions could have the biggest impact on the City of Phoenix's water supply?

Farmers
City government
State government
Residential households
Tourists
Industry
Golf courses
Other:

Whose water use reductions could have the biggest impact on Arizona's water supply?

Industry
Residential households
Golf courses
Tourists
State government
City government
Farmers
Other:

Please indicate how much you agree with the following statements:

The City of Phoenix is currently managing their water supplies effectively.

Strongly disagree	Somewhat disagree	Neither agree or disagree	Somewhat agree	Strongly agree	Don't know

Arizona is currently managing their water supplies effectively.

Strongly disagree	Somewhat disagree	Neither agree or disagree	Somewhat agree	Strongly agree	Don't know

The remaining questions are for statistical purposes. Please consider your home in the City of Phoenix when answering the following questions. Your answers to all questions are confidential.

What is the zip code of your house?

How many years have you lived in your current house?

Including yourself, how many people regularly live in your house?

None
1
2
3
4
5
6
7
8 or more

How many people living in your house are under the age of 18?

None
1
2
3
4
5 or more

What is the highest level of education you have completed?

Less than high school
High school degree
Some college
2-year college degree (Associate's)
4-year college degree (Bachelor's)
Post graduate degree (Master's, Ph.D., M.D., etc)

For all the people in your household, please choose the category which best describes the total combined income from all sources before taxes in 2015.

Under $15,000
$15,000-$29,999
$30,000-$49,999
$50,000-$74,999
$75,000-$99,999
$100,000-$149,999
More than $150,000
Don't know

Are you:

Male
Female
Prefer not to answer

How would you describe yourself politically?

Very conservative
Conservative
Slightly conservative
Moderate
Slightly liberal
Liberal
Very liberal
Don't know