Exploring Resident's Xeriscaping Preference: The Influence of Ecological World View and Place Identity

by

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ABSTRACT

For the last 10 years, the American Southwest has been experiencing the most persistent drought conditions on record. Based on future climactic predictions, there is a dire need to reduce water usage within Phoenix. An environmentally responsible behavior such as low water use landscaping (xeriscaping), has been shown to reduce household water consumption by 40%-70%. While much is known regarding the relationship between socio-demographics and xeriscaping choices, the influence of other variables remains to be explored. Using data from the 2017 Phoenix Area Social Survey, this study investigates the influence of two additional variables - ecological worldview and place identity on xeriscaping choice. Data was analyzed using two models - Ordinary Least Squares (OLS) and Linear Probability Model (LPM). Ecological worldview and place identity, along with income, ethnicity, and gender, were all found to be positively related to xeriscape preference. Additionally, when compared to the LPM, the traditional OLS was found to still be the most robust and appropriate model when measuring landscape preference. Finally, results suggested that programs to foster identity with the local desert mountain parks may help to increase xeriscaping in the Valley and thus lower residential water use.

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TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

CHAPTER 1

INTRODUCTION

Many researchers have argued that we have entered an entirely new epoch, known as the "Anthropocene", defined by a world where human activities have had such a profound effect on our world that they rival the forces of nature itself (Steffen, Crutzen, & McNeill, 2007). Many of these harmful human activities such as pollution and overuse of resources are clustered in the large metropolitan areas that have come to define the 21st century. Despite this, the continued urbanization of our country is expected to increase rapidly in the near future, causing potentially even more serious changes to human-environment interactions (Alig, Kline, Jeffrey, Lichtenstein, 2004). In 2015, 54% of the total global population lived in urban areas and that number is expected to increase each year (WHO, 2016). In the United States, 80.7% of the population was considered urban in the 2010 census and that number shows the same upward trend as the global prediction (United States Census Bureau, 2013).

Environmental issues such as climate change, pollution, and deforestation are regularly argued and discussed at a national and global level. These discussion have not translated into enough action and global predictions have shown steady or increasing levels of negative anthropogenic effects on our planet in the future (Pahari & Murai, 1999; IPCC, 2014; NCA, 2014). One region, the Sonoran Desert located in the Southwestern United States, has the potential to be greatly affected by anthropogenic effects such as climate change due the region's dependence on episodic rainfall and temperature niches (Cable, Ogle, Williams, Weltzin, & Huxman, 2008; Kimball, Angert, Huxman, & Venable, 2010; Munson, Webb, Belnap, Andrew Hubbard, Swann, &

Rutman, 2013). The Sonoran Desert's fragile ecosystem is one of the most likely to be negatively influenced by mankind's choices and presence (Agnew & Warren, 1996; Niering, Whittaker, & Lowe, 1963). Efforts to protect this unique ecosystem, which houses the greatest species diversity of any desert in North America, are incredibly important and time sensitive (National Park Service, 2017).

For the past 10 years, the American Southwest has been experiencing the most persistent drought conditions seen on record (Environmental Protection Agency, 2017). Researchers predict that this drought will not only persist, but worsen, (Cayan, Das, Pierce, Barnett, Yree & Gershunov, 2010) and will most likely exceed even the most severe megadroughts seen in the past (Cook, Ault, & Smerdon, 2015). Research, which has accounted for both medium and high future greenhouse gas emission levels, has concluded that these climatic drought conditions far exceed any modern experiences and could prove a significant problem to future human and ecosystem adaptation (Cook, Ault, & Smerdon, 2015; Lobell, Roberts, Schlenker, Braun, Little, Rejesus, & Hammer, 2014; Williams, Allen, Macalady, Griffin, Woodhouse, Meko, Swetnam, Rauscher, Seager, Grission-Mayer, Dean, Cook, Gangodagamage, Cai, & McDowell, 2013). These findings are coupled with the fact that water demands in cities across the Southwest are increasing rapidly with no end in sight (MacDonald, 2010). The demand is so great that many sources of nonrenewable groundwater reservoirs in the area have become depleted (Long, Scanlon, Lonquevergne, Sun, Fernando, & Save, 2013; Scanlon, Faunt, Lonquevergne, Reedy, Alley, Mcguire, & McMahon, 2012). This poses a serious risk to not only the individuals residing within these cities, but also to the ecosystems that rely on water in the arid regions.

One desert city of particular interest is Phoenix, Arizona. This city was ranked the 8th fastest growing city in the United States in 2017 (Forbes, 2017) and houses a population of over 1.6 million (US Census, 2010). This sprawling metropolitan area of over 500 miles is located in a desert region where droughts are common. In a state with an average yearly rainfall of only eight inches (U.S. Climate Data, 2017), individuals in Phoenix utilize, on average, over 100 gallons of water a day (Arizona Department of Water Resources, 2017), compared to the national average of only 88 gallons of water a day (EPA.gov, 2018). Like most other Southwestern cities, Phoenix relies on water from rivers such as the Colorado which have been heavily dammed and carry a strenuous water demand from multiple states (Carlson & Muth, 1989). These characteristics give the city the unique attributes of being a desert city as well as a growing urban metropolis, both of which are highly significant within the context of understanding urban water conservation.

In light of the serious climate predictions, it is vital that urban areas adapt water conservation strategies and cultivate a culture of low water use. Around 2/3 of water use in the Phoenix area is residential, of which 74% is utilized for outdoor purposes (Balling & Gober, 2007; Mayer, DeOreo, Opitz, Kiefer, Davis, Dziegielewski, & Nelson, 1999). Thus, one important step in achieving this goal is the adaption of xeriscaping, or low water use landscaping. Drought-tolerant xeriscape yards in the southwestern United States are typically characterized by gravel cover with low water use plants, such as cacti. By switching from landscape irrigation to xeriscape, households may be able to cut 40% to 70% of their water use (Hilaire, Arnold, Wilkerson, Devitt, Hurd, Lesikar, Lohr, Martin, McDonald, Morris, Pittenger, Shaw, & Zoldoske, 2008). This could prove a

significant benefit to urban areas located in drought prone states in the American Southwest.

Current approaches to residential water conservation, such as water rights policy and water pricing, have been considered ineffective. Issues include the lack of environmentally conscious water pricing (Brookshire, Burness, Chermak, & Krause, 2002; Cummings & Nercissiantz, 1992; Ferrara, 2008) and current water policies in Phoenix, which have promoted economic and population growth (Casagrande, Hope, Farley-Metzger, Cook, Yabiku, & Redman, 2007; Yabiku, Casagrande, Farley-Metzger, 2008). In addition, it has been suggested that policy alone is not enough to elicit water conservation (Inman & Jeffrey, 2006). The desert cities have been building and developing without restraint, causing an extreme water shortage that is not remedied by gutted water conservation laws (Hirt, Gustafson, & Larson, 2008). We know certain socio-demographics are important in understanding landscape preferences (Larsen & Harlan, 2006; Larson, Casagrande, Harlan, & Yabiku, 2009; Larson, Hoffman, & Ripplinger, 2017; Yabiku, Casagrande, Farley-Metzger, 2008; etc.), but these are not enough to explain the entire picture. While some research has examined how environmental values influence landscaping choices (Larson, Cook, Strawhacker, & Hall, 2010), the results of this work are mixed. Moreover, no research has quantitatively examined place attachment relative to landscaping choices. This thesis fills in these gaps by exploring individuals' ecological worldview as well as urban residents' place attachment to the desert.

By understanding how residents feel about the surrounding desert ecosystems, we may be better able to understand residents' landscape choices and thus steer people

towards xeriscaping. This goal has not been explored in research before and thus works to not only fill a gap in knowledge but also provide a more specific understanding of this landscape for improved conservation management.

One framework for understanding people's connections to the landscape has been through the notion of place attachment (PA). PA concerns the meaningful bonds that people form with their environments (Scannell & Gifford, 2010). It is considered useful in exploring how individuals connect with both man-made and natural places and has been shown to be related to pro-environmental behaviors (Buta, Holland, & Kaplanidou, 2014; Clayton, 2003; Scannell & Gifford, 2010; Vaske & Kobrin, 2001; etc.). Specifically, studies have found that individuals who identify strongly with a place exhibit more pro-environmental behavior (Chung, Kyle, Petrick, & Absher, 2011; Halpenny, 2010; Kyle, Absher, & Graefe, 2003; Stedman, 2003; Thorgersen & Olander, 2003; Vaske & Korbin, 2001). However, these studies have focused on nature in general or specific landscapes, none of which have represented desert landscapes.

Besides the type of natural landscapes, place studies exploring connections to nature have largely focused on recreationists in natural settings (Bricker, Kerstetter, 2000; Hwang, Lee, & Chen, 2005; Kyle, Graefe, Manning, & Bacon, 2003). Other studies utilizing place have focused on more rural populations in lieu of an urban setting (Gosling & Williams, 2010; Halpenny, 2010; Lokocz, Ryan, & Sadler, 2011; Manzo, 2005; Vorkinn & Riese, 2001). Rarely has attachment been studied among an urban population.

Given this, this study builds on previous knowledge to explore how ecological worldview, measured using the New Ecological Paradigm scale, and place attachment, measured using place identity, influence the pro-environmental behavior of xeriscaping.

Such a study will be important for local government and conservation programs in the effort to lower water usage as the metropolitan Phoenix area moves into the future. Understanding how attachment to the Sonoran Desert influences pro-environmental attitudes amongst Phoenix residents could not only help the city, but could lead to understanding water conservation in the entire Southwest Region.

Purpose Statement:

This study builds on previous research and existing knowledge to explore how ecological worldview, measured using the New Ecological Paradigm scale (Dunlap, Van Liere, Mertig, & Jones, 2000), and place attachment, measured using place identity (Williams & Vaske, 2003), influence residents' preferences for water conserving xeriscaping.

Question:

How do different attitudinal and demographic factrs influence residents' preferences for drought-tolerant xeriscaping as a landscape choice?

CHAPTER 2

LITERATURE REVIEW

The purpose of this study is to test how the emotional attachments of urban residents to their surrounding natural environment (i.e. identification with the desert) can predict their likelihood to participate in pro-environmental actions, in this case desert-like landscape preferences in arid Phoenix, Arizona. Given this purpose, the following theoretical review will focus on landscape research, ecological worldview (measured by the New Ecological Paradigm), and place identity (PI). Place identity was chosen due to its importance in related research as well as its novelty in relation to desert landscaping preferences. I will first discuss environmentally responsible behaviors (ERB) specifically in the context of landscape research. I will then discuss ecological worldview and its relation to landscape research, and finally, I will discuss place identity, its theoretical underpinnings, dimensions, and natural resource related findings. I will conclude by summarizing why the use of ecological worldview and place identity in landscape research will provide an opportunity to better understand how emotional attachments to the desert might influence pro-environmental landscaping choices.

Environmentally Responsible Behaviors

ERB refers to the behaviors of people that are considered environmentally friendly, such as volunteering and recycling. The concept has been studied from a behavioral science view point and has mostly focused on altruism as a critical motive for ERB (De Young, 1990). This concept, which is based off norm-activation theory (Schwartz, 1977), suggests that for a person to engage in ERB, they must be aware of environmental

problems and believe that these problems are a threat to their individual values (Corbett, 2005). Individuals will then feel the obligation to act on these feelings, thus resulting in altruistic behavior (Guagnano, Stern, Dietz, 1995). Of particular interest to this study is the ERB of low water use xeriscaping landscape preference.

The study of household landscaping choices is rooted in the historical growth of America (Bormann, Balmori, & Geballe, 2001; Jenkins, 2015; Larson, Casagrande, Harlan, & Yabiku, 2009). The idea of a managed area of grass known as a lawn has been around since the 16th century (Hoad, 1993). Lawns began gaining popularity in England and France around the 18th century as a pleasure ground for the wealthy. By 1733, the first American lawn emerged, emulating their English counterparts (Jackson, 1987; Jenkins, 2015). The idea of an American lawn was notably supported by Presidents such as Thomas Jefferson and John Adams, who insisted that every American should have ownership over a small plot of land (Bormann, Balmori, Geballe, 2001). In addition to political and cultural support, the prevalence of a lawn was aided by the distribution and invasion of European and Middle Eastern grasses to the new world (Jenkins, 2015). These grasses, which were heartier than their native counterparts, allowed people to grow grass in the extreme hot or cold of different regions of the United States (Jenkins, 2015). This gave settlers the opportunity to emulate the wealthy styles of the English landscape fashion. The invention of the lawn mower in 1830 allowed households without sheep or the help of gardeners to keep grass lawns tidy (Bormann, Balmori, Geballe, 2001). As the new nation was founded, the idea of a private piece of lawn began to be more popular.

However, the modern idea of the American suburb and accompanying lawn did not begin until after the Civil War. Historians have identified three major suburban

movements in American history that lead to the modern prevalence of the lawn (Jenkins, 2015). The first occurred during the Civil War in East Coast cities, where the public park movement began. This movement pushed to model suburban areas after parks in order to combat the filthy view of some urban areas. The second occurred in the 1920's as average Americans were able to purchase cars. This allowed people to move farther away from the city center, giving them a chance to own individual plots of land. The game of golf also increased in popularity during this time period and many lawns were built in imitation of the golf course. The third and final development came after World War II. The United States Government financed houses for veterans and encouraged people to pursue the American dream of a house with a grassy yard and a white picket fence. The pursuit of this dream lead to the monoculture of the lawn and the picturesque vision we still hold (Robbins & Birkenholtz, 2003). This final movement is considered the most important and the most influential (Jenkins, 2015).

The cultural and historical growth of lawns has led to a modern reality in which lawns cover 10-16 million hectares of land in the United States (Milesi, Running, Elvidge, Dietz, Tuttle, & Nemani, 2005). This accounts for about 25% of all urban landcover (Robbins & Birkenholtz, 2003). In addition, the ratio of potential lawn area to total household area has increased despite decreases in the size of lots (Robbins & Birkenholtz, 2003). This makes lawns one of the fastest growing landcover types (Robbins, 2012). The overwhelming presence of this landcover type has led to a plethora of research, including its effects on biodiversity (Lopez & Potter, 2003; Peeters, Vanbellinghen, & Frame, 2004), soil composition (Pouyat, Yesilonis, & Golubiewski, 2009; Yao, Bowman, & Shi, 2006), and pesticide and fertilizer use (Cockfield & Potter,

1984; Robbins & Birkenholtz, 2003; Robbins, Polderman, & Birkenholtz, 2001; Zimmerman & Cranshaw, 1990). However, of particular interest to both city planners as well as landscape researchers are the factors that influence landscape type and design.

This area of research has become increasingly popular over the years as urban areas have expanded and more people move into suburbia. On their own property, people have the choice of how to design their land and what features are most important to them. Most homeowners value their land as a financial investment, a connection to nature, and a symbolic representation of the homeowner themselves (Larsen & Harlan, 2006). This popular view of the landscape as a symbolic representation of the homeowner may hold close theoretical and applicable ties to the place identity of the homeowner (described later).

ERB and Residential Landscape Choices

One facet of ERB that has been overlooked in research is its connection with residential landscape choices. It is commonly predicted that individuals who have a higher environmental concern are more likely to engage in environmentally friendly landscaping choices (Larsen & Harlan, 2006; Yabiku, Casagrande, & Farley-Metzger, 2008). In the desert Southwest, environmentally friendly landscaping choices can translate into low-water use landscape. This is termed xeriscaping (or xeric landscapes), which is defined as a landscaping design that utilizes drought tolerant plants and crushed stone for groundcover (Larson, Casagrande, Harlan, & Yabiku, 2009; Martin, 2015). On the other end of the water-use scale is mesic landscaping, which indicates a turf grass lawn that requires substantial irrigation. Oasis landscaping falls between xeric and mesic

yards in terms of water-use and signifies a partial grass, partial rock mixed yard (Larson, Casagrande, Harlan, & Yabiku, 2009). One study in the Phoenix area found that

While xeric yards do conserve water, it is important to note that there are tradeoffs when it comes to switching lawns to xeric yards. Lawns have been shown to provide evaporative cooling (Harlan, Brazel, Prashad, Stefanov, & Larsen, 2006), which is vital in Phoenix where the urban heat island can negatively affect residents' health and well-being (Jenerette, Harlan, Stefanov, & Martin, 2011). Additionally, individuals with xeric yards were found to apply more herbicides than individuals with lawns in order to maintain a weed-free rocky aesthetic (Larson, Cook, Strawhacker, & Hall, 2010). These herbicides can be detrimental to both human health and the environment (Robbins, 2007; Steinberg, 2007). Therefore, while in the context of water conservation xeric landscaping may be considered an environmentally friendly behavior, it is important to keep in mind that this may not hold true for other facets of xeriscaping.

Residential landscapes are a unique and salient aspect of the current lifestyle in the United States. The decisions people make about their own yards are important not only on an individual level, but also at a citywide level. Municipal water use, a majority of which is used in landscaping, accounts for about 2/3 of all water use in the Phoenix area (Balling & Gober, 2007; Mayer, DeOreo, Opitz, Kiefer, Davis, Dziegielewski, & Nelson, 1999). As mentioned before, households may be able to cut 40% to 70% of their water use by switching from landscape irrigation to xeriscape (Hilaire, Arnold, Wilkerson, Devitt, Hurd, Lesikar, Lohr, Martin, McDonald, Morris, Pittenger, Shaw, & Zoldoske, 2008). Therefore, it is critical to understand both where our potential

connection to xeric landscapes might come from as well as what factors influence our landscaping preferences.

A study by Larson & Brumand (2014) found that nearly half their respondents expressed worry over water conservation in their yard management. However, interestingly, this did not necessarily translate into less water usage, since other priorities (such as aesthetic appeal and low maintenance) often dominate landscape choices. In a similar fashion, Larsen & Harlan (2005) found that concern about water conservation and engagement in natural desert environments did not predict landscape preference. This lack of a strong relationship is echoed in other academic papers (Larson, Cook, Strawhacker, & Hall, 2010; Yabiku, Casagrande, & Farley-Metzger, 2008). Some have suggested that conservation concerns may not be as important in landscaping decisions as preferred landscapes, social pressures, aesthetics, low maintenance (Larsen & Harlan, 2005; Larson & Brumand, 2014).

One of the most influential components of landscape design and choice is personal preference based on aesthetic appearance, maintenance needs, recreational use, and environmental impacts (Larson, Casagrande, Harlon, & Yabiku, 2009; Larsen & Harlan, 2006; Martin, Peterson, & Stabler, 2003). The aesthetic appearance of a lawn is deeply rooted in the historical and possibly evolutionary contexts. Some have speculated that landscape aesthetics are comprised of biological, cultural, and personal experiences which are viewed through the constraints and opportunities of laws, rules, and strategies (Bourassa, 1990). Many people consider the historical idea of turf grass lawns to be much more pleasing than xeriscaping (Sokol, 2005). However, aesthetics can be difficult to measure given its subjective nature (Frank, Furst, Koschke, Witt, & Wakeschin, 2012).

Some researchers have argued that due to the subjectivity, factors such as previous knowledge and experience, familiarity with the landscape, demographic factors, and cultural background may have a strong influence on aesthetics (Kaplan & Kaplan, 1989; Kearney, Bradley, Gordon, Petrich, Kaplan, Kaplan, Simpson-Colebank, 2008; Ribe, 2002; Virden & Walker, 1999). Meanwhile others have found that these personal factors did not influence aesthetic results (Frank, Furst, Koschke, Witt, & Wakeschin, 2013).

In either case, aesthetic reasons are often identified as a strong driver of landscape choices (Martin, Peterson, & Stabler, 2003). Research has shown, however, that xeric yards are often found to be aesthetically pleasing (Yabiku, Casagrande, & Farley-Metzger, 2008) and, more broadly, aesthetic appeal can vary across individuals. This means that some people may prefer the look of green grass while others prefer more naturalistic desert-like landscapes in Phoenix (Larson, Casagrande, Harlan, & Yabiku, 2009). Due to the varying nature of aesthetic taste, other factors besides aesthetics play a key role in landscape decisions. In addition, a multitude of studies have examined the impact of socio-demographic variables on landscaping choices.

Socio-Demographic Factors

Income has been shown to play a role in residential landscape preferences. Studies in Phoenix found that high income neighborhoods tended to have higher plant and bird diversity (Hope, Gries, Zhu, Fagan, Redman, Grimm, Nelson, Martin, & Kinzig, 2003; Kinzig, Warren, Martin, Hope, & Madhusudan, 2005; Larson, Casagrande, Harlan, & Yabiku, 2009). These high-income households were more likely to incorporate xeric and oasis yards while lower income residents tended towards mesic lawns (Larson,

Casagrande, Harlan, & Yabiku, 2009; Larsen & Harlan, 2006). This preference for mesic lawns in low-income areas may relate to the ability of grass to provide a cooling effect in the place of appliances such as air conditioners (Harlan, Brazel, Prashad, Sefanov, & Larsen, 2006). In a study by Larsen and Harlan (2006), income was found to be the only significant predictor of front-yard landscape preference unlike length of residence, environmental concern, and engagement in outdoor activities. They similarly found that lower-income households tended to prefer lawns, middle income households preferred desert landscaping, and upper-income households were divided between desert and oasis landscapes. Finally, they found that income may also be linked to yard maintenance concerns, where middle-income residents show higher concerns than lower- or higher-income respondents. Since income may be linked with environmentally responsible behaviors and has been found to be related to landscape preference, it stands that the higher a person's income, the more likely they will be to prefer xeriscaping.

Education is most commonly examined in conjunction with either income, race, or both. This grouping, known as socioeconomic status, has been found to be linked to environmentally responsible behaviors. Individuals with higher socioeconomic status have higher residential plant diversity (Hope, Gires, Zhu, Faga, Redman, Grimm, Nelson, Martin, & Kinzig, 2003; Kinzig, Warren, Martin, Hope, Katti, 2005; Mennis, 2006), are more environmentally concerned consumers (Balderjahn, 1988), and are more likely to recycle (Berger, 1997; Everett & Peirce, 1992; Lansana, 1992). Some, such as Mainieri et al. (1997), have found no relationship between education and green buying amongst consumers. However, in landscape literature while studies may group study census blocks by socioeconomic status (Larson, Casagrande, Harlan, Yabiku, 2009) or ask about

education in the survey (Larsen & Harlan, 2005), most do not seem to include education in their analysis. However, since education has been positively linked to environmentally responsible behaviors, it may be that the higher a person's education level, the more likely they are to prefer xeriscaping.

The same pattern is seen with respondent ethnicity, with ethnic minorities less engaged in conservation incentive programs (Gan, Onianwa, Schelhas, Wheelock, & Dubois, 2004) or have historical difficulty in participating (Kepe, 2009; Sundberg, 2004). Whites were also found to be more aware of which factors and products are safer for the environment (Mainieri, Barnett, Valdero, Unipan, & Oskamp, 1997). However, while frequently asked on questionnaires, ethnicity is rarely included in the actual analysis of landscape preference (Cook, Hall, & Larson, 2012; Larsen & Harlan, 2005; Larson, Casagrande, Harlan, & Yabiku, 2009; Lyons, 1983). Previously established connections to environmental responsible behaviors seem to suggest that ethnic minorities may be less likely to prefer xeriscaping in their yards.

Some studies have also suggested that gender may affect landscape preference (Abello & Bernaldez, 1986). One study found that gender was one of the most important factors in the formation of landscape preferences, with women tending to prefer lawns (Ode, Fry, Tveit, Messager, & Miller, 2009). Women have also been found to be significantly more averse to dry landscapes (Yabiku, Casagrande, & Farley-Metzger, 2008). However, other studies have found no significant correlation between gender and landscape preference (Larsen & Harlan, 2005; Yu, 1995) Overall, the relationship between gender and landscape preference is not fully understood and requires greater research (Yabiku, Casagrande, Farley-Metzger, 2008).

Differences in gender preference may relate to the typical chores that are culturally assigned to each gender (Greenstein, 1996; Larson, Casagrande, Harlan, & Yabiku, 2009; Schahn & Holzer, 1990; Yabiku, Casagrande, & Farley-Metzger, 2008), with men undertaking outdoor chores, thus shying away from the more maintenance intensive lawns, and women doing more childcare and indoor housework. Additionally, women are most commonly associated with child rearing. Xeriscape lawns may be considered dangerous by parents to their children due to the presence of cacti and other sharp plants (Larson, Casagrande, Harlan, & Yabiku, 2009; Yabiku, Casagrande, & Farley-Metzger, 2008). One study found that parents and female respondents had a higher concern over potentially dangerous wildlife (Zinn & Pierce, 2002) which may correlate to increased concern over potentially dangerous floral choices (Yabiku, Casagrande, & Farley-Metzger, 2008). Given the previous research, it may be reasoned that women will be less likely to prefer xeriscaping.

Another important factor in landscape design may be cultural and social norms (Bell, 2012; Bourassa, 1990; Hurd, 2006; Larson, Casagrande, Harlan, &Yabiku, 2009). These factors encompass attributes such as personal beliefs and social pressures. Landscaping choices may be viewed as symbolic of social status (Robbins, 2007), meaning that negligent lawn care can be characterized as a failure to meet social norms. Individuals may, in-turn, increase the value or status of their house by maintaining a certain type of front yard (Martin, Warren, & Kinzig, 2004; Yabiku, Casagrande, & Farley-Metzger, 2008). This aspect of landscaping seems to hold the most influence over front lawns, where residents feel the need to fit in with or impress neighbors, as opposed to backyard “dreamscapes” that are driven more by personal lifestyle and leisure interests

(Larsen & Harlan, 2006). Researchers found that appearance was especially important in visible front yards, whereas recreation is more important in back yards (Larson, Casagrande, Harlan, & Yabiku, 2009).

Other research has taken the variable even further to identify differences in landscape choices based on differences in culture. People have a strong preference for traditional landscape types, such as grasslands in Sweden (Hagerhall, 2001). In addition, individuals within the same culture had more similar landscape preferences than individuals across different cultures (Hull & Revell, 1989). However, this influence is stronger in areas with specific landscapes that are known to have cultural meaning. This idea may suggest that individuals that have spent a larger part of their life in a certain area may be more likely to prefer the dominant landscape type. Research has shown that a person's attachment to a place may be primarily affected by length of residence (Porteous, 1976; Stedman, 2006).

However, contrary to research in other fields, length of residence in Phoenix, AZ has not been a strong predictor of landscape preference (Larsen & Harlan, 2005) or, in several studies, has been found to be negatively related to xeriscaping specifically in the Phoenix area (Larson, Casagrande, Harlan, & Yabiku, 2009; Larson, Hoffman, & Ripplinger, 2017; Martin, Peterson, & Stabler, 2003; Yabiku, Casagrande, & Farley-Metzger, 2008). In Larson et al. (2017), residency was found to be negatively related to xeriscape preference, with long-time residents preferring older neighborhoods with grassier landscapes. This may be in part due to the legacy effect of historic neighborhoods and the promotion of the Phoenix region as a lush oasis that is distinct from its desert environment (Larson, Casagrande, Harlan, & Yabiku, 2009). Campaigns

that promoted the idea of 'doing away with the desert' may strengthen long-term residents' preference for mesic lawns (Larson, Casagrande, Harlan, & Yabiku, 2009; Larson, Cook, Strawhacker, Hall, 2017) Additionally, Phoenix residents were the least likely to prefer xeric landscape when compared to individuals from other areas (Martin, Peterson, & Stabler, 2003). However, these findings may be mediated by other factors, such as presence of children in the home (Yabiku, Casagrande, & Farley-Metzger, 2008). In addition, other cities in Arizona have been shown to behavior differently in regards to residency than Phoenix. Long term residents in Tucson, AZ were found to have higher preferences for native species (Kennedy & Zube, 1991) and were more accepting of native species than Phoenix (Zube, Simcox, & Law, 1986). Therefore, while residency has been studied in the Phoenix area, the findings do not necessarily represent a wider understanding of residency and landscape preference. It may be that the addition of variables, such as place identity, may help to explain why long-term residents prefer mesic yards. Despite residency's positive relationship with other theoretical fields, such as place attachment, within the Phoenix area, increased residency may lead to a significant lower preference for xeriscaping.

As mentioned above, landscape preference may also be affected by a legacy effect. This effect pertains to the historic landscape use patterns in an area (Hope, Gries, Zu, Fagan, Redman, Grimm, Nelson, Martin, & Kinzig, 2003). As previously discussed, Phoenix was built on the idea of an oasis in the desert which lead to widespread implementation in older neighborhoods. Therefore, Phoenix follows a trend that older neighborhoods are dominated by grass lawns and newer neighborhoods tend towards xeric landscapes. These landscaping norms, i.e. that all front yards contain a lawn, are

largely informal and are often maintained only by local neighborhood groups and social pressures in historic neighborhoods of Phoenix (Larson & Brumand, 2014). In some cases, these effects are actually the opposite of resident landscape preferences (Harlan, Brazel, Prashad, Stefanov, & Larsen, 2006), raising the concern that differences in preferences and actualization of yards may not be addressed by policy programs (Larson, Casagrande, Harlan, & Yabiku, 2009). Indeed, it may be that in the Phoenix area, these legacy effects still persist and are hindering current efforts to promote xeriscaping (Larson, Hoffman, & Ripplinger, 2017).

These legacy effects can strongly relate to the year that the house was built, in which the cultural landscape preferences of that time were implemented to sell houses (Larsen & Harlan, 2005). However, since these preferences change over time, residents may be left with purchasing houses that do not match their own landscaping desires. Residents may not be able to remodel their yards to suite their preferences due to constraints such as income or preexisting yard structure (Larson & Brumand, 2014). These legacy effects have influenced Phoenix landscaping, where many houses implemented water-intensive landscapes to match the general preferences of the late-1800's to mid-1900's when Eastern and Midwestern individuals moved to the Southwest (Larson & Brumand, 2014; Larson, Casagrande, Harlan, & Yabiku, 2009' Larson, Hoffman, Ripplinger, 2017). At the time, factors, such as location in a desert and limited water supply, were not considered. However, more recently, rising attention

Other legacy effects can include the distribution of urban development and the divide between rich and poor in cities (Harlan, Brazel, Prashad, Stefanov, & Larsen, 2006). This can lead to increased challenges for certain areas to achieve their desired

landscape preferences due to historical environmental and developmental challenges. To change these effects, we must change the way that we sell houses to incoming residents by promoting the area as a desert and not an oasis (Larson, Hoffman, Ripplinger, 2017). Due to the potential discrepancies between preferences and actualization that households may be unable to change, this study will focus on individual's landscape preferences. This way, we will be able to more directly measure the effect of the explanatory variables on xeriscaping without issues such as legacy effects confounding results.

Residential landscaping literature supplies a complicated and often-times conflicting view of personal yard choices. Due to the complex and confounding nature of human decision making it can be difficult to discern the actual factors behind choices. However, two additional bodies of literature might offer some insight. The first, is ecological worldview, measured as environmental attitudes. The second is place attachment. Both are reviewed below to provide insight into their connection with environmentally responsible behaviors and, by extension, xeriscape type landscape preference.

Ecological Worldview

Another variable of interest in exploring environmentally responsible behaviors is attitudes towards the environment, or a person's ecological worldview. This concept is most commonly measured using the New Ecological Paradigm (NEP) Scale. The original scale was called the New Environmental Paradigm Scale and was developed by Dunlap and Van Liere (1978). This scale was later updated into the NEP Scale by Dunlap et al. (2000) to include a wider range of ideas, utilize positive and negative statements, and

update the terminology. This scale, along with the original, measures pro-environmental orientation. It is important to note that the NEP Scale measures general environmental concern and not specific environmental problems.

The NEP scale consists of 15 items measured on a 1-5 Likert scale where 1 is strongly disagree and 5 is strongly agree. There has been some debate over whether the NEP scale is unidimensional or multidimensional (Dunlap, Van Liere, Mertig, & Jones, 2000). Some studies have concluded that the scale contains three distinct dimensions: balance of nature, limits to growth, and human domination of nature (Albrecht, Bultena, Hoiberg, & Nowak, 1982; Geller & Lasley, 1985; Noe & Snow, 1990). However, many have found that the NEP scale consists of only one dimension (Dunlap, 2008; Edgell & Nowell, 1989; Hawcroft & Milfont, 2010; Lefcourt, 1996; Mayer & Frantz, 2004; Schultz, 2001), some have found two dimensions (Amburgey & Thoman, 2012; Bechtl, Verdugo, Pinheiro, 1999; Gooch, 1995; Noe & Hammit, 1992; Nooney, Woodrum, Hoban, & Clifford, 2003; Scott & Willits, 1994), and some have found four (Furman, 1998; Roberts & Bacon, 1997). Therefore, the decision of whether to break the NEP scale down into dimensions remains based on the discretion and results of the research (Dunlap, Van Liere, Mertig, & Jones, 2000).

A multitude of studies have established a relationship between the NEP scale and various behavioral intentions as well as self-reported and observed pro-environmental behaviors (Dunlap, Van Liere, Mertig, & Jones, 2000). The scale has been able to differentiate individuals within the general population from those that are active in environmental groups (Dunlap & Van Liere, 1978; Steger, Pierce, Steel & Lovrich, 1989). In addition, a positive correlation between the NEP scale and pro-environmental

behavior has been found in a plethora of studies. A higher environmental concern has been associated with the pro-environmental behaviors such as lower household energy use (Poortinga, Steg, & Vlek, 2004), consumer decisions (Ebreo, Hershey, & Vining, 1999; Pickett-Baker & Ozaki, 2008; Roberts & Bacon, 1997; Scott & Willits, 1994; Shetzer, Stackman, & Moore, 1991) and recycling behavior (Ebreo, Hershey, & Vining, 1999; Vining & Ebreo, 1992).

In addition, the NEP scale has been utilized in connection with residential landscaping in the past. Yabiku et al. (2008) found that people with a preference for mesic lawns had higher anthropocentric values. A study by Larson et al. (2010) utilized the NEP scale to examine the influence of personal values on landscaping behavior. Their findings provide a complicating view on how ecological worldview and xeriscaping might be related. Individuals with an oasis yard were found to be more anthropocentric than those with either mesic or xeric yards, presumably due to an increased desire to derive the benefits from both mesic and xeric yards. In addition, contrary to what would be expected from an environmentally responsible behavior viewpoint, individuals with biocentric orientations opted for mesic yards and high levels of irrigation instead of the predicted xeric yards. Similarly, individuals who have higher environmental awareness have been found to use more pesticides (Robbin, Polderman, & Birkenholtz, 2001) and fertilizer than those with a lower concern for the environment (Templeton, Yoo, & Zilberman, 1999). Larson et al. (2010) speculated that this may be due to the multitude of ways that people define 'nature' in their own life, which is often referred to as the social construction of nature. Larson et al. (2009) found that respondents called mesic lawns 'pretty nature' and that a separation between people and the desert as nature existed.

Thus, the local biome may not represent an individual's view of what nature is. In other words, while desert landscaping is the most pro-environmental, individuals may not see the desert as 'nature' referenced in the NEP scale.

However, this does not mean that ecological worldview and xeriscaping are not related (Larson, Cook, Strawhacker, & Hall, 2010). It shows that the relationship is complicated and that other factors, such as place identity, should be included to better represent the multi-faceted behavior of preference. Overall, the connections provide evidence for a potentially positive relationship between ecological worldview and pro-environmental landscape preference. However, the mixed results from previous research warrant further investigation to clarify this relationship. In addition to a person's ecological worldview, an understanding of an individual's attachment to the surrounding landscape may help explain landscaping preferences.

Place Attachment

As indicated earlier, place attachment offers another perspective into xeriscaping landscape preferences. Place attachment concerns the psychological meaning of an environment for a person or group (Shumaker & Taylor, 1983; Taylor, Gottfredson, & Bower, 1985). This idea was formed from the geographical concepts of space and place. Space relates only to its corresponding spatial elements and is easily quantifiable for geographers (Tuan, 1979). Place, while equally as important in geography, is a unique location that must be understood in context of the people who give it meaning (Tuan, 1979). While space is defined by factors such as distance and size, when a person experiences a space for themselves and thus gives it meaning, it becomes a place (Tuan,

1979). This idea of symbolic meaning has been seen in the landscape literature. A person's household landscape has been found to be a symbolic representation of the homeowner themselves (Larsen & Harlan, 2006) as well as symbolic of their social status (Robbins, 2007). We know that landscapes hold certain meanings, thus the idea of place attachment and its core theoretical tenant of symbolic interactionism become important.

Symbolic interactionism is founded in sociological social psychology and is considered to have been first described by George Mead (McPhail & Rexroat, 1979). However, the term symbolic interactionism was coined by Herbert Blumer in 1936. Blumer's symbolic interactionism is founded on three principles: that human beings act towards things on the basis of the meaning that the things have for them, the meaning of things is derived from the social interaction that one has with one's fellows, and these meanings are handled in and modified through an interpretative process used by the person in dealing with the things he/she encounters (Blumer, 1936). In other words, a physical place is given meaning through interaction with people (Milligan, 1998). This link to place attachment has been defined as having two components: an interactional past, or memories of interactions associated with a place, and interactional potential, or the future experiences perceived as likely or possible to occur at a place (Milligan, 1998).

Symbolic interactionism, which has been considered a core tenant of sociology (Fine, 1993; Mcphail & Rexroat, 1979; Stryker, 2001), has also received some criticism (Fine, 1993; Mullins, 1973). One critique is that symbolic interactionism now lacks coherence as a theory because of fragmentation in its core ideas, expansion into too many fields, incorporation in other theories, and adoption by researchers without full theoretical integration (Fine, 1993). However, despite current debates, symbolic interactionism is

key to understanding the development of ideas surrounding human connections to places, such as the desert.

Place attachment has proven useful in understanding human connections to natural places (Kyle, Graefe, Manning, & Bacon, 2004; Halpenny, 2010; Hwang, Lee, & Chen, 2005; Ramkissoon, Weiler, & Smith, 2012; Warzecha & Lime, 2001). One stream of research has focused on understanding place attachment formation and its underlying dimensions. A majority of place attachment research focuses on the dimensions of place identity (PI), place dependence (PD), or a combination of the two (Moore and Graefe, 1994; Vaske and Kobrin, 2001; Budruk and Stanis, 2013). Place identity examines the meaning and significance of places to people and how those meanings affect an individual's personal identity and sense of self (Proshansky, 1978; Proshansky, Fabian, & Kaminoff, 1983). This idea includes not only the physical setting of place, but also the social aspects (Hummon, 1992; Korpela, 1989; Lavin & Agatstein, 1984). Place dependence addresses how certain places given no other substitute provide opportunities for achieving goals and personal needs (Stokols & Shumaker, 1981). Place dependence postulates that people are attached to a certain place for functional reasons and that these attachments and reasons are based off of previous experiences (Backlund & Williams, 2003; White, Virden, & Van Riper, 2008). Besides these two dimensions, other dimensions such as social bonding (Kyle, Graefe, & Manning, 2005; Ramkissoon, Weiler, & Smith, 2012; Scannell & Gifford, 2010), ancestral ties (Hay, 1998), place affect (Kals & Maes, 2002; Ramkissoon, Weiler, & Smith, 2012), and place bonding (Brandenburg & Carroll, 1995; Relph, 1976; Stedman, 2003) have been reported. However, researchers have noted that while place identity and place dependence are core

dimension, they should be treated as separate entities (Kyle, Absher, & Graefe, 2003; Kyle, Graefe, Manning, & Bacon, 2004; Stedman, 2002). Kyle et al. (2004) found that place identity and place dependence did not act uniformly.

Besides an emphasis on its dimensionality, several studies have focused on outdoor recreationists' attachments to natural settings such as national parks (Halpenny, 2010; Hwang, Lee, & Chen, 2005; Ramkissoon, Weiler, & Smith, 2012), mountains (Alexandris & Kouthouris, 2006; Kyle, Graefe, Manning, & Bacon, 2004; Silva, Kastenholz, & Abrantes, 2013), rivers (Bricker & Kerstetter, 2000), or urban green spaces (Budruk, Thomas, & Tyrrell, 2009). These studies have collectively provided an understanding of the level of attachment to these kinds of settings. Place attachment has been found to predict pro-environmental beliefs (Scannell & Gifford, 2010), influence people's intentions and behaviors regarding pro-environmental beliefs such as conservation and recreation use goals (Buta, Holland, & Kaplanidou, 2014) and increase engagement in pro-environmental behaviors (Clayton, 2003; Vaske & Kobrin, 2001). It has also been shown that place identity may have a more direct impact on environmental behaviors than place dependence (Vaske & Kobrin, 2001). Given the dimensionality of place attachment and this study's focus on place identity, a subset of place attachment gives insight into how place identity influences other variables. Of interest is the relationship with environmentally responsible behavior.

Vaske and Kobrin (2001) found that place identity was significantly and positively related to the development of specific ERB, such as talking with others about environmental issues and sorting recyclable trash. They also found that fostering local attachment to a place can lead to an increase in a person's overall environmental

responsibility. This same positive relationship was seen in seasonal and full-time lake residents among whom place identity influenced their likelihood to engage in place-protective behaviors (Stedman, 2002). Affective (place affect), functional (place dependence), and cognitive bonds (place identity) with a place may also predict a person's stewardship and protective behaviors relating to that place (Halpenny, 2010). Additionally, place identity may influence and inspire individuals to participate in other pro-environmental behaviors in addition to the one they are currently engaged in (Halpenny, 2010; Thorgersen & Olander, 2003).

Place identity may increase perceptions of negative environmental conditions in areas (Kyle, Graefe, Manning, & Bacon, 2004) as well as increase a person's desire for resource preservation and maintenance of primitive settings (Bricker & Kerstetter, 2000). In addition, place identity has been found to positively affect individual's attitudes towards park fee programs, thus leading to greater spending on environmental protection (Chung, Kyle, Petrick, & Absher, 2010; Kyle, Absher, & Graefe, 2003). Uzzell et al. (2002) found that place related social identity may positively influence green purchasing decisions. This multitude of studies provides a strong positive link between place identity and environmentally responsible behaviors. This study aims to build upon this literature to understand how place identity with the desert may affect the environmentally responsible behavior of xeriscaping landscape preference.

Summary of Literature

Given this literature background, it is clear that environmentally responsible behaviors are influenced by a variety of variables. Among the literature, income and education have positively influenced the environmentally responsible behavior of xeric

preference. Additionally, Non-Whites are less likely to engage in environmentally responsible behaviors, therefore, Non-Whites may be less likely to prefer xeric landscaping. Further, even though the relationship between gender and landscape preference has been somewhat conflicting, previous studies have suggested that women may be less likely to prefer xeriscaping. Given the previous research done within the Phoenix area, the person who has spent more of their life in Phoenix may be less likely to prefer xeric landscaping. Since ecological worldview has been shown to be so closely tied to environmentally responsible behaviors, it follows that individuals with a more positive ecological worldview will be more likely to prefer xeriscaping. Finally, since place identity is positively related to environmentally responsible behaviors, individuals with a higher identification with the desert may prefer xeric landscaping more so than others.

Overall, landscape preference has the potential to be influenced by income, education, race, gender, and residency. However, these variables are not enough to explain the preference of xeric landscaping. Ecological worldview and place identity offer an additional perspective through which to understand this environmentally responsible behavior. Although place identity has been shown to be an important and robust predictor of environmentally responsible behaviors, no studies have linked place identity with the desert and water-conserving landscaping preferences. In addition, identity specifically with the desert has been rarely utilized in place identity research, let alone within the context of xeriscaping. One study has looked at how environmental concern and engagement in desert recreation activities influenced landscape preference (Larsen &

Harlan, 2005). However, the study did not utilize place identity and examined environmental concern at a large scale while using drought concern as a local predictor.

This study will work to begin to fill these gaps that have been identified in literature. Based on the current literature, this study will explore how income, education, race, gender, residency, ecological worldview, and place identity with the desert influences landscape preference. Specifically, the study hypotheses are:

Hypotheses:

H1. The higher an individual's income, the stronger will be his/her preference for the environmentally responsible behavior of xeriscaping

H2. The higher an individual's education, the stronger will be his/her preference for the environmentally responsible behavior of xeriscaping

H3. Hispanics, as compared to Non-Hispanics, will have a weaker preference for the environmentally responsible behavior of xeriscaping

H4. Women, as compared to men, will be have a weaker preference for the environmentally responsible behavior of xeriscaping

H5. The longer an individual's length of residence in Phoenix, the weaker will be his/her preference for the environmentally responsible behavior of xeriscaping

H6. The higher an individual's pro-ecological world view, the stronger will be his/her preference for the environmentally responsible behavior of xeriscaping

H7. The stronger an individual's place identity, the stronger will be his/her preference for the environmentally responsible behavior of xeriscaping.

CHAPTER 3

METHODS

Study Area

Phoenix, Arizona is home to 1.6 million people and is steadily growing. 65.9% of the population is white and 40.8% of the population is Hispanic or Latino or any race (U.S. 2010 Census). Mean monthly temperatures range from 67^{o}F in January to 106^{o}F in July. Average annual precipitation is 8.04 inches and the area experiences around 330 days of sunshine a year (U.S. climate data, 2018). Many of the historical housing areas within Phoenix were built between the late 1800's to the 1950's and maintain the traditional legacy of high water use lawns (Larson, Hoffman, & Ripplinger, 2017). During this time period, individuals from the midwestern and eastern United States introduced exotic trees and turf grass species to the southwestern United States (Larson, Hoffman, & Ripplinger 2017; Zube, Simcox, & Law, 1986). In Arizona, In Phoenix, around 2/3 of all water use is residential, of which 74% is utilized for outdoor purposes (Balling & Gober, 2007; Mayer, DeOreo, Opitz, Kiefer, Davis, Dziegielewski, & Nelson, 1999). Therefore, any conservation in residential outdoor water usage is going to have a significant impact on overall water use in the Phoenix area.

Phoenix Area Social Survey

This study is based off data collected from the 2017 Phoenix Area Social Survey (PASS) collected by the Central Arizona-Phoenix Long Term Ecological Research (CAP LTER) Program at Arizona State University (ASU). In order to look at the views and practices of particular Phoenix-area neighborhoods, the 2017 PASS (on which this research is based) utilized 12 neighborhoods with a target of 65 respondents in each neighborhood. This allowed researchers to better understand entire neighborhood level perceptions, attitudes, and decisions on a variety of factors.

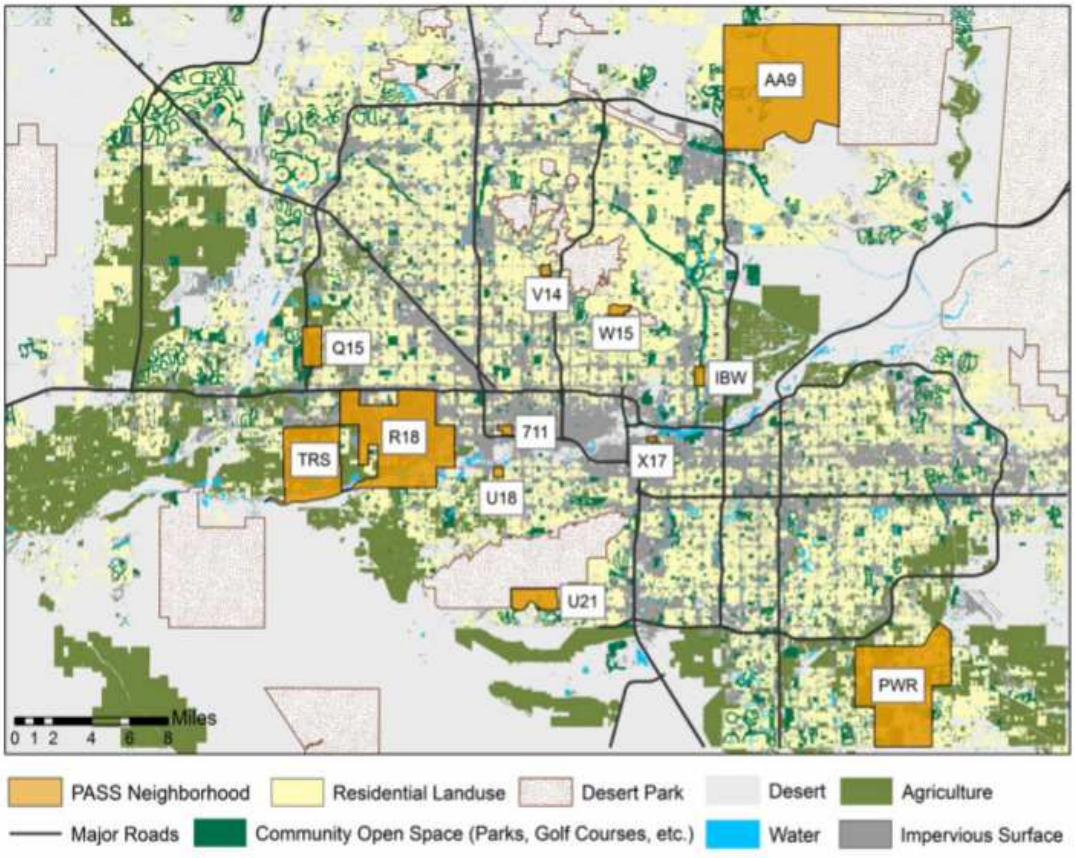
Survey Design

The design of PASS is historically coupled with CAP LTER's program for long-term monitoring in the metropolitan Phoenix area. Its creation and sampling are tied to the CAP LTER Ecological Survey of Central Arizona, which aims to characterize ecological indicators at approximately 200 randomly stratified sample plots throughout the Phoenix area. The 12 neighborhoods utilized in the 2017 survey were selected by PASS researchers based on the neighborhoods' ability to represent a wide range of income levels, ethnic profiles, house development time frames, and locations across the metropolitan area. It is important to keep in mind that these neighborhoods represent only a sample of the Phoenix population and are not representative due to the selection of the neighborhoods. Each neighborhood is spatially defined based on census block groups. Ten of these neighborhoods were surveyed previously in the 2011 survey and two additional neighborhoods were added to further bolster the connections between PASS

and current ecological work by CAP LTER at Indian Bend Wash and Tres Rios Wetlands. The 12 neighborhoods and their site codes are shown on the map below.

Figure 3.1

Map of Surveyed Neighborhoods



Map of 12 neighborhoods surveyed in PASS 2017 (Courtesy of PASS)

The characterization of each neighborhood is shown below:

Table 3.1

Summary of PASS Neighborhoods

Summary matrix of the 12 PASS neighborhoods surveyed in the summer of 2017

ID	Location	Nearby Infrastructure/ Land Use Context	Avg. Year Developed	Median Per Capita Income	Percent Non-White
AA9	Fringe: Scottsdale (NE)	McDowell Sonoran Preserve	2000	$88,000	14%
711	Core: Phoenix	Downtown Phoenix (city core)	1971	$11,000	85%
IBW*	Suburban: Scottsdale (E)	Indian Bend Wash	1974	$41,000	18%
PWR	Fringe: Gilbert (SE)	Agricultural	2007	$33,000	26%
Q15	Suburban: Phoenix (W)	Agricultural	2001	$22,000	76%
R18	Suburban: Phoenix (SW)	Salt River (unmanaged section)	2003	$15,000	88%
TRS*	Fringe: Phoenix (SW)	Salt River (Tres Rios Wetlands)	2006	$18,000	83%
U18	Core: Phoenix	Salt River (Audubon)	1953	$12,000	95%
U21	Fringe: Phoenix (S)	South Mountain Preserve	1995	$54,000	24%
V14	Core: Phoenix	Phoenix Mountain Preserve	1981	$32,000	29%
W15	Core: Phoenix	Camelback Mountain	1968	$73,000	12%
X17	Core: Tempe[2]	Salt River (Tempe Town Lake)	1982	$24,000	50%

*Neighborhoods newly added in 2017; all others were surveyed in previous versions of the PASS

Courtesy of PASS 2017

The target 65 respondents in each of the 12 neighborhoods equated to 1,400 households being invited to participate in the PASS. Of these, 188 addresses had been included in the 2011 PASS and 1,212 were provided by the Marketing Systems Group, which provides a list of all mailable U.S. Postal Service addresses. From this list, 115 addresses were randomly chosen within each 12 neighborhoods. The 115 addresses included 14 back-up addresses in case of the accidental selection of duplicate or bad addresses.

Survey Administration and Incentives

The surveys were administered by the University of Wisconsin Survey Center from early June through mid-August 2017. The surveys were delivered by mail in four waves using the wave data collection design. In the first wave, sent out on May 31st, households were sent a hard copy of the survey, a postage-paid card in order to request a Spanish copy of the survey if desired, and a return envelope. The Spanish copy of the survey was translated and back-translated according to the ASU Institutional Review Board requirements. In the second wave, sent out on June 6th, postcard with a reminder to complete the survey was sent to all households. In the third and fourth waves, sent out on June 22nd and July 18th respectively, all households that had not yet responded to the survey were sent another copy of the original packet. Survey collection ended on September 15, 2017.

In order to increase response rate, $5 was included in each of the original survey packets. In addition, each participant was assigned to one of 15 post-survey incentive groups. These groups included $5, $25, and $40 rewards that were either given to the participant, or to one of the following local charities: St. Mary's Foodbank, Phoenix Children's Hospital, Desert Foothills Land Trust, or a participant's choice of charity.

Response Rates

In total, 496 completed or partial questionnaires were received. This constituted a 39.4% response rate out of the total 1,400 households. The response rate was calculated by the American Association for Public Opinion Research's Response Rate 2. This takes the total number of completed or partial questionnaires divided by the total N minus the

vacant and undeliverable addresses. Response rate within each neighborhood block varied greatly, from 22.2% to 55.6%.

Table 3.2

Response Rates by Neighborhood

Sampling Details and Response Rates across the Twelve Study Neighborhood

	711	AA9	IBW	PWR	Q15	R18	TRS	U18	U21	V14	W15	X17	All Nbhds.
Sampled addresses	113	114	101	121	122	121	101	122	121	122	121	121	1400
Fully/partly completed (n)	**22**	**46**	**37**	**60**	**39**	**28**	**29**	**34**	**56**	**50**	**56**	**39**	**496**
Refusals	0	3	1	0	0	0	0	0	1	1	1	0	7
Returned as undeliverable	7	12	12	9	1	4	4	0	5	3	5	8	70
Returned as vacant address	7	6	0	4	3	6	3	1	3	15	6	16	70
Response rates (%)	**22.2**	**47.9**	**41.6**	**55.6**	**33.1**	**25.2**	**30.9**	**28.1**	**49.6**	**48.1**	**50.9**	**40.2**	**39.37%**

Response Rate for each of the 12 neighborhoods (Courtesy of PASS)

Constructs and Variables

Landscape preference was measured using two separate questions, one addressing landscape preferences in the front yard and one addressing landscape preferences in the back yard (See Appendix A). Each question gave eight different landscaping options which were divided into four standard categories: (1) mostly or all grass (mesic), (2) mostly or all gravel (xeric), (3) a mix of both grass and gravel (oasis), (4-8) or a patio, courtyard, and bare dirt (other). For my purposes, only the first three responses were utilized in the analysis since this study focused on water conservation and the final five options did not include yard types that required watering.

Income level was measured in the survey with one question which had 11 options, with a range from under $20,000 to more than $200,000. Education level was measured using one question on the PASS survey that asked respondents to pick from seven levels of education ranging from Grades 1-8 to Graduate or professional school; master's degree, PhD, MD, JD, etc. For this study, race was determined by a single "yes" or "no" question in which respondents were asked whether or not they were Hispanic. Sex was assessed in the survey using a single question where "1" was male and "2" was female. Survey respondents indicated the number of years living in the Phoenix area. This was then used to determine residency for each survey.

Ecological worldview was measured using the New Ecological Paradigm (NEP) scale (Dunlap, Van Liere, Mertig, & Jones, 2000) and consisted of two separate questions. The first question contained 8 items and the second question contained 7 items (See Appendix A). All of the items utilized a 5-point Likert scale were 1 was "Strongly Disagree" and 5 was "Strongly Agree". An example item is: "Humans were meant to rule over the rest of nature."

The items utilized in the PI question were developed from the traditional PA scale developed by William and Vaske (2003). This scale, which traditionally includes place identity and place dependence was paired down to just place identity due to the specific interests of the PASS. Place identity was measured using a five-item scale (See Appendix A). Each item utilized a 5-point Likert scale were 1 was "Strongly Disagree" and 5 was "Strongly Agree". An example item is: "I identify strongly with desert parks in the Valley." The specific wording of the place identity questions in reference to the desert

parks was used in context of the geography of the Phoenix region. Within Phoenix, the regional desert parks are the main areas that remnant desert land exists and the most likely form of interaction with the desert by most citizens. Response may differ if the context of the desert is changed in other surveys.

Analysis

The data was entered and cleaned in Statistical Package for the Social Sciences (SPSS version 23). All of the surveys in which respondents answered other (patio, bare dirt, etc.) for both their back and front yard preference were removed given their lack of connection to landscaping water usage. Next, the data was prepped to be used in further analysis. The front and back yard landscaping choices are both separate projections of landscaping preference so they were combined in two different ways to take this into account. One method was to create four categories - 4: xeric front and back yard, 3: xeric and mesic, xeric and oasis, and xeric and other, 2: oasis front and back, oasis and other, and 1: mesic front and back, mesic and oasis, mesic and other.

The combined front and back yard preferences were also transformed into a binary variable were 1 was xeric front and back, xeric and mesic, xeric and oasis, xeric and other and 2 was all other combined types.

The explanatory variables were also processed in the following ways. Residency was calculated after the survey was completed by dividing the number of years the respondent had lived in Phoenix by their age. This gave a percent of their life that they had lived in Phoenix. A composite place identity score was calculated for each individual survey using the average score across all five place identity items. For NEP, the score for

each of the 15 items was averaged to create a single NEP score. A factor analysis was then run to check to see if any of the 15 items fell out into individual dimensions. However, the factor analysis did not indicate any dimensionality so NEP was treated as unidimensional. Cronbach's alpha was calculated for place identity and for NEP to test for reliability in the scales.

Once the variables had been created and prepped, a series of two models described below were run to explore the influence of socio-demographic variables, ecological worldview, and place identity on landscape preference. The significance for each model was measured at a $p<0.05$ level.

The first model utilized was an Ordinary Least Squares (OLS). This model is the traditional method for analyzing landscape preference and has been used widely throughout the landscape literature. OLS attempts to minimize the differences between the sum or squares for the observed dependent variable, in this case landscape preference, and the ones predicted by the linear function. This model included the 8 independent variables (residency, education level, income, sex, race, ecological worldview (NEP scale), and place identity) against the five-category value for landscape preference.

The measure of the overall model fit was assessed using the R^2 value, which measures how close the data are to the fitted regression line.

Due to the different ways of categorizing landscape preference, a linear probability model was run as well. In the OLS the 4-category landscape preference is used as a semi-continuous variable. This follows the logic that there is a landscape type that falls between each of the five categories, making it continuous. However, it can also be argued that landscape preference in the scope of this survey is a categorical variable

and could be treated as such. To further explore the effects of treating landscape preference as categorical on relationships with independent variables, the LPM was run. The LPM is a type of binomial regression model that looks at the probability of observing either a 0 or a 1 depending on the independent variables. To properly run this model, all of the categorical variables must be binary. Therefore, education level and income were changed to be binary as outlined previously in this chapter. All of the other independent variables were left unchanged. In addition, the model used the binary 2-category landscape preference as the dependent variable.

CHAPTER 4

RESULTS

This chapter presents results from the study in the following sections. The first section discusses the PASS response rates and sampling size. The second details the demographics of the study population by neighborhood and overall. The third section describes landscape preferences, ecological worldview, and place identity of the respondents. The final section presents results of the OLS and LPM models. Landscape preference has been used in a multitude of ways in analysis. This includes treating the landscape preference for front and backyard separately, or combining front and back yard for a single preference. Given this, three OLS models were run, one using only front yard preference, one using only back yard preference, and one using front and back yard preference combined as the dependent variable. Similarly, three LPM models were run, one using only front yard preference, one using only back yard preference, and one using front and back yard preference combined as the dependent variable. The best models for each of the OLS and LPM, which examined overall preferences instead of front versus backyards, are presented while the four remaining models are included in Appendix B.

Response Rates

Table 4.1 shows the response rates for each of the 12 neighborhoods sampled over the study period (early June – mid August, 2017). Overall response rate was calculated as the number of completed and partial questionnaires (496) divided by the total sampled (1,400) minus the undeliverable or vacant addresses (140). Thus, the average response rate across all 12 neighborhoods was 39.4% (496/1,260). Response rate varied greatly

depending on the average income level. One of the lowest income level areas (neighborhood 711) had a response rate of 22.2% while a middle-income agricultural fringe area had the highest response rate at 55.6%.

Table 4.1

Visitor Survey Response Rates by Neighborhood

	PASS Neighborhood Number												
	711	**AA9**	**IBW**	**PWR**	**Q15**	**R18**	**TRS**	**U18**	**U21**	**V14**	**W15**	**X17**	**Total**
Sampled Addresses	113	114	101	121	122	121	101	122	121	122	121	121	**1,400**
Completed/ partially comp.	22	46	37	60	39	28	29	34	56	50	56	39	**496**
Refusals	0	3	1	0	0	0	0	0	1	1	1	0	**7**
Returned as undeliverable/ vacant address	14	18	12	13	4	10	7	1	8	18	11	24	**140**
Percentage	**22.2**	**47.9**	**41.6**	**55.6**	**33.1**	**25.2**	**30.9**	**28.1**	**49.6**	**48.1**	**50.9**	**40.2**	**39.4**

Socio-Demographic Profiles

The socio-demographic profiles for all 496 respondents are summarized by neighborhood and overall in Table 4.2. There were no significant differences in the number of female versus male respondents, with female respondents making up 60.0% of the sample ($\chi^2 = 11.42$, $p > 0.05$). This is slightly higher than the entire Phoenix population, which is divided evenly between men and women (U.S. census data, 2010). There were significantly more Non-Hispanic respondents (78.2%) than Hispanic respondents ($\chi^2 = 187.28$, $p < 0.05$). However, this varied largely by neighborhood (see

Table 4.2). Again, this is higher than the overall population of Phoenix, which includes about 60% Non-Hispanics (U.S. census data, 2010). Overall, the respondents were highly educated with 57.1% of respondents having a college degree or higher and only 17.1% having a Grade 12, high school, GED or lower education.

Table 4.2

Survey Respondent Socio-Demographic Profiles (measured in percentage)

	PASS Neighborhood												
	711	**AA9**	**IBW**	**PWR**	**Q15**	**R18**	**TRS**	**U18**	**U21**	**V14**	**W15**	**X17**	**Overall**
Gender													
Female	50.0	55.6	56.8	66.7	63.2	60.7	69.0	76.5	58.5	58.3	50.0	59.0	**60.0**
Male	50.0	44.4	43.2	33.3	36.8	39.3	31.0	8.9	41.5	41.7	50.0	41.0	**40.0**
Race													
Hispanic	77.8	0.0	2.7	8.8	49.5	39.3	58.6	78.1	3.8	8.3	1.8	18.4	**21.8**
Non-Hispanic	22.2	100.0	97.3	91.2	54.1	60.7	41.4	21.9	96.2	91.7	98.2	81.6	**78.2**
Education													
Grades 1 to 8	5.0	2.3	0.0	0.0	0.0	3.6	3.6	6.1	0.0	0.0	0.0	0.0	**1.2**
Grades 9 to 11	25.0	2.3	0.0	0.0	2.6	3.6	0.0	15.2	0.0	2.1	0.0	2.6	**3.1**
Grade 12, high school, or GED	5.0	4.5	8.3	15.0	21.1	28.6	25.0	39.4	11.1	16.7	5.5	15.4	**17.1**
Community College	15.0	9.1	22.2	15.0	23.7	25.0	17.9	15.2	3.7	12.5	9.1	17.9	**14.5**
Vocational or technical school	5.0	0.0	5.6	5.0	15.8	7.1	14.3	9.1	3.7	16.7	1.8	5.1	**7.0**
College, bachelor's degree	0.0	34.1	44.4	41.7	23.7	21.4	21.4	9.1	31.5	16.7	38.2	43.6	**29.8**
Graduate or professional school; PhD, MD, JD, etc	0.0	47.7	19.4	23.3	13.2	10.7	17.9	6.1	50	35.4	45.5	15.4	**27.3**
Household Income													
$20,000 and under	55.0	2.9	2.8	1.7	5.4	7.4	0.0	20.7	0.0	6.5	0.0	23.7	**7.9**
$20,001 to $40,000	30.0	0.0	11.1	3.4	13.5	11.1	14.3	51.7	4.1	17.4	1.9	39.5	**14.2**
$40,001 to $60,000	5.0	5.9	27.8	10.3	21.6	33.3	35.7	6.9	2.0	17.4	7.4	15.8	**14.7**

$60,001 to $80,000	5.0	11.8	13.9	24.1	16.2	25.9	14.3	10.3	8.2	23.9	7.4	2.6	**14**
$80,001 to $100,000	0.0	2.9	11.1	5.2	10.8	3.7	17.9	3.4	10.2	13.0	3.7	7.9	**7.9**
$100,001 to $120,000	0.0	14.7	22.2	8.6	16.2	11.1	10.7	3.4	4.1	4.3	13.0	2.6	**9.4**
$120,001 to $140,000	0.0	11.8	5.6	15.5	2.7	0.0	0.0	3.4	12.2	8.7	11.1	5.3	**7.7**
$140,001 to $160,000	0.0	5.9	0.0	8.6	5.4	7.4	3.6	0.0	8.2	2.2	11.1	0.0	**5.0**
$160,001 to $180,000	0.0	0.0	0.0	6.9	0.0	0.0	0.0	0.0	8.2	0.0	1.9	0.0	**2.0**
$180,001 to $200,000	0.0	8.8	5.6	3.4	5.4	0.0	3.6	0.0	6.1	2.2	3.7	0.0	**3.5**
More than $200,000	0.0	35.3	0.0	12.1	2.7	0.0	0.0	0.0	36.7	4.3	38.9	2.6	**13.8**

Landscape Preference

The individual response frequencies and percentages for both the front and back yard landscape preferences are summarized in Table 4.3 and 4.4 respectively. In the front yard, people were most likely to prefer xeric landscaping (37.7%) while in the back yard people were most likely to prefer mesic landscaping (31.6%). The combined percentages for both front and back are summarized in Table 4.5. When front and back yards were combined, people preferred the category mesic front and back, mesic and oasis, and mesic and other the most (38.2%).

Table 4.3

Survey Respondent Landscape Preferences Front Yard

Item	Frequency	Percent
A yard with grass, some shrubs and leafy trees	**135**	**27.3**
A yard with some grass and some crushed stone with plants, shrubs, and trees	**103**	**20.9**
A yard with crushed stone and native desert plants and trees	**186**	**37.7**
A yard with large areas of hard surface, such as flagstone or finished concrete, and plants and shrubs in container *	**18**	**3.6**
A yard with patches of bare soil and little or no grass and trees *	**4**	**0.8**
A balcony or patio without plants, shrubs, or trees *	**8**	**1.6**
A balcony or patio with a garden area or flower beds or plants *	**24**	**4.9**

Items with a '*' were designated as 'other' in the analysis

Table 4.4

Survey Respondent Landscape Preferences Back Yard

Item	Frequency	Percent
A yard with grass, some shrubs and leafy trees	**155**	**31.6**
A yard with some grass and some crushed stone with plants, shrubs, and trees	**139**	**28.3**
A yard with crushed stone and native desert plants and trees	**79**	**16.1**
A yard with large areas of hard surface, such as flagstone or finished concrete, and plants and shrubs in container *	**32**	**6.5**
A yard with patches of bare soil and little or no grass and trees *	**5**	**1.0**
A balcony or patio without plants, shrubs, or trees *	**5**	**1.0**
A balcony or patio with a garden area or flower beds or plants *	**45**	**9.2**

Items with a '*' were designated as 'other' in the analysis

Table 4.5

Percentages for Combined Front and Back Yard Preferences

Combined Preference	Percentage
Xeric front and back yard	**14.8**
Xeric + mesic, xeric + oasis, xeric + other	**28.2**
Oasis front and back, oasis + other	**18.8**
Mesic front and back, mesic + oasis, mesic + other	**38.2**

Ecological Worldview

The individual response percentages as well as mean and standard deviations for each of the 15 items in the NEP scale are summarized in Table 4.6. Factor analysis revealed a unidimensional NEP scale, with one factor explaining 37% of the variance and the scree plot leveling off after one factor. The Scale had a Cronbach's alpha of 0.87 indicating a reliable scale (Gliem & Gliem, 2003). The overall mean and standard deviation for the NEP scale is also shown in Table 4.3. Overall, respondents had a neutral ecological worldview (mean = 3.71, s.d. = 0.70). While some individual items had more positive ecological leanings, the respondents were fairly divided on the subject.

Table 4.6

Response Percentages, Mean, and S.D. for NEP Scale

Item	Strongly Disagree	Somewhat Disagree	Neither disagree nor agree	Somewhat Agree	Strongly Agree	Mean	S.D.
NEP						**3.71**	**0.70**
Humans were meant to rule over the rest of nature ***	37.2	18.9	19.5	13.0	11.4	**2.42**	**1.39**
Human ingenuity will insure that we do not make the earth unlivable ***	15.9	27.8	19.8	26.1	10.4	**2.87**	**1.26**
The earth has plenty of natural resources if we just learn how to develop them ***	13.4	13.6	11.6	39.4	22.1	**3.43**	**1.33**
Plants and animals have as much right as humans to exist	2.8	4.9	11.2	29.2	51.9	**4.23**	**1.02**
Humans are severely abusing the environment	4.3	7.7	8.1	35.8	44.1	**4.08**	**1.10**
When humans interfere with nature, it often produces disastrous consequences	4.3	7.9	16.8	37.7	33.4	**3.88**	**1.09**
Despite our special abilities, humans are still subject to the laws of nature	1.2	0.6	10.0	32.5	55.7	**4.41**	**0.80**
We are approaching the limit of the number of people the earth can support	9.3	10.8	30.1	25.8	24.0	**3.44**	**1.23**
Humans will eventually learn enough about how nature works to be able to control it ***	28.8	28.6	19.4	19.6	3.7	**2.41**	**1.20**

The Earth has limited room and resources	5.1	6.5	10.2	40.1	38.1	**4.00**	**1.10**
If things continue on their present course, we will soon experience a major ecological catastrophe	7.3	8.6	17.3	36.5	30.3	**3.74**	**1.20**
The balance of nature is strong enough to cope with the impacts of modern industrial nations ***	27.5	33.0	20.8	13.6	5.1	**2.36**	**1.17**
Humans have the right to modify the natural environment to suit their needs ***	33.7	29.3	17.3	14.8	4.9	**2.28**	**1.21**
The balance of nature is very delicate and easily upset	2.8	12.4	17.1	38.2	29.5	**3.79**	**1.08**
The so–called ecological crisis facing humankind has been greatly exaggerated ***	39.6	21.2	18.6	14.1	6.5	**2.27**	**1.29**

Note: Measured in percentage

Items with *** indicates that the item was reverse coded for overall analysis due to the wording of the item

Place Identity

The individual response percentages as well as mean and standard deviations for each of the 5 items in the place identity scale are summarized in Table 4.7. The overall mean and standard deviation for the place identity scale is also shown in Table 4.7. The overall place identity scale had a Cronbach's alpha of 0.95 indicating a reliable scale (Gliem & Gliem, 2003). Respondents had a fairly neutral identity with the desert (mean =

3.48, s.d. = 1.34). While few respondents (9.0%) disagreed that they had some identity with the desert parks, most respondents (59.9%) were either neutral or somewhat agreed.

Table 4.7

Response Percentages, Mean, and S.D. for Place Identity Scale

Item	Strongly Disagree	Somewhat Disagree	Neither disagree nor agree	Somewhat Agree	Strongly Agree	Mean	S.D.
Place Identity						**3.48**	**1.34**
I feel the desert parks in the Valley are part of me	7.6	12.2	33.1	29.8	17.3	**3.37**	**1.13**
The desert parks in the Valley are very special to me	6.5	7.8	28.2	32.5	24.9	**3.62**	**1.13**
I identify strongly with desert parks in the Valley	7.4	11.5	35.5	27.5	18.2	**3.38**	**1.13**
I am very attached to the desert parks in the Valley	8.6	11.2	34.2	25.6	20.4	**3.38**	**1.18**
The desert parks in the Valley mean a lot to me	7.8	9.0	25.6	27.7	29.9	**3.63**	**1.22**

Note: Measured in percentage

Model Results

This section reports the results of the OLS model and the LPM model as discussed in the methods chapter. Both models examined front yard and back yard preference as one combined variable.

Ordinary Least Squares analysis was used to test if the seven independent variables significantly predicted participants' preference for xeriscaping in their personal household. The results are summarized in Table 4.8. The results of the regression indicated that the seven predictors explained 18.0% of the variance (R^2=.18, F(7, 372)=12.85, p<.000). It was found that being Non-Hispanic positively predicted xeriscaping preference (β=.436, p<.001) as well as ecological worldview (β=.237, p<.01), place identity (β=.171, p<.001), and income (β=.049, p<.05). Longer residency in Arizona was negatively related to xeriscaping preference (β=-.453, p<.01). Neither gender nor education were significantly related to xeriscape preferences.

Table 4.8

Results of Ordinary Least Squares

	Xeriscape Preference		
	B	**SEB**	**β**
Household Income *	.049	.019	.140
Education Level	.058	.037	.085
Hispanic *	.436	.136	.165
Gender	-.138	.106	-.061
Residency *	-.453	.171	-.127
Ecological Worldview *	.237	.075	.151
Place Identity *	.171	.052	.158
Adjusted R^2		**.180**	

Variables with a '*' indicates a significant relationship with xeriscape preference at the p<0.05 level

The Linear Probability Model analysis used binary variables (discussed in the methods chapter) to further test if the seven independent variables significantly predicted participants' preference for xeriscaping. The results are summarized in Table 4.9. The results of the regression indicated that the seven predictors explained 11.5% of the variance (R^2=.115, F(7, 390)=3.162, p<.000). It was found that higher place identity positively predicted xeriscaping preference (β=.083, p<.01). Similarly, higher ecological worldview positively predicted xeriscaping preference (β=.600, p<.01). Individuals with an income of $20,000 or less (β=-.526, p<.05), $20,001 to $40,000 (β=-.196, p<0.05), and $80,001 to $100,000 (β =-.434, p<.05) were less likely to prefer xeriscaping. Longer residency in Arizona was negatively related to xeriscaping preference (β=-.329, p<.05). Finally, males were more likely to prefer xeriscaping than females (β=-.072, p<.01).

Table 4.9

Results of Linear Probability Model

	Xeriscape Preference		
	B	**SEB**	**β**
Income			
$20,000 and under *	-.316	.146	-.453
$20,001 to $40,000 *	-.288	.126	-.179
$40,001 to $60,000	-.186	.128	-.348
$60,001 to $80,000	-.179	.129	-.625
$80,001 to $100,000 *	-.279	.139	-.374
$100,001 to $120,000	-.139	.137	-.987
$120,001 to $140,000	-.039	.140	-.081
$140,001 to $160,000	-.071	.166	-.102
$160,001 to $180,000	-.295	.187	-.183
$180,001 to $200,000	-.242	.173	-.453
More than $200,000	-.110	.130	-.386
Education Level			
Grades 1 to 8	-.200	.244	-.123
Grades 9 to 11	.029	.254	.054
Grade 12, high	.047	.235	.163

school, or GED			
Community College	.154	.243	.206
Vocational or technical School	.140	.248	.996
College, bachelor's degree	.159	.236	.331
Graduate or professional school; PhD, MD, JD, etc	.167	.239	.239
Hispanic	.053	.035	
Gender *	-.111	.042	.076
Residency *	-.190	.074	-.069
Ecological Worldview *	.100	.032	.713
Place Identity *	.071	.023	.095
Adjusted R^2		**.115**	

Variables with a '*' indicates a significant relationship with xeriscape preference at the $p<0.05$ level

Hypotheses

The support for each individual hypothesis is summarized in Table 4.10. For the OLS, all hypotheses were supported in the direction expected, except for education level and sex which were insignificant in explaining xeriscape preferences.

For the LPM, all hypotheses were supported in the direction expected, expect for Hispanic and education level, which were insignificant in explaining xeriscape preferences.

Table 4.10

Support for Original Hypotheses

Hypothesis		OLS	LPM
↑ Income	↑ Xeric Preference	✓	✓
↑ Education	↑ Xeric Preference		
Hispanics	↓ Xeric Preference	✓	
Women	↓ Xeric Preference		✓
↑ Residency	↓ Xeric Preference	✓	✓
↑ Ecological Worldview	↑ Xeric Preference	✓	✓
↑ Place Identity	↑Xeric Preference	✓	✓

The check marks indicate that the model supported the original hypothesis. A blank space indicates no relationship between the variables

Additional Model Testing

The two models reported above are the best fitting models. The four additional models, OLS with front yard preference only, OLS with backyard preference only, LPM with front yard preference only, and LPM with backyard preference only were not as strong predictors for xeriscaping preference. Details of these models are reported in Appendix B.

CHAPTER 5

DISCUSSION

This final chapter details how the findings of this thesis fit in with previous research as well as how these conclusions may be used to potentially increase water conservation in the Phoenix area. In addition, the methodological implications and limitations of this study are briefly discussed.

Socio-Demographic Variables

The relationship between income and xeriscape preference was as hypothesized in both the OLS and the LPM. Specifically, the higher a person's income, the more likely they were to prefer xeriscaping. This relationship between income and landscape has been seen in the literature before, although the direction has been varied (Larson, Casagrande, Harlan, & Yabiku, 2009; Larsen & Harlan, 2006). For the OLS, income was found to have a positive correlation with xeriscape preference. However, due to its binary nature, the LPM is able to demonstrate a more complex look at this relationship. Lower income individuals ($40,000 and under) were significantly more likely to prefer non-xeric landscaping. This same relationship was seen in Larson et al. (2009) where lower income residents were more likely to implement mesic lawns. Interestingly, both this study and Larson et al. (2009) found that higher income households tended towards xeriscaping. Larsen and Harlan (2006) found that middle income households preferred xeriscaping while higher income households were divided between xeric and oasis. However, since this thesis specifically looked at the preference towards xeriscaping on a binary scale so it was not able to specifically gauge attitudes towards oasis landscaping. It may be that other predictive model types, possibly an OLS with a series of binary

variables for income, could illuminate this potential relationship seen by Larsen and Harlan (2006). Utilizing a non-linear model may also add depth to the results.

Unlike the original hypothesis, education level was not significantly related to landscaping preference in either the OLS or the LPM. As discussed in the literature chapter of this thesis, education is rarely included in landscaping preference models and it may be because of its weak predictive power. While some studies have related education to other ERBs such as recycling and higher plant diversity (Balderjahn, 1988; Berger, 1997; Everett & Pierce, 1992; Hope, Gries, Zhu, Faga, Redman, Grimm, Nelson, Martin & Kinzig, 2003; Mennis, 2006), others have found no relationship at all (Mainieri, Barnett, Valdero, Unipan, & Oskamp, 1997). The reason behind this varied relationship is still unclear. The lack of a relationship may suggest that the common use of socio-economic status to represent both income and education is not as suitable when measuring landscape preference. It has been previously shown that the two dimensions of socioeconomic status, income and education, reflect different forces (Winkleby, Jatulis, Frank, & Fortmann, 1992). Education may better measure social and psychological factors while income better reflects a person's household and their spending power (Antonovsky, 1967; Susser, Watson, & Hopper, 1985). Since landscape preference relates to a person's household as well as their spending constraints in implementing landscaping preferences (Larson & Brumand, 2014), income may be an overall better predictor than education level. Future studies should examine the differences between income and education further and how they may relate to other behaviors both within the landscaping context and beyond.

Ethnicity was significantly related to xeriscape preference in the OLS but not in the LPM. In the OLS, the model showed that Non-Hispanics were significantly more likely to prefer xeriscaping than Hispanics. While understudied in the field of landscape literature, this finding follows the previous conclusions that ethnic minorities are less likely to engage in environmentally responsible behaviors (Gan, Onianwa, Schelhas, Wheelock, & Dubois, 2004; Kepe, 2009; Mainieri, Barnett, Valdero, Unipan, & Oskamp, 1997; Sundberg, 2004). In the context of the OLS, landscape preference fits in with the other environmentally responsible behaviors and their relationship with ethnic minorities. Interestingly, since this variable showed up as significant in the OLS but not the LPM, this elicits a further need to explore the potential relationships between ethnicity and landscape preference.

The relationship between gender and landscape preference was as hypothesized in the LPM but showed no significant relationship in the OLS. Gender has been previously found to affect landscape preference (Abello & Bernaldez, 1986). The findings from the LPM suggested that women were less likely to prefer xeriscaping than men. This finding was expected given previous studies showing that women are more likely to prefer mesic yards (Greenstein, 1996; Larson, Casagrande, Harlan, & Yabiku, 2009; Ode, Fry, Tveit, Messager, & Miller, 2009; Zinn & Pierce, 2002). This study adds to the literature given the previous need for more research in the area (Yabiku, Casagrande, & Farley-Metzger, 2008). The presence of children in the household was not examined in this study but it may help to explain the relationship between gender and xeriscaping (Yabiku, Casagrande, & Farley-Metzger, 2008; Zinn & Pierce, 2002). However, there may be more to gender differences (Yabiku, Casagrande, Farley-Metzger, 2008). One possibility

may be that the aesthetic personal preference plays a role in gender differences. The cultural groundings of landscape preference may manifest in differences seen between typical roles of men and women and the types of landscape they prefer (Greenstein, 1996; Larson, Casagrande, Harlan, & Yabiku, 2009; Schahn & Holzer, 1990; Yabiku, Casagrande, Farley-Metzger, 2008).

The final socio-demographic variable that was measured in this study was residency. As hypothesized, residency was negatively related to xeriscape preference in both the OLS and the LPM. This is strongly in line with previous landscaping research done in the Phoenix area, where long-term residents have been found to be more likely to prefer mesic landscaping (Larson, Casagrande, Harlan, & Yabiku, 2009; Larson, Hoffman, & Ripplinger, 2017; Martin, Peterson, & Stabler, 2003; Yabiku, Casagrande, & Farley-Metzger, 2008). Similarly, this supports the findings in Hilaire et al. (2010) where length of residence in the southwestern United States was negatively related to a person's willingness to use high desert plants. They postulated that this may be due to older respondents' bias towards traditional landscaping as well as their potentially more anthropocentric ecological worldview (Hilaire, VanLeeuwen, & Torres, 2010). Overall, it seems that the relationship between length of residency and residents' xeric preferences in the Phoenix area is fairly well understood at this point in time. In future studies, it could be additionally interesting to look at age alone instead of using residency as a proxy. In addition, a specific study examining the effects of residency and age on place identity may provide more clues as to why the relationship between residency and xeriscape preference is negative.

Ecological Worldview

Overall, respondents held a somewhat neutral ecological worldview (mean = 3.71), which is similar to respondents from the previous PASS (mean = 3.23). Ecological worldview positively predicted xeric preference in both the OLS and the LPM. This same relationship was seen in other studies where ecological worldview was found to be positively related to the environmentally responsible behaviors of reduced water consumption and the perception of personal landscaping choices influencing resource scarcity (Larson, Wutich, White, Munoz-Erickson, & Harlan, 2011). This finding may mean that increasing a person's ecological worldview may increase their preference for xeriscaping as well. In addition, the relationship between ecological worldview and xeriscaping preference is similar to other studies linking ecological worldview and environmentally responsible behaviors (Dunlap & Van Liere, 1978; Dunlap, Van Liere, Mertig, & Jones, 2000; Ebreo, Hershey, & Vining, 1999; Pickett-Baker & Ozaki, 2008; Poortinga, Steg, & Vlek, 2004; Roberts & Bacon, 1997; Scott & Willits, 1994; Shetzer, Stackman, & Moore, 1991; Steger, Peirce, Steel & Lourich, 1989; Vining & Ebreo, 1992; etc.). This thesis, however, does not examine the potential relationship between xeriscaping and environmentally detrimental behaviors such as herbicide use found in Larson et al. (2010). This limitation should be addressed in future studies to further examine the nature of xeriscaping as an environmentally responsible behavior. Overall, the model findings suggests that low-water use landscaping preference does act similarly to other environmentally responsible behaviors when it comes to ecological worldview. In addition, this study provides further support that the NEP scale functions well as a unidimensional scale (Dunlap, 2008; Edgell & Nowell, 1989).

Place Identity

Similar to ecological worldview, place identity was found to positively predict xeriscape preference in both the OLS and the LPM. While untested in the landscape literature, this relationship was expected due to place identities strong relationship with other environmentally responsible behaviors. This relationship again demonstrates that landscape preference may act similarly to other environmentally responsible behaviors and should be treated as such both theoretically and methodologically in future studies. The study provides further evidence that fostering identity with a place helps to improve site specific environmentally responsible behaviors, in this case water conservation. It is important to keep in mind that this study only examined the dimension of place identity. In future iterations of the PASS survey, it would interesting and potentially illuminating to include additional dimensions of place attachment, such as place dependence.

Methodological Implications

This study also utilized two different methods for examining landscape preference: categorical and continuous. The OLS model theoretically viewed landscape preference as continuous, with landscape type shifting between xeric and mesic. The LPM model viewed landscape type as categorical, with people responding 'yes' or 'no' to each of the landscape categories. The differences between the two methods of classifying landscape preference may have had a substantive impact on the findings and may account for some of the differences in significance between the models. The exact effect of the use of binary landscape preference on the explanatory variables should be examined further. The two models showed that treating landscape as categorical versus continuous did have

a varied affect both on the model fit as well as the relationships between the explanatory variables and landscape preference.

Several advantages and disadvantages to both models arose. The OLS has the ability to utilize a five-category proxy for landscape preference as the dependent variable. This allows there to be greater specificity in the relationships between the explanatory and dependent variable. In contrast, since the LPM necessitates a binary explanatory variable, landscape preference had to be simplified down to xeric or non-xeric, where non-xeric included both oasis and mesic yard preferences. This removed the ability of the model to look at oasis versus mesic preferences and thus underrepresented the environmentally responsible behavior of simply switching from mesic to oasis in terms of water conseration. However, the binary nature of the LPM allowed for more detailed relationships between within the explanatory variables, with each categorical variable becoming a set of binary variables. This allowed a closer examination of specific income and education levels and evoked a more interesting and complicated look at how differences in income levels affected landscape preference than the OLS.

Overall, the two models had their pros and cons, with both models showing significant relationships between five of the seven explanatory variables and landscape preference. The differences in significance with ethnicity and gender most likely relate to the binary versus non-binary treatment of landscape preference. Since the LPM did not improve the model fit (R^2 = 11.5%) when compared to the traditional OLS (R^2 = 18.0%) and did not show an increase in significant relationships between the explanatory and dependent variable, future studies may choose to simply focus on utilizing the traditional OLS. Given the low R^2 value of both models, researchers should prioritize adding

additional explanatory variables to the traditional OLS model to further explore landscape preference.

Managerial Implications

Based on the results of this study, ecological worldview and place identity have a significant positive impact on xeriscape preference in the Phoenix metropolitan area. This predictive relationship suggests that the city of Phoenix should work to change opinions on desert-like landscapes by fostering these two attitudes. Phoenix has the unique ability to enhance place identity given the prevalence of our desert mountain parks within the city limits. By implementing programs that increase visitation and interest in these parks, the city could increase resident's identity with the desert. By creating an emotional attachment with the desert, individual residents may become personally invested in water conservation in a way that policy alone cannot elicit (Inman & Jeffrey, 2006). With states such as California, Nevada, and New Mexico already implementing water conservation policies and education, it is necessary for Arizona to acknowledge the future of drought in the America Southwest.

Through the use of a combination of incentive programs, green infrastructure programs, and education, Tucson, Arizona was able to cut their daily per capita water use by 33.9% from 1996 to 2015 (City of Tucson, 2018; MAPaz, 2017). Likewise, Southern Nevada implemented water use restrictions and turf limits, which have led to a 38% decline in gallons per capita per day of water. Both areas have websites devoted to teaching residents about the benefits and beauty of native plants which could be even more effective when coupled with programs to help people interact with the desert to

build identity. There is a strong foundation for Phoenix to stand on as the city begins its campaign to conserve water and it is vital that we utilize multiple methods to help sway public opinion.

In addition, the models demonstrated that different populations act differently with regards to landscape preference. By understanding which populations have the most potential to increase their place identity and ecological worldview, the city may be able to utilize their resources and funding to greater effect. Policy makers and conservations should tailor their messages depending the population they are addressing.

One important factor to keep in mind when applying the findings to future managerial decisions is the difference between landscape preference and actual household landscapes. Even when people prefer xeriscaping, they may not be able to actually implement it in their own household due to monetary or legacy effect constraints (Larson & Harlan, 2014). A study in Phoenix found that one-third of respondents had landscape preferences that did not reflect their actual landscape behaviors (Larsen & Harlan, 2005). Due to the magnitude of households in the Phoenix area with pre-existing water-intensive landscapes, it may be difficult for families to change their yard structure despite their actual preferences (Harlan, Brazel, Prashad, Stefanov, Larsen, 2006). This means that while current policies might not address this issue (Larson, Casagrande, Harlan, & Yabiku, 2009), city wide programs in the future must confront this complicated issue. Understanding residents' preferences towards xeriscaping won't help to conserve water unless it can be translated into actual xeriscaping on the ground. In the future, the city will need to look into the constraints between landscape preference and actual landscape and work to remove these barriers. For example, this could mean the

implementation of a system in which individuals receive county funding or tax breaks if they decide to change their yard from mesic to xeric.

Similarly, these programs will need to take into account differences in preference between front yards and back yards. While the models looking at front yard and back yard separately did not perform as well in this study, previous studies have found significant differences between them (Larsen & Harlan, 2006; Larson, Casagrande, Harlan, & Yabiku, 2009; Martin, Warren, & Kinzig, 2004; Yabiku, Casagrande, & Farley-Metzger, 2008). Front lawns are seen as a status symbol (Larsen & Harlan, 2006; Martin, Warren, & Kinzig, 2004) in which aesthetic appearance is especially important (Larson, Casagrande, Harlan, & Yabiku, 2009). Therefore, programs to limit water use will have to address any stigmas that desert-like landscape are a symbol of lower social status. Once again, fostering positive bonds with the desert may help to dispel these cultural stigmas.

Future Directions and Conclusions

This study adds to the growing body of literature on landscape preference and its relationship with both socio-demographic as well as provide an additional significant predictor of place identity. Given the R^2 value of both models, future studies should prioritize adding additional explanatory variables to the traditional OLS model to further explore landscape preference. There is still a multitude of missing and potentially unkown factors that explain preference. In addition to including other dimensions of place attachment, future research may consider including social or cultural variables relating to yard aesthetics in their analysis. In addition, ethnicity could be studied on a

more specific scale looking at a greater number of ethnicities, instead of simply Hispanic or Non-Hispanic. One variable that might be of particular interest in future studies is the distance from the respondent's household to the nearest desert park or other geographic factors.

Place identity has been shown to differ based on geographic scale (Lewicka, 2008). Research has found that local identity is usually high and that regional identity is lower than national or local identity (Lewicka, 2006). Therefore, it is necessary to study place identity at the local Phoenix level. Since place identity is rooted to the geographic sense of place, it is reasonable that Tobler's first law of geography, that "everything is related to everything else, but near things are more related than distant things" (Tobler, 1970, pg. 236) may apply. Researchers have found that as a person moves away from "home" their sense of place identity becomes lost (Chow & Healey, 2008). Given this, there may be a connection between place identity with the desert and distance from the desert. It follows then that if place identity is related to environmentally responsible behaviors, then distance may be related as well. Due to the constraints of this study, distance was not able to be examined but future research should include this potentially important explanatory variable.

In conclusion, this study adds both methodologically and theoretically to the fields of landscaping preference as well as place identity. Despite the addition of other models, the traditional OLS was found to the most robust and appropriate method for modeling predictive relationships with landscaping preference. Additionally, income, ethnicity, gender, ecological worldview, and place identity were all found to be positively related to xeriscape preference. This suggests that in addition to targeting individuals

within certain socio-demographic categories, programs to foster identity with the local desert mountain parks may help to increase xeriscaping in Phoenix and thus lower residential water use. Given the fact that about 2/3 of Phoenix water is used for residential purposes, a significant reduction in usage on the municipal level will have an overall effect on water conservation in the area. While further research is needed to expand our understanding on the topic, this study provides a valuable example of the benefits of incorporating other theoretical fields into landscaping research.

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APPENDIX A

SELECT RESEARCH QUESTIONS FROM PASS

Income:

62. Which category below best represents the total combined income before taxes for all the people in your household for 2015?

- ○ $20,000 and under
- ○ $20,001 to $40,000
- ○ $40,001 to $60,000
- ○ $60,001 to $80,000
- ○ $80,001 to $100,000
- ○ $100,001 to $120,000
- ○ $120,001 to $140,000
- ○ $140,001 to $160,000
- ○ $160,001 to $180,000
- ○ $180,001 to $200,000
- ○ More than $200,000

Education:

63. What is the highest level of school you have had a chance to complete?

- ○ Grades 1 to 8
- ○ Grades 9 to 11
- ○ Grade 12, high school, or GED
- ○ Community college
- ○ Vocational or technical school
- ○ College, bachelor's degree
- ○ Graduate or professional school; master's degree, PhD, MD, JD, etc.

Ethnicity:

65. Do you consider yourself to be Mexican, Mexican-American, Chicano, Hispanic, Latino, or of Spanish background?

- ○ Yes
- ○ No

Gender:

64. Are you male or female?

- ○ Male
- ○ Female

Residency, Calculated Using:

50. The following questions help us to better understand who has taken the time to answer our questions. All of your answers will be kept private and confidential.

In what year were you born?

[ ]
YYYY

52. How many years have you lived in the Valley?
If less than one year, enter the number of months

[ ] Years **or** [ ] Months

Ecological Worldview:

48. The following statements are about a number of environmental issues. There are no right or wrong answers, we are interested in your opinions.
How strongly do you disagree or agree with each of the following statements?

	Strongly Disagree	Somewhat Disagree	Neither disagree nor agree	Somewhat Agree	Strongly Agree
a. Humans were meant to rule over the rest of nature.	○	○	○	○	○
b. Human ingenuity will insure that we do not make the earth unlivable.	○	○	○	○	○
c. The earth has plenty of natural resources if we just learn how to develop them.	○	○	○	○	○
d. Plants and animals have as much right as humans to exist.	○	○	○	○	○
e. Humans are severely abusing the environment.	○	○	○	○	○
f. When humans interfere with nature, it often produces disastrous consequences.	○	○	○	○	○
g. Despite our special abilities, humans are still subject to the laws of nature.	○	○	○	○	○
h. We are approaching the limit of the number of people the earth can support.	○	○	○	○	○

49. This next series contains more statements about a number of environmental issues. There are no right or wrong answers, we are interested in your opinions.
How strongly do you disagree or agree with each of the following statements?

	Strongly Disagree	Somewhat Disagree	Neither disagree nor agree	Somewhat Agree	Strongly Agree
a. Humans will eventually learn enough about how nature works to be able to control it.	○	○	○	○	○
b. The Earth has limited room and resources.	○	○	○	○	○
c. If things continue on their present course, we will soon experience a major ecological catastrophe.	○	○	○	○	○
d. The balance of nature is strong enough to cope with the impacts of modern industrial nations.	○	○	○	○	○
e. Humans have the right to modify the natural environment to suit their needs.	○	○	○	○	○
f. The balance of nature is very delicate and easily upset.	○	○	○	○	○
g. The so–called ecological crisis facing humankind has been greatly exaggerated.	○	○	○	○	○

Place Identity:

4. Next, please think about the desert parks in the Valley. How strongly do you disagree or agree with the following statements about the desert parks in the Valley?

	Strongly Disagree	Somewhat Disagree	Neither Disagree nor Agree	Somewhat Agree	Strongly Agree
a. I feel the desert parks in the Valley are part of me.	○	○	○	○	○
b. The desert parks in the Valley are very special to me.	○	○	○	○	○
c. I identify strongly with desert parks in the Valley.	○	○	○	○	○
d. I am very attached to the desert parks in the Valley.	○	○	○	○	○
e. The desert parks in the Valley mean a lot to me.	○	○	○	○	○

APPENDIX B

ADDITIONAL MODELS

Additional Ordinary Least Squares Models

Table B.1 Results of Ordinary Least Squares for Front Yard Only

	Xeriscape Preference		
	B	**SEB**	**β**
Household Income	.000	.015	.001
Education Level	.008	.029	.017
Hispanic *	.377	.111	.192
Sex	-.091	.085	-.056
Residency	-.051	.139	-.019
Ecological Worldview *	.211	.061	.185
Place Identity	.070	.041	.089
Adjusted R^2		**.095**	

Variables with a '*' indicates a significant relationship with xeriscape preference at the $p<0.05$ level

Table B.2 Results of Ordinary Least Squares for Back Yard Only

	Xeriscape Preference		
	B	**SEB**	**β**
Household Income	-.006	.016	-.027
Education Level	-.022	.031	-.046
Hispanic	.104	.114	.057
Sex	-.122	.088	-.080
Residency	-.275	.140	-.114
Ecological Worldview	.100	.062	.094
Place Identity	.070	.043	.094
Adjusted R^2		**.019**	

Variables with a '*' indicates a significant relationship with xeriscape preference at the $p<0.05$ level

Additional Linear Probability Models

Table B.3 Results of Linear Probability Model for Front Yard Only

	Xeriscape Preference		
	B	**SEB**	**β**
Income			
$20,000 and under	-.290	.158	-.414
$20,001 to $40,000 *	-.311	.131	-.190
$40,001 to $60,000	-.209	.134	-.377
$60,001 to $80,000	-.196	.134	-.689
$80,001 to $100,000 *	-.341	.143	-.464
$100,001 to $120,000	-.174	.144	-1.231
$120,001 to $140,000	-.112	.180	-.234
$140,001 to $160,000	-.042	.191	-.060
$160,001 to $180,000	-.321	.144	-.196
$180,001 to $200,000	-.253	.199	-.456
More than $200,000	-.129	.133	-.452
Education Level			
Grades 1 to 8	-.181	.258	-.111
Grades 9 to 11	-.063	.261	-.113
Grade 12, high school, or GED	.040	.249	.141
Community College	.187	.258	.254
Vocational or technical School	.176	.262	1.245
College, bachelor's degree	.188	.246	.390
Graduate or professional school; PhD, MD, JD, etc	.204	.249	.291
Hispanic	.035	.037	.050
Sex *	-.092	.045	-.057
Residency *	-.175	.082	-.363
Ecological Worldview *	.101	.035	.712
Place Identity *	.068	.025	.093
Adjusted R^2		**.105**	

Variables with a '*' indicates a significant relationship with xeriscape preference at the $p<0.05$ level

Table B.4 Results of Linear Probability Model for Back Yard Only

	Xeriscape Preference		
	B	**SEB**	**β**
Income			
$20,000 and under	-.013	.117	-.023
$20,001 to $40,000	-.036	.090	-.027
$40,001 to $60,000	.042	.098	.092
$60,001 to $80,000	.014	.103	.061
$80,001 to $100,000	.083	.122	.123
$100,001 to $120,000	.126	.116	1.100
$120,001 to $140,000	.005	.118	.f012
$140,001 to $160,000	.074	.138	.128
$160,001 to $180,000	.135	.212	.102
$180,001 to $200,000	-.026	.147	-.058
More than $200,000	.076	.111	.320
Education Level			
Grades 1 to 8	-.331	.266	-.252
Grades 9 to 11	-.107	.280	-.237
Grade 12, high school, or GED	-.195	.256	-.825
Community College	-.146	.259	-.215
Vocational or technical School	-.148	.263	-1.293
College, bachelor's degree	-.178	.256	-.450
Graduate or professional school; PhD, MD, JD, etc	-.116	.261	-.200
Hispanic	.025	.029	.043
Sex	-.054	.046	-.041
Residency *	-.260	.069	-.659
Ecological Worldview	.065	.033	.569
Place Identity *	.052	.021	.077
Adjusted R^2		**.052**	

Variables with a '*' indicates a significant relationship with xeriscape preference at the $p<0.05$ level

87