

REGIONAL PLANNING SOLUTIONS TO CHANGING THE CULTURE OF WATER
CONSUMPTION IN PHOENIX, ARIZONA

By

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Abstract

Arizona has put time and effort into drought preparation—with water banking, surface water storage, and laws to dictate water planning for future developments. However, these securities are stretched thin and weakened by the wake of Arizona’s rapid development. In this paper I will focus on the state catalyst for growth, and precedent for political decisions: Phoenix. With a political-economic foundation rooted in a culture of consumption, Phoenix has enabled boundless growth within its impermanent borders—gaining population and short-term economic benefits, while losing its unique desert identity. If adjustments are not made to current means of allocation and rates of demand, Phoenix will face a supply gap in the future. These issues are compounded by climate change, which threatens the longevity of surface water supplies. This paper will outline the strengths and highlight the shortfalls of previous water policies and projects, then discuss threats to available supplies. Embodying a desert identity and embracing conservation in both the urbanized area and economy will be key to the future success of Phoenix, as the necessary changes in policies that link water and land use planning will not be possible without an engaged public base.

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Introduction

Phoenix, “the Valley of the Sun,” has long attracted residents due to its warm climate, affordability and promise of opportunity for success. For the purposes of this paper, I define “Phoenix” as the greater metropolitan area of Phoenix within the Phoenix Active Management Area, including the individual municipalities that compose the entire land base (see figure 1). Phoenix has a long history of promoting economic growth and consumer spending while minimizing regulation. Housing, business, land and resource development in Phoenix grew in a similar fashion, with minimal restrictions, high incentives, and a “growth is good” model. As a result, the metropolitan area and the people of Phoenix formed based off of this “culture of consumption” ideology: the core social value of consumption that drives all aspects of society’s decisions and lifestyles (Schipper, 2008).

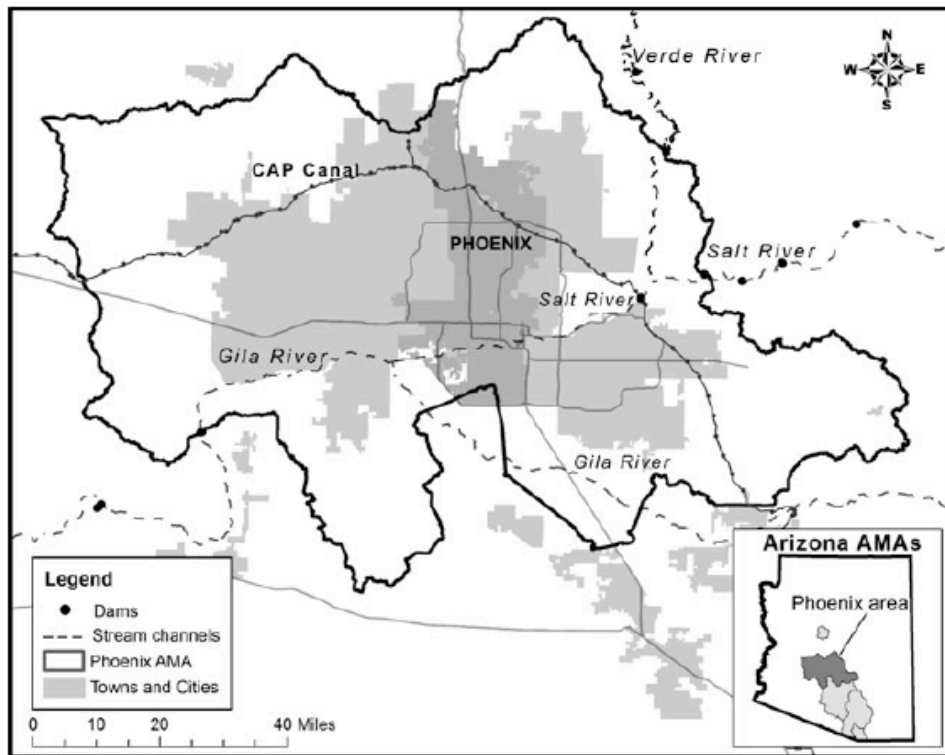


Figure 1: Phoenix Metropolitan and Active Management Area
Source: Larson, Gustafson & Hirt (2009)

This philosophy has resulted in a land base of the Phoenix metropolitan area larger than Paris, Rome, San Francisco and Manhattan combined. Sprawl, and its associated ailments, now dominate the lifestyles of Phoenicians—increasing temperatures within the area, elongating commute times, increasing pollution, and spreading infrastructure farther. Yet development continues to occur on the outskirts of the city as a result of cheaper land, greater profit, and ease for master-planned developments (Making Sense of Place, 2003). Such unbounded development is not without need for resources. Phoenix was able to develop so drastically due to its ability to manipulate surface water, and secure water resources through policies and litigation. The state has a long-standing history of water developments governed by an institutional motto of “Arizona grows where water flows,” so long as we have the economy and political will to fund augmentation projects find alternative supplies (see figure 2).

William DeBuys (2011), an environmental activist and conservationist, argues “the attraction of the [Valley of the Sun], and its life of warmth, health, and clear skies, is founded on an assumption of sufficient water resources, but sufficient for how many, for how long?” (p. 173).

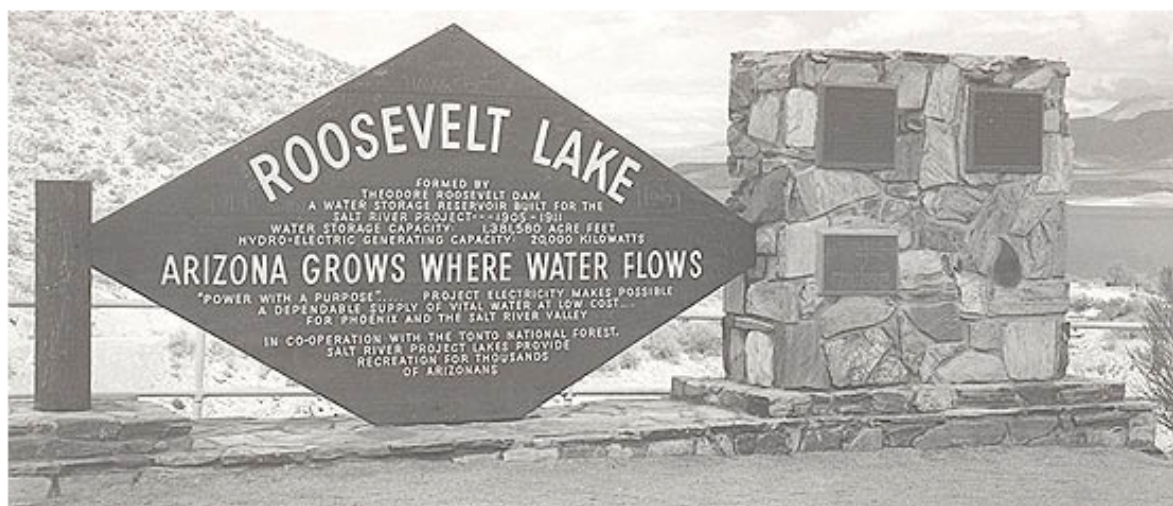


Figure 2: Sign at Roosevelt Dam with Arizona Growth Model
Source: United States National Park Service (2014)

In 2004, former governor of Arizona, Janet Napolitano urged Arizona to adopt a “culture of conservation” in approaching water resources, in order to build resilience in times of shortage and make “better use” of our current supplies (Davenport, 2004). A “culture of conservation,” in contrast to a culture of consumption, is an ideology where the social value of conservation drives all aspects of society’s decisions and lifestyles.

While the former governor set a goal to adopt this “culture of conservation,” a culture of consumption has prevailed in parts of the state, as evidenced by Tucson’s reduction of water consumption from 107 gallons per capita per day (gpcd) in 2005 to 94 gpcd in 2010, and Maricopa County’s increase from 151gpcd in 2005 to 162 gpcd in 2010 (MAP, n.d.). Why has culture of conservation not taken hold in all of the state? What political and institutional environment is necessary to start making those shifts? These are questions that I will attempt to answer in this paper.

A population growth rate of 6.2% in 2014 and climate change prediction models forecasting a hotter and drier southwest urge Phoenix to change its growth and development patterns—to shift its culture of consumption to one of conservation for long-term water supply by its people and its economy (U.S. Census Bureau, 2015; Gober & Kirkwood, 2010).

Phoenix has the opportunity to set the standards for change in water use, care for land, and patterns for future development through embracing their desert identity and adopting an ethic of stewardship (see section 3). Securing a water future for the entirety of the West will take coordination between land use planners and water planners, water providers, hydrologists, industrialists, agriculturalists, and stakeholders beyond the political boundaries of cities and states. It does not mean stifling growth, but growing in a smarter, coordinated fashion. In this paper I will discuss the history of Phoenix’s water developments and specific changes in policies

to benefit the constant growth paradigm in section one, challenges to the water supply in section two, and lastly, the methods and rational behind adopting a “culture of conservation” in section three.

Section 1: Building the Valley of the Sun

The Beginning of Arizona Water Projects

Arizona's valleys have always been dependent on water infrastructure to meet the needs of crop cultivation and population. The Hohokam, ancestral puebloans from the 15th century, are well known for their water developments in the now Phoenix area, and also for their disappearance, likely due to the loss of water (Balchin, 1988). Phoenix has grown off of the same surface water resources and water projects, but on a larger, more intensive scale. Phoenix is currently supplied with water from groundwater in underlying aquifers, the Salt River, Agua Fria River, Gila River, and Colorado River through the Central Arizona Project (Bush et al., 2006).

Climate patterns of alternating drought years with wet years have long characterized Arizona, leading to the recognition for the need for reservoirs in the early 20th century (Pitzer, Eden, & Gelt., 2007). One of the first Bureau of Reclamation developments was Roosevelt Dam and its lake along the Salt River in central Arizona (Balchin, 1988). Complete in 1910, the Roosevelt Dam was the first of many water projects in Arizona that helped to secure resources for major growth and development in Phoenix during the next century. Subsequently, the Salt River Project was created to expand the efforts of Roosevelt Dam and help to facilitate further housing and agricultural development in the area (Hirt et al., 2008).

Next, Arizona looked to its larger river that borders the state—the Colorado. In 1922 the Colorado River Compact was negotiated between the seven Colorado River basin states to establish water rights and uses, and serve as “the law of the river.” Because the compact did not discuss Arizona's claim to the Gila River, which runs through the center of the state, the compact was not ratified by Arizona until 1944 when the state approved the compact as a means of reserving further water rights for the state (Pitzer, Eden & Gelt 2007).

While the compact set the parameters for management of the basin as a whole, the Boulder Canyon Project Act of 1928 determined how the three lower basin states, Arizona, California, and Nevada, would divide their 7.5 million acre-feet apportionment, and sought approval for construction of the Hoover Dam. Arizona was allotted 2.8 million acre-feet (maf), with California receiving 4.4 maf and Nevada 0.3 maf (Boulder Canyon Project Act of 1928). Both the Colorado River Compact and the Boulder Canyon Project established precedence along the Colorado River system and determined the fate of the watershed and its residents.

Planning for the Future of Phoenix

Because Arizona's politicians knew that water was key to the success of the state, they continued to advocate for further water projects and rights for the latter half of the 20th century. In 1963 Arizona sued the state of California over tributary, excess water and water rights disputes (Pitzer, Eden & Gelt, 2007). The resolution was in favor of Arizona, establishing further claims to the Colorado River and its tributaries, that fall within the state's boundaries, and putting the state in a position to gain approval for bigger water developments (Pitzer, Eden & Gelt, 2007).

It was the CA v AZ resolution and subsequent policies that allowed the Central Arizona Project (CAP) to be approved, then delivered to Phoenix by 1987. The CAP is a 336-mile aqueduct that delivers over 1.5 maf of water to central Arizona annually, including the Phoenix and Tucson metropolitan areas. It was built to augment urban and agriculture supplies and to satisfy some of the 2.8 maf allotted to Arizona in the Colorado River Compact (Wiley & Gottlieb, 1982; Colby & Jacobs, 2007). While the CAP supplements Arizona's surface waters, allowing for reduced groundwater consumption, it is also the most vulnerable water source, as it has junior priority to California in the event of a Colorado River deficit (Colby & Jacobs, 2007).

While the state continued to build surface water supply projects, central Arizona was facing issues of groundwater overdraft throughout its growing urban areas. At the risk of complete groundwater depletion, which would leave the state with no groundwater reserves for its continually growing population, Arizona leaders were pressed to resolve this major resource supply issue. Hirt et al. (2008) explain that Congress believed that Arizona “should earn” their funding for the CAP, which could help to combat issues of ground water depletion. The result, after years of adjusting policies, was the 1980 Arizona Groundwater Management Act (GMA).

The GMA’s fundamental goal was to establish a net-zero loss in Arizona’s aquifer’s by 2025 (Hirt et al., 2008). This “safe-yield” standard means that ground water pumping can not exceed natural aquifer recharge. It later established Active Management Areas (AMAs) in regions of extreme overdraft, to further regulate resource use in the five established areas and help to better conserve water (Hirt et al., 2008).

In addition to conservation expectations for agricultural, industrial, and municipal water users, AMAs required Assured Water Supply (AWS) for all new residential developments (Pitzer, Eden & Gelt, 2007). In order to gain approval of a new development, residential real estate developers had to prove access to adequate water supplies for 100 years and the ability to provide necessary infrastructure to secure that access (Pitzer, Eden & Gelt, 2007). However, over time, and debate, the assured water supplies requirements have become less of a mandate, and more of a suppressed guiding principle, due, in large part, to resistance from real estate developers (Hirt et al. 2008).

Defying Natural Restrictions to Growth

While the GMA helped to secure CAP for Arizona, its good intentions and guiding regulatory principles slowly faded out, and the GMA today lacks the integrity and rigor of the

original act. Hirt et al. (2008), identify the shortfalls of the GMA in their article, “The Mirage in the Valley of the Sun.” They explain that the ineffectiveness of the GMA is first due to the lack of regulatory backing for the irrigation conservation program. This led to changes to instead adopt “Best Management Practices” for farms, which meant approved non-compliance with GMA conservation goals. Because the Arizona Department of Water Resources (ADWR) shifted their original stance, regulation and enforcement of specified water use reductions for farmers, farmers did not have the incentive to conserve in the ways the original GMA had intended (Hirt et al., 2008). Second, the slack in conservation regulations was supported, for the most part, by the Phoenix population, because many farms were converted to urban area, and more continually used water rights for a farm meant more water rights for people, due to the principles of prior appropriation.

While the switch from agricultural to urban land created a temporary surplus of water, Hirt et al. (2008) explain, true sustainable development will require much better “management of urban demands” (p. 494). The primary flaw in the GMA was the placement of conservation accountability on service providers instead of consumers (Hirt et al., 2008). Phoenix did not see much reduction in per capita consumption under this management regime, due to its lack of emphasis on consumer responsibility, which the American Water Works Association (2006) notes is key to effective water use reduction. Instead of implementing stricter measures to enforce conservation standards, the ADWR exempt water providers from required water use reductions. As a result, Best Management Practices, similar to the irrigation program, were put in place, and providers could “buy their way out of compliance” (Hirt et al., 2008, p. 497). In this way, Phoenix was able to strengthen its consuming culture, by avoiding putting increased efforts

into strengthening conservation, which Hirt et al (2008) argues is a result of Phoenix's "political culture to capture resources without regulating users" (p. 497).

At the same time as the GMA was being adjusted to fit the needs of the continually growing Phoenix population, the AWS was also tweaked to better benefit real-estate development and its supporters. The primary concern for developers was the ability of the law to "block construction" in areas where assured water supplies could not be determined (Hirt et al., 2008). If the AWS rules had functioned the way they were originally drawn up, the greater Phoenix area may have successfully faded its culture of consumption out, in terms of water consumption, by restricting further growth and development by the availability of natural resources; however, its adjustments gave further misrepresentation of water availability, which allowed developments to expand as it had done decades before.

The Central Arizona Groundwater Replenishment District (CAGRDR) was created to help developers achieve assured water supply through purchasing surplus CAP water and recharge the water into aquifers along the valley to offset increased groundwater pumping in development areas with insufficient groundwater supplies (Hirt et al., 2008). However, replenishing groundwater at offsite areas is controversial to hydrological principles, as not all aquifers are connected—leaving developed areas, whose approval hinged on CAP groundwater replenishment, without access to recharged water when their supplies run dry. After a home sells, Hirt et al. (2008), explain that the accrued cost of paying the CAGRDR is shifted to homeowners instead of the developer.

A fundamental lack of recognition and disregard for the limitations in scope and supply of natural resources has enabled the growth of Phoenix, but will ultimately lead to its ruin. Because the CAGRDR depends on impermanent water supplies, the entire system of new

developments, the lives of thousands of families, rely on other areas underusing their water rights while new developments continue to pump their limited supplies dry. Hirt et al. (2008) explain that these kinds of “short term economic gains” often outweigh the recognition of limited resources in implementing the type of water policies that will assure a secure water future in the state (p. 501).

Further Coordination of Supplies

Accountability for developments participating in the CAGRDR was created with the passing of Arizona Water Settlement Act (AWSA) in 2004, which established parameters of consumption for areas within designated zones of influence. The AWSA was passed to settle claims to the Gila River, a tributary to the Colorado River that runs through central Arizona. In addition to quantifying American Indian water claims, the AWSA also reallocated surface water claims, determined allocations for excess CAP water, and placed restrictions on non-Indian groundwater pumping to preserve groundwater for the surrounding reservations (Bark, 2009). In this way, the AWSA is protective to both the tribal community and surrounding populations in AMAs, as it places restrictions on groundwater pumping in the buffer zones around the reservation, lessening groundwater overdraft, and protecting future supplies (Bark, 2009). While developments participating in the CAGRDR for assured water supplies in the AWSA buffer zone areas are required to pump at more sustainable levels, areas outside of the buffer zone continue to disregard the hydrologic connections between where groundwater is pumped, and where it is recharged (Bark, 2009).

The AWSA separated water allocations between Indian and non-Indian uses. This gave each user relatively secure supplies with clear priorities for times of shortage, at least on paper. Through the Indian firming program, non-Indian users were able to switch water allocated to

non-Indian agriculture to municipal and industrial water rights for surrounding developments to utilize CAP water. Bark and Jacobs (2009) explain that for Arizona, firming is done through using excess CAP water to recharge aquifers, then extract during times of shortage. They continue to explain that in recharging excess, future water deficits can be mitigated and managed when the time comes.

In reallocating water rights, the AWSA shifted southern Arizona irrigators, American Indian communities, municipal, and industrial sectors to further reliance on the Central Arizona Project, leaving those who depend on excess allocations and the security of CAP supplies in trouble for not only future development, but also supplies from the ever dwindling Colorado River.

Political Foundations for Poor Water Policy

The driving factor of development, and really the growth of Phoenix as a whole, comes from the cultural and political mindset the constant, unbounded consumption is good. Elizabeth T. Shermer (2013), an urban historian, explains that the philosophic base for Phoenix's growth "can be best understood as a homegrown, developmental 'neoliberalism,'" or a political system that promotes government action to expedite commerce while "decreasing regulations, taxes, and union rights" (p. 3). These principals helped to establish the political culture of continual economic growth and consumption in Phoenix. Here, I define "political culture" as the fundamental ideologies that influence the political and habitual behaviors of both public leaders and the community.

Shermer (2013) argues that Phoenix's leaders used their "statecraft" to create a state that embodies conservative ideals, a growth economy, and ultimately the pattern of unyielding development throughout the Sunbelt region (p. 12-13). She continues to explain that this form of

leadership “reoriented [American politics] toward an underlying principle that the government and the citizenry should be in service to a distinct stratum of American capital”—the growth economy (p.13).

Phoenix was able to quickly grow after World War II by promising each newcomer a piece of their own American Dream, and was able to supply the resources to do so through their business-oriented politics (Schipper, 2008). As a result, the development community resisted and shut down any policies that stifled their continual economic development. Ironically, the “desert lifestyle” that Phoenix advertised “include[d] abundant quantities of water” (Schipper, 2008, p. 85). The combination of rapid land development, community ambitions for an “oasis” lifestyle, and a government willing to stretch their policies to accommodate the types of development its population craved enabled Phoenix to accept weakened water policies to achieve economic growth.

In turn, a “consuming culture of freedom” or consumption without perceived limits, has dominated the Phoenix community, Janine Schipper (2008), a public sociologist, explains. She describes this phenomenon as a “culture of consumption.” In a culture of consumption, the community’s core “social practice” is consumption (p. 79). This kind of culture believes “consumption . . . is the ultimate road to happiness,” which enables the commodification of natural surroundings and even social experiences (p.79-91).

While the citizens of Phoenix act as the driving consumptive force for growth, they are simply responding to the policies, promotions and “political guarantee” of obtaining the American Dream by the region’s political leaders (Shermer, 2013, p. 184). The American Dream ideology that Phoenix was founded on had to be backed by water and energy, or else the promises of the desert lifestyle could not be fulfilled (Wilkinson, 1999). Shermer (2013)

describes that resource issues, including water, “required reflexive policy-making to provide the infrastructure that industry needed without making the tax code uncompetitive” (p. 192).

Examples of this can be seen in the weakened GMA and AWS provisions to promote development, while stifling conservation.

Section 2: Supply Management and Environmental Challenges

Water policy based on loopholes, contradictory to hydrologic principles, based on the bottom line paper record of supplies has set Phoenix up to fail, given changing climate, population growth and an overburdened infrastructural system. While through policies and development negotiations the Phoenix AMA has created adequate water supplies, it has been achieved through increasing dependence on a perceived “renewable” water supply—the CAP (Buschatzke et al., 2015). With current Colorado River projections predicting decreased snow pack in the Rockies and overall decline in Colorado River flows, the entire supply system is challenged with multiple factors, threatening its bottom line of water supplies (Vano et al., 2014). In this section we will discuss the factors challenging water supplies, and some of the consequences of those events if Phoenix maintains business as usual.

Changes to the Region: threats to rigid supplies

Because the past and future development of the greater Phoenix area depends intensely on the CAP and continued Colorado River supplies, the people, economy, and wellbeing of the state of Arizona as a whole are vulnerable to climate change and long-term climatic adjustments to the Southwest Region. DeBuys (2011) is cautious of Arizona’s water security with the state’s increased dependence on CAP for supplies and its junior appropriation to California in the face of climate change. We will explore the four reasons for his skepticism: climate change predictions; patterns of drought in tree ring studies of the region; rapid growth of Arizona cities into their agricultural “buffers”; and “the persistent overdraft of resources in the Lower Basin” (p. 171).

Climate change threatens the entire globe's resources, people and developments. In the southwest, climate change means the intensification of already challenging environmental elements. Glen Macdonald (2010), Co-PI for the Department of the Interior's Southwest Climate Science Center explains that drought models indicate warming across the southwest region as a whole, which could lead to exacerbated aridity. This means that overall, less surface water will be flowing through the state of Arizona, and certainly less will be available in the Colorado River Basin. In the event that water is reduced to critical levels along the Colorado River, decision makers will use the height of the water in Lake Mead to determine what actions need to be taken.

However, Arizona will be the most effected by lower levels in Lake Mead, due to the agreement to the subordination of their Colorado River water rights to California, in order to approve its life source: the CAP. This means that Arizona will have to cut back almost all of their Colorado River water use, which so many developments and legal actions have depended on, including the assured water supply requirement of the GMA (see section 1). During reduced CAP deliveries, Phoenix will stretch its surface water resources, and increase reliance on groundwater to meet the surface water supply gap (Dimick, 2015). Gober and Kirkwood (2010) explain through their scenario modeling that "with or without reduction in river flows caused by climate change" Phoenix needs to implement policies to achieve water sustainability, as current

practices leave Phoenix vulnerable to water shortages and will give the metropolitan area little time to adapt to reductions in water supplies.

Annual and multiyear cycles of drought also impact Arizona groundwater and surface water supplies similar to climate change. Garfin, Crimmins, and Jacobs, in Colby and Jacobs (2010) explain that there are seasonal droughts in Arizona due to its bimodal precipitation patterns, or two seasons of intense precipitation throughout the state. Reservoirs within the state are in place to mitigate these patterns of drought (Macdonald, 2010). Yet, tree ring studies indicate patterns of more extreme drought intermixed with Arizona's seasonal droughts. Stages of longer and more extreme droughts have occurred in the southwest, and pose a threat to current water supplies, as they may affect the major watersheds that serve the city of Phoenix (Garfin, Crimmins, and Jacobs in Colby & Jacobs, 2010).

Not only do historic records of intermittent droughts and models predicting a hotter, drier southwest point towards water supply challenges, but when combined with increasing population growth and diminishing agricultural areas issues of climate change and water scarcity become compounded. Increasing population increases water demands and places more stress on an already stressed system. However, the issue is worsened when population growth is combined with rapid agricultural conversion, as agricultural buffers have acted as insurance for urban areas to convert agricultural demand to municipal, giving the illusion of generous amounts of water (Debuys, 2011). While the agricultural sector holds vast quantities of some of the most senior water rights, they are still subject to conservation standards. When agricultural areas start using less water, they forfeit their water rights, under the prior appropriation doctrine. This means that

although agriculture does possess water rights that can be converted for urban use, the amount that agriculture holds is deceptive as conservative uses become more widespread.

Additionally, converting water from agricultural use to urban use presents new challenges for existing agricultural irrigation infrastructure and supplies. Urban use follows similar peak use seasons as agriculture, but contributes greater spikes in than system than when the area was solely agriculture. This has led to greater stresses on the existing infrastructure of systems, especially in areas along the Salt River Project because its capacity was designed for agricultural demand and urban demands are currently requiring more water being pumped to treatment facilities instead of fields (Gooch et al., 2007).

Once all of the agricultural buffers are dried up into concrete oases, there is no more buffer for over allocation, drought and climate change. Luther Propst, founder of the Sonoran Institute explains that this form of “water security”—urbanization of farmland, works temporarily for the “go-go mentality” of “make your money and move on” in Arizona development. In the long-term, given climate variability, the reliance on retiring agriculture for urban water supplies is not sustainable for the economy or environment, as it too is a finite supply (as cited in DeBuys, 2011, p. 193).

Among the list of challenges Phoenix is facing to meet its water demands, its reliance on the CAP, which is one of many stakeholders in the lower basin apportionments, could face cuts if the upper Colorado River Basin states start using their full 7.5 million acre-feet apportionment to Colorado River supplies. Currently, excess supplies from the upper basin are being utilized by the lower basin states, and has caused overdraft of allotted Colorado River Compact supplies to the three lower basin states (DeBuys, 2011). When the upper basin states start withdrawing their

full apportionments, the CAP, the lowest priority in the lower basin, will face the majority of the repercussions of decreased Colorado River flows.

According to the Colorado River Governance Initiative, the obligation of the upper basin states to deliver water to the lower basin states is contested under the interpretations of the “law of the river.” They explain that the “delivery obligation,” or the argument that the lower basin states are supposed to receive fixed amounts of water because their water is divided in acre-feet, while the upper basin is divided by percentages, is the most commonly referred to interpretation by Colorado River decision makers. Alternately, the “obligation not to deplete,” or the argument that the lower basin states are supposed to receive some water, but not any fixed amount is the lesser adopted interpretation. In any case, when the upper basin chooses to draw upon its legal share of the Colorado River basin, the lower basin will be forced to operate with less water, starting with the Central Arizona Project, the vital resource to the Phoenix area.

Business as Usual Under Potential Resource Shortage

In the event that the CAP will receive less water on a given dry year, or when the upper basin begins to take a fuller share of its water apportionments, there is a hierarchy of needs in place for where the CAP delivery cuts will occur. Because various sectors hold subcontracts from the Central Arizona Water Conservation District, they are given one of four priorities for “shortage provisions,” depending on the use (Bark, 2009). The cuts will first be seen in non-Indian agriculture, then in Indian agriculture, then in both municipal and industrial, and Indian supplies. Bark (2009) explains that non-Indian agricultural uses are declining, while municipal and industrial, and Indian supplies are expanding, which puts the latter uses at risk for larger delivery cutbacks in the future as the agricultural buffer declines (p. 84). This means that as municipal and industrial, and Indian supplies continue to grow, they increase their risk of impact

from cuts in CAP deliveries. They're additionally becoming more vulnerable to reduced water supplies as a result of shrinking agricultural buffers and increased dependence on CAP deliveries to not only satisfy current needs, but also augment needs in other areas through the Central Arizona Groundwater Replenishment District (section 1). Karen Smith (2015), a professor at Arizona State University and former director of water quality for the Arizona Department of Water Resources, explains that the biggest impacts of a reduced water portfolio will be seen in industrial and municipal water, with agriculture eventually sorting itself out.

If business as usual continues—with low-density developments reaching further into the agricultural and desert buffers of Phoenix, deliveries continue to increase on the already stretched Salt River Project and CAP systems, and assured water supplies are met through weak systems, Debuys (2011) speculates that “Phoenix ... will find it difficult to keep [its] thirsts slaked and [its city] running” (p.172). Contradictorily, stifling growth will put less stress on water resources, but put Phoenix’s economy into “crises,” while continued growth enabling “the housing-dependent economy” to advance, will put water resource quantity and quality at risk (Bolin, Seetharam, and Pompeii, 2010, p. 275).

A balance between economy, land use and water planning must be met in order for Phoenix to prosper the way that it has for the past century. Current patterns of low density, quick to build, suburban development not only put stress on water infrastructure, but also on other areas of urban infrastructure and Phoenix’s surrounding environment due to an overstretched service area. Continued sprawl compounds existing urban ailments—increasing traffic, pollution, travel times, and the city’s footprint. Such expansion of development additionally leads to an urban heat island effect—increasing the overall temperature of Phoenix, and in turn, increasing

residential water use (Guhathaktura & Gober, 2010). These connections between land-use patterns and increased water use, as a result of Phoenix's economic model demand a change in the way Phoenix continues to develop, so that the metropolitan area may find balance between its economy, land and water resources.

It is important to note that Phoenix is not currently, nor is extremely close to a water catastrophe or crisis (APA Arizona, 2015). Models are predicting that in the event of a water crisis, changes made now within the system will increase resiliency of the city in the long-term (Gober & Kirkwood, 2011). Phoenix is already starting to develop differently as a result of the *Growing Smarter Act*, passed in 1998 (Witherspoon, 2008). The Act was a statewide law to encourage "Smart Growth" or denser, more compact development with better plans for the longevity of new developments (Atkinson-Palombo, 2010).

Phoenix has since included more multifamily housing options instead of solely single-family housing options in its new developments. However, these types of development are primarily occurring on the "urban fringe," or outskirts of the existing urbanized area (Atkinson-Palombo, 2010). Phoenix needs to continue to make progress towards not only denser developments, but a more compact urban footprint for the greatest water savings and increased resiliency to water crises (Guhathaktura & Gober, 2010).

As Debuys (2011) points out, "new south westerners will need water and energy, new towns and urban centers, highways and rail lines, houses, jobs, and parks" (p. 175). It is up to our

policy makers to decide whether or not we are “obligated” to give them that infrastructure with undoubted water supplies, or with the hodgepodge of groundwater over pumping and dependence on a dwindling system to recharge in a different area (Winter, 2015). Matt Jenkins (2006) notes that “paradoxically, [while] the dearth of available water creates increasing conflict, . . . [it also] forces people . . . to confront the finite nature of the region’s resources . . . the trick will be getting conservation started.” Additionally, the “trick” will be balancing conservation with economic stability and “smarter” forms of urban growth. We will explore more of these suggestions in section 3.

Section 3: Shifting Future Paths: conservation through a desert identity

Demand Management Challenges

Given the many supply management challenges Phoenix will face with future population growth and a predicted hotter, drier climate, one of the best ways to mitigate water supply shortages is reducing consumption, rather than augmenting supplies with desalination or additional surface water canals (Bolin et al., 2010). Water simulation models suggest that continuing with business and consumption as usual in the Phoenix area will, in the long term, increase the vulnerability of the region's water supplies and its ability to respond to shortages (Gober & Kirkwood, 2010). The need for conservation programs to reduce consumption throughout the valley has been present since the mid 1900s; yet, the programs in place are still not enough to increase the area's resiliency to shortages (Larson, Gustafson, & Hirt, 2009).

There are dozens of water conservation and water awareness programs throughout Arizona, and many focused on Phoenix. Arizona Water Awareness, for example, is a website hosted by the Arizona Department of Water Resources that informs citizens across the state of Arizona where their water comes from and what influences individual consumers may have based on seasonal states of the supply (Arizona Water Awareness, 2015). While these are options, opportunities and information for the community, conservation hasn't been adopted as the responsibility or identity of Phoenix residents (Larson, Gustafson, & Hirt, 2009). Larson, Gustafson and Hirt (2009) explain that many demand-side conservation programs and supply management policies, such as the GMA, were products of "an era of regulatory accommodations" which "weakened" water management throughout the Phoenix area.

Because conservation programs in the Phoenix area have become largely voluntary, and the cultural foundations of Phoenix are based on constant consumption, conservation programs

have traditionally not worked for the Valley ((Larson, Gustafson, & Hirt, 2009). One of the changes to the GMA, discussed in section 1, was the responsibility of reducing water consumption placed on water providers and not the consumers themselves (Hirt, et al., 2008). Larson, Gustafson, and Hirt (2009), describe three eras of demand-side management for the city of Phoenix, and attempt to explain why all three have not had success.

From 1980-1990, the GMA required fixed percent reductions in per capita use, which was responded by non-compliance in 19 of the upwards of 30 service providers within the Phoenix AMA. Because of the sheer amounts of resistance the Arizona Department of Water Resources (ADWR) faced during this first era, they began to weaken their regulations, exempting smaller service providers, and accommodated regulations to the demands of larger service providers.

From 1990-1999 the GMA specified conservation targets for each individual provider, which again, faced resistance from some of the largest service providers. They argued that conservation standards negatively impact their economy and they should focus on acquiring more water supplies instead of increasing conservation. Due to the roots of Phoenix's political economy fostering constant consumption and economic growth, and conservation being perceived as inhibiting economic growth, water conservation regulations during this era failed to take hold. This era is marked by the shift from performance based conservation standards to less effective procedural standards. Performance based standards measure conservation based on how much water has been conserved while procedural standards measure conservation through how many programs are in place.

The final era Larson, Gustafson, and Hirt (2009) describe, 2000-2010, is the institutionalization of previous loophole practices into standard conservation management

programs. Instead of requiring water use reductions, in this third era of water management, ADWR implemented “best management practices,” for incentives and outreach. Essentially, in this era ADWR moved from requiring measurable conservation standards from all providers to determining sufficient compliance as adoption of a determined number of best management practices.

These management decisions have contributed to the inability of the Phoenix AMA to meet safe yield, and comply with the AWSA (Maguire, 2007). The lack of force in ADWR in requirements for service providers has helped to perpetuate illusions of plenty in the Phoenix area, and in the end, have done little to affect change in overall demands. Larson, Gustafson, and Hirt (2009) explain that these trends in water-policy exemplify the political foundations and “social momentum” in Phoenix to promote capital interests “essentially maintaining business as usual” (p. 126).

Additionally, water-pricing structures have made it difficult to get users to reduce consumption, as the subsidization of water has made it cheap for users to intensely consume. Because federal reclamation projects supply water to the Phoenix area, it is highly subsidized. It is cheaper to pay for water that is highly dependent on federally funded projects in Phoenix, than to pay for water in a wetter climate, such as the northeastern United States (APA Arizona). This disproportionate pricing does not reflect the true value or scarcity of water as a resource, allowing consumers to use relatively high quantities, without any real or perceived consequences.

Approaching demand management concurrently with supply management is Phoenix’s best option for resiliency in its water distribution systems. Water supply scenarios all reveal that the longer Phoenix waits to face its growing scarcity in water supplies, the more difficult it will

be to mitigate shortages (Gober & Kirkwo., 2010; Bolin et al., 2010). This warrants more rigorous demand management programs, and initiatives to reduce water demands throughout the entire area. Gober and Kirkwood (2010) speculate that there is not “a single likely or optimal future for Phoenix,” but the greater area has to adapt to climate changes through “lifestyle” changes including less pools, more desert landscaping, and changes in urban form to include higher densities (p. 21295). After assessing shortage scenario models for the Phoenix area, Bolin et al. (2010) suggest that conservation efforts should be directed towards reducing domestic consumption, particularly through education, better price structures that disincentivize heavy water consumption practices, rainwater harvesting to promote groundwater recharge and “penalties” for intensive water uses. Most of these actions, Bolin et al. explain, are against the Arizona philosophy that water resources are not a problem to continue to consume (p.276-277). They additionally emphasize that shifting the form of Phoenix’s urban growth from a sprawled, resource intensive model to one that has higher density, mixed-uses, and infill development will be key to the long-term vitality of the greater Phoenix area’s resilience in climate change, water shortages, and ability to accommodate future population growth. However, Larson, Gustafson, and Hirt (2009) explain that “a deficit of leadership” and “lack of imminent water-supply crisis” are preventing conservation and land use change initiatives from being able to affect change to a perpetual land development and population growth dependent Phoenix.

A faulty groundwater management program, loop-holed assured water supplies for future development, pliant systems of regulating consumption, and history of policy makers weakening sustainable practices to strengthen the area’s ability to conduct business and benefit from short-term economic gains does not leave hope for future policies or practices that promote the longevity of the region. The underlying flaw in the system is Phoenix’s fundamental culture of

consumption that chokes out any chance for change if it limits consuming practices. Before creating policies to shift water demands, and change urban form to increase resiliency to climatic and resource changes, the political and economic culture of the Phoenix must first shift to instead embrace conservation, starting with its citizens.

Adopting a New Water Identity—Embracing a Culture of Conservation

Water resource scholars tend to point towards the adoption of a conservation ethic as a solution to water supply issues in their publications. Well-known water lawyers at the University of Colorado, Boulder explain in their book, *Searching Out the Headwaters*, “communities grow out of a sense of shared needs. Ironically water, the West’s most important resource, has been eagerly ‘parted out’ [of our communities]” (Bates et al., p.78). They argue that this abandonment of water values calls for a shift in “core values and concerns” to form a “water ethic [. . .] rooted in the principles of conservation, fairness and ecology”—the key to achieving “long-term success” in the West (p.178-201).

Arizona leaders have sensed the urgency for a cultural shift in its population’s consumption of water resources, with previous governor, Janet Napolitano, calling for a culture of conservation throughout the state in the early turn of the century. Aldo Leopold, creator of the “land ethic”—or the core value of stewardship, explains the impediment to adopting a land ethic under the constant consumption paradigm. He writes, “We abuse land because we regard it as a commodity belonging to us. When we see land as a community to which we belong, we may begin to use it with love and respect” (p. xviii). The political economic foundation of Phoenix has shaped residents’ and developers’ perspectives of their land and water as simply commodities (Schipper, 2008). The sense of water’s scarcity is absent from consumers because it’s been cheap to them.

Not only does commodifying water lead to “abuse,” or use beyond its natural limits, of the resource, but it also limits our ability to fully value water. In a culture of consumption, the symbolic importance of water is negligent to the short-term economic gains by resources availability. Ingram and Brown (1987) note, “the symbolic importance of water is both profound and profoundly underestimated.” They suggest that by fostering a greater sense of the actual commodity value of water in prices and politics, and the community value of water in resource stewardship, equity, and recognition of its spiritual ties, communities can start to work towards reflecting water’s true scarcity and value in its management practices.

These solutions water scholars offer will require a shift in the public base to vote for policies and people that are more in line with conservation values. This culture of conservation has to emerge from the individual and community level to take affect on the larger political framework of Phoenix. When the public is interested in, cares for, and is demanding change in management practices, then we may start to form a new “water identity.” Engaging, informing, and involving the public base in water issues will take greater outreach and education, price structures that inform consumers of the “true value” of water, and forming a communal sense of place within the desert.

Saltz, Elser and Cutts (2008) suggest that water reduction education programs can help to foster a more educated and engaged community base, leading to “shifts in policy and social norms, and help develop a cultural of environmental awareness.” This shift is key to the future of water in the west, according to Bates et al (p. 41). In a study of the success of current conservation education programs in Maricopa County, Saltz, Elser and Cutts (2008) found that there are gaps in the “water literate” public, or resident understanding of water quality, quantity,

sources, and purposes, in Phoenix, including renters, young adults, upper and lower socioeconomic groups, and Spanish speakers.

While the current programs are effective in top-down teaching, education programs that foster higher levels of comprehension to encourage more public participation and political involvement are needed. Saltz, Elser and Cutts (2008) suggest a “comprehensive evaluation of the entire education environment” so that all of the Maricopa County population is included, and groups are included in informed decision-making. They remark that the degree of water literacy among the Maricopa county public “will play an increasingly significant role in economic and ecological sustainability,” because informed individuals will be able to take intentional action. The programs for water education are in place, but a higher degree of collaboration, outreach, and measurement of public engagement are needed to improve democratic participation, and community care in Maricopa County.

Another way to increase awareness of the value of water is through higher price structures. The greater Phoenix area has already adopted a municipal specific block-rate structure for water pricing, or incremental costs to use, to encourage conservation (Waters et al, 2014). While these price structures are a good start towards further conservation, Eden et al. (2014) explain that incorporating all of the costs to provide water in Arizona through canals and expensive water projects may help consumers to better understand the true value of water, so long as they maintain an equitable base. These economic reflections of water’s value, if combined with educational material in a water bill, may then spark inquiry for the intrinsic value of water—a more powerful means of conservation rooted in ethic and responsibility (Eden et al., 2014; Schipper, 2008; TMWA, 2007). This sort of price reform will not come without barriers.

Having a population rooting in water awareness will increase the likelihood for such reforms to pass (APA Arizona).

However, Larson et al. (2009) explain that water education campaigns and price changes alone will not be enough to adopt a culture of conservation in the Phoenix area, as they do not fully target the core of “what motivates water-use behaviors.” Phoenix’s entire metropolitan mantra is founded on the idea of the urban area as an “oasis” within the desert (Making Sense of Place, 2003). While the notion of oasis is true to the extent of its proximity to surface waters given its geography, the idea of oasis has perpetuated growth and water consumption beyond the capacity of its ecological base (Bush et al., 2008). Trumbo et al. ‘s (2001) studies on the effect of water information on conservation reveal that water conservation information is only effective if “preexisting attitudes” and “social norms” are positioned to shape behaviors of consumers. In other words, education conservation programs are only effective when individuals are paying attention and already care about environment-related issues.

Schipper (2008) suggests that recognition by a community that they are part of an arid, desert region is necessary in order to foster a community of stewardship that is aware of environmental issues. This “desert identity” is a form of cultural identity. Gilbert (2010) defines cultural identity as the way in which a group of people views their relationship to the world. Echoing the sentiments of Leopold (1987), a desert identity is where individuals and groups of people recognize themselves as members of a desert ecosystem.

Additionally, Malloy et al. (2013) argue that having a sense of place in relation to natural amenities will improve the way a community interacts with its resources, and help to develop a sense of care. Locals often joke that the difference between Phoenix and Tucson, two cities that heavily rely on the CAP for supplies and have followed similar sprawling development patterns,

that in Tucson you can't tell where the desert ends and the city begins. Where Phoenix prides its self in being an oasis, Tucson prides its self as being part of, and working to conserve the desert (Stern, R. 2015). The effects of this perspective may be evidenced in the two city's water consumption—with Phoenix consuming 162 gpcd, while Tucson just 94 gpcd in 2010 (MAP). In order to develop Phoenicians' relation and sense of care within the desert, its landscapes and urban facades need to start reflecting its desert identity.

The sense of oasis in Phoenix, while effective at attracting residents, has heightened location based issues in the desert such as heat, dust and water scarcity (Gober & Guhathakurta, 2007). In *Design with the Desert*, Kim Sorvig explains the resources versus place paradox: “we value new materials enough to destroy the living land in extracting them” (2013, p. 289). For Phoenix this means removing its unique, endemic Sonoran Desert landscape for housing, developments, water parks, swimming pools, golf courses, and freeways. In a political economic culture of growth is good, and short-term economic gains triumph all, the living land gets the least say (Schipper, 2008). Sorvig continues to explain that shifting towards planning for “place based resources”—focusing on the strengths of the Sonoran Desert to provide amenities such as shade and drought resiliency, instead of relying on extractive, trade intensive systems for the economy, will be key to future development. In this sense, Sorvig is arguing for improving place-based advantages, instead of trying to expand into economies that are not locally or sustainably available.

This economic shift reflects adjusting community values from consumption to conservation through respecting, celebrating, and utilizing environmental specific services within a given landscape. These principals can be used in future urban planning through connecting

land use planning and water resource planning to reflect and protect a desert identity in Phoenix, a collaboration imperative to the communities future prosperity (Malloy et al., 2013).

Integrated Solutions to Balancing Supply and Demand into the Future: Conclusions and Recommendations

An engaged public base with care for their future and understanding of the limitations of resources will help to fuel the policy and individual actions necessary for greater resiliency in climatic challenges to come. In this paper I have discussed the water projects and policies that enabled Phoenix to rapidly develop during the last century; the failures of resource supply policies to effectively create a secure water future; the climate and development factors challenging a secure water future; and finally the initiatives necessary to start shifting the consuming culture of Phoenix from one of consumption to one of conservation. From here, Phoenix can start to change its development trajectory. My argument is not for conservation alone through education and pricing, but to use conservation education as a platform to build a desert identity of stewardship.

In the long-term, the Phoenix area is in need of infrastructural change to water laws, practices, and policies for guiding future development, while linking land use and water resources (Malloy et al., 2013). Regional comprehensive planning has the ability to encourage compatible use of land, rather than forcing trade offs between economic, natural, cultural, and human resources (Larson et al., 2013; Carter et al., 2004). Not all Phoenicians will partake in changing their consuming habits to increase the region's resiliency to changes in its water portfolio. Not all will embrace a "desert identity" and work towards a better outlook for future Phoenicians. However, an improved political foundation to manage water supplies and hold

consumers responsible for their water use will start to lay the necessary framework for changing the majority of consumer actions.

The Valley is at an essential turning point—the impacts of drought and climate change have not yet affected municipal water supplies, and Arizona is still receiving its full Colorado River apportionment. Phoenix has the opportunity right now to prosper better, stronger, and smarter than before, while strengthening sense of place, identity and draw to the region before a water catastrophe. It starts with shifting its political and social foundations towards a culture of conservation so that future policies and land use planning may highlight and benefit from the resilient assets of the region as a whole.

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