POLICY POINTS

POLICY POINTS BRINGS RELEVANT DATA TO TIMELY PUBLIC POLICY ISSUES IN ARIZONA

How Will the Current Drought Affect Our Future Water Supply?

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Living in the desert, we are used to warm weather, sunny skies, and little rainfall. But even in the midst of an extended drought, the lack of rain this year has some people asking if this is one of Arizona's driest years ever? Rainfall levels are different throughout the state, but looking at the historic precipitation records for Phoenix's Sky Harbor International Airport, we see that the five year running average for precipitation measured at this station, variable throughout the historic record, has been on a downward trend since the mid-1990s. Comparing data for the first six months (January - June) of each year, the current year of 2012 has the second lowest rainfall total since records were kept (2002 had the lowest). Even with the monsoon season arriving in July and several storms delivering almost an inch of rain that month at the airport, 2012 is likely to end up with rainfall totals below the historic average. Arizonans generally like the sunshine, which is why we live here, but what does declining rainfall mean for our water supply?

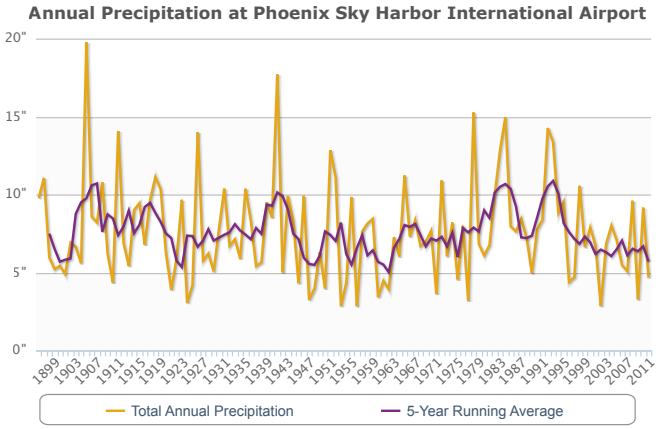

Figure 1: *Annual Precipitation at Sky Harbor Airport.* Source: ThreadEx precipitation data, obtained from the Office of the Arizona State Climatologist.

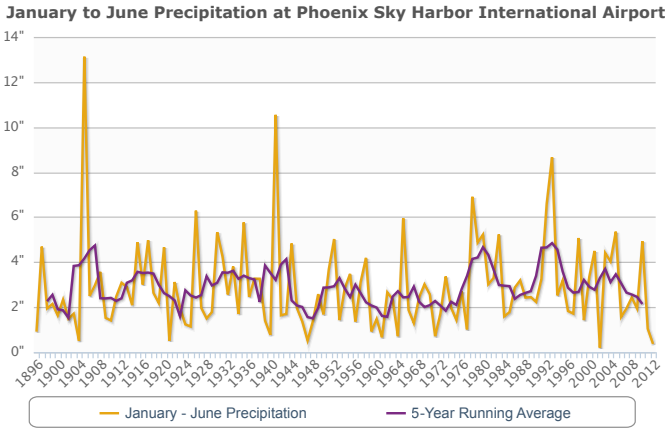

Figure 2: *January to June Precipitation at Sky Harbor Airport.* Source: ThreadEx precipitation data, obtained from the Office of the Arizona State Climatologist.

The Source of Our Water

In the Phoenix metropolitan area, local rainfall is not that important in terms of our water supply, especially in the summer when evapotranspiration (water loss by evaporation from the soil and other surfaces and transpiration from plants) is so high. Rainfall does allow us to turn off our sprinklers for a few days, greens up the desert, and, depending on the storm, may provide some groundwater recharge. In the Tucson area, local precipitation is more closely tied to groundwater recharge. But the water supplies of both Phoenix and Tucson are also dependent on precipitation far outside the state, as both places receive a large share of their water from the Colorado River by way of the Central Arizona Project (CAP) canal. Much of the Phoenix area is also heavily dependent on surface flow from the Salt and Verde Rivers, which originate inside the state, but well outside the Phoenix metropolitan area.

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Figure 3: *Source of Surface Water for Phoenix and Tucson Metropolitan Areas.* Source: Decision Center for a Desert City.

Colorado River water originates as rain and snowfall throughout its multi-state watershed. Water from the snow is released slowly during the spring melt and makes its way to the Colorado River and the reservoirs downstream where it is released for use in the lower basin states (Arizona, Nevada, and California) as well as to satisfy Mexico's allotment. Water from the Salt and Verde Rivers comes from rain and snowmelt in the mountains of central and eastern Arizona. Groundwater largely completes the water supply picture, although other sources, such as effluent (reclaimed wastewater that has been treated to the level that it can be used for irrigation and other non-potable uses), also contribute. In other parts of the state, the use of groundwater dominates the supply, but may be supplemented by surface water in some areas.

Depending on the local water provider (municipal or private), the water supply for the Phoenix and Tucson areas comes primarily from differing percentages of CAP water (from the Colorado River), SRP water (from the Salt/Verde Rivers) in the Phoenix metro area only, and groundwater. Arizona's 1980 Groundwater Management Act created the Active Management Areas (AMAs), establishing a strong groundwater management program in the state's five groundwater basins most at risk. The urban AMAs, including Phoenix and Tucson, seek to limit groundwater use to safe (sustainable) yield, where groundwater withdrawals do not exceed natural and artificial recharge. As a result, it is important that water providers in the Phoenix and Tucson areas limit groundwater use through the increased use of renewable supplies (i.e., surface water and effluent reuse) and conservation of existing supplies. Although many cities have decreased consumption on a per capita basis, a growing population means total water use may remain constant or even increase.

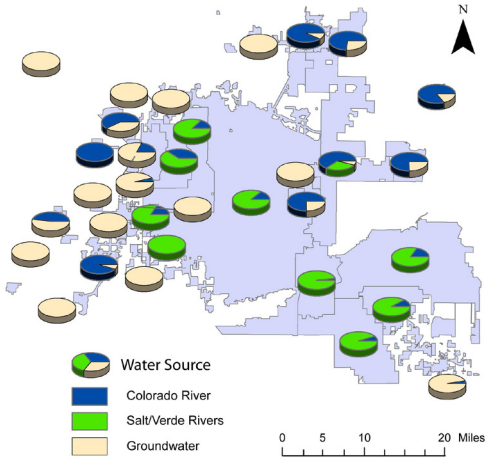

Figure 4: *Water Source for Phoenix Metropolitan Water Suppliers.* Source: Decision Center for a Desert City.

The State of Our Future Water Supply

Currently, the water supply for the Phoenix and Tucson areas is in good shape, at least for the near future, and the lack of rain this year doesn't affect that. The storage of surface water is a key factor in our short-term water supply. Colorado River water is stored in several reservoirs, with the largest being Lake Mead and Lake Powell, and water from the Salt and Verde Rivers is stored in six reservoirs, four on the Salt River and two on the Verde. Reservoir storage can be variable, but this storage acts as a safeguard, storing water that we can access in times of drought. Lake Mead, the largest of the reservoirs, shows a "bathtub ring" these days as the current water level sits well below where it was ten to twelve years ago, exposing once submerged rock. In 2010, Lake Mead fell to a dangerous level and hit a record low in November of that year, almost to the point where a shortage sharing agreement would have been put into effect and Arizona and Nevada would have been required to reduce their withdrawals from the Colorado River. Due to conditions put in place when the CAP received its federal funding, in the case of shortage to the lower basin states, California will receive all of its water before Arizona and Nevada receive their full share. Levels have rebounded over the past two years and for now Arizona is receiving enough Colorado River water that in some locations water is being "banked" in the ground—similar to being put into a savings account that can be accessed during a period when Arizona may not get its full share of Colorado River water.

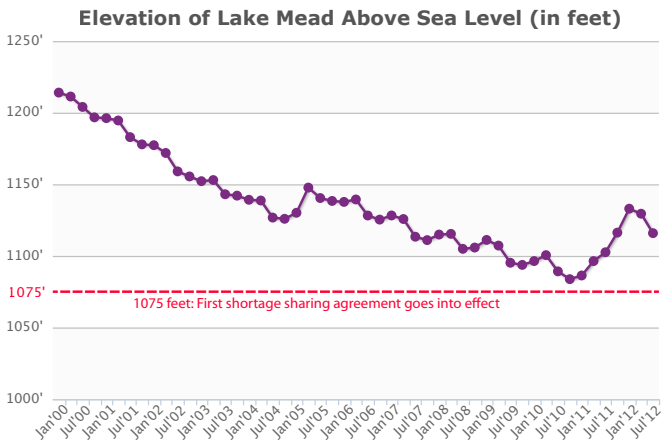

Figure 5: *Elevation of Lake Mead Above Sea Level.* Source: Bureau of Reclamation Archives of Daily Levels/Elevations Reports for Lower Colorado River Reservoirs.

More important to our future water supply is what happens throughout the Southwest as a result of climate change. The Colorado River Basin has been warming over the last century, and the results of climate models suggest that temperatures

in the region will continue to increase. Although there are conflicting estimates from the models on future precipitation and whether it will increase or decrease, warmer temperatures will certainly result in less snow (due to higher snow elevations) and earlier snowmelt, as well as increased water consumption in the summer. Another uncertainty is population growth. Population growth in the Sun Corridor (the central Arizona region that includes Phoenix and Tucson), once among the highest in the nation, has slowed as a result of the economic downturn and we have yet to see what will happen as the economy rebounds.

What Are Our Options?

There are still places where we might find more water to support potential urban growth. From 2001-2005, agriculture consumed about 70% of the freshwater used in the state, but this percentage was less in the Phoenix AMA (about 47%, including Indian agriculture) and the Tucson AMA (about 32%, including Indian agriculture). Although Indian agriculture will likely continue, non-Indian agriculture in the Phoenix and Tucson AMAs has continued to decline since the 1980s as farmland has been retired and some transformed to urban uses. In some cases, the water that used to support agriculture is now being used to meet the needs of urban areas. In the future, agricultural water rights are also a potential source of water for urban growth and may help us to endure a long term drought. However, as agricultural land is retired, it cannot provide the services it now does, including the economic and social benefits of food production for both people and livestock, cotton production for textiles, and urban cooling.

In the municipal sector, over half of the water for single family homes goes to outdoor uses, especially in the Phoenix area, where green lawns and backyard swimming pools are the norm. By reducing our outdoor water use, through the use of native plants and xeriscaping (low water use landscape) and reducing the number of backyard pools in new developments, we can help to conserve water for the future. However, the comfort of urban residents must be considered when reducing outdoor water use. Not only does green landscape help to break up the monotony of the urban setting, but irrigated landscape also helps to maintain cooler temperatures and mitigate the urban heat island. Research has shown that the greatest gains in cooling come from adding vegetation to neighborhoods that are sparsely vegetated, while adding additional vegetation to already lush areas does little to increase cooling. It is important that we use water wisely and make sure that irrigated landscape is properly placed where it will do the most good to enhance the comfort level of those living in urban areas and to protect the most vulnerable populations against the dangers of extreme heat.

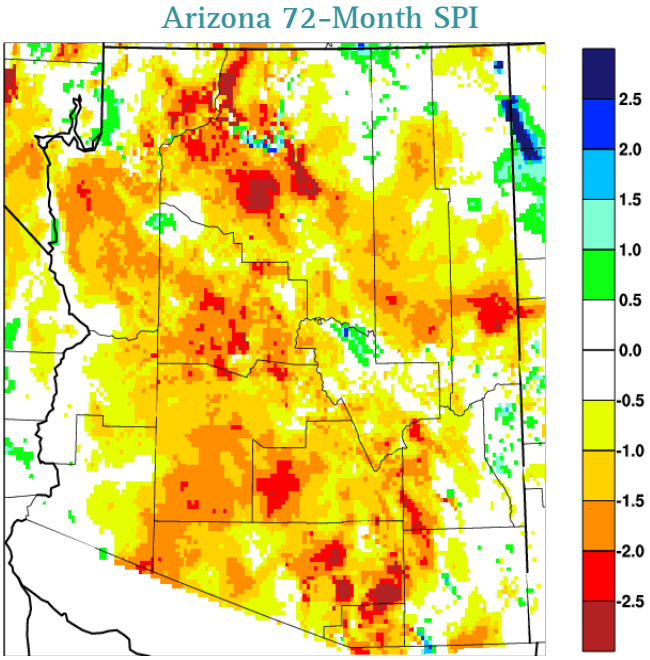

Figure 6: *Arizona 72-Month SPI.* Source: Western Region Climate Tracker, West Wide Drought Tracker [http://www.wrcc.dri.edu/research/jtwrcc/WWDT/].

A look at the Standardized Precipitation Index (SPI), an index that compares current precipitation for a given time scale with historic precipitation for the same time scale, shows most of Arizona in drought conditions over the past 72 months. Long term SPI observations are most important in terms of reservoir storage and groundwater recharge which in turn influence our water supply. CAP water is drawn from the much larger area of the Colorado River Basin, which has been dry recently, but more variable over the long term.

As we move forward in the twenty-first century, the uncertainty of both the effect of climate change on our water supply and of the size of the population that will share in that supply needs to influence the decisions made by water planners. The water that we have stored in reservoirs will hold us over during a short term drought. But if surface water supplies diminish over the longer term as a result of climate change, then we will have to make hard decisions about the changes that will need to be made to maintain a sustainable water supply. Water currently devoted to agriculture is a potential source of water for urban areas in the future, but its use must be done in a way that balances the economic and social benefits that agricultural land now provides. We also have a savings account in existing and banked groundwater, but if we use groundwater unsustainably, then that safety net will also be gone. Another strategy is conserving the water that we have and making sure that we use water efficiently to meet our urban, agricultural, and environmental needs. If we wisely plan for the uncertainties in our future water supply, we will be able to enjoy living in the desert sunshine far into the future.