

Marisa Barajas

SBE 498 Capstone

Perceptions of water shortages among Tucson residents

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Abstract

Arizona has been experiencing water shortages due to climate change and population growth. This has led the City of Tucson to increase water prices for the residential sector. By surveying and interviewing 14 residents of Tucson, this study looked at people's perceptions of this new policy change to determine attitudes toward and awareness of the water crisis in Tucson. The study found that there is a relationship between the number of years people have lived in Tucson and the level of awareness of the water crisis. It also showed that people's perceptions of the impact of increased water prices are short-termed. This indicates a need for increased water awareness among the residential sector. Additionally, future studies need to look at the difference in perceptions of water crises among different age groups. This will provide a better understanding on what information should be made available to different age groups.

Key words: Water shortages, perceptions, Arizona, water prices

Introduction

The Colorado River is the lifeline of the Southwest. It supports over forty million people in seven states: California, Arizona, Nevada, Utah, Colorado, New Mexico, and Wyoming. The delta of the Colorado River is in Mexico (Tucson Water's Long Range Water Resource Planning, 2023). However, in the last two decades with population growth and warmer temperatures, the reservoirs along the Colorado River have reached dangerously low levels. This has caused major strain for states along the Lower Colorado River Basin (Arizona, Nevada, California, and Mexico). The increased conflict and competition for water had led to significant

cuts along the Lower Basin. This has also had major impacts on states' economies, specifically agriculture, tourism, water supply and utilities companies.

The Bureau of Reclamation has announced that the Lower Basin is in a Tier 2 shortage, meaning that Arizona is asked to cut water consumption by twenty one percent, Nevada by eight percent, and Mexico by seven percent (Partlow, 2022) Tucson receives roughly 44 billion gallons of water from the Colorado River that is transported via the Central Arizona Project (CAP) (*Figure 1*). This is a 335-mile-long canal that runs from Lake Havasu, through Phoenix, and finally to Tucson. Tucson is unique because it has three sources of water: the Colorado River water, ground water, and reclaimed water. (Tucson Water's Long Range Water Resource Planning, 2023) However, Tucson uses about 20 billion gallons of the water from the Colorado River while the rest is pumped underground to recharge aquifers. Pumping CAP water into the aquifers allows the city to replenish groundwater withdraws while also storing water for future needs.



Figure 1: Map of the Central Arizona Project (*Tucson Water's Long Range Water Resource Planning, 2023*)

Living in the desert presents many challenges for water conservation and innovation. Over the last 30 years, Tucson has implanted many features for sustainable water management. Some of these features are CAP groundwater recharge, water reuse, rainwater harvesting, integrated land and water planning and efficiency (The University of Arizona: Water Resource Research Center & WRRC Staff, Students, and Pima Cooperative Extension and Stakeholder Partners, 2022). These innovations are responses for conserving water levels while the population is increasing.

The residential and commercial sectors are the biggest users of water in Tucson. Collectively, they use 144 million gallons a day. Irrigation uses 42 million gallons a day, livestock and industrial sector use 2 million gallons daily. (Arizona Water Factsheet Pima County, May)

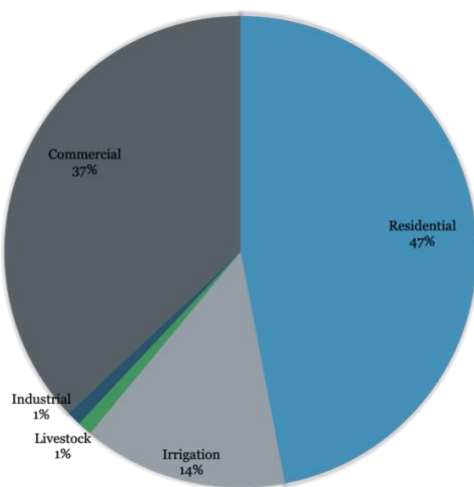


Figure 2: Sectors and their uses of water

In the 1980's, Arizona recognized the need to manage its groundwater to keep the local economy growing. Areas that depended on groundwater designed a plan to manage its natural resource. These areas include Prescott, Phoenix, Pinal, Tucson, and Santa Cruz, each are subject to regulation pursuant to the Groundwater Code. (<https://new.azwater.gov/ama>, n.d.) These groundwater codes are known as Active Management Area (AMA). In the Phoenix, Prescott, and Tucson AMAs, the primary management goal is safe yield by the year 2025. Safe yield is accomplished when no more groundwater is being withdrawn than is being replaced annually. (<https://new.azwater.gov/ama>, n.d.) The plans contain rigorous management requirements from each sector, agricultural, municipal, and industrial. Each series of the AMA reflects new codes for groundwater management, mandatory conservation programs for any residents that withdraw water, distributes or receives groundwater.

Tucson water and environmental service had planned to increase utilities cost back in 2020, however, due the pandemic, they decided to postpone that and are now set to increase the CAP surcharge in February of 2023. The last increase for water service fees was in 2011, when Arizona was in a severe drought from 2010 to 2013. The increase for 2023 will be \$0.30 cents more. Currently, Tucson residents pay \$0.70/Ccf (hundred cubic feet) and starting next year will be \$1.00Ccf. (Water and Environmental Services rate increases, 2023-2027, March). A centum cubic foot (CCF) is the equivalent to 748 gallons. The average American household uses around 300 gallons per day. In Arizona, the average resident uses 146 gallons. (PUBLIC CONSERVATION RESOURCES, 2023). In addition to these increases, there will also be a 5.5% increase every year over the next five years. What does this mean for Tucson residents? Starting March 2023, Tucson residents will be paying around 4 to 5 dollars more for their water

each month or \$55 to \$60 a year more. While that may not seem like a lot of money initially, this increase will continue into 2027 resulting into water bills as high as ...

a. Problem Statement

Water shortages are impacting the state of Arizona, including Tucson. To continue to provide water to its citizens, the city needs to implement new policies to reduce water consumption and incentivize water conservation. For these policies to be successful, the city needs to study peoples' perceptions of water-related policies.

II. Methodology

a. Research Questions

1. How does the increase in water prices impact water use in Tucson among the residential sectors?
2. What is the water awareness among Tucson residents?

Methods

A questionnaire was created to gain understanding of people's knowledge of and concerns for water levels in the Colorado River. The questionnaire was divided into three parts. The first part covered demographics. The second part asked about people's perceptions of water issues in Tucson. The third part asked about water use. These questions were more specific to each person and their household.

The questionnaire was sent out via social media (i.e., Instagram and Facebook) and through text messages to 14 people. Interviews were also conducted with six respondents to follow up on their questionnaire responses. These interviews were informal and done with

friends and neighbors. They helped understand more about individual perceptions of water issues in Tucson.

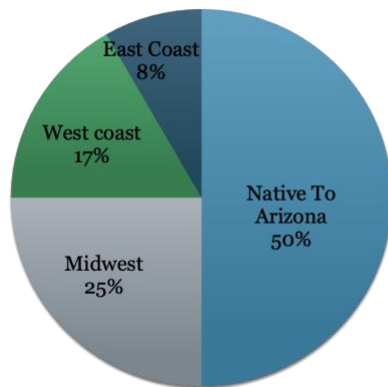
Justification

The purpose of this study is to conduct and to better understand perceptions of water issues in Arizona. By understanding people's perception of the city, different sectors of society can address water issues effectively and in a timely manner.

Results

The results from the survey were all follow. There was a total of 14 responded, however, only 13 were used due to one being an outlier. This outlier was a resident from South Africa, and it did not work to include one international person.

Survey respondents and their origin



Number of years residents have lived in Tucson

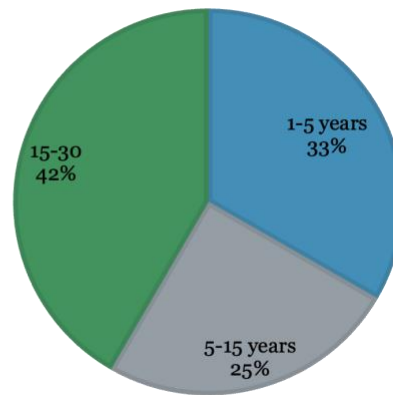
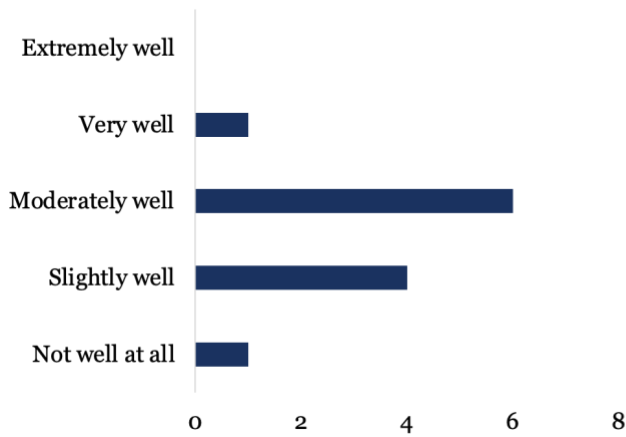


Figure 3 pie chart on the left: Where survey respondents are from. Pie chart on right: number of years residents have lived in Tucson

How do you rate your understanding of water issues in Tucson?



Is Tucson running out of water?

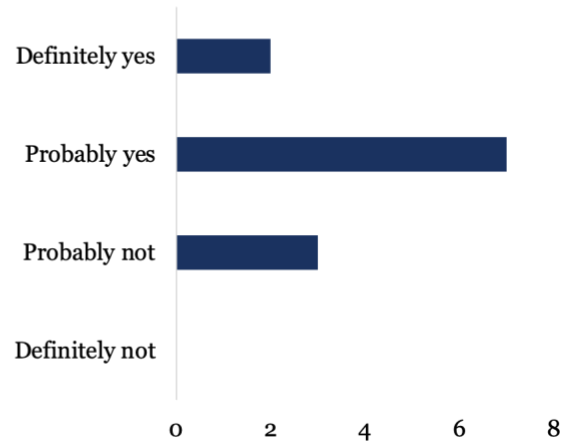
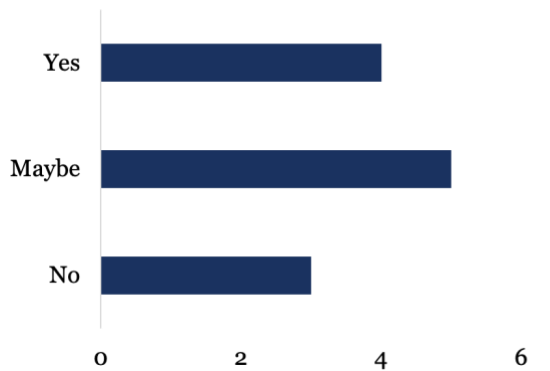


Figure 4 How residents rate their understanding of water.

Is water priced fairly?



Are you aware of the water levels in the Colorado River?

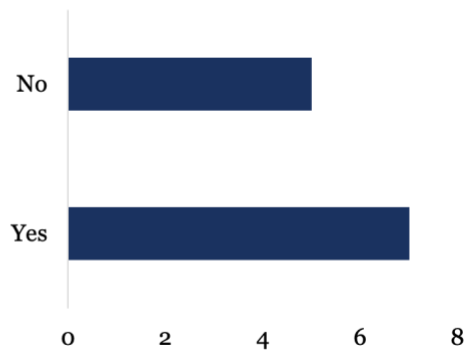


Figure 5 how residents rate price of water in Tucson. Graph on the right: How aware residents are of levels in the Colorado River.

A few of the interviewees were aware of the drought that has been occurring in the Colorado River and what that means for residents of Tucson and the Southwest. These interviews all shared the same concern that the city should have resources for the public, such as

short videos or publications with different methods to conserve water. Others interviewed did not have as much knowledge about water issues. One of the interviewees was from Iowa and showed more concern about water levels in the Colorado River but did not care about the increase in water price. This interviewee said that if the water bill is under \$100 a month, their water habits would not change.

Discussion

What are perceptions of water shortages among Tucson residents? Over half the residents that took the survey were aware of the water crisis that Arizona has been in. However, there was about a quarter of people that were not aware of these issues. In the survey, there was a question about Tucson residents and their home origin and how long they have lived in Tucson. There was a correlation between how long residents' have lived in Tucson and their level of concern and knowledge of the water shortage. Residents that have lived in Tucson for more than 5 years, had a great understand of the water issues that Tucson is facing. The second correlation was between the residents and their home origin. Residents that came from the Midwest and East Cost that have been living in Tucson for less than 5 years had less awareness of the water crisis. There was also about three responds from the Midwest and East Cost that said they would not likely change their water habits if their bill remained under \$100 a month. On average these responds had a monthly water bill that ranged from \$65 to \$83 dollars. This showed that people's perceptions of the impact of increased water prices are short-termed.

One of the most important things to come out of this survey was that majority of the responds said that the City of Tucson needs to have more readily available information on water shortage and how residents can help to conserve water. Some of the comments that were listed and made during the survey were as follow: user friendly publications, short videos on social media, more

incentives for rainwater harvesting. In short, lawmakers, public utilities companies, and residents need to have a collective effort to set up a framework about this issue. The water shortage is not an issue for one group but an issue for each group and working together can help resolve the water crisis.

In the last year, there has been many articles about the lack of political attention the water crisis has received. An article by The State Press, Rhett Larson, a professor of the Richard Morrison of Water Law at Sandra Day O'Connor College of Law, said "Arizona needs innovative new approaches and the shortage at this point is so serious that whatever we've been doing in the past is not good enough going forward." "The vast majority of the water is used by agriculture, so even if the cities and houses made all of these fixes, it wouldn't be enough," Larson said. Kathryn Sorensen, the director of research at the Kyl Center for Water Policy said, "We have really strong, really progressive water management in central Arizona, but those rules don't apply statewide" (Osmonbekov, 2022).

Tucson has good water management, but it still lacks in this crisis. In 1985, Tucson set up a five-part series of water management plans, which are set to go until 2025. These plans are known as the Active Management Area (AMA). The plans contain rigorous management requirements from each sector, agricultural, municipal, and industrial. Each series of the AMA reflects new codes for groundwater management, mandatory conservation programs for any residents that withdraw water, distributing or receives groundwater. Currently, Tucson is in the fifth and final series of the AMA, which started in 2020 continue until 2025. The most notable change in this series is the top 25% of agricultural may see a reduction in water by 5%. Another notable change in the municipal sector that updates current technologies and practices for water saving measures (Arizona Department of Water Resources).

There is still much work to be done about the current water crisis in Arizona. However, Tucson has implanted good practices for conserving water and plans for long-term water shortages. By implanting these practices Tucson is doing its part in this crisis. However, is that enough? Only time will tell if that is enough. Tucson still needs to work with its residents to collectively work together to solve issues about this water crisis.

Conclusions

Arizona has been experiencing water shortages by surveying and interviewing 14 residents of Tucson. This study looked at people's perceptions of this new policy change to determine attitudes toward and awareness of the water crisis in Tucson. The study found that there is a relationship between the number of years people have lived in Tucson and the level of awareness of the water crisis. It also showed that people's perceptions of the impact of increased water prices are short-termed. There is a need for increased water awareness among the residential sector. The good news for Arizona is that more and more people are talking about the water crisis, but the bad news is that water isn't a topic that captures public interest until it becomes a crisis. Tucson has done a remarkable job trying to find innovated way to maintain its water supply while also storing water for a later time. Unfortunately, living in the desert during historical drought presents many challenges that cannot be solved in a few years. Only time will tell if Tucson's combined efforts are enough to deal with this water crisis. However, it is evident that the City needs to work with its residents if it wants to combat these issues.

Limitations

There are many limitations to this research project. First, only one person was responsible for data collection. The sample size was too small and thus wasn't representative enough of the population studied. By putting the questionnaire on social media, it attracted a certain type of

respondents. The study has personal bias because only people that were on social media had access to the surveys, and it was only posted on the author's social media. It left out a large population of people who either do not have social media or those who could not access the survey.

Future work

The next step to make this study more successful is to look at the difference in perceptions of water crises among different age groups. This will provide a better understanding on what information should be made available to different age groups. Secondly, in five years, it would be interesting to readminister the survey and see if residents' perception have changed or stayed the same.

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