Water Management in the Southwestern United States: The Case of Arizona

Amy Ramirez
Faculty Advisor: Nirmal Goswami, Professor of Political Science

TEXAS A&M UNIVERSITY KINGSVILLE®
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ABSTRACT

The objective of this study is to determine the effects of urban growth on water management in Arizona. This study is primarily based on publicly available information from the U.S Geological Survey, the Arizona Department of Water Resources, and the U.S Census Bureau. Using a mixed methods approach, the two variables - urban growth, and water management - were analyzed to determine if there was a relationship between the two variables and policies that have been implemented. Using a qualitative approach, the assessment of secondary sources and regional journalist reportage were used to create a timeline of water management issues and the policies that were implemented. A quantitative method was used to determine the relationship between urban growth and water use through statistical analysis. First, population trends were examined to determine the growth rate. Next, decennial water usage data was compared to determine if there was a significant change is how water was being used. Lastly, the two variables were analyzed to determine if there was a relationship between the changes in urban growth and the changes in water use. The expected results of this study are to find a relationship between the increase in urban growth and the decrease in water levels. The goal of this study is to advise policy makers when making decisions that would benefit the population of the region that is being affected by poor water management and those that might face the same problem in the future.

INTRODUCTION

- This study is attempting to discover the effects of urban growth on water use in Arizona.
- Water policy and water management cannot improve for the benefit of the public without all the information. The purpose of this analysis is to discover when water management issues started and how they were resolved. As well as to determine what the rate of urban growth is in Arizona and its impact on the water usage and to learn if the growth rate continues with increased water usage, when will it become unsustainable.
- The research questions are
  - (i) When did Arizona start to experience water management issues and how were they resolved?
  - (ii) What is the rate of urban growth and its impact on water usage?
  - (iii) If the growth rate continues with increased water usage, when does it become unsustainable?

METHODS

- A mixed methods approach was used to determine the rate of growth and its consequences on water usage. Using a quantitative method, data was collected using interactive maps and data collections for the two variables, water usage and population.
- Information was gathered for decennial water usage data from 1990 to 2020 for the state of Arizona. The water levels were used to determine where the water was being used the most.

Methods cont.

- The decennial urban growth data was collected through the U.S Census Bureau from 1990 to 2020 and was used to determine the change in population growth.
- A qualitative approach was used to examine secondary sources to determine the timeline in which water management issues began and which policies were implemented because of it.

RESULTS

Population Growth Rate

Although the population did increase, the growth rate did not follow the same pattern. The year 1980 was used as a base to calculate the growth rate for 1990. The growth rate is important to track the changes in demographics in Arizona. The data gathered was from the United States Census Bureau. Below is the formula used to calculate the growth rate, where the variables PY is the population in a given year.

$$\frac{PY_2 - PY_1}{PY_1} \times 100$$

The growth rates from 1990 to 2020 are shown below in Figure 1.

Figure 1

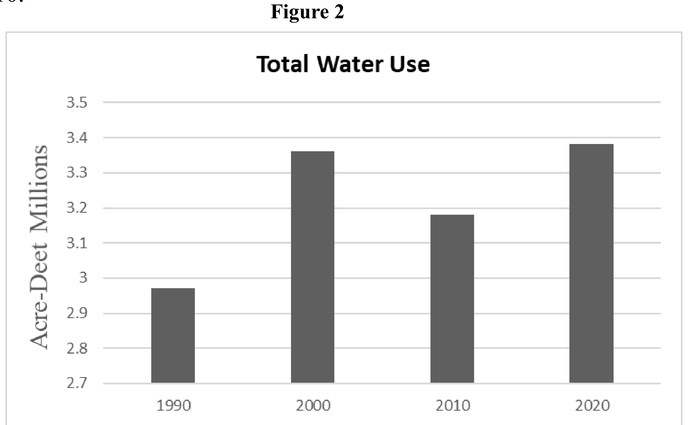
Year	Population	Growth Rate
1980	2718215	
1990	3665228	35%
2000	5130632	40.00%
2010	6392017	24.60%
2020	7151502	11.90%

United States Census Bureau, 2021

Water Use

One major challenge most cities, states, and countries face are how to properly manage their water. The data collected for water use was done from the year 1990 to 2020 in decennial time periods through the Arizona Department of Water Resources (ADWR). Below is the total water use from 1990 to 2020. There was an increase in water use in 2000 and then a significant decrease in 2010.

Figure 2



Arizona Department of Water Resources, 2021

DISCUSSION

- There are three sectors that use the majority of Arizona's water. Industrial, Agricultural, and Municipal.
- The Agricultural sector has used 70% of the states total water, while the Municipal sector accounts for 20% of the states total water use. While the remaining 10% is used for the Industrial Sector
- With the population continuing to grow, the municipal sector will use more water and cause issues for the Agricultural sector.
- In 2014, ADWR published "Arizona's Next Century: A Strategic Vision for Water Supply Sustainability," where they detailed how the state is planning on handling the arising issues on water sustainability. This details management plans the state has on facing water unsustainability (ADWR).
- Based on past projections and articles that have been previously mentioned, Arizona is unlikely to be able to sustain current population growth trends

CONCLUSIONS

- The research provided additional evidence for a relationship between population growth and water use that had already been established through previous research. Although the population is continuing to increase, it is not increasing at the same rate that as it was in the past, with it decreasing after the year 2010.

- With the population increasing, water that is being used in the municipal sector has increased, while the agricultural sector decreased. This can lead to challenges for the agriculture sector because water that was once used for agriculture purposes is now being reallocated to the municipal sector. With Arizona being in the Southwestern part of the country, drought is very common and has continued to be a leading factor in water unsustainability.

- Although Arizona has been implementing new water policies, they are still facing water supply issues and will continue to have these problems. Water sustainability is the main goal when policies regarding water management are being applied. Without the proper water management, regions in Arizona will continue to face water insecurity in the future, and eventually become unsustainable for the increasing population.

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