

# Shifts in Water Usage In the Colorado River Watershed

## Introduction

The Colorado River supplies water to over 40 million people in the US. Of these, only 12.6 million people live in the river's watershed while the others benefit from water pumped out of the watershed through aqueducts. The water has many uses ranging from public supply, to agriculture, to mining. Countless regulations dictate who gets access to each ounce of the water, contributing to making it the most over allocated river in the world.

As the river's resources continue to be depleted and the land use in the watershed continues to change, the distribution and water usage changes as well. Understanding where and how water is being used is important in planning for the future of water security in the area. This projects aims to examine how water usage in the basin changed between 2000 and 2010 in relation to changes in population.



Figure 1. The Colorado River in Grand Canyon National Park

Source: <https://www.nps.gov/media/photo/gallery.htm?tagid=0&id=F77B17BF-155D-451F-678AFC210F0CA27&maxrows=20&startrow=21>

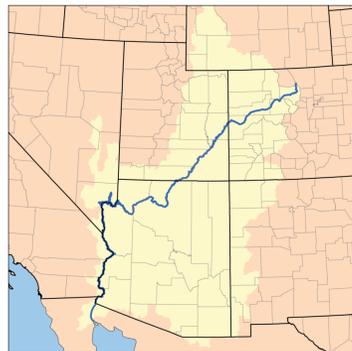


Figure 2. The Colorado River Watershed  
Source: Watershed: [https://commons.wikimedia.org/wiki/File:Colorado\\_watershed.png](https://commons.wikimedia.org/wiki/File:Colorado_watershed.png)

## Methodology

Water use data has been aggregated by the U.S. Geological Survey (USGS) for all counties in the US since 1950. The 2000 and 2010 data were selected to look at changes in the watershed with changes in population in recent years. Shapefiles on county boundaries were downloaded from the US Census and were joined with water use data by attribute. Watershed data information was downloaded from the USGS Watershed Boundary Dataset, selecting only the desired regions, HUC-14 and HUC-15. The counties in the Colorado River Watershed were selected using an intersect of the county data with the watershed boundary layer. All analysis was done only on these counties. Statistics on changes in water use categories were calculated by joining the 2000 and 2010 data by attribute. New fields were created representing calculations of changes in categories from 2000 to 2010. Data layers were symbolized by changes in water use and population. These were included in the final maps along with layers of the Colorado River and major cities in the region.

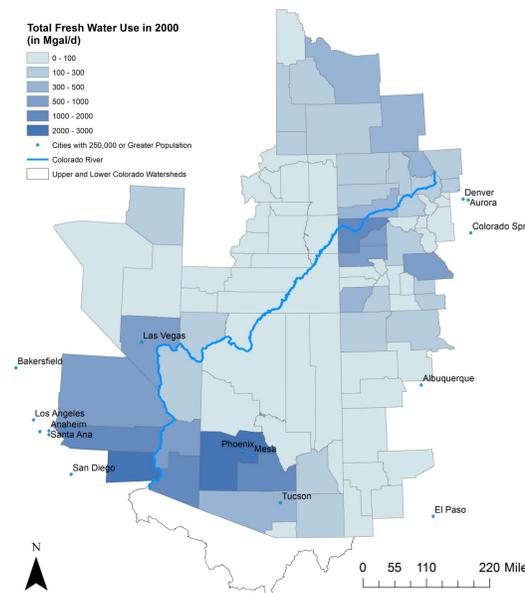
## Results

Water usage in 2000 and 2010 was concentrated in the Lower Colorado River Basin. In these counties, large cities such as Las Vegas, Phoenix, Mesa, and Tucson can be found. Despite the large populations, the largest water use category was often irrigation. In the counties with the 3 highest water use levels in 2000, all of which were in the top 5 counties in 2010, irrigation was the largest use of water followed by public supply. From 2000 to 2010 the share of water devoted to irrigation in these counties decreased, with more water being used for public supply. One possible explanation of this is a change in population. In Maricopa and Riverside counties, where the percent of public supply water significantly increased, there

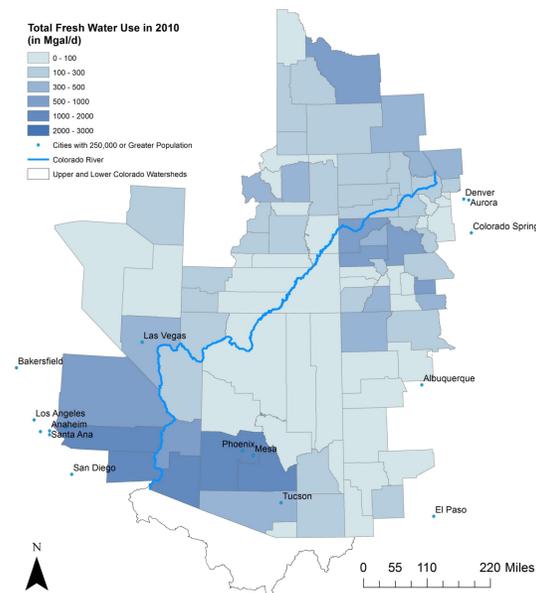
were also large increases in population with at least 326 thousand more residents in 2010 than in 2000.

Although this holds true for these particular counties of interest, it does not hold true across all counties when comparing the maps for changes in population with changes in public supply water use. Around Las Vegas, despite the large increase in population, the amount of public supply water significantly decreased. In the high water use counties in southern California and Arizona, fresh water use had a significant decrease over the 10 year period. Despite this, they remained the counties with the highest fresh water use.

## Fresh Water Use 2000



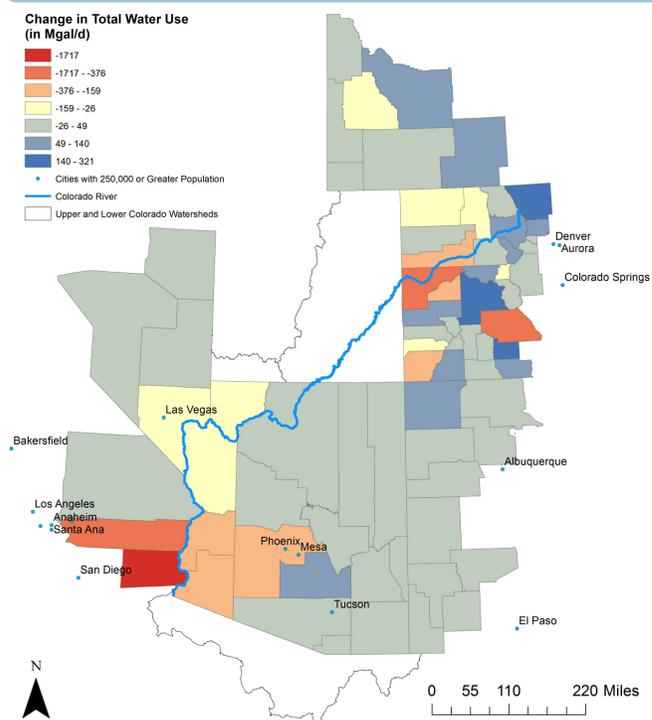
## Fresh Water Use 2010



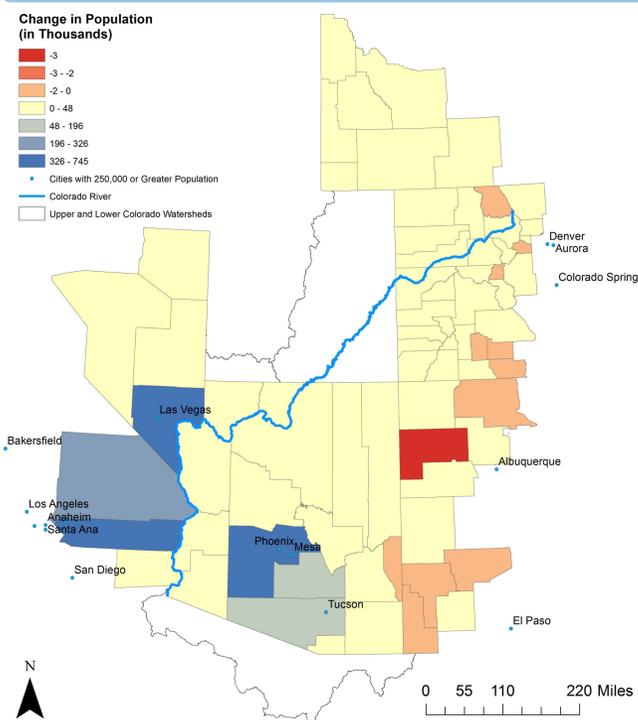
## Limitations

Explanations for shifts in water use cannot be addressed by one factor alone. Looking at population offers one analysis, but does not give the whole story of the watershed. Despite the river decreasing in available resources, there was also no significant changes or patterns in the ratio of surface water to ground water used in the watershed. Since the river is so highly regulated and the watershed covers many diverse types of land area, many more factors for changes in water use must be explored. Further work needs to be done on the impact and success of the regulations on the river.

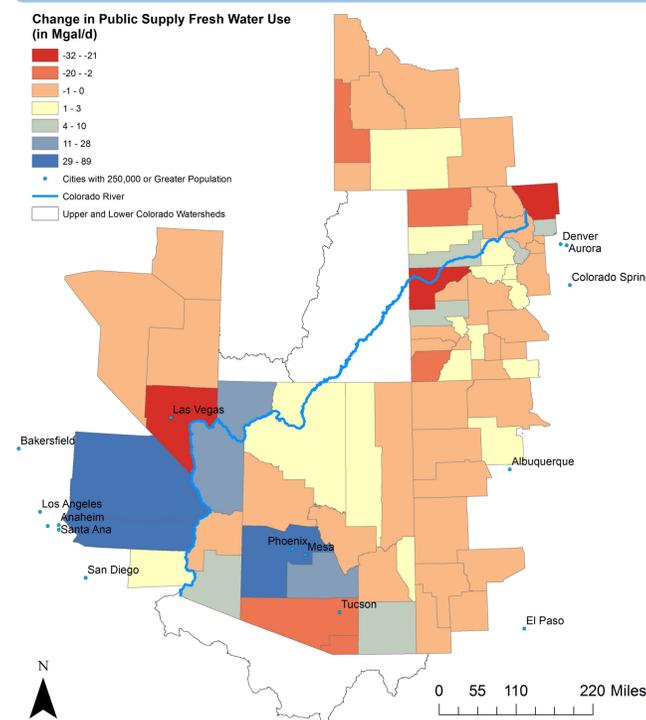
## Change in Fresh Water Use



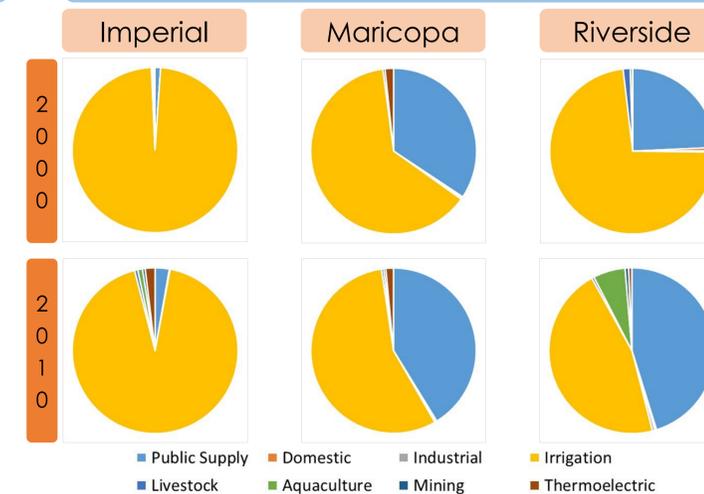
## Change in Population



## Change in Public Supply Water Use



## Categories of Water Use



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GIS 101, Fall 2017

Projection: NAD 1983 UTM Zone 12N

Data Sources: USGS, US Census Bureau, ArcGIS Online

