

The Colorado River: An Analysis of Human and Natural Effects on Water Levels ...

Project Information

Project Team (Group 3)

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Project Scope:

- As a group we have decided to gather data to perform an analysis on population growth and drought and how they affect the Colorado River Basin water levels.

Attributes Analyzed:

- County Populations
- Reservoir Water Elevation
- Drought Severity Coverage Index (DSCI)

Questions

What attributes have had the most impact on the Colorado River Basin water levels shrinking so rapidly in the past decades?

- Has the population growth of the counties in the Colorado Basin region affected the water levels the most?
- Has the prolonged drought affected the water levels the most?

How will we attack this problem?

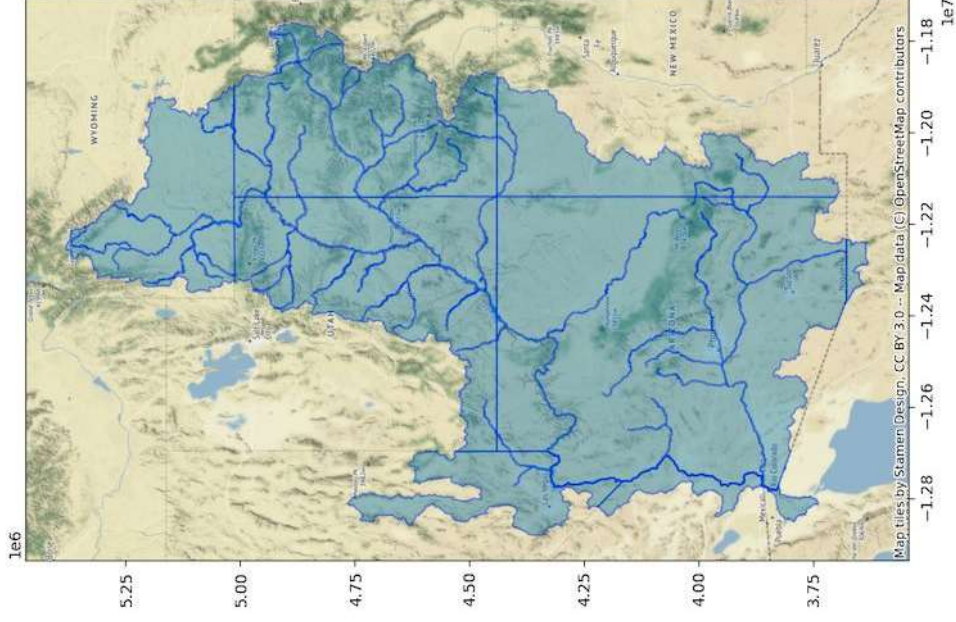
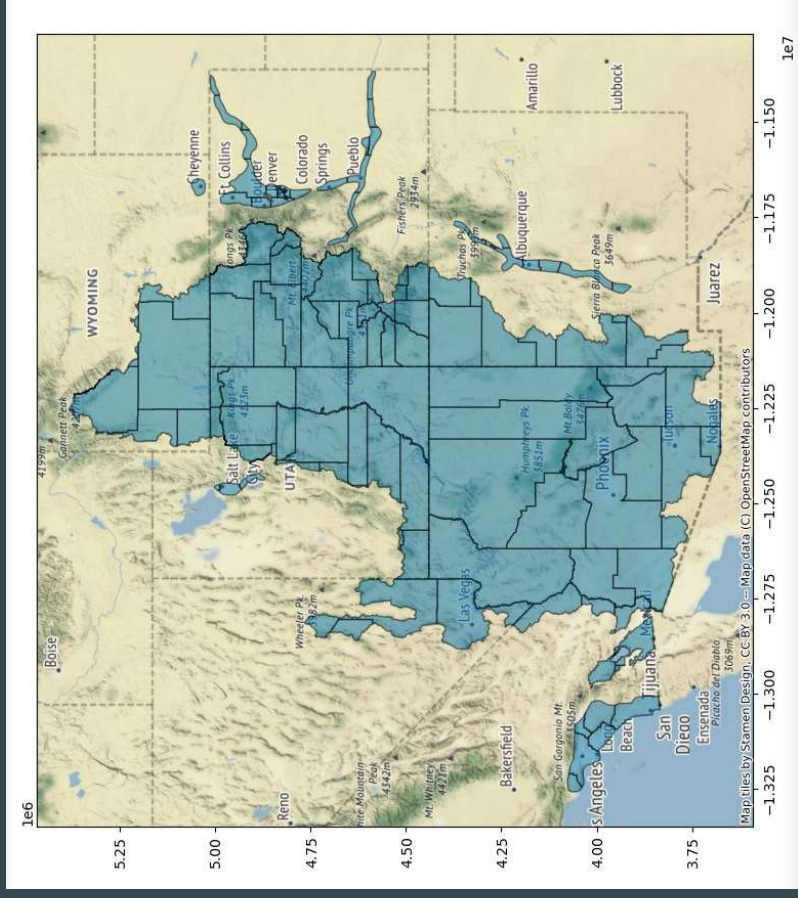
- Graphically, we will represent our data in line and bar plots to show our changes over time, as well as using linear correlations to find which attribute has the most impact on the basin water levels.

Null Hypothesis & Hypothesis

Null Hypothesis: Prolonged drought and population growth over time have had no effect on the decrease in water level in the Colorado River Basin

Alternative Hypothesis: Prolonged drought and population growth over time have caused the decrease in water level in the Colorado River Basin

Project Data Locations



Project Data Sources

Data Commons: Population data of relevant counties, per year.
<https://datacommons.org/>

Colorado River Basin GIS Open Data Portal: Shape files to create map figure.
<https://coloradoriverbasin-lincolninstitute.hub.arcgis.com/>

Bureau of Reclamation: Historic water levels of major reservoirs.
<https://coloradoriverbasin-lincolninstitute.hub.arcgis.com/>

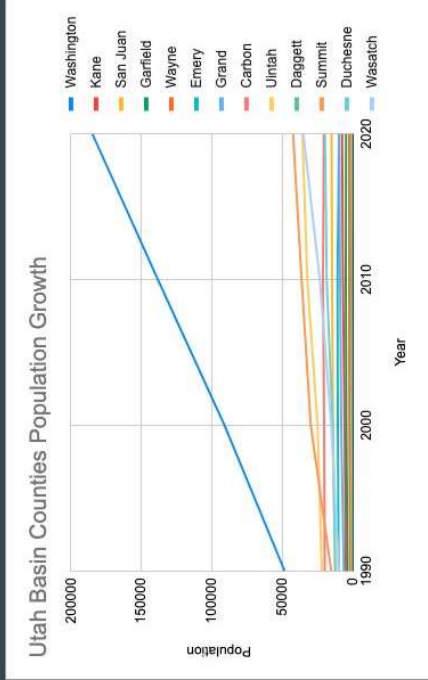
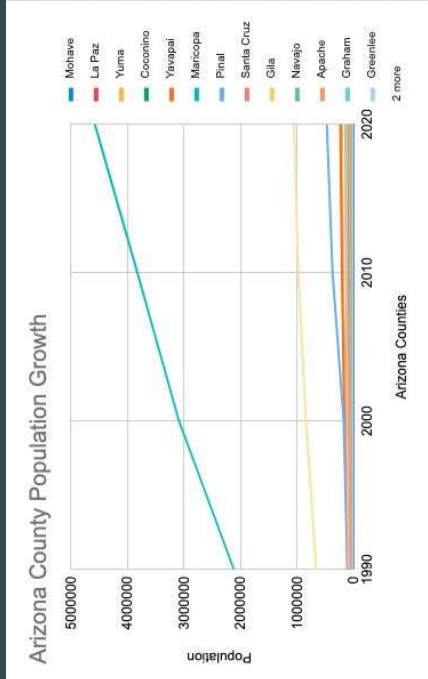
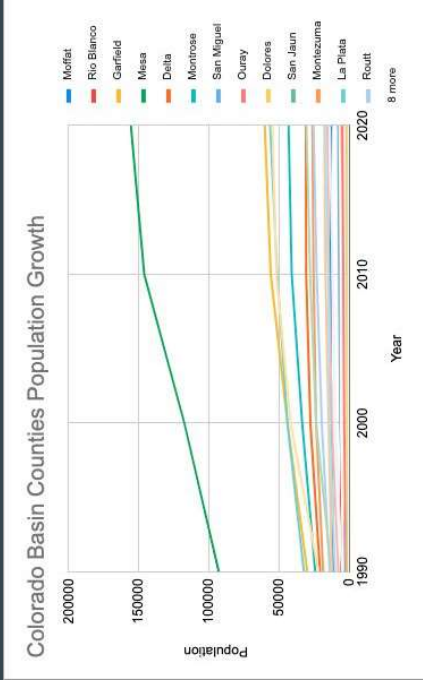
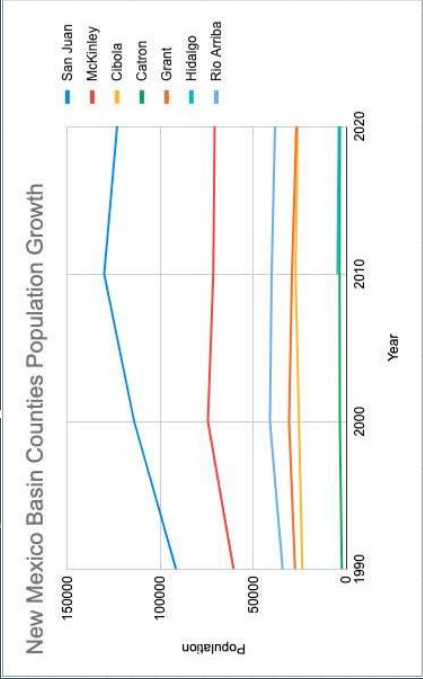
U.S. Drought Monitor: Historic drought data.
<https://droughtmonitor.unl.edu/>

Data Cleanup

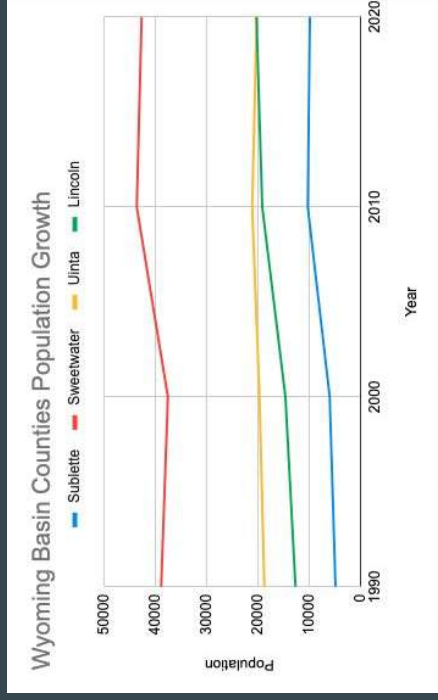
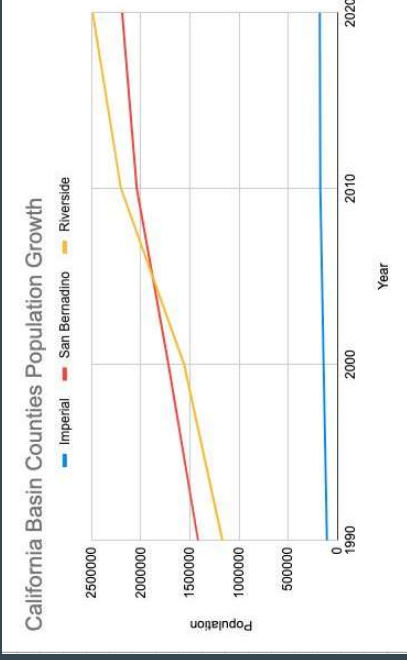
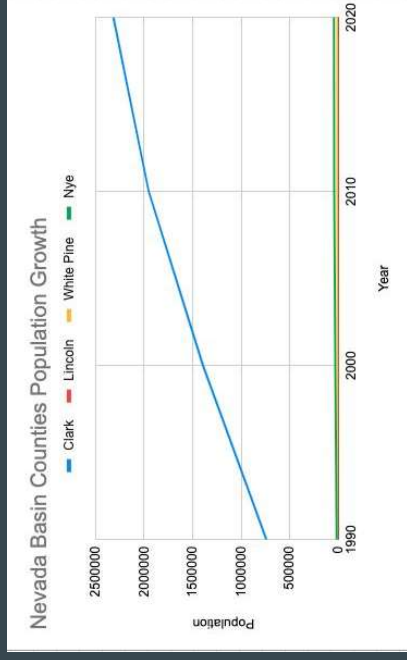
- Drought level data needed to be adjusted from weekly observations to yearly.
- Reservoir water level data needed to be adjusted from monthly observations into yearly.
- Needed to create own data sets for population growth over time.

Visuals

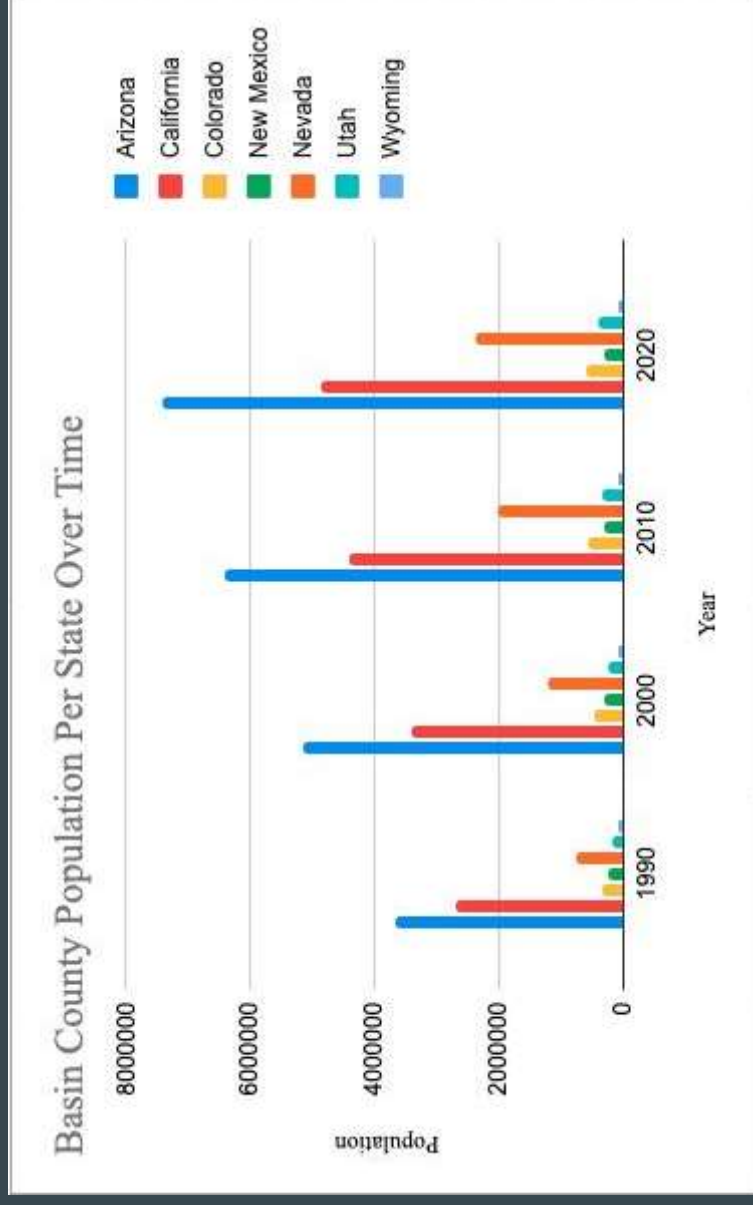
Basin County Population Per State



Basin County Population Per State pt.2

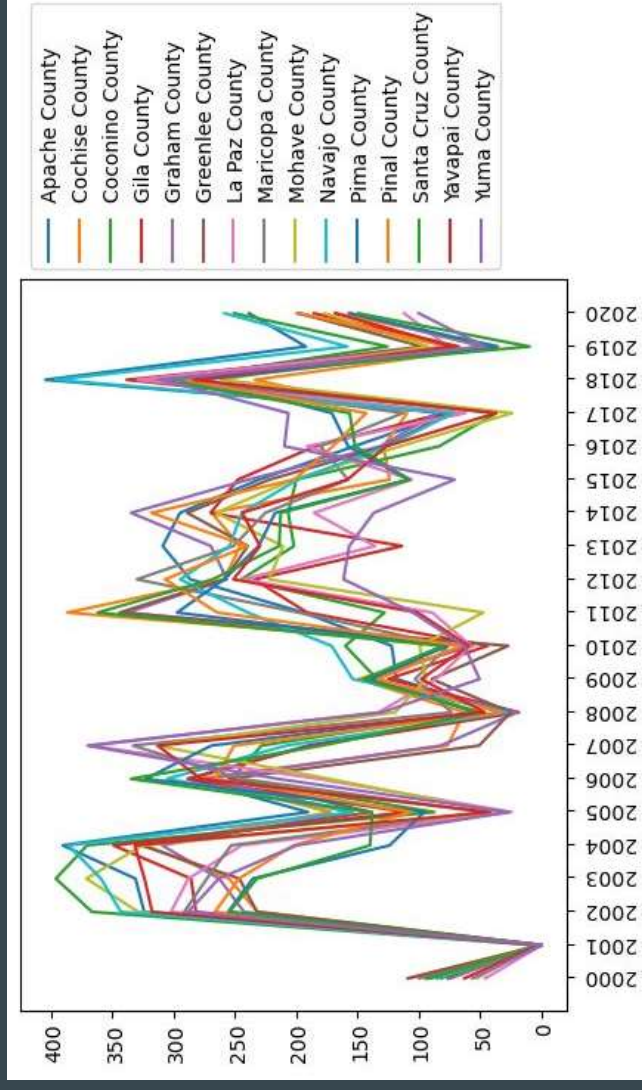


Basin Population Per State

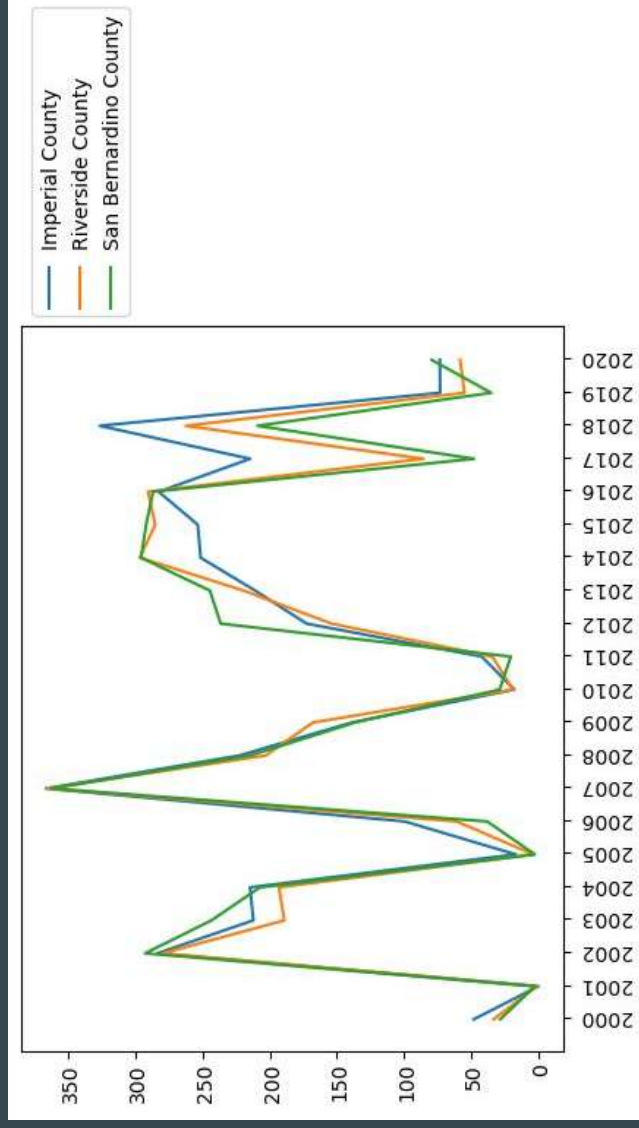
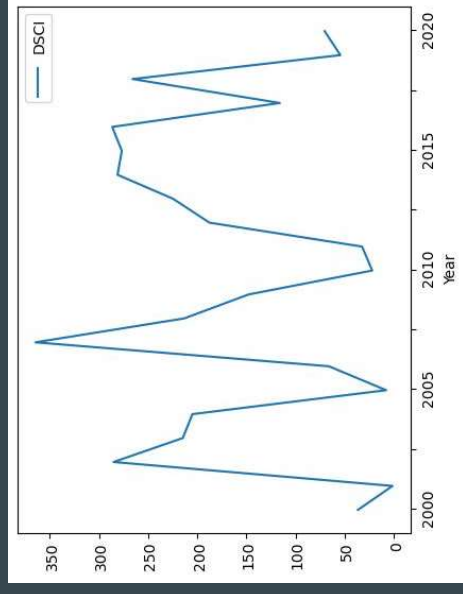


The graph displays the DSCI over a 20-year period. The index starts at approximately 100 in 2000, rises to a peak of about 280 in 2008, and then experiences a sharp decline to around 100 in 2014. It remains relatively stable between 100 and 150 until 2020.

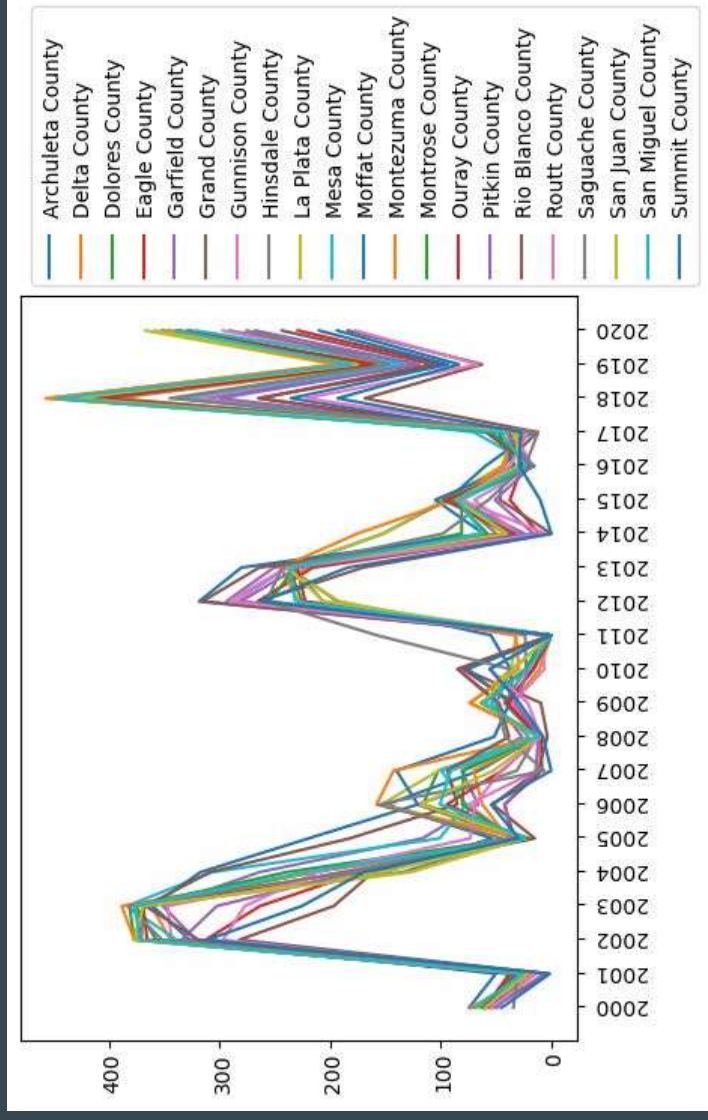
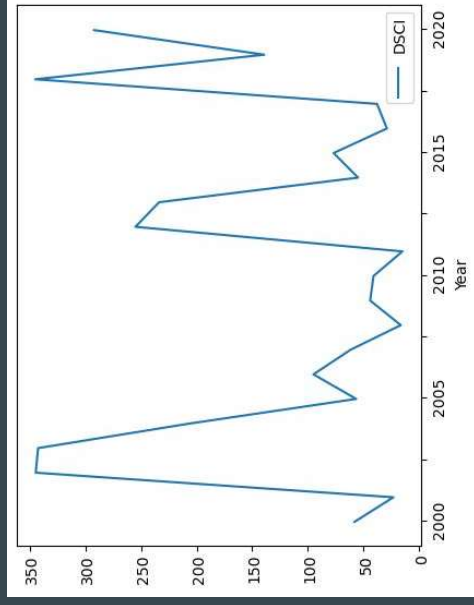
Year	DSCI (approx.)
2000	100
2001	120
2002	150
2003	180
2004	220
2005	250
2006	280
2007	250
2008	280
2009	250
2010	220
2011	200
2012	180
2013	150
2014	100
2015	120
2016	150
2017	180
2018	150
2019	120
2020	100



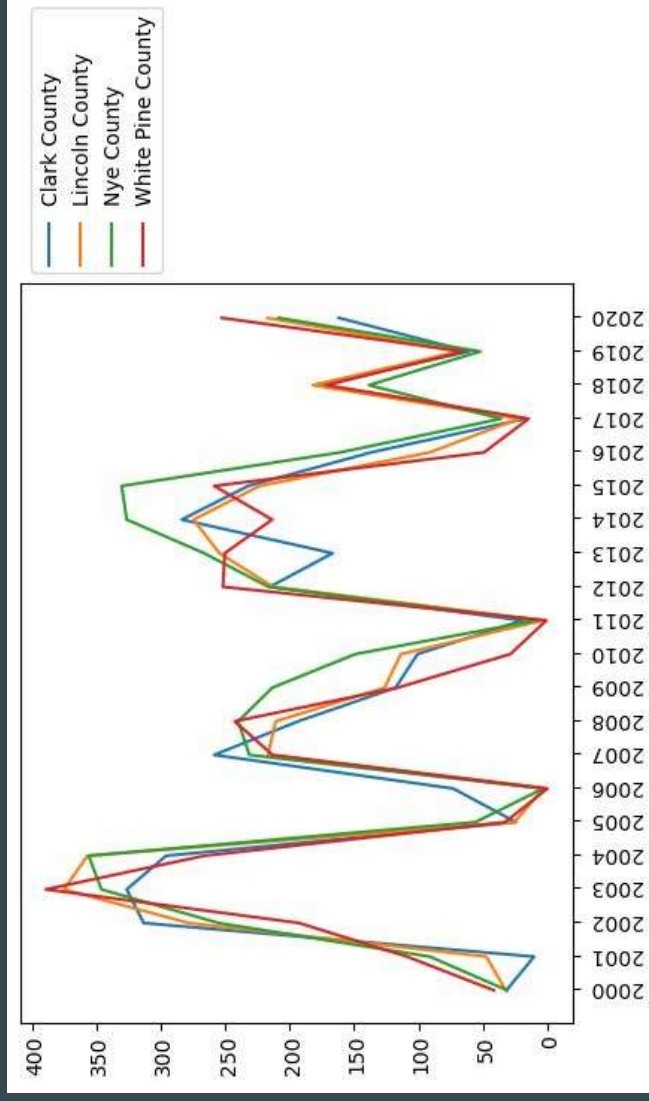
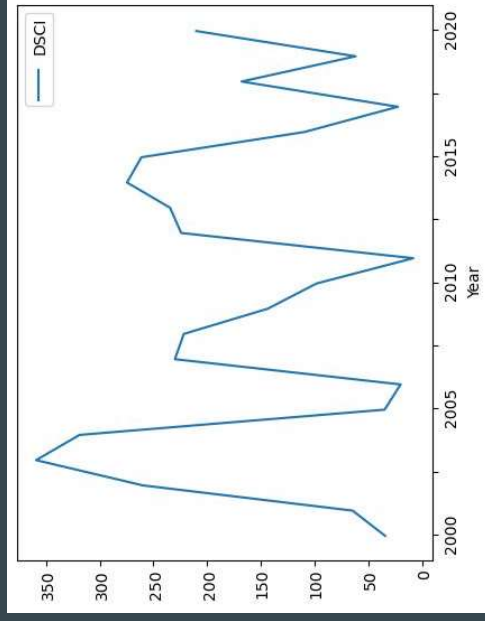
California Counties DSCI Levels



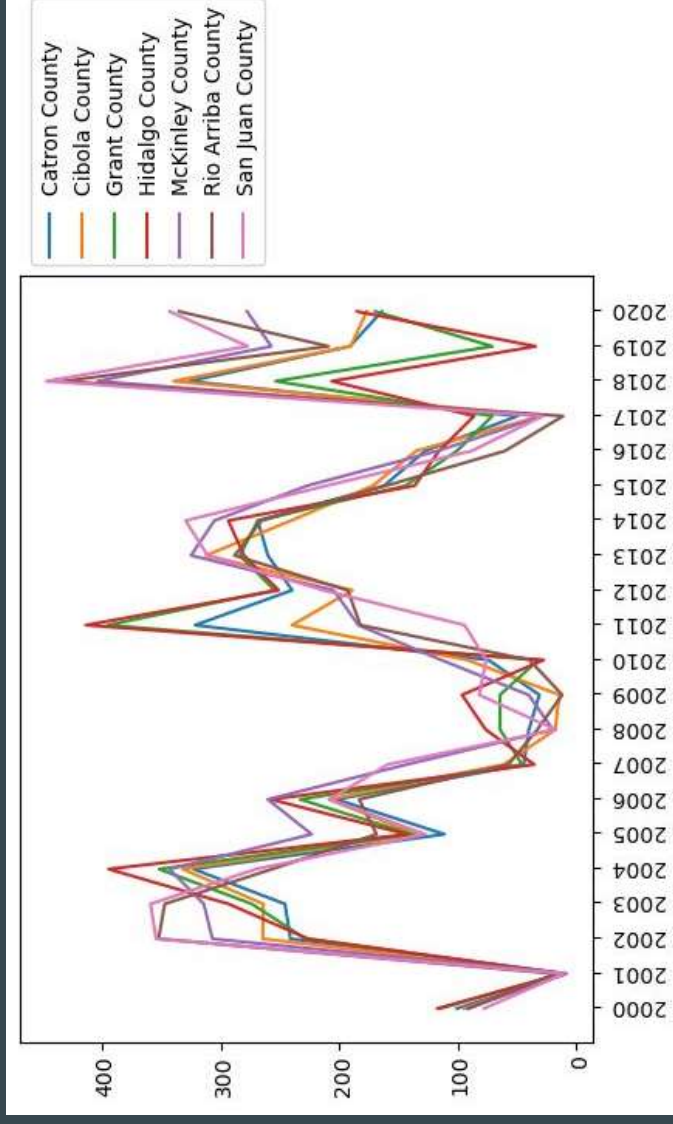
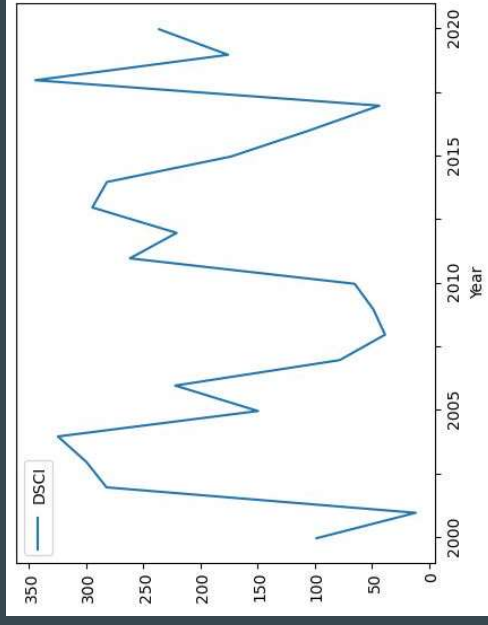
Colorado Counties DSCI Levels



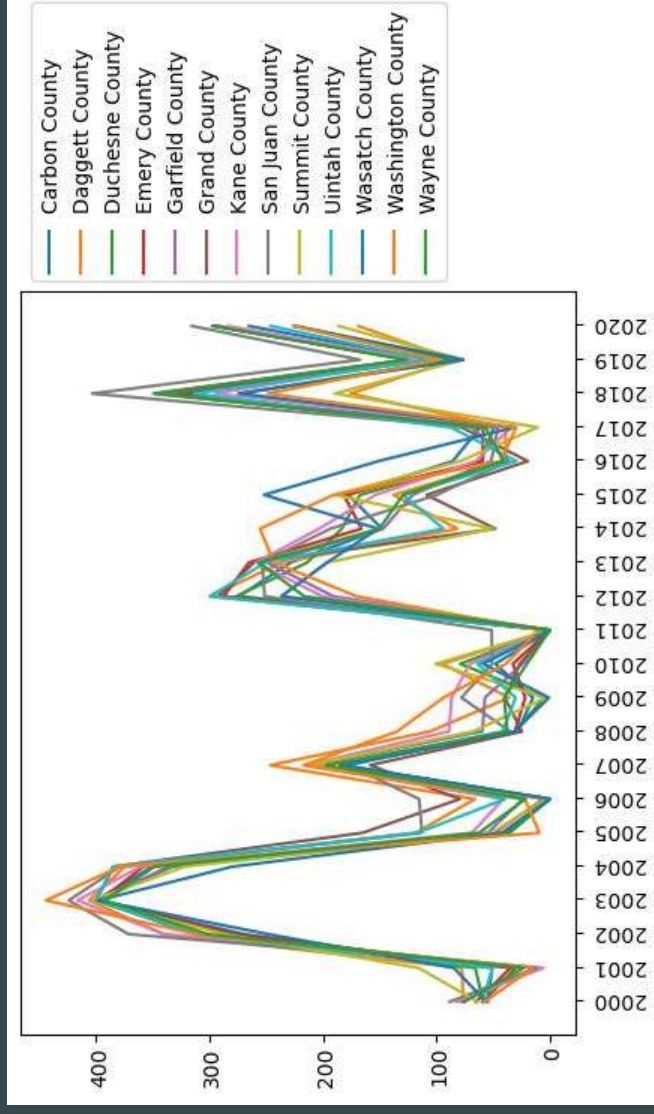
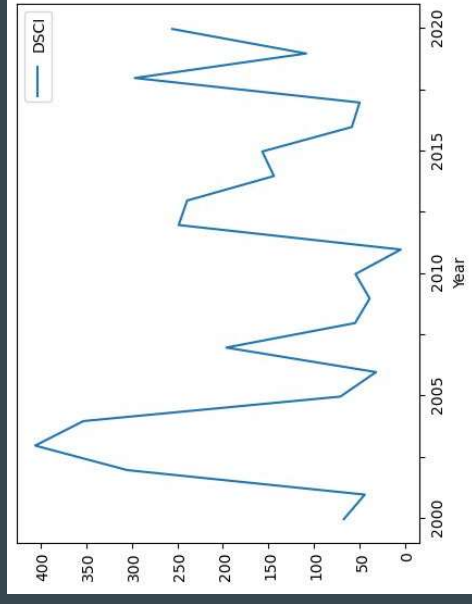
Nevada Counties DSCI Levels



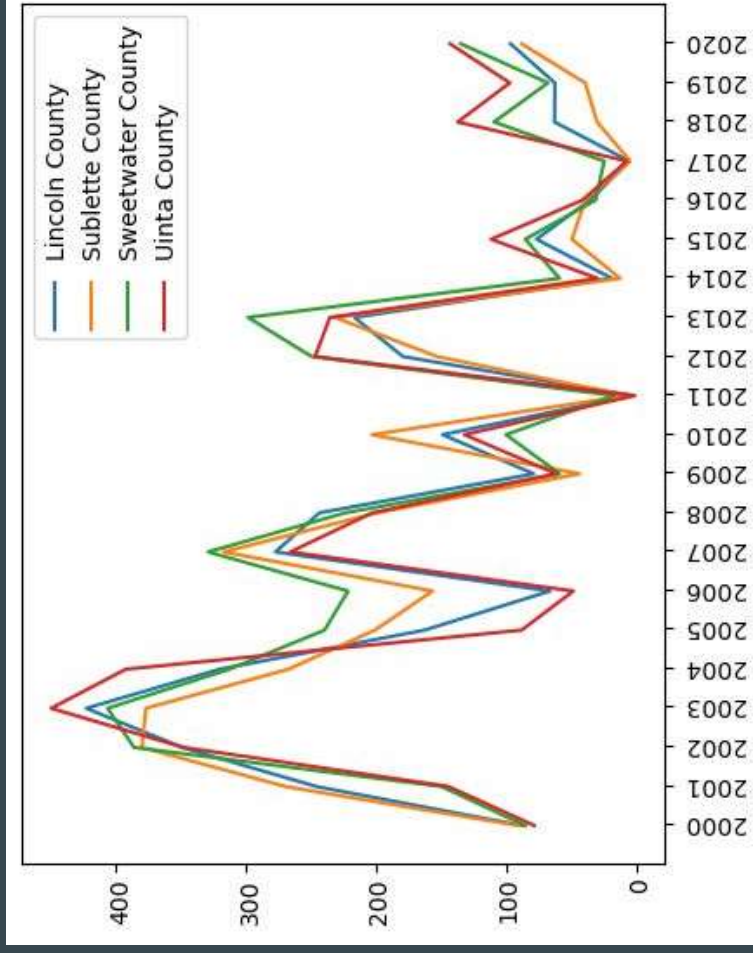
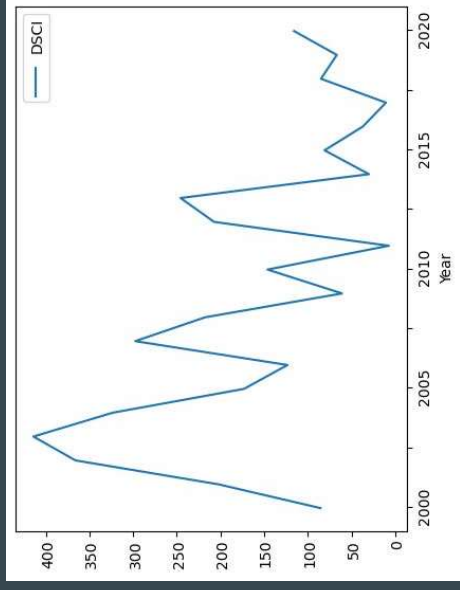
New Mexico Counties DSCI Levels



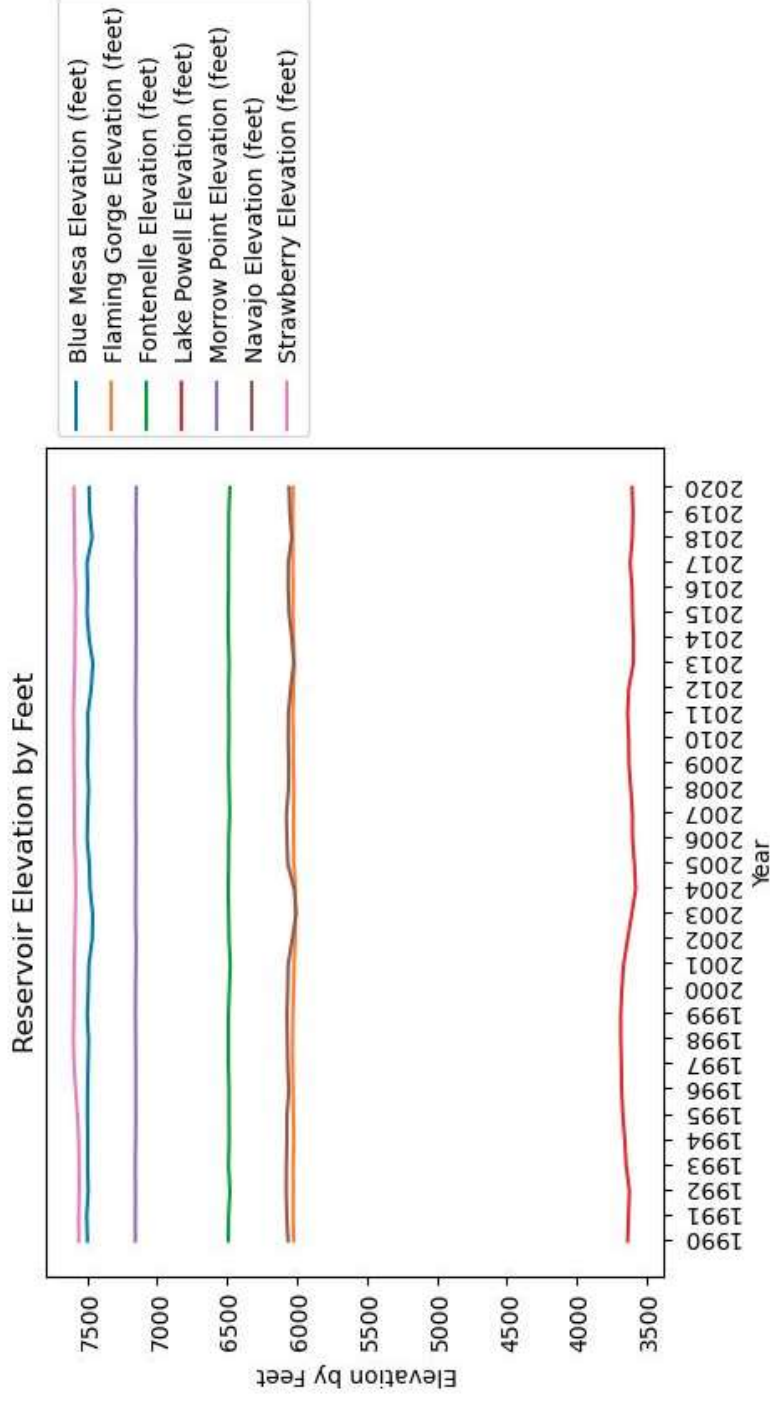
Utah Counties DSCI Levels



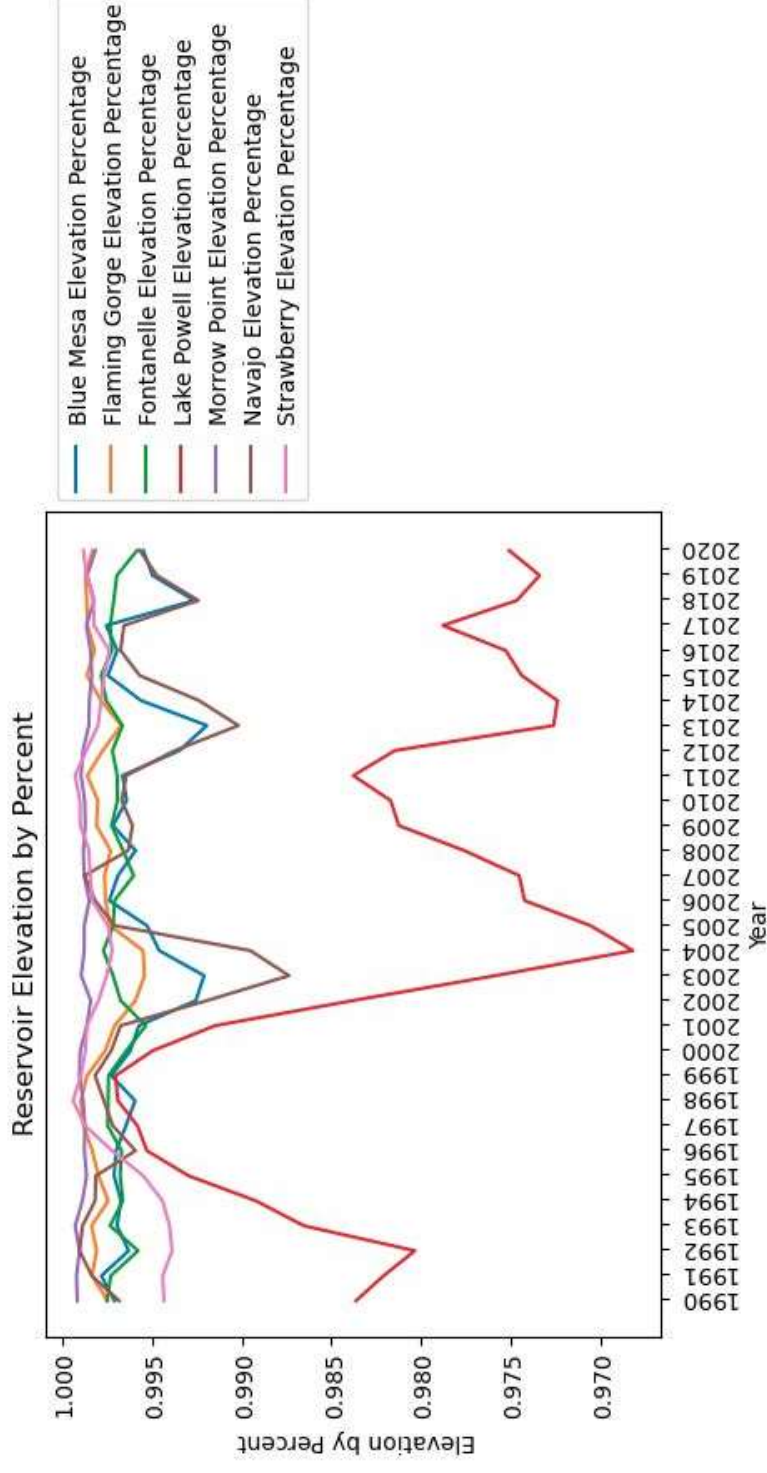
Wyoming Counties DSCI Levels



Reservoir Elevation

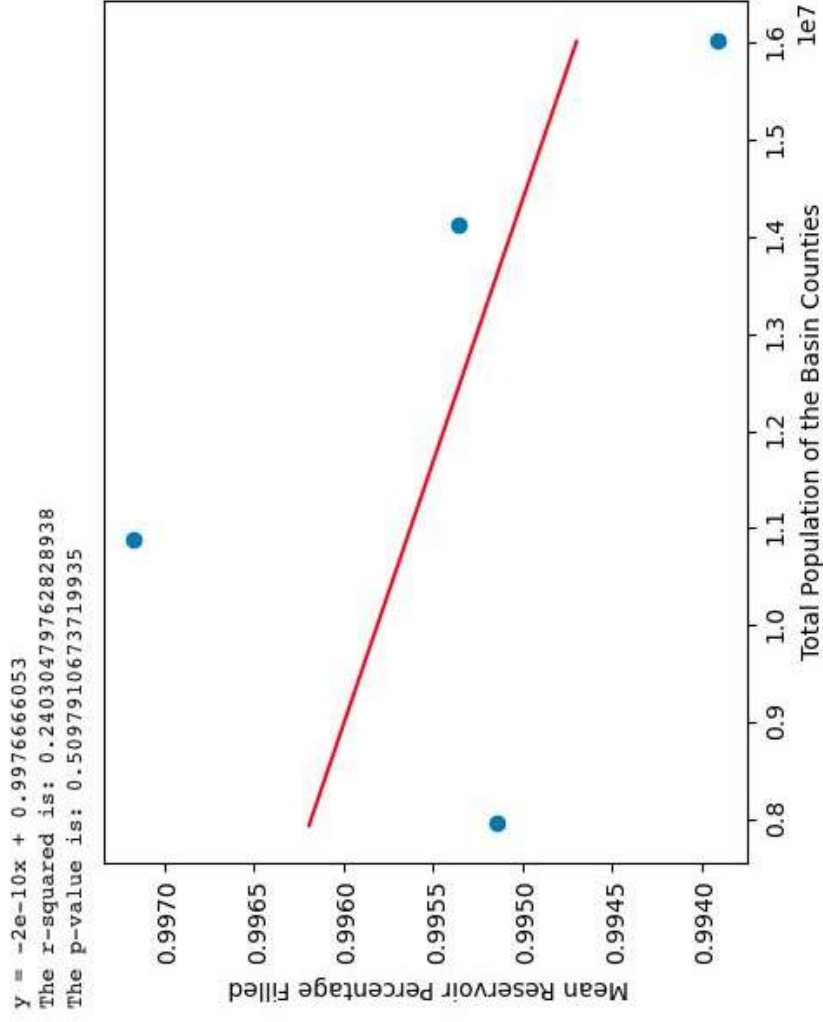


Reservoir Elevation

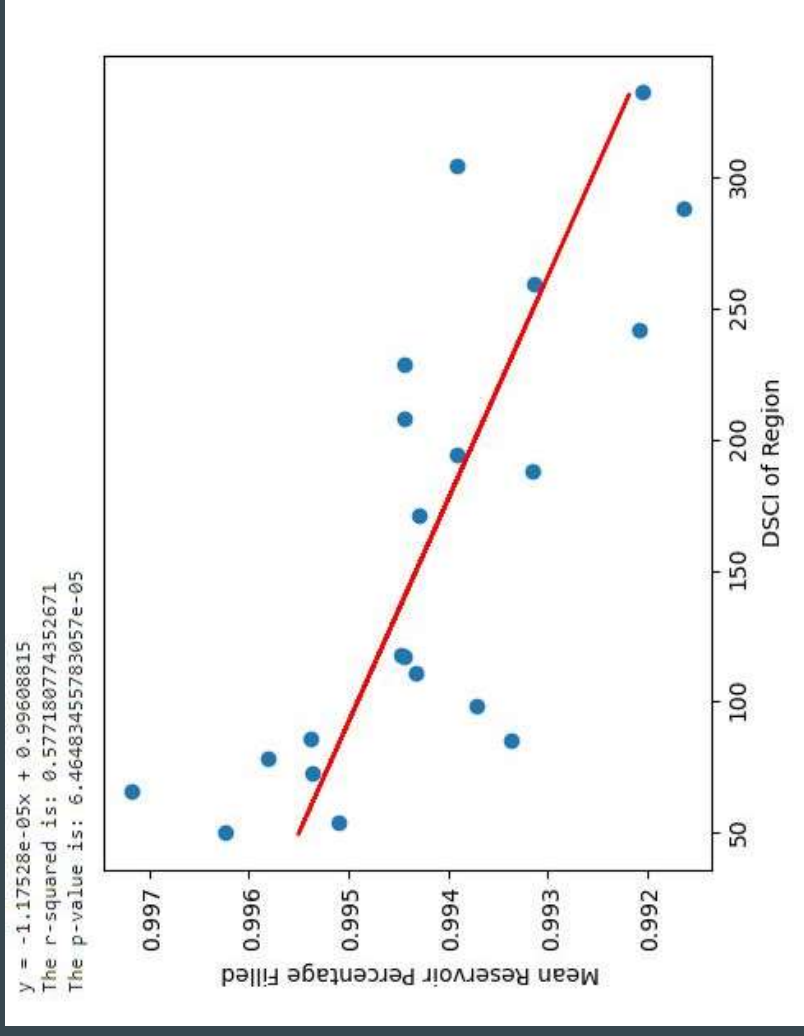


Correlations

Population and Reservoir Levels



DSCI vs. Reservoir Level



Conclusions

In relation to drought effects on the Colorado River Basin's water levels we have disproved our null hypothesis. In the past decades there is correlation between drought and the shrinkage of the Basin's major reservoirs.

In terms of population growth effects, due to the lack of data we cannot confidently disprove our null hypothesis.

Limitations and Considerations

- Some counties have more than one water source.
- Not all Basin counties were observed, just those who were more than 50% covered by the Basin.
- Lack of water volume data for reservoirs.
- There is lack of organized population data, creating our own data sets with the amount of time we had, ultimately meant less data to compare to reservoirs water levels.

Continued Analysis

The Colorado River, it's Upper and Lower Basins provide water for 5.5 million acres of irrigated farmland, flows through 11 National Parks and annually generates \$1.4 trillion in economic value.

Interesting analysis could continue with extra effort and time:

- Which agricultural sectors draw the most water from the basin?
- How much of the country relies on these agricultural sectors?
- Hundreds of species live in the river and in its surrounding ecosystems, how will the wildlife in these areas be affected?

Resources

- <https://gisgeography.com/>
- <https://www.drought.gov/watersheds/colorado>
- <https://coloradriverbasin-lincolninstitute.hub.arcgis.com/search?tags=boundaries%2Cwater>
- <https://labs.waterdata.usgs.gov/visualizations/OWDI-drought/en/index.html>
- <https://datacommons.org/>
- <https://coloradriverbasin-lincolninstitute.hub.arcgis.com/>
- <https://droughtmonitor.unl.edu/>
- <https://cwcb.colorado.gov/colorado-river>

Questions?