Examining Urban Outdoor Water Usage within the Colorado River Basin

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20 October 2023

Note: From *Financing the Future: How to Pay for Turf Replacement in Colorado* by Western Resource Advocates (2022)

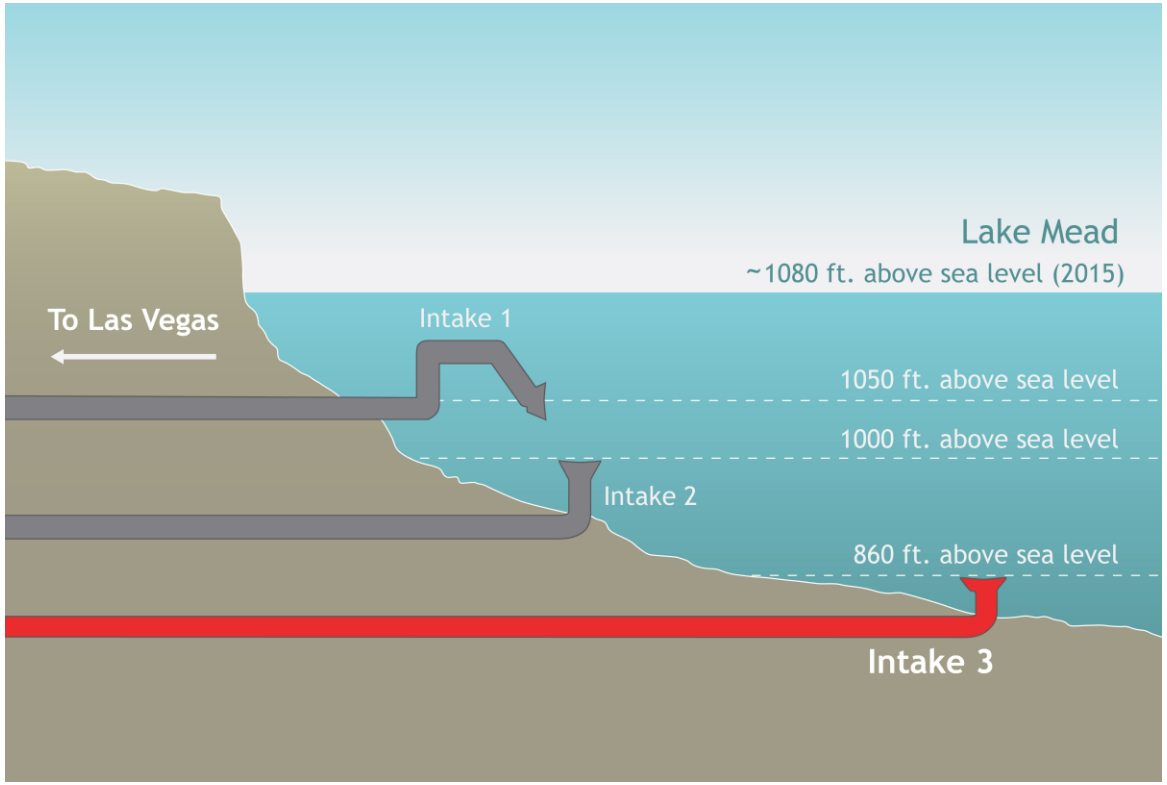
The Colorado River Basin provides over 40 million people with water for municipal use

- Outdoor water use is estimated to be over 50% of total residential use in the summer months
- The EPA estimates that the average American Family uses 100 Gallons of water per day for outdoor uses

Note: From *Colorado River Basin Water Supply and Demand Study* by US Bureau of Reclamation (2012)

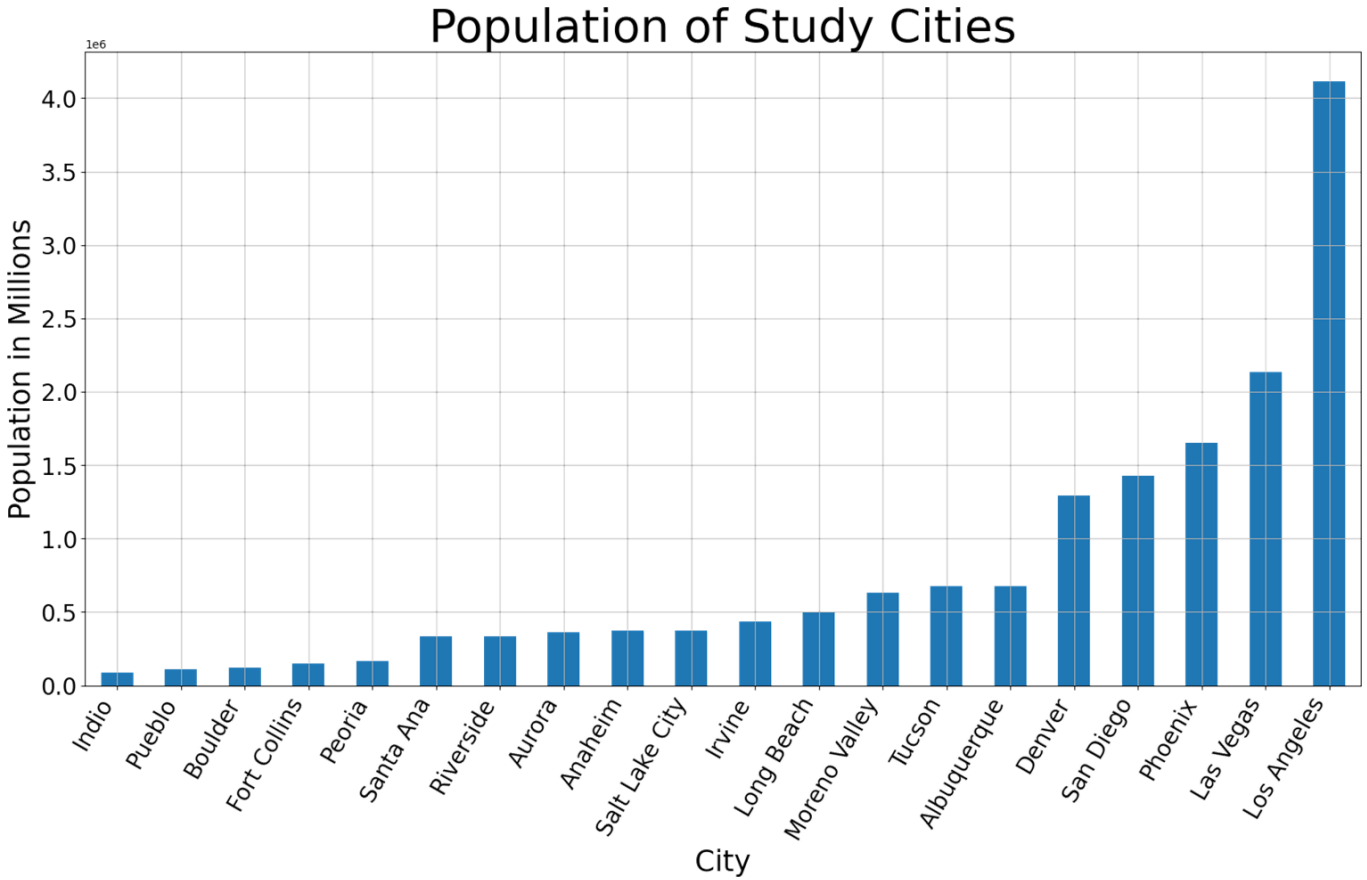
Many Cities Within the Basin are Investing in Ensuring their Supply and Reducing Usage

- Las Vegas installed a third intake valve in Lake Mead at a cost of almost a billion dollars
- Appliance retrofit, turfgrass replacement, and watering restrictions are all being implemented by cities within the Colorado River Basin



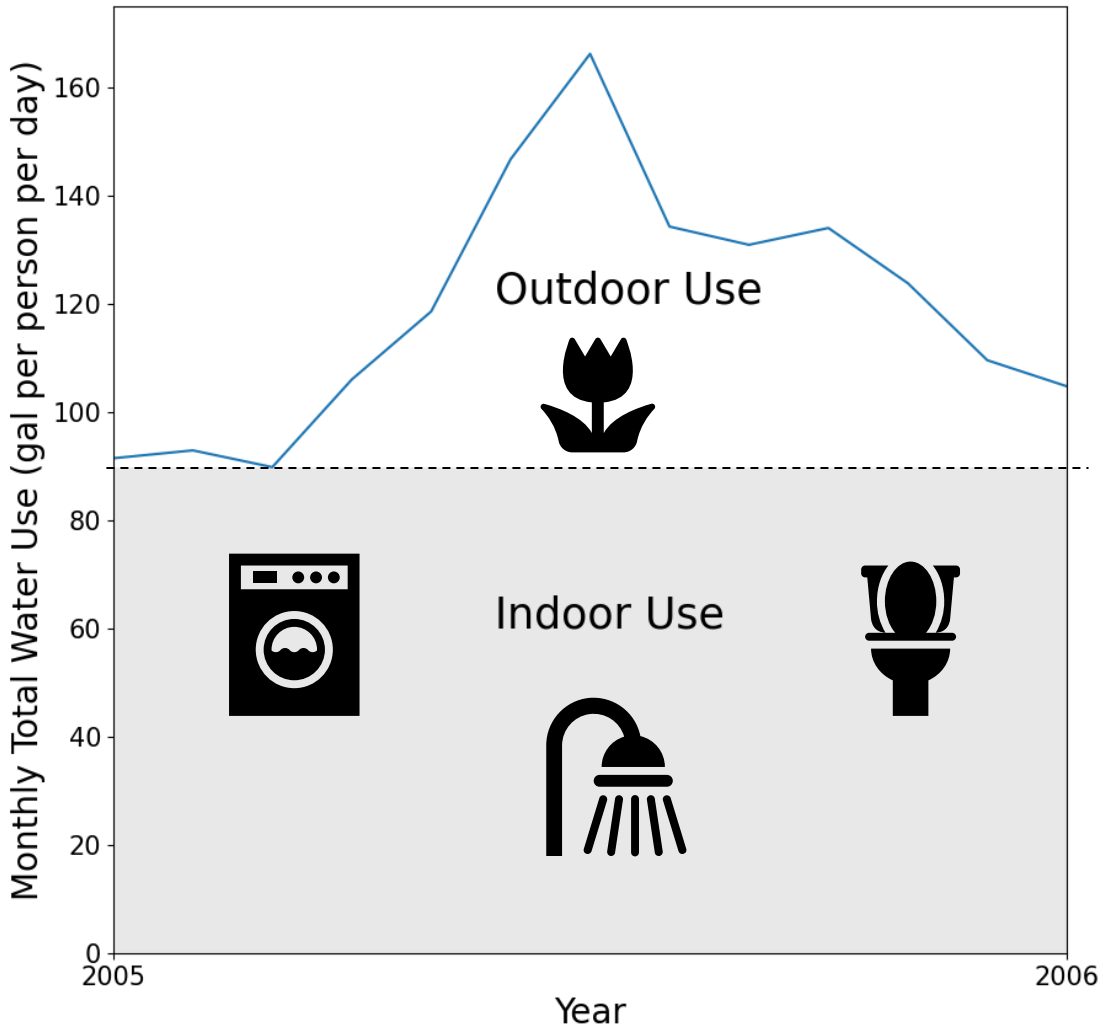
Over Thirty Cities' Water Use Data was Compiled and Analyzed

- Monthly water billing data for 36 cities was used to characterize the residential uses of water
- Seven cities (Los Angeles, Riverside, Phoenix, Denver, Las Vegas, Fort Collins, and Boulder) were chosen for this presentation



Traditional Outdoor Water Usage Estimation

- Determining that the month with the lowest water usage is the baseline of indoor water usage for the entire year
- Removing the minimum water usage from all other months to obtain outdoor usage
- Has limitations in climates with warm winters where outdoor irrigation can occur year-round



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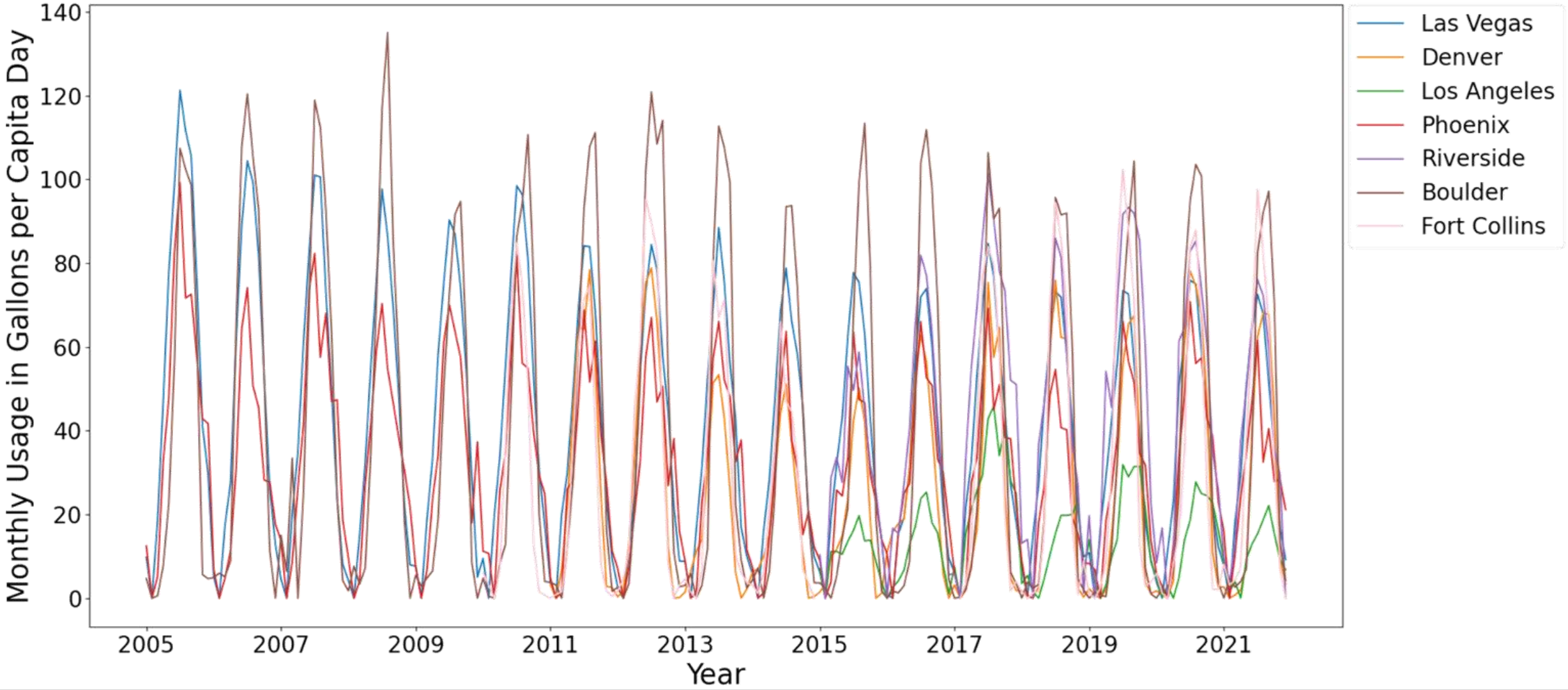

Flume Data

- Smart metering devices that track usage on a fine scale
- Uses AI and Machine Learning to determine what appliances are using water
- Outdoor/Indoor usage percentages available for Los Angeles, Phoenix, and Riverside

https://flumewater.com/product/?gad=1&gclid=Cj0KCQjw4bipBhCyARIsAFsieCy9NntIyJ1x7j1gwrfgtUfLGKCEC4-nP7Atm2K4UfELkDWr6oDAG50aAjQoEALw_wcB

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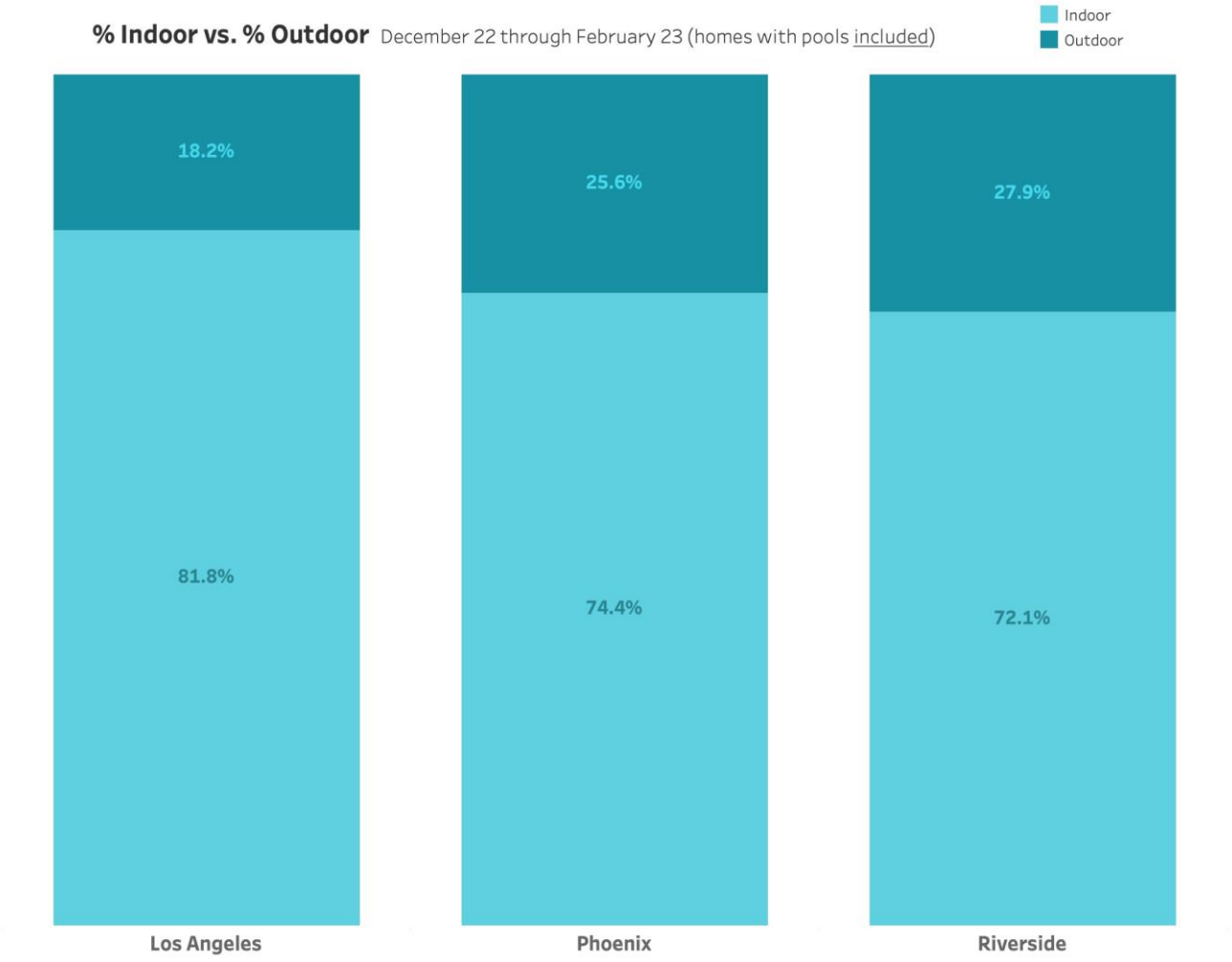
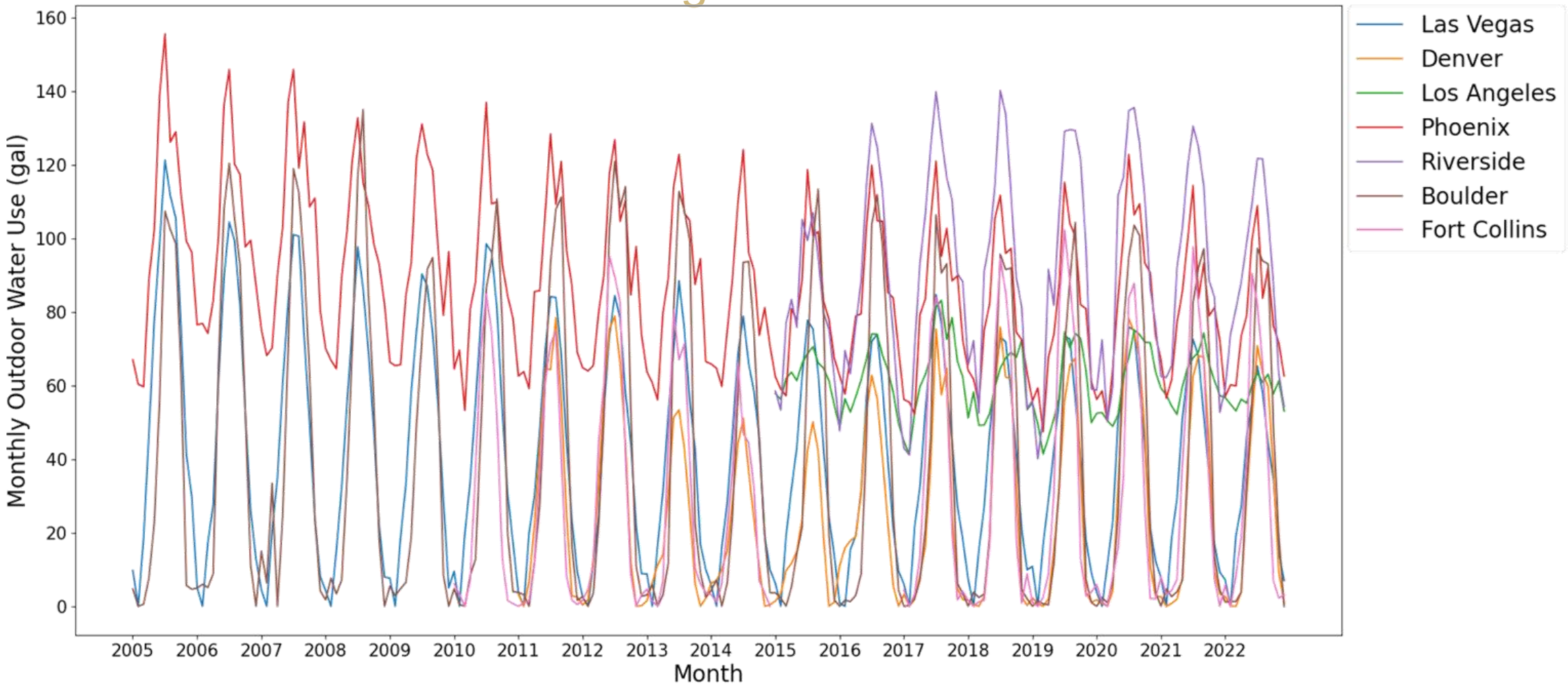


Cities in Warmer Climates saw a Large Increase in Predicted Residential Outdoor Water Usage



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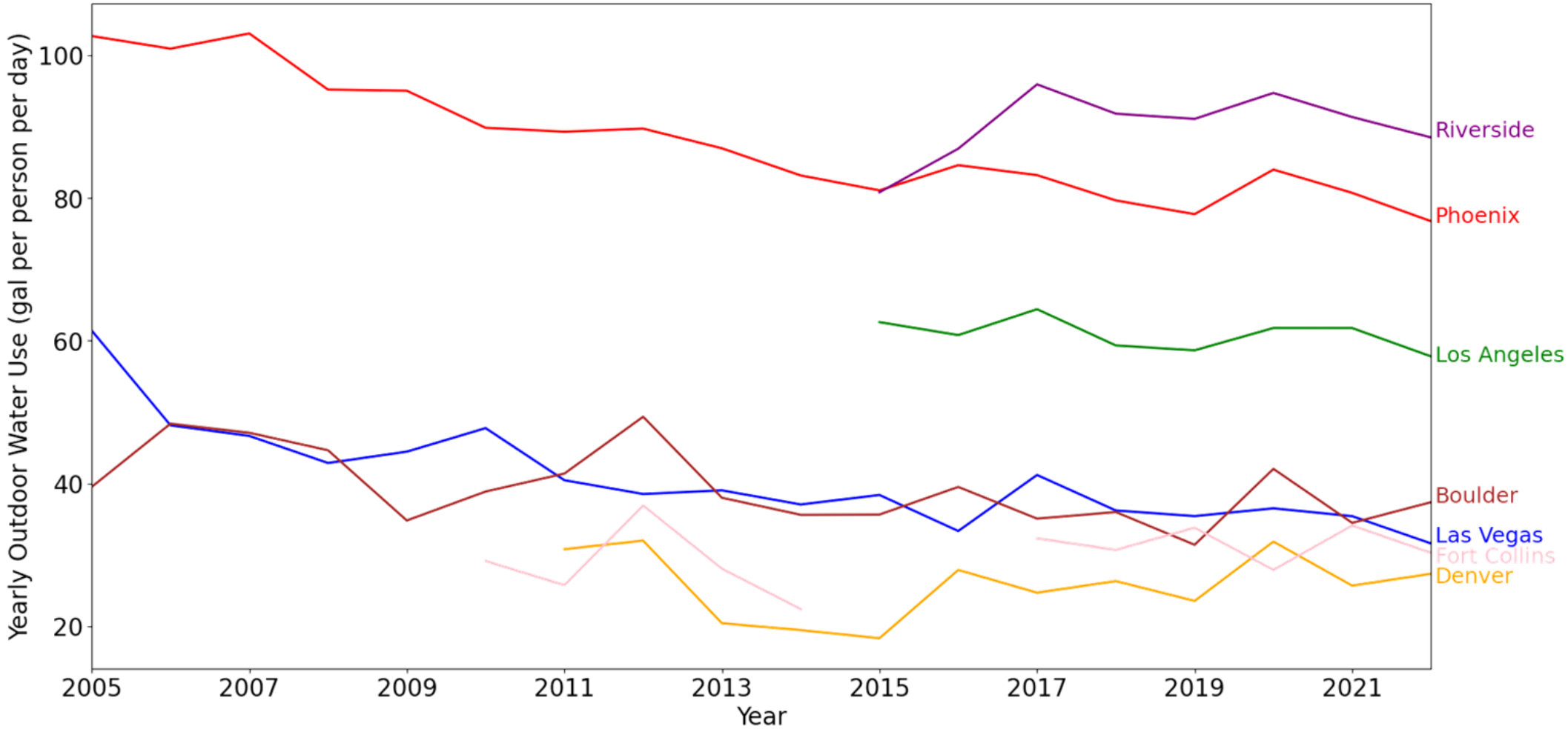

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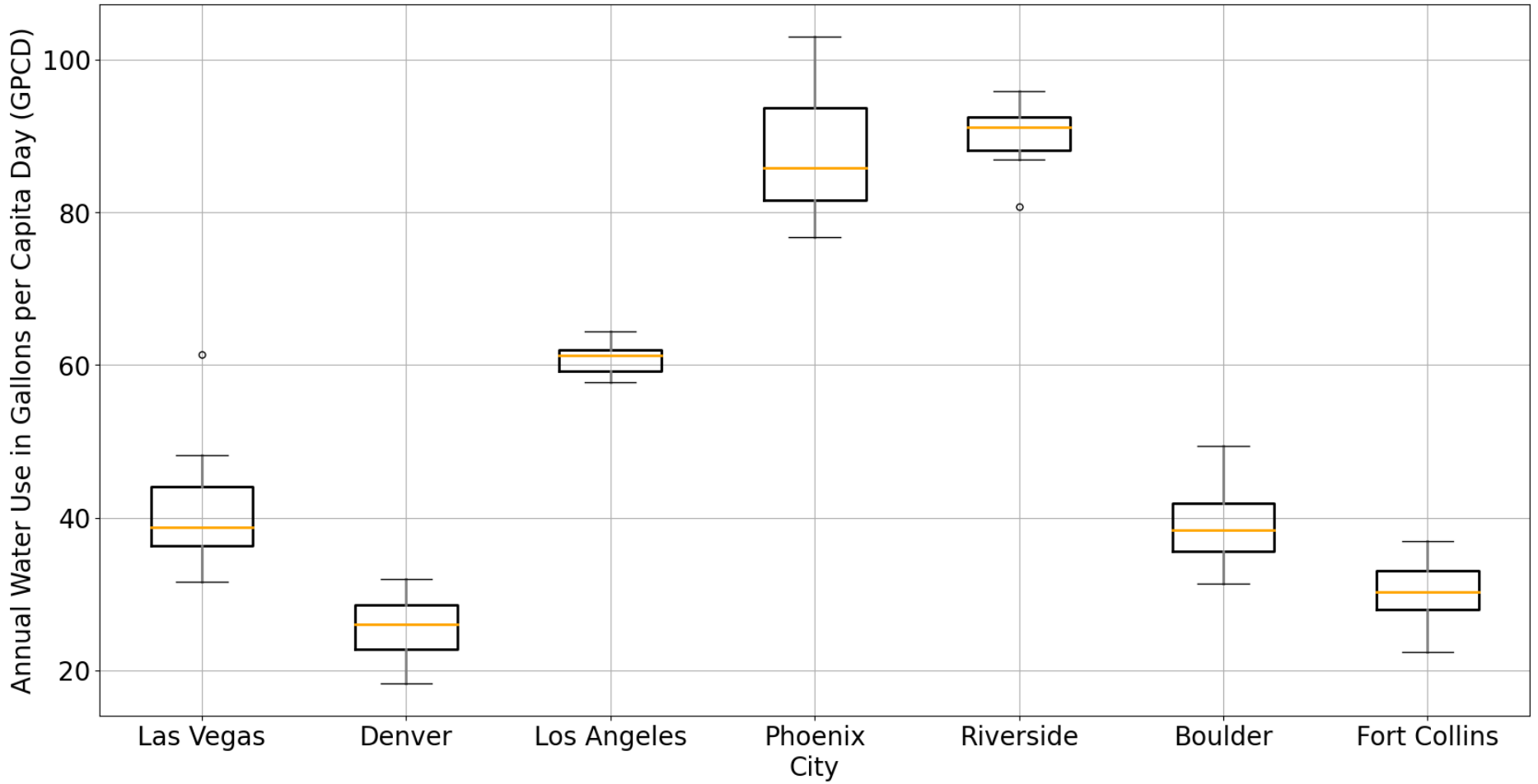

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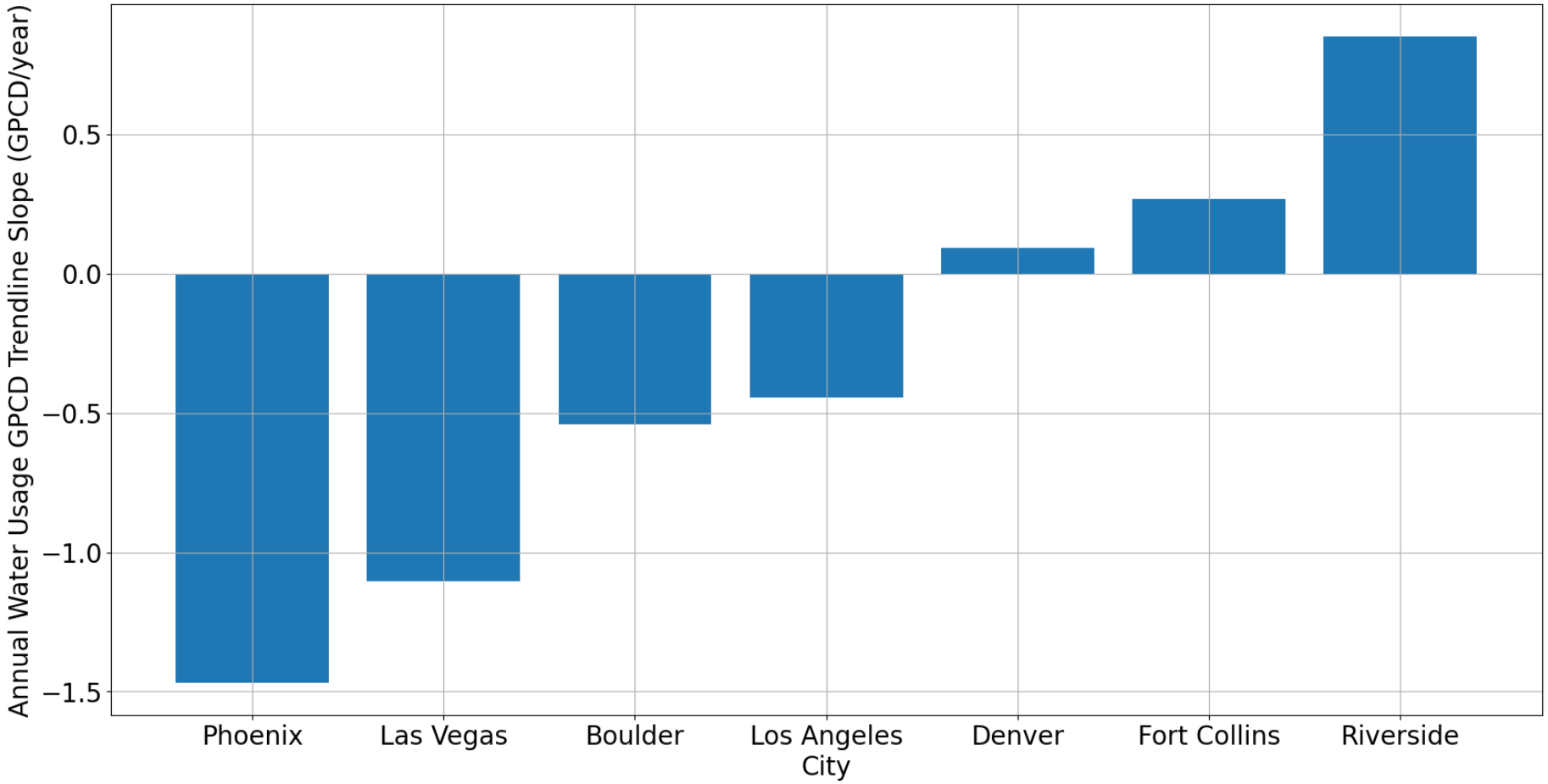
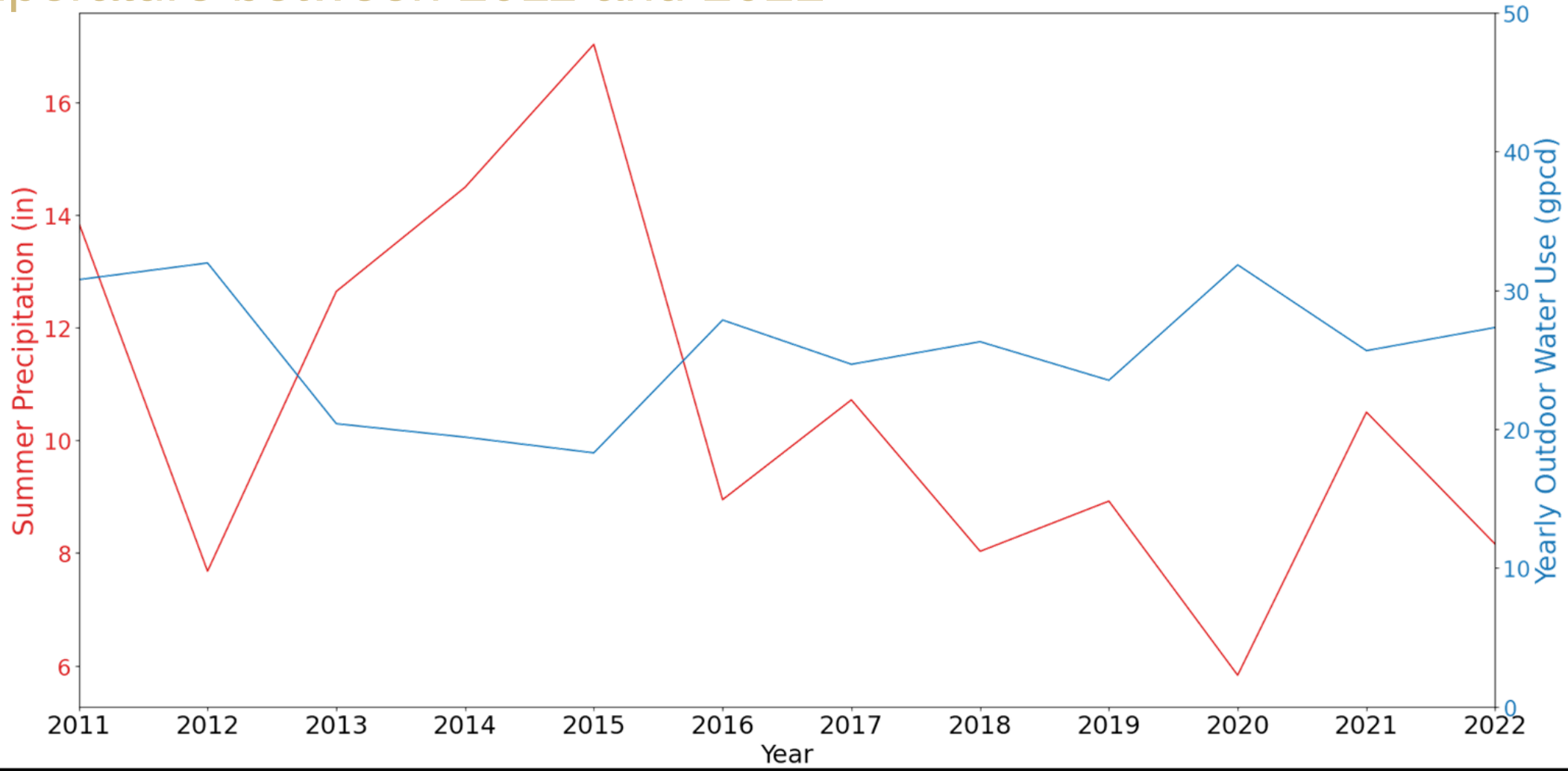


Examining Explanatory Variables that can affect Outdoor Residential Water Usage in Denver

- Used PRISM Climate Data to obtain monthly Precipitation and Mean Temperatures
- Using only half of the year (April-September)
- Water Rates taken from Denver Water Annual Reports
- Found the monthly cost of 1,500 cubic feet of water (an AWWA benchmark)

Denver's Outdoor Water Use was Driven by Precipitation and Temperature between 2011 and 2022



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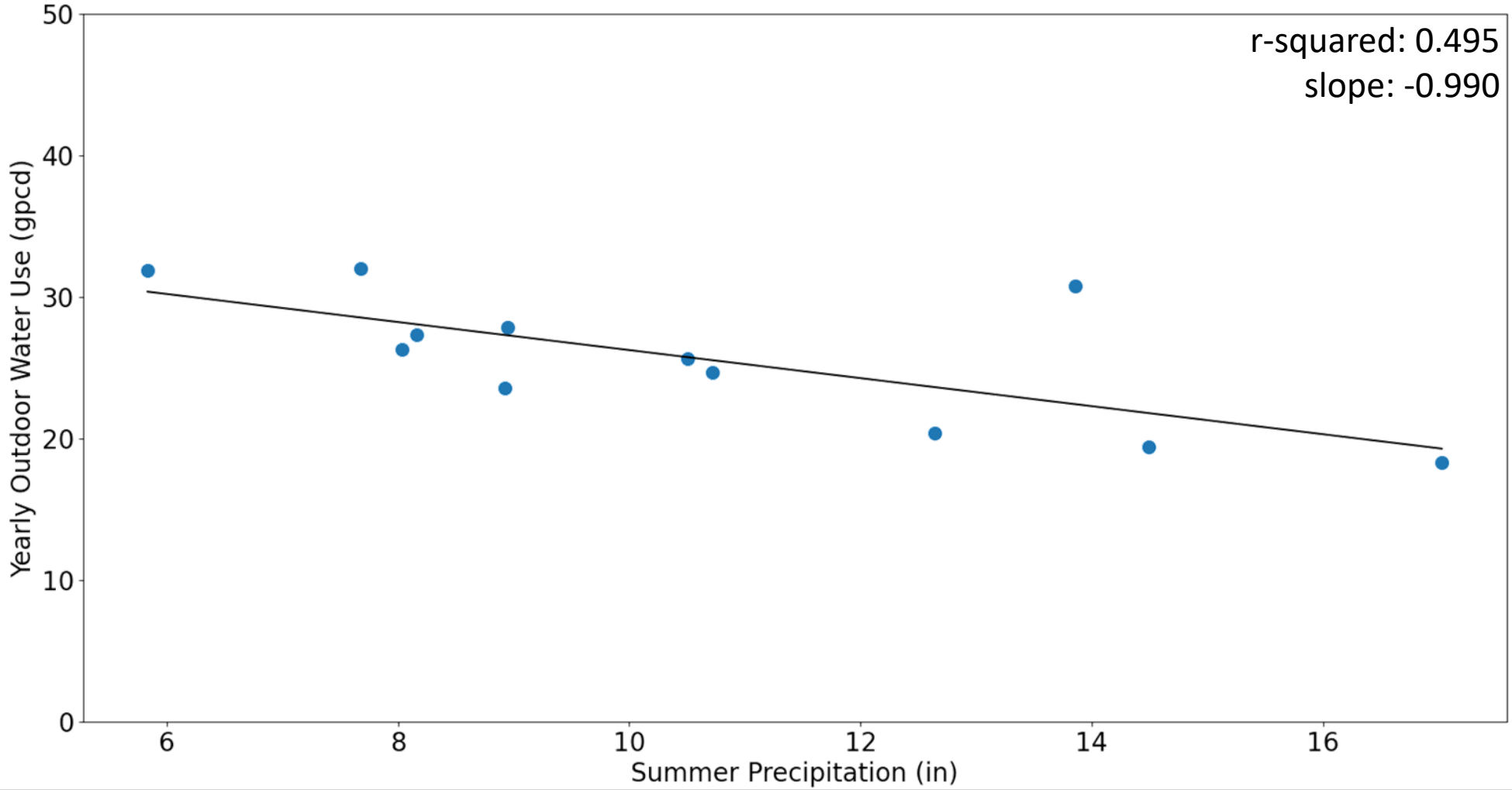

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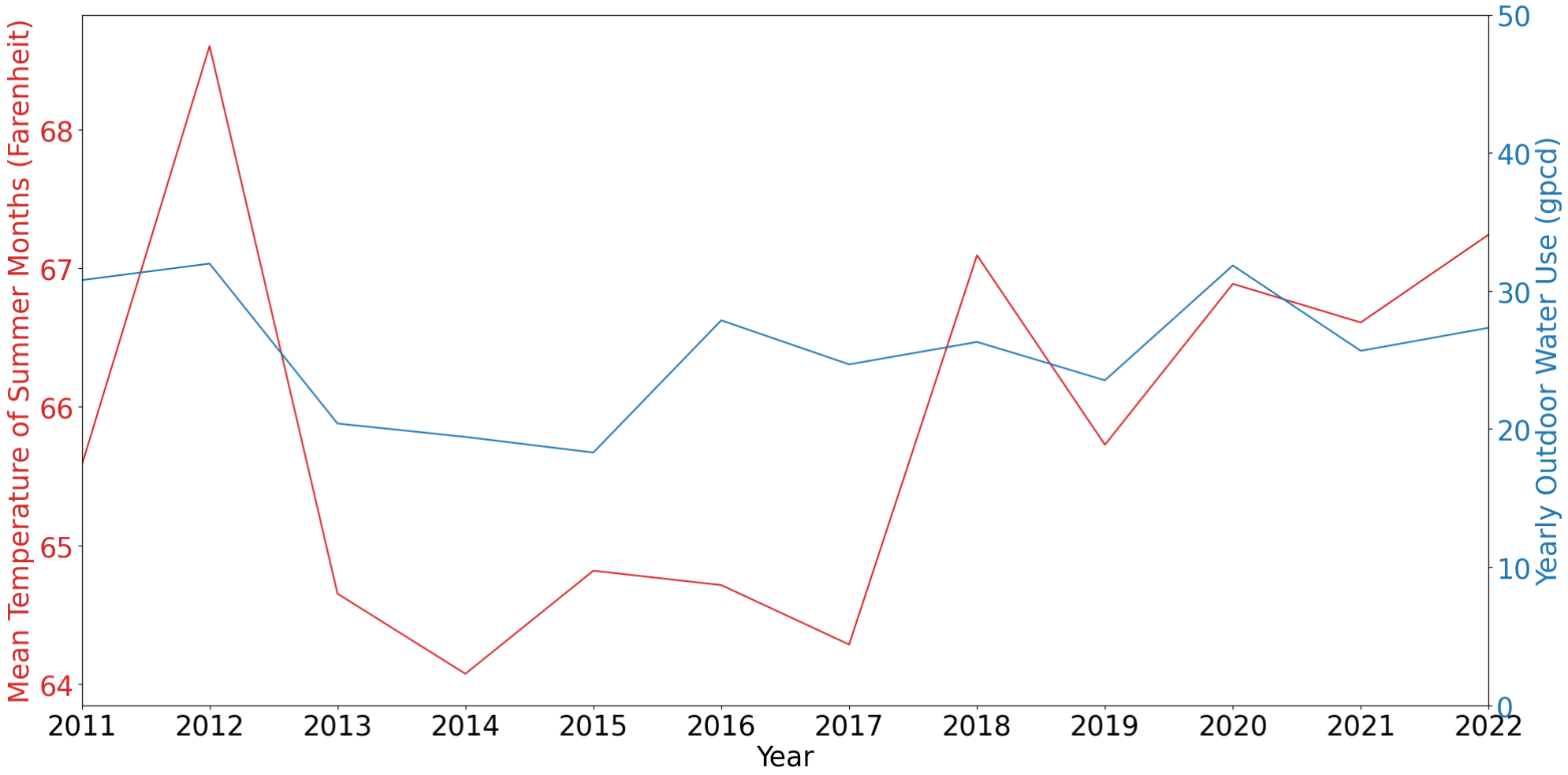

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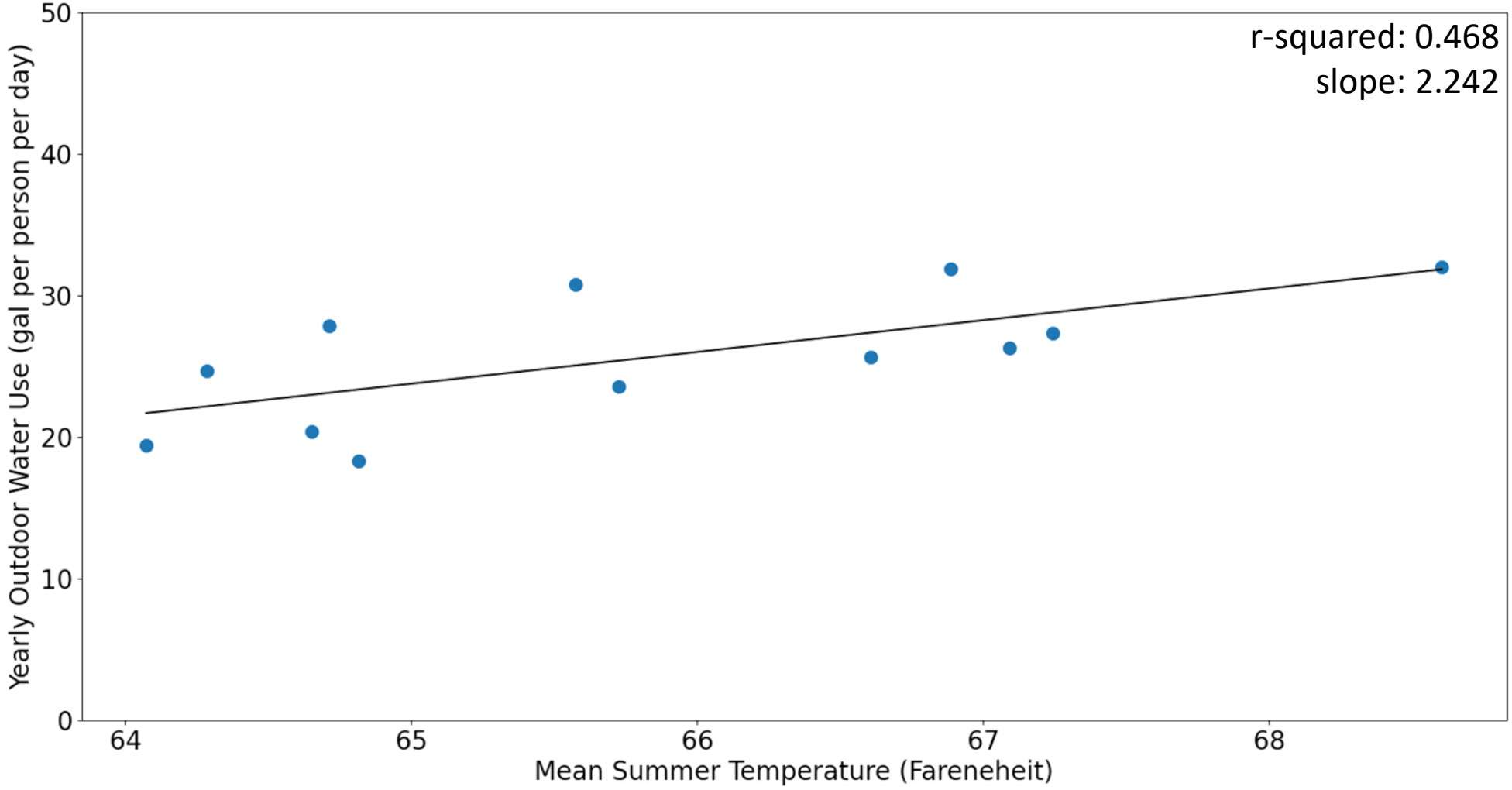

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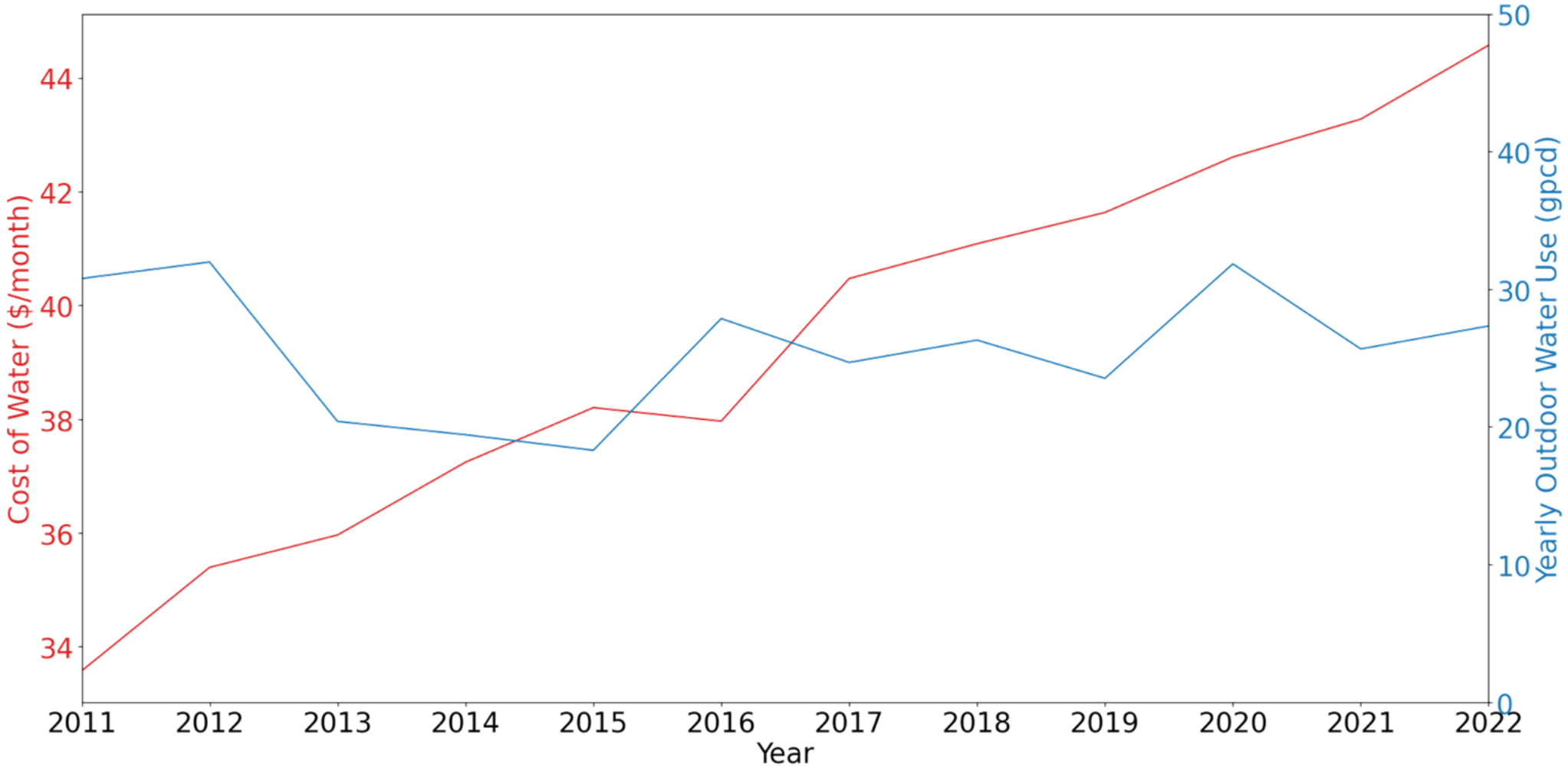

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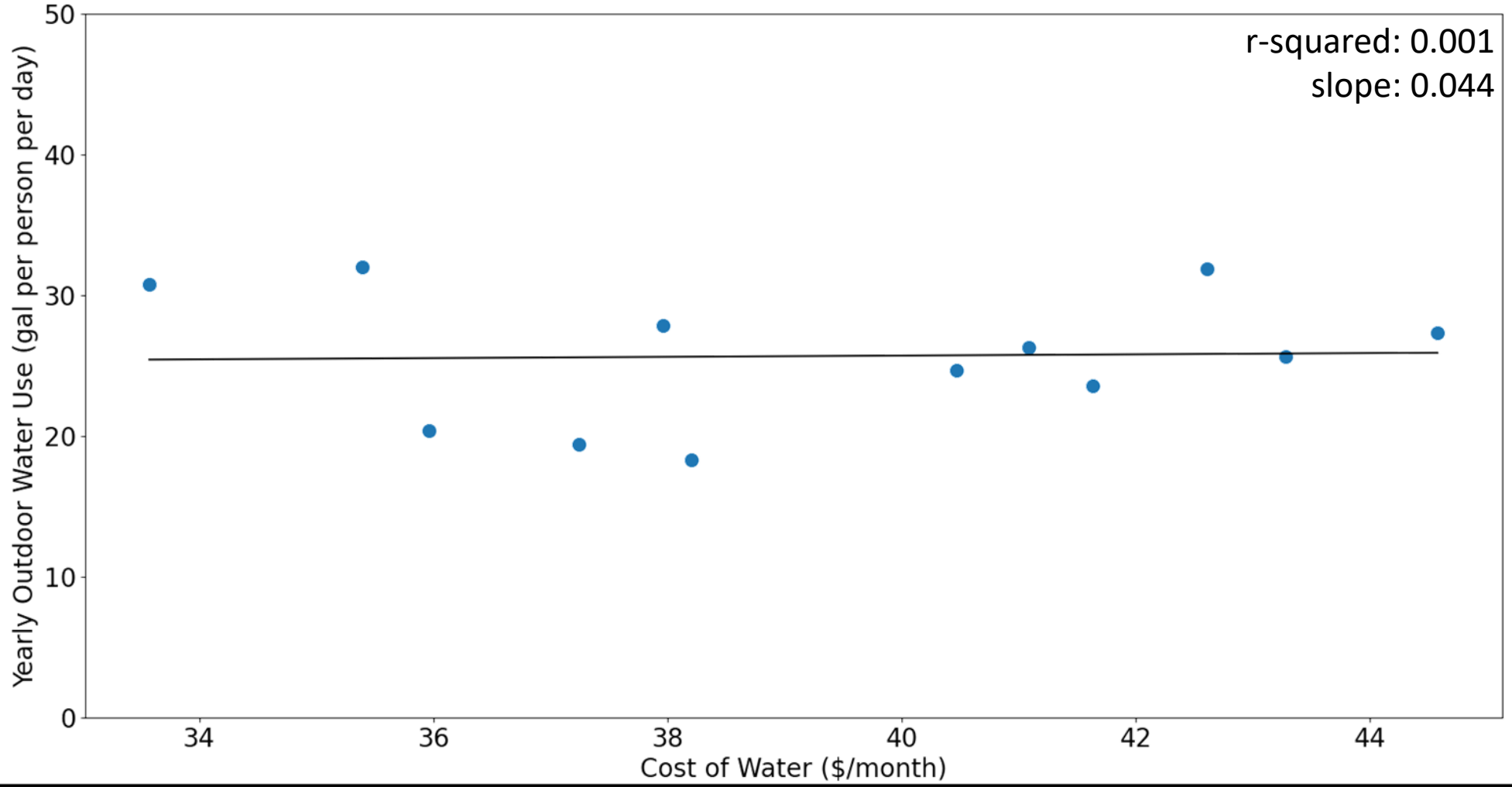
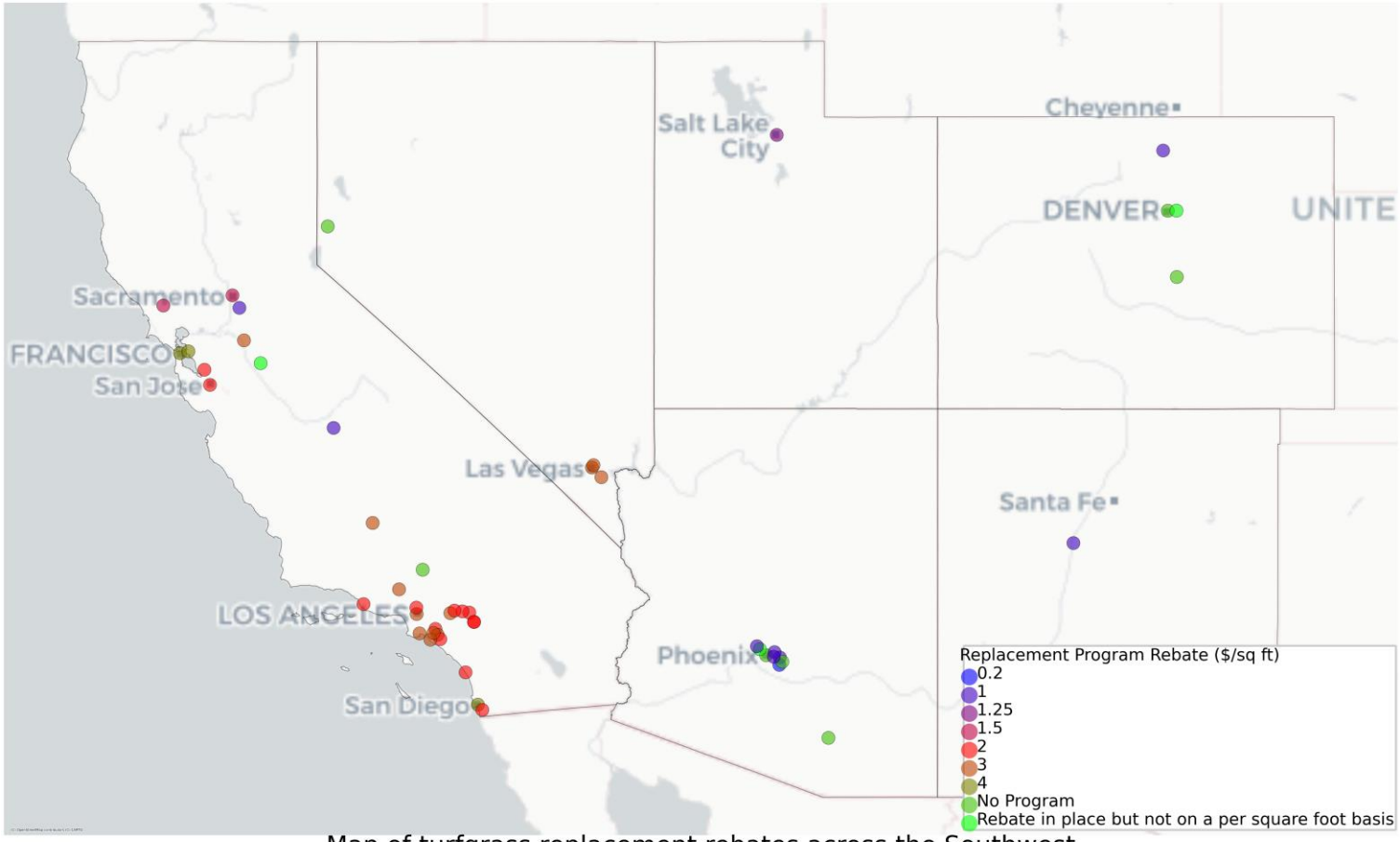


Potential Future Work Quantifying the water savings from Turfgrass Replacement Programs

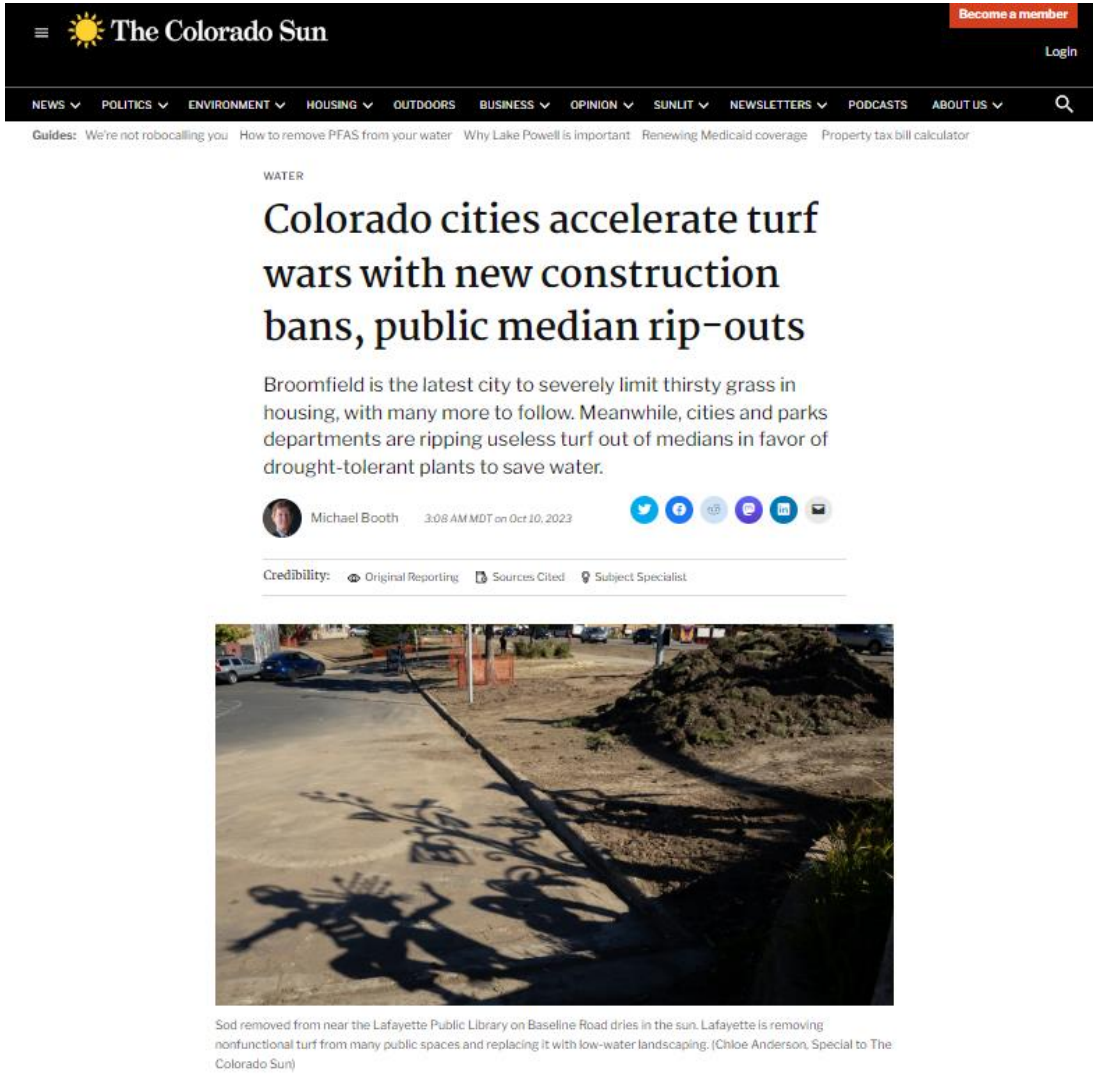
- "Cash For Grass" Replacement programs have become more prevalent in the Southwest
- Heavy adoption of these programs by Southern California



Map of turfgrass replacement rebates across the Southwest

Potential Future Work: Quantifying the water savings from Turfgrass Replacement Programs

- Slow implementation by cities within Colorado
- Many cities have begun to introduce these programs



https://coloradosun.com/2023/10/10/colorado-cities-turf-bans-grass-removal/

Potential Future Work

- Examining the effectiveness of water conservation policies in the Colorado River basin
- Using different methods to estimate outdoor usage (remote sensing of the environment)
- Modeling the effect of past changes in policy, climate, population, and water rates

References

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Thank You! Questions?