

DO STATE WATER USE POLICIES IMPACT STATE WATER USE?

Executive Summary By Stephanie Herbst

Introduction

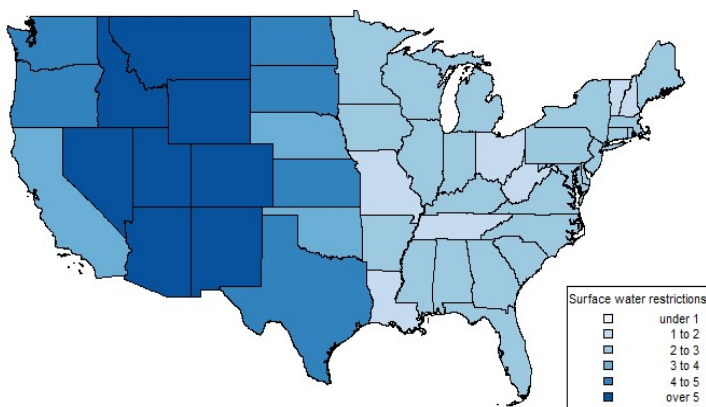
Agriculture now accounts for about 80 percent of the United States' consumptive water use¹, and meeting agricultural demand for food and fuel despite limited freshwater availability will be a major challenge in the 21st century. Despite the importance of these issues, substantial gaps in our understanding of irrigated land and water use remain. Agricultural land use decisions respond to a variety of factors, including: regional water supply and demand; agronomic conditions; economics and market conditions; and federal, state, and regional policies. The correlation between irrigation and these factors (predictors) is poorly understood.

Project Purpose

Drawing from the USGS' "Estimated Use of Water in the United States in 2010" data¹ and information on state water doctrines,^{2,3} I address the following two questions:

1. As surface water law restrictiveness (independent variable/predictor) increases, does surface water use (dependent variable) decrease?
2. As groundwater law restrictiveness increases, does groundwater use decrease? (See full report for results)

Figure 1: Choropleth map created in R showing surface water doctrine's level of restriction.



Methods

To answer my questions, I first tested correlation using Pearson's correlation coefficient. Pearson's shows the strength, but not direction of a linear relationship. To show the direction of correlation, I built two linear regression models and tested its goodness of fit.

Results

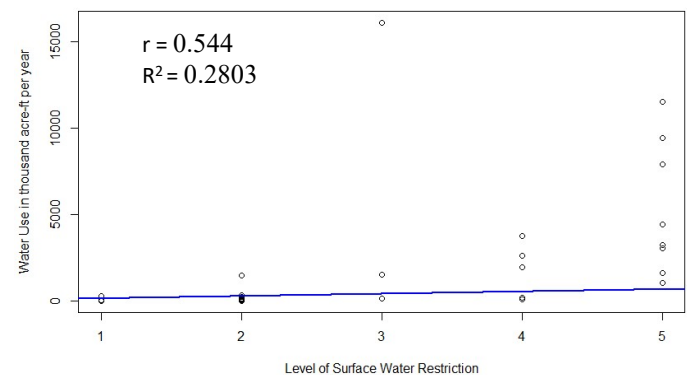
As shown with Pearson's r , the relationship between surface water use and surface water law is linearly positively correlated. As the level of restriction of surface law increases, the surface water use increases.

My dependent variables are water use from irrigated sources only. Irrigation is implemented in more-arid regions, or where rainfall is highly variable. The majority of total U.S. irrigation withdrawals (83 percent) and irrigated acres (74 percent) were in the 17 conterminous Western States.¹ These regions typically implement more restrictive water doctrines. Thus, it makes sense that irrigated water use and level of restriction would be higher in the Western states.

Future Research

I only conducted a simple linear regression model, but there are many factors that contribute to irrigated water use. In future work, I would like to include more predictors.

Figure 2: Surface water use vs. law restriction



I will build a regression decision tree with the following:

- Dependent: Total irrigation water use
- Predictor: Water availability (rainfall)
- Predictor: Surface water law
- Predictor: Groundwater law

Acknowledgements

¹ Maupin et al. (2014). Estimated Use of Water in the United States in 2010. USGS Cir.

² Sax et al. (2006). Legal Control of Water Resources: Cases and Materials. Fourth Edition. Textbook.

³ Joshi, S. (2005). Comparison of Groundwater Rights in the United States: Lessons for Texas. Tech University.