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States, water, and climate: Who's planning for change?

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ABSTRACT

The primary objective of this study is to determine what drives states to plan for the impacts of a changing climate. As the climate continues to change, climate scientists have projected changes in water quantities available for human and other uses. This quantitative study examines how state water plans and state hazard mitigation plans address climate change. Plans were coded for the extent to which they address climate change in their calculations regarding future water supply and demand. Ordinal logistic regression models were developed to test the predictive value of independent variables including statewide voting, vulnerability to climate change, and recent experience with droughts and natural disasters. The most significant predictor variable for both state water planning and state hazard mitigation planning was state partisanship. Democratic leaning states were much more likely to include climate change in their plans than were Republican leaning states.

1. Introduction

Management and protection of the water resources needed to support life and drive the economy is generally left to state governments within the United States. Furthermore, while all disasters are local they tend to be mitigated and managed at the state level in the United States. Consequently, planning for and responding to major risks to key resources, especially for water resources, frequently occurs at the state level. In a country that is increasingly politically polarized and drastic changes in weather patterns and water availability increasingly challenge urban and rural areas, how to secure future access to water and mitigating nature based risk has become a significant policy challenge.

Twenty-nine out of fifty U.S. states have developed formal water plans to guide their future water supply investments. Normally, these plans make both assessments and projections of current and future water demand and supply. The projections frequently account for population, demographic, and economic changes anticipated by the state. Some states also consider the impact of a changing climate on their water supply and/or demand. Significant variation exists between the states on the consideration of climate. This paper seeks to explain that variability. Possible explanations include the importance of political attitudes and beliefs around the role of government in collective risk management or around climate science, previous experience with disasters tend to make policy makers more vigilant to all risk, orr that some states have simply have less to worry about based on the ratio of population growth and water availability in those states.

This study explores the drivers of state government water resource management as represented by the State Water Plans. In the empirical part of this study, independent variables representing vulnerability and political preferences will be tested as drivers of the choices made by states to either incorporate or not to incorporate climate change science into their state

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water plans. These results will be compared to a similar analysis of state hazard mitigation plans to examine congruencies and differences in how states approach planning for different resources.

State policy making is a complex and frequently issue-area specific process in terms of the influence that experts, public opinion and innovation play. This study uses two models to examine that process and assess what variables drive it.

2. Theory

The body of research on the application of climate science in water management is dominated by anecdotal evidence and qualitative studies that focus primarily on inputs into, rather than the output of, water management agencies regulations, rules, forecasts, and science. For example, Pulwarty and Redmond (1997), using a semi structured interview strategy, assessed the extent to which water managers in the western US utilize climate forecasts in their work. They found, similar to others, that water managers generally do not use climate forecasts in their work (e.g., Callahan and Miles, 1999; Rayner et al., 2005). Instead, most water management strategies are tied to standard operating procedures that prescribe actions based on observed conditions, such as reservoir levels, the time of year, and the amount of snow on the ground.

Quantitative and large N research on factors driving the use of climate science in state water planning are rare. An unusual example is a survey from the year 2000 establishing the use of forecasts in water resources management (Dow et al., 2007; O'Connor et al., 2005). The survey of water managers in South Carolina and the Susquehanna River Basin of Pennsylvania was designed to assess (1) the size of respondents' water management responsibilities, (2) the perception of their own risk for system failure (e.g., not being able to supply their customers with water), and (3) the managers' perception of climate and weather forecast skill. The survey response was substantial for both regions (N = 405 in Pennsylvania and N = 269 in South Carolina), allowing for a robust statistical analysis of the results (O'Connor et al., 2005). The results showed that only a small percentage of water managers used climate and/or weather forecasts for flood protection, water supply, and power generation in either state. Furthermore, only 10–25% of the managers surveyed reported using forecasts to plan for future water storage needs, expanding distribution systems, adjusting reservoir levels, adjusting inventory supply needs, or similar uses. A higher forecast use was only connected to 1) scheduling personnel for maintenance and construction, and 2) starting public information campaigns to conserve water.

O'Connor et al. (2005) have shown however, that the perceived risk of system failure is significantly correlated with managers' willingness to use forecasts in their decision-making. i.e., if a particular agency were at greater risk of not meeting its water delivery or water quality requirements, it would be more willing to seek new information (such as a forecast) to help make its decisions. The analysis also showed that agency size and the perception of forecast skill did not correlate strongly with actual use of, or willingness to use, forecasts. Therefore, O'Connor et al. (2005) conclude that application of forecasts in water management is more determined by perception of risk, particularly with recent experiences with extreme weather and climate, than by any improvements in forecasting skills or the potential value of climate science for the intended end user. These results are consistent with more anecdotal studies with smaller samples and interview based methods (e.g., Pulwarty and Redmond, (1997)).

Water supply systems' vulnerability to failure is obviously related to variation and trends in water supply. Many studies have examined vulnerabilities to water shortages, such as Averyt et al. (2013) study of stress on fresh water resources in the US. They developed a water supply stress index based on observed water use and supply at approximately 700 square miles. They applied their water supply stress index to both current supplies and water usage. Their results showed that the stress is greatest in the southwestern US. This is the same geographic region that expects to see the greatest declines in fresh water supply as a result of climate change.

As noted above, much of previous research has focused on input to and planning by water management agencies. The studies described thus far have largely assessed whether climate science and forecasts were used as input at all to decision making. Much less attention has been paid to whether considerations of climate adaptation in water management agencies decisions and outputs. Classic research results (Page and Shapiro, 1983; Monroe, 1998) describe coherent relationships between a) policy preferences of constituents and b) the policy choices of their elected government. This suggests that constituent political preferences around climate change may impact how climate change science is used by water planners who are charged with supplying water to those constituents. However, an assessment of planning by water management agencies at the state-level and the extent to which they address (or do not address) climate change is still lacking.

Page and Shapiro (1983) and Monroe's (1998) classic studies found stronger congruence between voter policy preferences and political preferences in policy areas most important to voters and less congruence in relatively obscure policy areas of less interest and visibility to voters, and in policy areas such as campaign financing that directly impact politicians. Water policy tends to be a somewhat obscure policy area if the public does not feel threatened (Gleick, 1998). Thus, one might expect governments to make policy choices that respond more to perceived state water vulnerabilities than to the policy preferences of voters, in cases where the two are at odds.

Even though the inclusion of climate change in state water planning has not been studied systematically before, scholars have examined water planning efforts in general at other policy-making levels. Feldman (2013) for example, described water planning efforts to address climate change on scales ranging from very local to global. He described planning efforts in Brazil where climate scientists were connected directly with farmers in the Amazon River Basin to promote the co-creation of scientific data for farmers to apply to their decision-making. He also described planning efforts at the city level in Los Angeles

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