RESEARCH BRIEF
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NAWI
National Alliance
for Water Innovation

Robust Technology and Policy Pathways for Urban Water Security

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Challenge

Urban water managers face an increasingly complex and challenging environment in which to plan for future reliable and affordable water supplies for their communities. Climate change can adversely affect both water supply and water quality, and the effect of such perturbations on other water supply and demand options is not straightforward. Globally, maintaining reliable water supplies in a changing climate will require investments of up to $100B per year[1,2] but water managers lack tools and methodologies to perform sophisticated trade-off analyses or multi-objective scenario optimization that would maximize the impact of future financial investments they make in their water systems. In the absence of such tools and methods, managers are forced to adopt highly conservative, "supply-oriented" strategies that cost more, have a higher GHG footprint, and fail to maximize the potential of distributed treatment and reuse as well as water conservation.

Research Approach

Innovation in the form of smaller, modular, and more rapidly deployed technologies may yield significant financial benefits over large, centralized capacity expansion investments that prove to be oversized once the drought ends. Maintaining resilient water supply in a changing climate requires decision support tools that explicitly account for these user preferences and technology attributes.

This project will develop a decision support tool that informs best practices for municipal adaptation to uncertain climates by identifying climate conditions that jeopardize current supply portfolios (Figure 1, top panel) and detailing cost-optimal strategies for supply expansion (middle panel) tailored to the city's water resources (bottom panel). Heuristic decisions in response to water supply shortages will be replaced with a formal multi-objective and multiscale simulation and optimization model that supports water portfolio decision- making at high spatial-temporal resolution over a range of technology, climate, and policy futures.

RESEARCH PARTNERS

Stanford University: Marta Zaniolo, Meagan Mauter, Sarah Fletcher, Yang Liu

Impact

Our project will address urban water insecurity through four pathways. First, we envision the adoption of our findings by our research partners in the City of Santa Barbara, who are informing the framing, research questions, and providing data. Second, the generalized design of our tool encourages adoption by other cities. Third, our findings on water conservation policies will maximize the benefits of water efficiency investments. Fourth, we will develop climate-specific R&D targets for new water technologies by identifying cost-optimal technological attributes for enduring droughts of varying duration and severity.

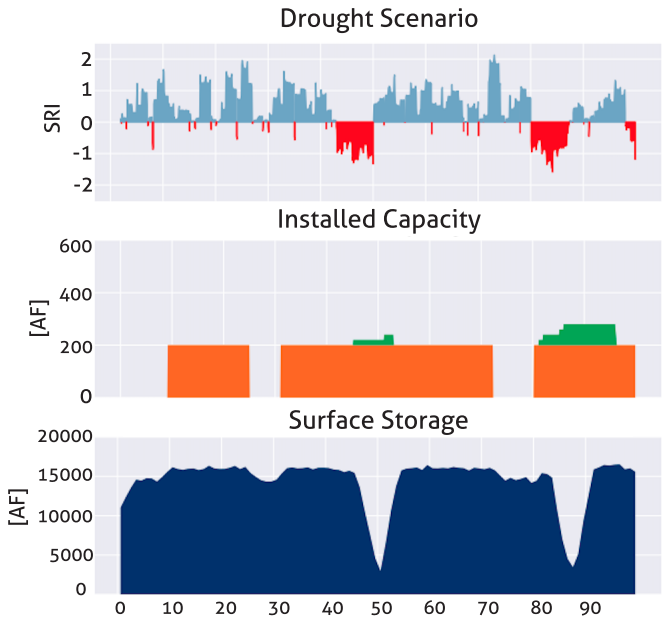

Figure 1. The designed planning policies respond to drought conditions (top panel) by installing additional capacity (middle panel) to supply water demand when surface storage is rapidly depleting (bottom panel).

REFERENCES

1. World Bank, "Economics of Adaptation to Climate Change: Synthesis Report," The World Bank, 2010.

2. United Nations Framework Convention on Climate Change. "Potential costs and benefits of adaptation options : A review of existing literature.," https://unfccc.int/resource/docs/2009/tp/02.pdf, 2009.

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