Stanford | Water in the West

Research Brief

FALL 2017

Out of sight but not out of mind – The growing role of water conservation in California

Introduction

With full reservoirs and most of California out of drought conditions, the state's recent concerns about water availability seem like the distant past. Even though drought and water conservation are no longer in the spotlight, water management is a recurring challenge in the American West that we must learn to address in more effective ways. The driest 4-year period in California's recorded history (2012-15) was immediately followed by the wettest winter (2016-17) in the 122-year hydrologic record. These extreme weather patterns have put the state under significant stress and raised awareness of the risks of a more extreme climatic future.[1]

1 *https://woods.stanford.edu/sites/default/files/files/Extreme-Weather-Winters-Research-Brief.pdf*

Photo Courtesy of Kelly M Grow/CDWR

Even though the 2012-16 drought is out of sight and out of mind for many of us, its impacts have left a lasting mark on drought preparedness and response at the local and state levels. California, for example, now has a more robust set of tools to enhance water conservation that includes public awareness and behavioral changes, water use policies and regulations, and a thirst for more resilient and locally-driven water management approaches. Nevertheless, questions remain about how long these effects will persist in the absence of motivation from emergency conditions. If utilities and decision-makers are to take advantage of lessons learned during the recent historic drought and the unprecedented conservation levels that ensued, we must take a step back and look at the impacts and drivers that this experience highlighted.

New Visualization Tool

To help decision-makers better understand these impacts and drivers, a team of Stanford researchers (see inset) have developed a new interactive web portal.[2] Titled "Visualizing California's Dynamic Urban Water Use," this publically-available resource summarizes important lessons from the recent drought. Users can explore water conservation in California between 2014 and 2016 in almost 400 utilities

2 *https://ca-drought.herokuapp.com/*

About the Researchers

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Research Brief

California's Recent Historic Drought

Drier-than-normal conditions began in 2012.

In the spring of 2014, California Governor Brown declared a state of emergency and called for voluntary conservation.

Starting in the summer of 2015, after continued drought conditions, the first-ever water conservation mandate went into effect.

In 2016, when drought conditions started to ease up, the state allowed water utilities to switch from their mandatory conservation targets to lower self-certified goals.

Figure 1 shows an example of summer water conservation in the Bay Area, with very high conservation levels during the 2015 mandate, and a backslide in water savings as restrictions were lifted in 2016.

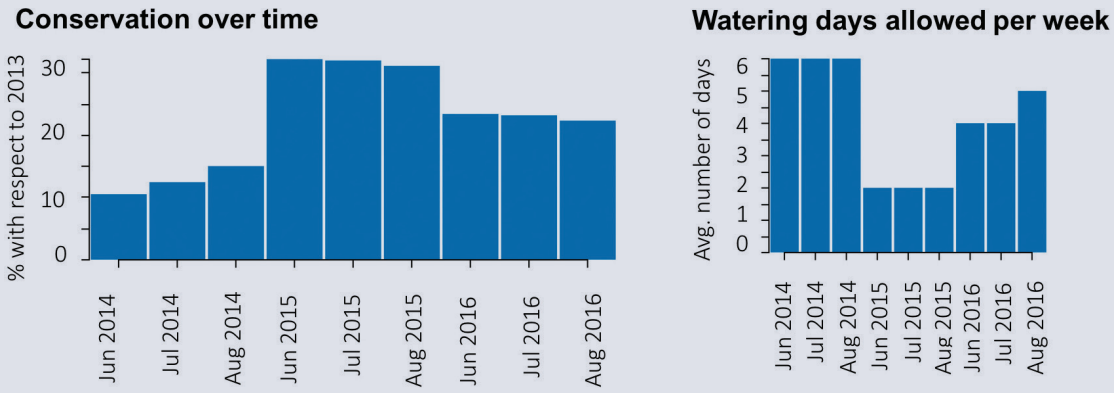


Figure 1. Summer water conservation in the Bay Area region.

The Bay Area exemplifies the statewide water conservation trends during the summer months of 2014, 2015, and 2016. Not surprisingly, water savings were highest in 2015, and proceeded to drop in 2016 along with the relaxation of outdoor watering restrictions, but these levels remain higher than what they were in 2014 when Gov. Jerry Brown first called for voluntary conservation.

Photo Courtesy of Kelly M Grow/CDWR

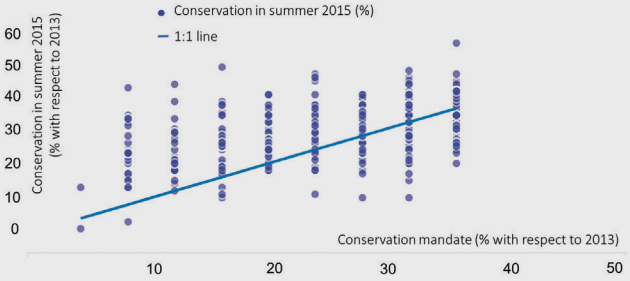
from around the state. This statewide perspective offers insights about how well utilities complied with the Governor's mandate to conserve[3] in addition to highlighting underlying opportunities and challenges for the growing role of water conservation and effective urban water management. As demonstrated in the web portal, these opportunities are closely related to the interplay between state and local climatic, social, and governance characteristics.

1. Water conservation policies

A look at drought in urban California requires an understanding of water use patterns and the role of water policies more generally. Water utilities collectively achieved significant water savings at the peak of the recent drought between 2014 and 2016; however, water use and conservation were largely site-dependent and utility-specific. Additional notable observations from the visual data portal include:

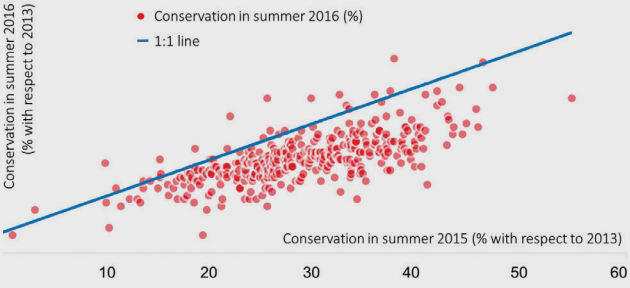
- **Residential water use in California is highly seasonal, with outdoor irrigation accounting for the majority of use during the summer months.** This seasonality represented a low-hanging fruit that helped utilities cope with severe drought conditions, especially once Governor Brown called for the first-ever mandatory water use restrictions[4] that included a strict limit on outdoor irrigation.
- **Policies limiting outdoor water irrigation to a couple days per week are attributed to much of the savings achieved during the mandate.** Even as utilities saw rebounding water use patterns, water demand levels have remained below what they were in 2013, attesting to both structural and behavioral changes that remain after the drought.
- **At the local level, population socioeconomic characteristics and local drought severity seem to play an important role on conservation levels achieved.** For example, higher income residents tend to have a lower responsiveness to water conservation policies, while more severe drought conditions with tangible local impacts tend to increase public awareness and willingness to conserve (Figures 2 and 3 show the diverse water conservation levels achieved by California utilities in 2015 and 2016).

Figure 2. How did California utilities do in summer 2015 compared to their mandated conservation targets?



Dots under the 1:1 line represent utilities with lower conservation levels than their mandated target in the summer months of 2015 (June-August). Dots above the line represent utilities that surpassed their conservation goal.

Figure 3. During the summer of 2016, many utilities lowered their conservation levels compared to the summer of 2015 when the state mandate was in effect.



Dots under the 1:1 line represent utilities with lower conservation levels in the summer months (June-August) of 2016 than in 2015. Dots above the line represent utilities that maintained and even surpassed their conservation efforts.

3 *http://www.waterboards.ca.gov/press_room/press_releases/2015/pr050515_water_conservation.pdf*

4 California Assembly Bill 2572

- **At the regional level, the interconnection and interdependencies between water utilities present opportunities for success.** Utilities in California are traditionally highly fragmented, yet may share interdependencies in their water supplies and governance systems, especially when they rely on common imported water sources.

As utilities move forward and identify appropriate management strategies, policies and incentives need to be tailored to fit existing institutions and local conditions. These actions should also allow and promote regional scale collaborations where utilities can leverage their local opportunities, such as through conjunctive use management and more flexible sharing of resources.

2. Infrastructure and technology

Lack of information and data availability can limit effective decision-making for water managers by impeding both the exchange of knowledge and the ability to track the success of various management actions.

- **Water metering is an important tool for utilities to better understand changing water use patterns, especially during periods of drought.** While a mandate exists for all connections in the state to be metered by 20251, many utilities did not have these tools in place during the recent drought.

1 California Assembly Bill 2572

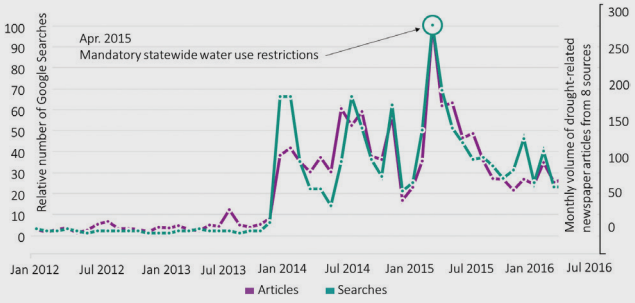
- **In the absence of a robust understanding of changing customers' demands and potential future challenges, new infrastructure and adaptation actions can be daunting.** For example, there is a concern for "demand hardening," or conservation efforts such as removing lawns, becoming fixed features of water demand. This effect limits future potential for water conservation and emergency response. But it is difficult to assess how much flexibility utilities have before reaching these levels without a better understanding of customers' water demand behaviors and practices.

Better information reporting and tracking can help cities throughout the state identify appropriate adaptation pathways, establish partnerships, and foster an enabling environment for innovation. Information technology applications such as smart metering and the "Visualizing California's Dynamic Urban Water Use" web portal are only the beginning of the suite of tools that can help inform decision-making in the future.

3. Changing community behaviors

Many uncertainties remain about the water use dynamics that made water savings possible between 2014 and 2016. For example, determining what level of water savings were attributable to outdoor watering restrictions versus voluntary behavioral changes or forecasting if or how fast water use patterns may bounce-back to pre-drought conditions now that the drought has been declared over, is difficult. What is certain is that a clear correlation exists between media attention, growing public awareness, and changing attitudes towards water use and conservation (Figure 4).

Figure 4. Political actions during the drought, media coverage, and the resulting public awareness of severe conditions can help explain changing customers' behaviors and water conservation efforts.



Positive behavior change could be better achieved by:

- **Increased communication and data-driven insights such as those provided by new metering and information technology applications.** A better understanding of local population behaviors could help water managers tailor their conservation campaigns more effectively in the future, not only during drought, but also as a long-term water reliability strategy.
- **The water sector should become more open to new drivers that are not traditionally included in demand forecasting models.** Quantifying changing population behaviors in response to increased scarcity awareness, as well as short-term and long-term impacts of changing policies, laws and regulations at every scale are two examples.

Looking ahead to future droughts: Considerations for Policy-makers

Prolonged droughts can have severe social and economic impacts. Yet the extent of those impacts is highly dependent on how much planning and preparation utilities can do before the drought. For utilities and customers to be able to mitigate and adapt to drought conditions, water conservation and more resilient management practices need to be better integrated into the water management paradigm, not just as tools for emergency response. Adaptive policies, innovative technologies, and customer engagement need to go hand-in-hand as utilities make these transitions. The "Visualizing California's Dynamic Urban Water Use" web portal provides a glimpse of some of the challenges and opportunities that can inform decision-making in this direction. Hopefully, the momentum from the recent drought experience has incentivized utilities and stakeholders to be proactive, think ahead and start implementing changes in preparation for future water challenges rather than waiting for the next one to emerge before taking action.

This brief is based on the interactive web portal *"Visualizing California's Dynamic Urban Water Use,"* developed by the Urban Water Policy and Innovation team, an initiative of Stanford's Water in the West and ReNUWIt programs. The portal was featured as a finalist in the 2016 California Water Data Innovation Challenge.

About Water in the West

Water in the West, a joint program of the Stanford Woods Institute for the Environment and the Bill Lane Center for the American West, marshals the resources of one of the world's preeminent research universities to answer one of the most urgent questions about the American West's future—how can the region continue to thrive despite growing water scarcity? Through Water in the West, Stanford University's world-class faculty, researchers and students are working to address the West's growing water crisis and to create new solutions that move the region toward a more sustainable water future. Learn more: waterinthewest.stanford.edu

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