

Seeking Resilience: A Discussion on Southern California's Water System

An ELISS Sponsored Project

Amber Habowski, Amy Dixit, and Nicole Deville

Overview

In today's society scientist can't be trapped in their lab, free from political and societal impact. Instead, we must actively engage with the public and policy makers to distill what we know and offer assistance to create a well-informed public and influence scientifically based policy. As graduate students, this is not training we traditionally receive but it can be instrumental to our future success in whatever capacity of employment we seek including academia, industry, or government. Emerging Leaders in Science and Society (ELISS) is an extracurricular graduate fellowship that attempts to provide this training. Through the American Association for the Advancement of Science (AAAS), ELISS brings together a diverse group of graduate students pursuing degrees ranging from Math and Public Health to Biomedicine and Law, to tackle a complex societal issue. Our task for the 2015-2016 cohort, inspired by recent events in Flint, Michigan, was how to promote safe, sustainable, and affordable drinking water in the United States.

What ensues in the following report is a summary of key topics and themes that have emerged during our interviews, reading, and conferences. Based on this we designed a local forum for a broad audience to come together and discuss current challenges in our water system. We particularly focused on how the Southern California water system can become resilient, including what challenges we face and what we hope to achieve in the future. The structure of our unique forum, in addition to the forum outcomes are described in the report. As three non-water experts who have, in the past year, broken into the water community, we hope this report will illuminate weaknesses we have but most importantly highlight the strength of building collaborative multidisciplinary task forces to discuss and eventually solve our complex water problems.

Water Use

The current state of drinking water in our region is complex because of the nature of water infrastructure in California, especially in southern California. A semi-arid area that enjoys a Mediterranean climate, this region is not naturally water-rich. Approximately three-quarters of the precipitation in the state falls north of Sacramento, while roughly three-quarters of the water demand occurs in southern California. In the most populous state in the country, more than 39 million Californians need water for survival. However, of all the water that the state sets aside for human use, only 20% goes toward residential, commercial, and industrial uses. Roughly 80% of water in California is used in the \$50 billion dollar agriculture industry that produces valuable commodities for domestic and international use. High demand and low local supply, combined with a changing climate and a fragmented policies and governance, positions southern California to contribute a unique perspective on water.

Recycling and Other Water Sources

In Irvine, our drinking water is a mixture of local ground, surface, and recycled water, as well as water that has been imported from the Colorado River and northern California via hundreds of miles of aqueducts. However, different parts of Orange County (OC) have even greater diversity in their water portfolios. Other important water sources used in OC include stormwater capture and water recycling. When Los Angeles and the surrounding areas (including OC) were first developed, roads and structures were designed in a way that would mitigate flood risk. Thus, they were designed to direct stormwater out of the region and into the ocean as quickly as possible. As the climate changes and the weather ceases to follow patterned behavior, the region is working hard to recapture rainwater and divert it towards storage and groundwater recharge rather than letting it flow to the ocean. Central OC has also pioneered efforts of recycling water for indirect potable reuse through the Groundwater Replenishment System (GWRS), which extracts and purifies water from sewage to replenish the groundwater basin. Recycled water, both for direct non-potable use through Irvine Purple Pipes and direct potable reuse has continued to grow in popularity. It is both a reliable and a fiscally sound technology as

it is cheaper than importing water. Although extremely controversial, several desalination plants have been proposed in the region; most recently, the plant in Carlsbad became operational after nearly two decades of planning. Critics of desalination dislike the involvement of private entities and the high financial cost and energy demand, while some supporters view it as a “drought proof” water supply.

Climate Change and Precipitation

Climate change has been a key player in shaping recent water policy in the state. The drought has garnered a lot of attention in the media and the focus has been on reducing residential usage of water. However, water rights and economic pressures make it difficult for the conservation efforts to affect agricultural use in a significant way. Nonetheless, conservation efforts have been implemented in the state in order to stave off potentially unrecoverable massive loss of groundwater reserves. Due to spring rainfall restoring the snowpack in the northern mountains to 94% of normal levels, the state-imposed mandatory 25% cut in usage has been repealed. Unfortunately, snowpack levels in many of the southern mountain ranges were closer to 70% of average levels in spring 2016, and the snow melted faster than usual, affecting summertime availability of water in the region. Without the state-mandated conservation efforts in effect, the determination of conservation and usage rates is now left to the local water districts, to be enforced at their discretion as a potentially rainy winter season approaches [[NY Times](#)].

Water Districts and Infrastructure

Southern California is served by several water districts and primarily one water wholesaler, the Metropolitan Water District. These local water districts must sell water to consumers at rates that will allow them to treat and deliver water to their consumers and also leave them with sufficient funds to respond to emergencies such as water main breaks, earthquakes, and droughts. Since revenue decreases as water usage decreases, conservation measures have had a noticeable impact on the districts’ budgets and many consumers have seen changes in their rate structures as a result. While conservation is encouraged by all the water districts, it is challenging for the water districts to adjust their rates too abruptly. The loss of revenue has also hampered water agencies’ ability to stay on

schedule with infrastructure maintenance. In the city of Los Angeles, for example, the infrastructure repair is approximately one century behind schedule and is expected to cost approximately \$1 billion dollars to bring up-to-date. Severe water main breaks and resulting pipe repairs are common in the area and over the past eight years, they have cost \$44 million dollars each year on average [[LA Times](#)]. Beyond the cost of maintenance and other repair, one must also consider the cost of the water that is lost. It is estimated that about 8 billion gallons of water are lost each year to leaks, firefighting, evaporation, theft, and other losses [[LA Times](#)]. As we move into an era where water scarcity becomes the “new normal,” it is imperative to direct resources to safeguarding the clean water that we have in our possession. A current \$15 billion dollar proposal, the [California Water Fix](#), would prevent the loss of over 300 billion gallons of water each year from limitations in the aqueduct system from northern California.

Groundwater

In addition to big infrastructure changes, it is also important to maintain this valuable resource through intelligent management of groundwater reserves. The cuts in water use and the recent drought have led farmers in Central Valley to over-pump water from the groundwater basins. This has led to dangerous levels of depletion in the water table and has been correlated to an increase in seismic activity in the area [[Nature 2013](#)]; it also increases the potential for seawater intrusion that can contaminate the groundwater basins. Recent policies have begun to address this lack of groundwater management in the agricultural sector. However, historic water right laws complicate and strain the dynamic between farmers and policy makers. As we look toward the future however, it is clear that effective and sustainable groundwater management is necessary and should be enforced in a way that balances the needs of environment and general population with the needs of the farmers so that all Californians can have access to safe, sustainable, and affordable drinking water.

The future of water in the region is unclear and projections fluctuate wildly depending on which set of stakeholders is making them. However, the general consensus of the preferred vision for water in our region revolves around a targeted and more innovative approach to water. This can range from urban development that emphasizes

conservation and creates dual-piped households to promote water reuse and recycling to crop rotations and fallow fields that redirect water to rivers and streams to help fish and wildlife. In the face of this water crisis, Californians have been quick to seize upon the opportunity and to develop innovative solutions that can make a difference. Water activism and water education is growing at a rapid pace and Californians today, have an arguably improved understanding of where the water in their taps comes from than they have before. Without a silver bullet solution to this problem, we recognize that all change must start at the local level before it can have a visible impact.

Purpose of the Forum

Although current water challenges in California have motivated many residents to become more involved and aware of current water policy and projects, there are still many disconnects between water leaders and non-water leaders. Many traditional conferences and water symposiums focus on dissemination of knowledge from one water leader to other water leaders. The goal of this forum was instead to promote involvement among a broader audience that included not only water leaders, but lay public, students, academics, industry leaders, and policy makers. These individuals have varied backgrounds and are able to bring together unique perspectives to better understand barriers to achieving resilience of our water system. We also specifically wanted to focus on small group discussion and encourage dialog between participants, rather than simply focusing on traditional presentations. This allows for cross discipline collaboration which leads to sharing and melding of different opinions and knowledge and can be key to understanding and working towards a solution for our water system.

Convening Methods

We hosted a four hour-long gathering of approximately 40 local politicians, leaders in the water industry, academics, local community members, and students on October 4, 2016. The meeting was structured as follows:

- 1) Meet and greet, lunch, and “Water Bingo”
- 2) Breakout sessions led by content advisors on “Environment” (Dr. Diego Rosso), “Infrastructure” (Dr. Jian Peng), and “Technology/Innovation” (Dr. David Feldman).
- 3) Interactive sharing activity to discuss the outcome of each breakout session



Short presentation by ELISS fellows welcoming the attendees. Unlike traditional conferences, this meeting had minimal presentations and instead focused on group discussion.

- 4) Panel discussion led by representatives from water districts, former mayors and water activists, and an expert in water testing technologies.

Convening Outcome

We were able to generate excellent discussions within our three major topic areas and were able to carry those individual discussions forward into the group discussion that followed. Some key suggestions for a more resilient drinking water system that emerged each of our breakout sessions are outlined below.

Environment

- Increase the use of the groundwater replenishment system (GWRS)
- Address the inherent disconnect between environmental science and water policy
- Incorporate the water-energy nexus into water policy



Small group discussion with a leader that encouraged everyone's participation and allowed for flexibility in the discussion topic based on attendees' interests.

Infrastructure

- Develop a publically available emergency or disaster preparedness plan with regard to our water supply
- Create and maintain a diverse water portfolio in conjunction with low-impact, conservation-focused development

Technology/Innovation

- Identify which new innovations are or are not working
- Address the need for innovative policy to tackle complex and unprecedented issues
- Understand the importance of increased communication across sectors and between stakeholders to aid in developing effective technological innovation

Conclusions

The discussion with the entire group uncovered several additional cross-cutting issues. The first was the issue of undervaluation of water. In California, water rights and individual needs can occasionally outweigh the need to provide public good. We discussed why communication was so critical in increasing public awareness of and appreciation for the water issues surrounding us. The second issue the panel discussion highlighted was the need to balance resiliency with efficiency and working on balancing personal water needs with environmental needs. The problem of aging infrastructure has exacerbated the deficiencies in our water system's ability to respond to change in a rapid and efficient manner. Given the pace at which climate change is affecting our water supply, a substantial change in water policy is warranted. However, the push-pull effect of private interests against public good is felt in the glacial pace at which water policy discussions move through the political gridlock.

We also asked our panelists and audience what they thought a resilient water system would look like. The major themes that emerged from their responses are listed below:

- 1) Diversify the water portfolio to improve water reliability while decreasing reliance on imported water
- 2) Increase water reuse, recycling, and conservation
- 3) Promote an environmentally sustainable system (including keeping energy demands low)
- 4) Maintain water quality
- 5) Promote equity in the billing and payment structure for water delivery
- 6) Improve/repair aging infrastructure and urban/landscape design to conserve
- 7) Develop and advertise a comprehensive emergency or disaster-preparedness plan

Forum outcomes

One goal of the forum was to help water stakeholders gain new perspectives and expand options for addressing California's water needs. After attending this event, 68% of

participants reported they changed or expanded their mind on the topics discussed. As one attendee explained, “Embarrassing to say, but I never truly saw the depth of the water crisis before this. It appears to be a greater problem than I knew of.”

Another important goal was networking and improving transdisciplinary collaborations in order to tackle complex problems that require a broader mindset. When asked how they thought collaboration in the water setting could be improved, more than 73% of participants thought it was an unmet need to improve communication. About half remarked that meetings such as this were critical and the other half indicated the need to bring a diverse group of people to the table for discussion. One attendee stated, “I get the impression that California isn't making people (stakeholders, agencies, innovators, scientists, homeowners) sit down and brainstorm for our future.” It is our hope that through ELISS and this local forum, a step has been taken towards moving the conversation about resilience in our Southern California water system forward.