UC DAVIS UNIVERSITY OF CALIFORNIA Climate Change, Water and Society IGERT

2015-1
Policy Brief
March 2015

Climate Change and the Future of Groundwater in California

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Issue

Droughts, floods, population growth, land-use change and climate change threaten to undermine California's ability to sustainably manage its groundwater resources. California will continue to experience decreases in snowpack, changes in the timing of snowmelt runoff, changes in groundwater recharge, and increases in extreme events like droughts. Moreover, groundwater over-withdrawal in California is already a major problem in several basins. Conjunctive management of groundwater and surface water is one important strategy to manage scarce resources, but barriers prevent wider adoption.

In September 2014, Governor Brown signed three bills (AB1739, SB1168, SB1319) to enact the Sustainable Groundwater Management Act (SGMA). While the Act does not explicitly require Groundwater Sustainability Plans (GSPs) to address climate change, local managers have the option to address it in their implementation to avoid over-depletion of supply, seawater intrusion, or other undesirable results.

Policy Implications

Without sustainable management, continued reliance on groundwater during dry years will lead to long-term risks in the quality and quantity of available groundwater. The SGMA could help mitigate the long-term risk to water resources from climate change, especially if the Department of Water Resources (DWR) includes managing for climate changes in its guidance on GSPs and the Act's implementation.

CCWAS Workshop Findings

A workshop held April 16, 2014 at UC Davis brought together an array of stakeholders to identify key challenges and solutions to ensure a sustainable groundwater future in California.

This brief summarizes the political & technical recommendations produced by the workshop discussions for groundwater management, focusing on three distinct themes.

Theme 1: Integrate Hydrologic and Climate Modeling and Monitoring

Consistent and reliable monitoring programs can contribute to robust models and science-based policies.

Improve models, data quality and quantity

- Centralize and make data from well-log and depth measurements available
- Develop state-sponsored databases that are uniformly formatted and reflect local oversight
- Fill gaps in well monitoring data with high resolution and remotely sensed data from satellites

Build stronger ties between universities and agencies

- Improve agencies' accessibility to academic expertise and training on modeling
- Develop hydroclimate models that align with planning and management cycles

A focused workshop discussion on integrated modeling.

Theme 2: Manage Surface Water and Groundwater Conjunctively

Managed aquifer recharge (MAR) is a way to stabilize and recover groundwater levels.

Barriers need to be removed at individual & institutional scales for successful MAR

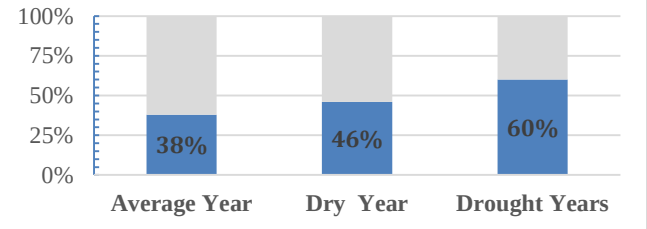
- Provide a reliable funding mechanism to promote MAR statewide, e.g. incentives or land valuation changes based on MAR, subsidized MAR infrastructure, etc.
- Streamline state and county laws with local agency rules on water quality and managed recharge water

- Align MAR policies with annual and interannual seasonality of water demand
- Have Groundwater Sustainability Agencies (GSAs) coordinate funding, water-budget calculations, and technical aspects of basin-scale MAR

Success of new MAR projects will vary and needs improved technical knowledge

- Quantify MAR project water budgets for accurate implementation of accounting, incentives and water rights. This improves water quality and supply reliability.
- Develop a standard method for evaluating the potential for new MAR projects. This is possible with existing tools and data.

Groundwater is a vital resource in dry years.



***Groundwater (blue) as a percent of total CA water supply**. As surface water supplies diminish in dry years, groundwater is increasingly utilized to meet demands e (DWR, 2014).*

Theme 3: Manage for Sustainability

Sustainable groundwater management will continue to be a top-down / bottom-up balancing act but certain decisions at state and local levels can make this act easier.

Define Sustainable Basin Yields

- Develop locally determined, yet state-approved, sustainable levels of pumping, ranges of aquifer depletion and storage. These levels must address land subsidence, public and ecosystem health, and operate as a drought bank.
- Be prepared to accept tradeoffs. North-South water transfers and groundwater pumping must also guarantee sustainability. There will be losers in regulating groundwater withdrawals.

Align GSA boundaries with hydrology

- Basins are interdependent. Hydrology must be the basis of groundwater basin management either by creating new or using existing regional boundaries like those used by the state's Integrated Regional Water Management program.

Flexible Governance Models are Available

- Low and very-low priority basins, ranked by the California Statewide Groundwater Elevation Monitoring (CASGEM) system, that continue current management modes may lead to over-depletion or overdraft, especially in dry years.
- Basins can voluntarily adjudicate, a process in which local authorities decide on an allocation. In contrast to court adjudication, the process is potentially quicker (2-3 years), more flexible, and less costly.
- The SGMA empowers local management by GSAs in medium and high priority CASGEM basins, with state backstop and oversight as necessary when local agencies are unwilling or unable to correct problems.

Conclusion

The ongoing drought offers an opportune moment to make legislative and management changes regarding the current groundwater crisis and California's future. The SGMA will help produce more resilient groundwater basins and a more secure California water system, particularly if some of the recommendations in this brief are addressed.

Invited Experts

Many thanks to our invited speakers: Ken Alex; Claudia Faunt; Andrew Fisher; Adam Hutchinson; Ruth Langridge*; Jeff Loux; Jay Lund*; Reed Maxwell; Philip Mote*; Tim Parker*; Tim Quinn; Bridget Scanlon*; Scott S. Slater*.
*Denotes that keynote videos are available: http://ccwas.ucdavis.edu/State_of_the_Science_and_Policy_Workshop/2014/.

For information about future workshops: ccwas.ucdavis.edu/State_of_the_Science_and_Policy_Workshop/.

References

DWR, 2014. http://www.water.ca.gov/groundwater/ and www.water.ca.gov/waterconditions/docs/Drought_Response-Groundwater_Basins_April30_Final_BC.pdf

The 2014 Workshop, Climate Change and the Future of Groundwater in California, was funded by the UC Davis NSF Integrative Graduate Education and Research Traineeship on Climate Change, Water and Society (NSF DGE #1069333) and organized by the 2013 cohort of UC Davis and Colorado School of Mines (CSM) PhD students, who also contributed to this policy brief (ccwas.ucdavis.edu/People/Trainees/).