

# SAN FRANCISCO ESTUARY & WATERSHED SCIENCE

Sponsored by the Delta Science Program and the UC Davis John Muir Institute of the Environment

## EDITORIAL

# Essays on Groundwater

Samuel N. Luoma<sup>1</sup>, Editor-in-Chief, *San Francisco Estuary and Watershed Science*

Johnnie N. Moore<sup>2</sup>, Associate Editor, *San Francisco Estuary and Watershed Science*

Volume 13, Issue 3 | Article 1

doi: <http://dx.doi.org/10.15447/sfewsv13iss3art1>

1 John Muir Institute of the Environment  
University of California, Davis  
One Shields Avenue  
Davis CA 95616 USA  
[snluoma@ucdavis.edu](mailto:snluoma@ucdavis.edu)

2 Emeritus Professor  
Department of Geosciences  
University of Montana  
Missoula, MT 59812 USA  
[johnnie.moore@mso.umt.edu](mailto:johnnie.moore@mso.umt.edu)

This issue continues our policy at *San Francisco Estuary and Watershed Science* (SFEWS) of publishing short essays on a timely subject of interest to those concerned about the Bay-Delta watershed. Groundwater is one of the pillars upon which California water supplies depend and an important buffer during periods of drought such as the present one. However, our understanding of how much groundwater we use and how long it will last is currently inadequate if we are to manage the resource sustainably. To help alleviate this uncertainty, Governor Jerry Brown signed the Sustainable Groundwater Management Act in 2014, which encourages local agencies to work cooperatively to manage groundwater resources within their jurisdictions and to provide a methodology for developing a Groundwater Management Plan ([http://www.water.ca.gov/groundwater/groundwater\\_management/legislation.cfm](http://www.water.ca.gov/groundwater/groundwater_management/legislation.cfm)). The intent of these essays is to update readers on the status of California groundwater and discuss the methods used to understand the resource and its connections to the larger water supply in California. Groundwater has not been the subject of many papers in SFEWS, so we first asked Dr. John Bredehoeft to give us a short perspective on principals underlying sustainable groundwater use. Dr. Bredehoeft is Principal at The Hydrodynamics Group headquartered in Sausalito, California. He was a senior leader with the U.S. Geological Survey (USGS) for 32 years, both as a scientist and manager. He has served in many national and international advisory functions and has written seminal papers on topics ranging from mining groundwater for sustainable yield to underground storage of nuclear waste. We also asked Drs. Claudia Faunt and Michelle Sneed of the USGS to update us more specifically on the status and history of Central Valley groundwater resources and issues. Dr. Faunt is the Program Chief for Groundwater Framework and Applied Modeling for the USGS' California Water Science Center and was a co-author of a 2012 National Academies of Science study "Groundwater depletion and sustainability of irrigation in the U.S. High Plains and Central Valley." That study contrasted the limited life expecta-

tions of the High Plains aquifer with the more dynamic situation in the Central Valley, where groundwater recharge could contribute to solutions. Dr. Sneed is an expert on the land subsidence that has occurred in association with groundwater withdrawals in the Central Valley in the past, which is re-occurring today. She uses a wide range of ground-based and remote sensing techniques and tools to determine the detailed structure of aquifers and how overdraft can have far-reaching effects on water supply infrastructure as well as aquifer capacity. She has been recently invited to serve on the UNESCO Working Group on Land Subsidence, which advises the U.N. on global subsidence issues. We also asked Dr. Alexandra S. Richey to update us on the status of using remote sensing technology to assess groundwater resources. Dr. Richey is a postdoctoral associate at Washington State University in Pullman working on groundwater sustainability. In 2015 she published papers on annual change in groundwater storage from 2003 to 2013 in the 37 largest aquifer systems in the world. That study was partly based on data from the Gravity Recovery and Climate Experiment (GRACE), a pair of satellites that measures small changes in mass and gravity near Earth's surface (<http://earthobservatory.nasa.gov/IOTD/view.php?id=86263>). She explains outcomes for Central Valley groundwater using the GRACE technology.

The future resilience of California's water supply depends on how well we understand groundwater and surface water connections, and how well water managers incorporate that understanding into policy. These four authors give readers a deep insight into the complexity and connectedness of groundwater. Insights such as these will be needed by future water managers and policy-makers as they struggle to supply a vibrant and growing California with the water it needs.