



ANNUAL REPORT **2023**



**CALIFORNIA
INSTITUTE
FOR WATER
RESOURCES**

CIWR

California Institute for Water Resources

The California Institute for Water Resources (CIWR) integrates California's research, extension, and education programs to develop solutions for water management challenges. CIWR focuses on:

- Leading and supporting water resources research in collaboration with academic and agency partners in California
- Communicating research through engagement, extension, and media
- Coordinating resources across California's academic institutions and connecting researchers, communities, industry, and public agencies.

CIWR is based within University of California Agriculture and Natural Resources (UC ANR). Through our projects and programs, we work with collaborators across the state, including: University of California (UC) campuses and the Cooperative Extension (UCCE), California State University (CSU) campuses, federal and state agencies, local governments, and community-based organizations.

History

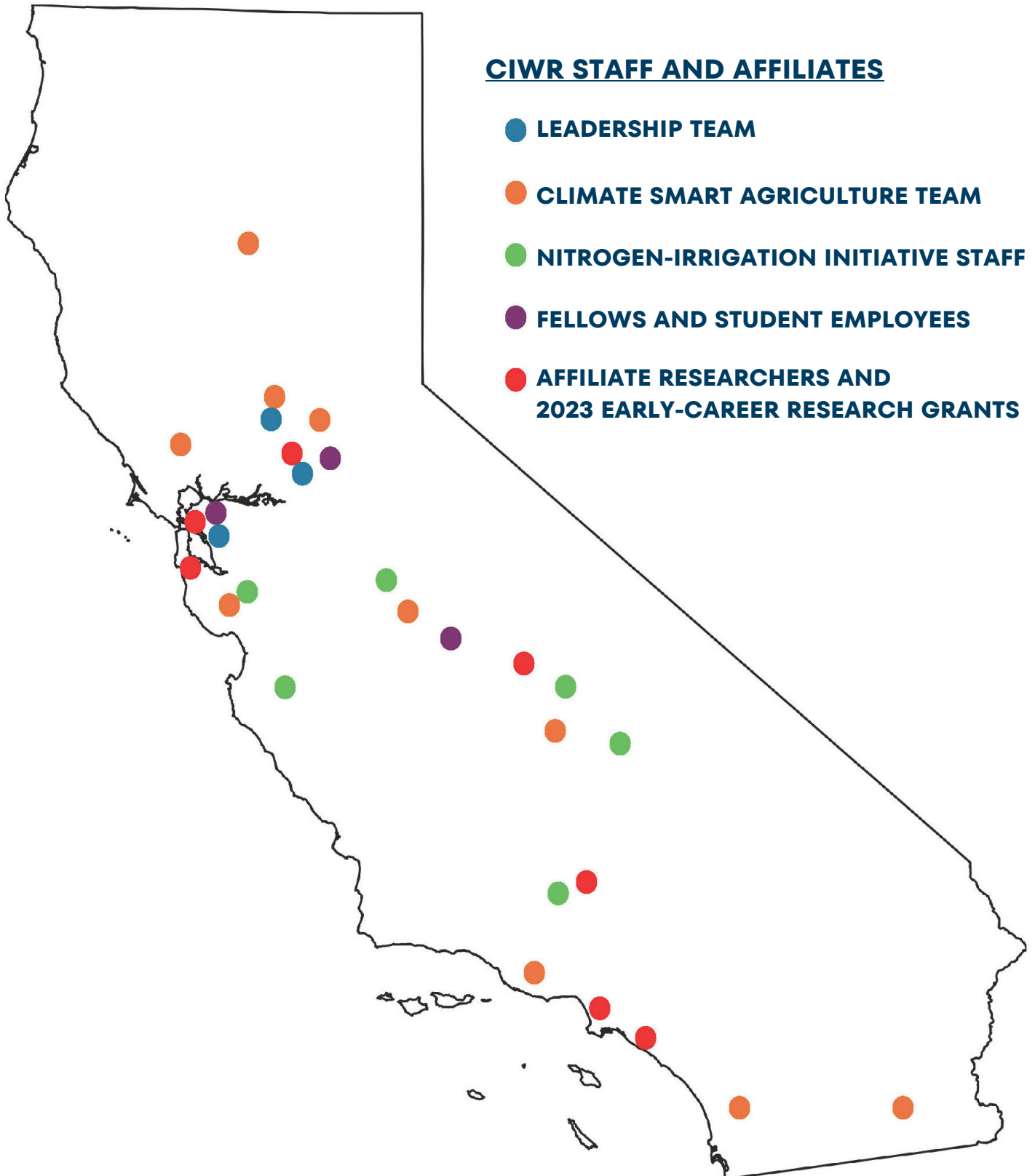
The first UC Water Resources Center was funded by the California State Legislature in 1957 to provide research and training for water resources in the state. The Center was alternatively housed at UCLA, UC Berkeley, UC Davis, and UC Riverside through 2009.

In 2011, the California Institute for Water Resources was founded as a statewide entity within the University of California, the state's land grant institution, which supports Cooperative Extension.



Yolo Bypass, Yolo County, California

LOCATIONS





LEADERSHIP



Erik Porse, Ph.D.

*Director, Cooperative
Extension Specialist*



Sam Sandoval Solis, Ph.D.

*Lead Faculty Affiliate, Professor of
Cooperative Extension, UC Davis*



Rachel Shellabarger, Ph.D.

*Academic Coordinator, Nitrogen and
Irrigation Initiative Program Manager*



Hope Zabronsky, M.S.

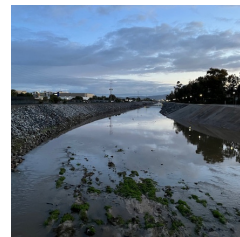
*Academic Coordinator, Climate Smart
Agriculture Program Manager*

PROGRAMS & PROJECTS

CIWR runs programs and projects in collaboration with partners throughout California, all focused on applied research, extension, and education for 21st Century water management.

WATER SYSTEMS

Water Resources Research



CSA

Climate Smart Agriculture



NIWR

National Institutes for Water Resources



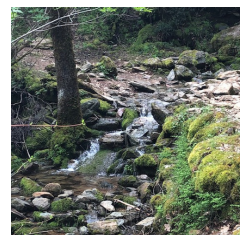
NII

Nitrogen and Irrigation Initiative



STUDENTS AND FELLOWS

Supporting Water Futures



WATER SYSTEMS

Research Projects in Water Resources

CIWR focuses on applied research for water management through systems-based and participatory approaches. We work with collaborators across California's universities and the Cooperative Extension.

Projects

California Wastewater Needs Assessment

CIWR is part of a team developing a first-of-its-kind assessment of water-related sanitation needs in California. The project will create a statewide framework to prioritize funding for sanitation systems in California, especially in marginalized and vulnerable communities.

COEQWAL: Collaboratory for Equity in Water Allocation

CIWR is supporting a use case of the COEQWAL project focused on drinking water. The use case will evaluate risks to community water systems in the Sacramento-San Joaquin Delta dependent on surface water given changes in climate and system operations.

Urban Water Systems and Finance

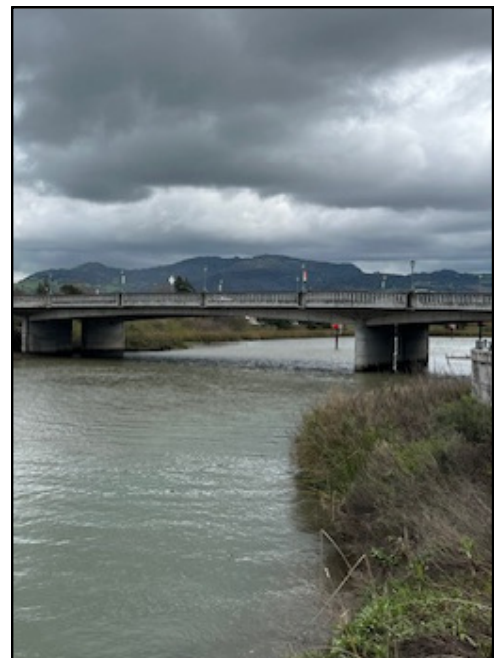
CIWR's projects are developing demand forecasting tools and evaluating the effects of drought on urban water agency finances.

Systems Modeling of Nitrogen Management

CIWR is evaluating drivers of decision-making for nitrogen management and developing statistical and simulation models to understand the effectiveness of enhanced management practices for fertilizer and irrigation use.

Resources for Community Drinking Water

CIWR is developing extension materials and capacity to support community drinking water access in collaboration with Colleen Naughton and the FEWS lab at UC Merced.



Napa River, Napa, California



Climate Smart Agriculture Program

In 2018, UC ANR and the California Department of Food and Agriculture (CDFA) developed a joint program to provide technical assistance in applying for and implementing Climate Smart Agriculture practices, which help agricultural producers build climate change resilience, increase water-use efficiency, and reduce greenhouse gas emissions.

UC ANR's team of Community Education Specialists provides technical assistance, outreach, and education to increase the adoption of climate smart agriculture practices targeted at soil health, manure management, and water use efficiency across California. Through the Climate Smart Agriculture team's programs and outreach, we:

- Establish and maintain grower connections
- Develop and present flyers, case studies, blogs, and newsletters
- Lead trainings, field days, on-farm visits, and workshops
- Participate in research and communicate findings
- Support project design, application, implementation, monitoring, and verification of CDFA's financial incentive programs
- Tailor assistance to especially support socially disadvantaged, non-English speaking, and priority population farmers and ranchers

Impacts

Since 2019, UC ANR's Climate Smart Agriculture Team has provided in-depth technical assistance to more than 1,300 farmers and ranchers in 25 counties, which has resulted in over 420 successful projects that are expected to save an estimated 8.3 billion gallons of water and reduce greenhouse gas emissions by more than 355,000 metric tons of carbon dioxide-equivalent.



Climate Smart Agriculture Tabling at Merced Farm Bureau's FARM2U Day

NIWR

National Institutes for Water Resources

CIWR represents California in the National Institutes for Water Resources, a national network of water institutes in states and territories. NIWR institutes work with the U.S. Geological Survey (USGS) to support water research and student training through the Water Resources Research Act (WRRRA). In California, CIWR uses WRRRA funds to support projects by early-career researchers at University of California campuses, California State University campuses, and UC Cooperative Extension (UCCE) offices. For the 2023-2025 grant cycle, CIWR's funded projects include:

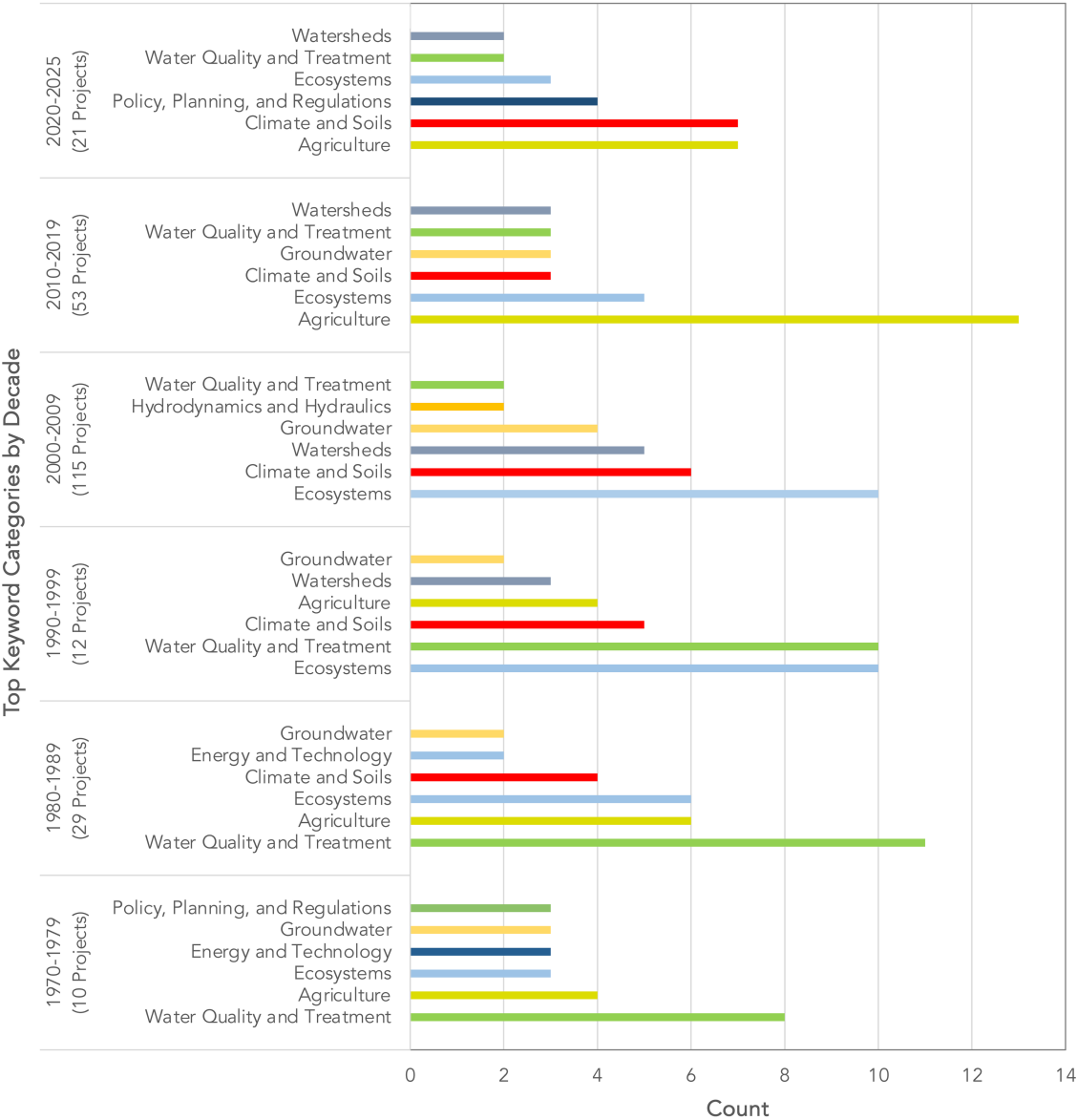
- **Jackie Atim** of Kearney Agricultural Research and Extension Center (sorghum production)
- **Nail Moonilall** of UC Davis (regenerative agriculture)
- **Erin Bray** of San Francisco State University (river modeling)
- **Kristin Dobbin** of UC Berkeley (drinking water system consolidations)
- **Sarah Light** of UCCE Sutter-Yuba (cover crops)
- **Abdelmoneim (Moneim) Mohamed** of UCCE Stanislaus, San Joaquin, and Merced Counties (modeling for deficit irrigation)
- **Chris Olivares Martinez** of UC Irvine (groundwater contamination and climate change)
- **Jorge Pesantez** of CSU Fresno (water distribution systems demand)
- **Danielle Zoe Rivera** of UC Berkeley (community-based flood risk resilience)



Fifty Years of Water Research Projects in California

For decades, CIWR and its predecessors have offered grants for water research at California's universities. Since 2011, the California Institute for Water Resources has funded research projects at UC (campuses and extension) and California State University campuses totaling nearly \$2 million in federal funds, including \$1 million to early-career researchers, which are all matched by state funding. How have these projects changed over time? We analyzed project data from 1970-2025 to see how the research interests have changed over time.

Prevalence of Water Resesarch Topics by Decade





Nitrogen Irrigation Initiative

The Nitrogen and Irrigation Initiative (NII) is a joint program for research and extension, with the goal of improving nitrogen and irrigation management in California. Through the program, UC ANR Advisors, Specialists, and Staff Research Associates (SRAs) deliver educational content, training, and consultations to growers and consultants in the San Joaquin Valley and Central Coast. The NII is a collaboration of CDFA, UC ANR, and UC Davis. Within UC ANR, the program is led by the Kearney Agricultural Research and Extension Center (KARE) and CIWR.

We work directly with growers, farm workers, and consultants to improve nitrogen use and irrigation efficiency. UC ANR Advisors and staff researchers collaborate with growers to deliver science-based, practical information for on-farm nitrogen and water management.

Activities

The NII program focuses on four main activities to improve irrigation and fertilizer management:

- *Educational Resources*- Printed materials, videos, blogs
- *On-Farm Trials*- Demonstrations to promote best practices for irrigation and nitrogen management
- *Training Events*- Webinars, workshops, field days, trainings, and one-on-one field visits
- *Grower Consultations*- Individualized grower consultations to make recommendations and assist with implementation



Nitrogen Management Training Workshop

STUDENTS AND FELLOWS

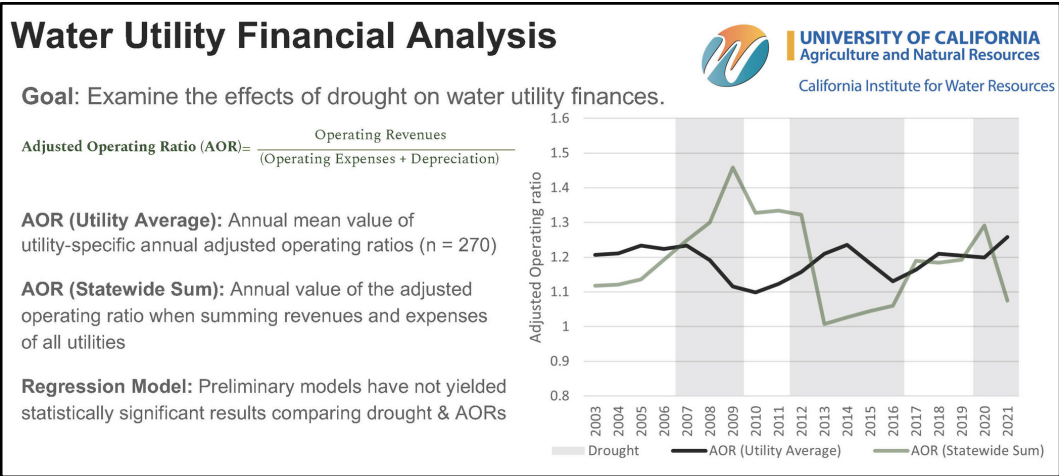
Supporting Water Futures

Student employees and fellows at CIWR work with our staff on applied research projects for water resources policy and management. Our students undertake projects ranging from data analysis and modeling to development of extension and outreach materials. Since 2023, CIWR has hosted fellows from UC Berkeley’s GrizzlyCorps program.

Examples of Projects

Extension Resources for Community Drinking Water Access

Water Utility Finances and Drought





EVENTS

Workshops

California Agricultural Policy and Engagement Workshop with California Climate and Agriculture Network (CalCAN), Climate Smart Agriculture, and Small Farms Programs. January 30, 2023. (Online)

2023 Irrigation Training Workshop with Small Farms, Climate Smart Agriculture, and NII programs. Fresno, CA. February 3-6, 2023

Technical Assistance for Nutrient Management and Reporting for the San Joaquin Valley Training Workshop. February 16, 2023. (Online)

2023 Alternative Manure Management Program (AMMP) Training Workshops: Best Practices and Support for Dairy and Livestock Producers. April 14, 2023. (Online)

Summer 2023 Climate Smart Agriculture Program Training Workshop. Ventura, CA. July 26-28, 2023

Fall 2023 Nitrogen and Irrigation Training Workshop. November 14, 2023. UC Kearney Research and Extension Center (KARE)

12th Pre-AGU Informal Water Management Workshop. December 8-9, 2023. Davis, CA (co-organizers: Erik Porse, Jon Herman, Josue Medellin-Azuara, Alvar Escrive-Bou, and Sam Sandoval Solis)

Workshops (continued)

California Small Agricultural Business Drought and Flood Relief Grant Workshop with Climate Smart Agriculture and Small Farms Programs. Santa Clara, CA. October 5, 2023. (co-facilitators: Aparna Gazula and Bailey Smith-Helman)

2023 State Water Efficiency and Enhancement Program (SWEET) Application Workshop. El Centro, CA. December 18, 2023 (co-facilitators: Aliasghar Montazar and Ana Resendiz)

Climate Smart Agriculture for Nut Production. Merced, CA. March 22, 2023 (co-facilitators: Samuel Ikendi, Vikram Koundinya, Caddie Bergren, Namah Chiamo Taku-Forchu, Lauren Parker, Natalia Pinzon, Leslie Roche, and Tapan Pathak)

Sacramento Valley Technical Assistance Provider Workshop. (Online). May 4, 2023

Multifaceted Pathways to Climate-Smart Agriculture through Integrated Participatory Program Development and Delivery: Focus Group Interviews and Information Sessions with Farmers and Ranchers in San Diego. San Diego, CA. July 20, 2023 (co-facilitators: Tapan Pathak, Vikram Koundinya, Samuel Ikendi, and Esther Mosase)

Supported Events

SGMA in 2023: Advancing an Agenda to Meet Emerging Needs. June 6, 2023, Banatao Auditorium, UC Berkeley (co-organizers: Ellen Bruno and Kristin Dobbin).

Marsh on the Move. Fairfield High School. UC Davis Center for Watershed Sciences.

Journey for Water, Climate, and Environmental Justice. UCLA Luskin Lecture by Catherine Coleman Flowers. April 27, 2023. UCLA.

Secure Water Future Water Hack Challenge. April 21-23, 2023. UC Merced.

PUBLICATIONS

Reports, Articles, and Abstracts

Qing Shuang, Ring Ting Zhao, and Porse, Erik C., "Cluster Analysis and Predictive Modeling of Urban Water Distribution System Leaks with Socioeconomic and Engineering Factors." (2023). *Water Resources Management*. Volume 38. Pages 385-400.

Erik Porse, "Systems analysis of metropolitan-scale reuse with effects on water supply resilience and water quality" (2023). *Civil Engineering and Environmental Systems*. 1-23.

Erik Porse, Jonathan Kaplan, Harold Leverenz, Caitlyn Leo, Dakota Keene, David Babchanik, Erick Eschker, and Jonathan Kaplan (2023). "Adapting Wastewater Systems in California for Water Conservation and Climate Change." *Sustainable and Resilient Infrastructure*.

"The Climate Smart Agriculture Program at UC ANR: 2019-2022 Report." (2023). CIWR and the California Department of Food and Agriculture. June 2023.

Joanna Solins, Erik Porse, Bogumila Backiel, Stephanie Pincetl, Mary L Cadenasso. "Evaluating risk for residential trees under new standards for urban water use in California, USA." *American Geophysical Union 2023 Conference*. December 12, 2023.

Erik Porse and Jonathan Kaplan. "Forecasting Urban Water Conservation and Wastewater Production in California with Climate, Technological, Economic, and Social Influences." *American Geophysical Union 2023 Conference*. December 13, 2023.

Marie Philine Gross, Erik Porse, Alvar Escriva-Bou, and Andrea Cominola, "Evaluating the Potential of Combined Water Supply and Demand Management Strategies in California." *American Geophysical Union 2023 Conference*. December 11, 2023.

Sam Sandoval Solis and the UC Davis Water Management Lab (2023). "Guidelines for Agave Selection and Production in California: A guidebook for California's emerging Agave industry."

Samuel Ikendi, Vikram Koundinya, Caddie Bergren, Namah Chiamo Taku-Forchu, Lauren Parker, Natalia Pinzon, Leslie Roche et al. "Communicating Climate Smart Agriculture to Tree Nut Growers in the San Joaquin Valley of California." In Western Region of the American Association for Agricultural Education Research Conference: The Crossroads of Food, Agriculture, and Innovation. 2023.





CIWR Supported Research

Research supported fully or partially through funding from the Water Resources Research Act and UC ANR.

Dobbin, K. and McBride, J. (2023). "LAFCo and Water System Consolidation: Bridging the gap between local and state regulators to stop and reverse water system fragmentation." University of California, Berkeley.

Perrone, D., Rohde, M.M., Hammond Wagner, C. et al. (2023) Stakeholder integration predicts better outcomes from groundwater sustainability policy. *Nat Commun* 14, 3793.

Qin, Y., C. Hong, H. Zhao, S. Siebert, J. Abatzoglou, L. S. Huning, L. L. Sloat, S. Park, S. Li, D. K. Munroe, T. Zhu, S. J. Davis, and N. D. Mueller (2022), Snowmelt risk telecouplings for irrigated agriculture, *Nature Climate Change*, 12, 1007-1015.

Rhoades, A. M., B. J. Hatchett, M. D. Risser, W. D. Collins, N. E. Bambach, L. S. Huning, R. McCrary, E. Siirila-Woodburn, P. A. Ullrich, M. F. Wehner, C. M. Zarzycki, and A. D. Jones (2022), Asymmetric emergence of low-to-no snow in the midlatitudes of the America Cordillera, *Nature Climate Change*, 12, 1151-1159.

AghaKouchak, A., L. S. Huning, M. Sadegh, Y. Qin, Y. Markonis, F. Vahedifard, C. A. Love, A. Mishra, A. Mehran, R. Obringer, A. Hjelmstad, S. Pallickara, S. Jiwa, M. Hanel, Y. Zhao, A. G. Pendergrass, M. Arabi, S. J. Davis, P. J. Ward, M. Svoboda, R. Pulwarty, and H. Kreibich (2023) Toward impact-based drought monitoring: From indicators and processes to cascading hazards, *Nature Reviews Earth & Environment*, 4, 582-595.

Kreibich, H., and 90 co-authors including L. S. Huning (2023), Panta Rhei benchmark dataset: Socio-hydrological data of paired events of floods and droughts, *Earth System Science Data*, 15, 2009-2023.

Scordo, F., Sadro, S., Culpepper, J., Seitz, C., & Chandra, S. (2022). Wildfire smoke effects on lake-habitat specific metabolism: Toward a conceptual understanding. *Geophysical Research Letters*, 49.

Thaw, M., GebreEgziabher, M., Villafaña-Pagán, J.Y., Jasechko, S. (2022). Modern groundwater reaches deeper depths in heavily pumped aquifer systems. *Nature Communications* 13, 5263.

Hilton, A., Jasechko, S. (2023). Widespread aquifer depressurization after a century of intensive groundwater use in USA. *Science Advances* 9.

NUMBERS

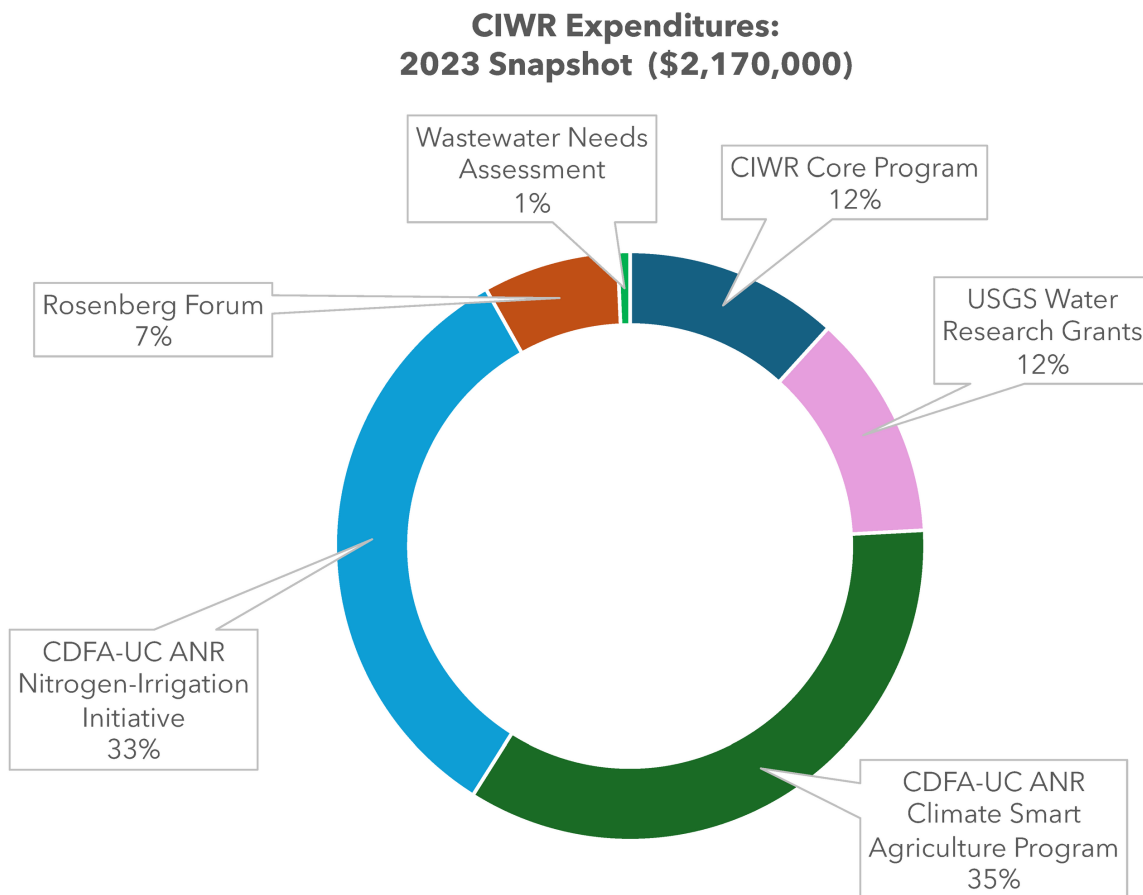
Networks of Collaboration

As a statewide program within the University of California, our staff, students, and fellows are based in counties and at campuses across California to serve communities throughout the state.

27 researchers, students and fellows

28 counties

\$2.1 million of state and federal funding for projects throughout California.



COMMUNICATIONS

An Active Voice in California Water

CIWR is a leader in research communications for water management in California. We promote innovative and diverse views in water management through social media, webinars, and outreach, including Twitter/X (10,000+ followers), YouTube (1 million+ views), and The Confluence Blog.

CIWR maintains informational resources and tools on drought management, water research history, and nitrogen management.

CIWR's Lead Faculty Affiliate Sam Sandoval Solis maintains the

California Virtual Water Tour

A unique platform for exploring California water management

In 2023, the highly rated **Water Talk** podcast finished its fourth season covering topics of:

- Sierra Snowpack
- Water Advocacy
- Rural Sociology and Water
- Comparative Water Politics
- Nitrogen Management
- Salton Sea
- Dam History
- Water Insecurity
- Atmospheric Rivers



ALUMNI

Leadership

We all stand on shoulders. CIWR's current programs and projects are a direct result of a decade of work by its founders:

Doug Parker, *Director Emeritus* (2011-2022)

Faith Kearns, *Research Communications Director* (2013-2023)

CIWR Research Grant Recipients (2011-2023)

Amanda Banet
Amir Haghverdi
Andrew Fisher
Andrew Gray
Brent Haddad
Scott Jasechko
Scott Hauswirth
Carolina Balazs
Haizhou Liu
Daniel Geisseler
Debra Perrone
Ellen Bruno
Greg Husak
Helen Dahlke
Isaya Kisekka
Jennifer Duggan
Joseph Blankinship
Laurie Huning
Mallika Nocco
Maura Allaire
Michael Bogan

Michael Cahn
Nathaniel Bogie
Priya Ganguli
Roya Bahreini
Stephanie Carlson
Steven Sadro
Ted Grantham
Albert Ruhi
Bruce Linquist
Kevin O'Hara
Michelle Leinfelder-Miles
Amelia Vankeuren
Leah Stokes
Jonathan London
Larry Williams
Eric Palkovacs
Leigh Taylor Johnson
Mark Matthews
Jeff Mitchell
Margaret Zimmer
Igor Lacan



The California Institute for Water Resources

is a hub for water research, extension, and education programs in California. Our mission is to bring knowledge into practice through collaborations that address water resource challenges.



California Institute for Water Resources

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