

# FY22 ANNUAL REPORT



**COLORADO  
WATER CENTER**

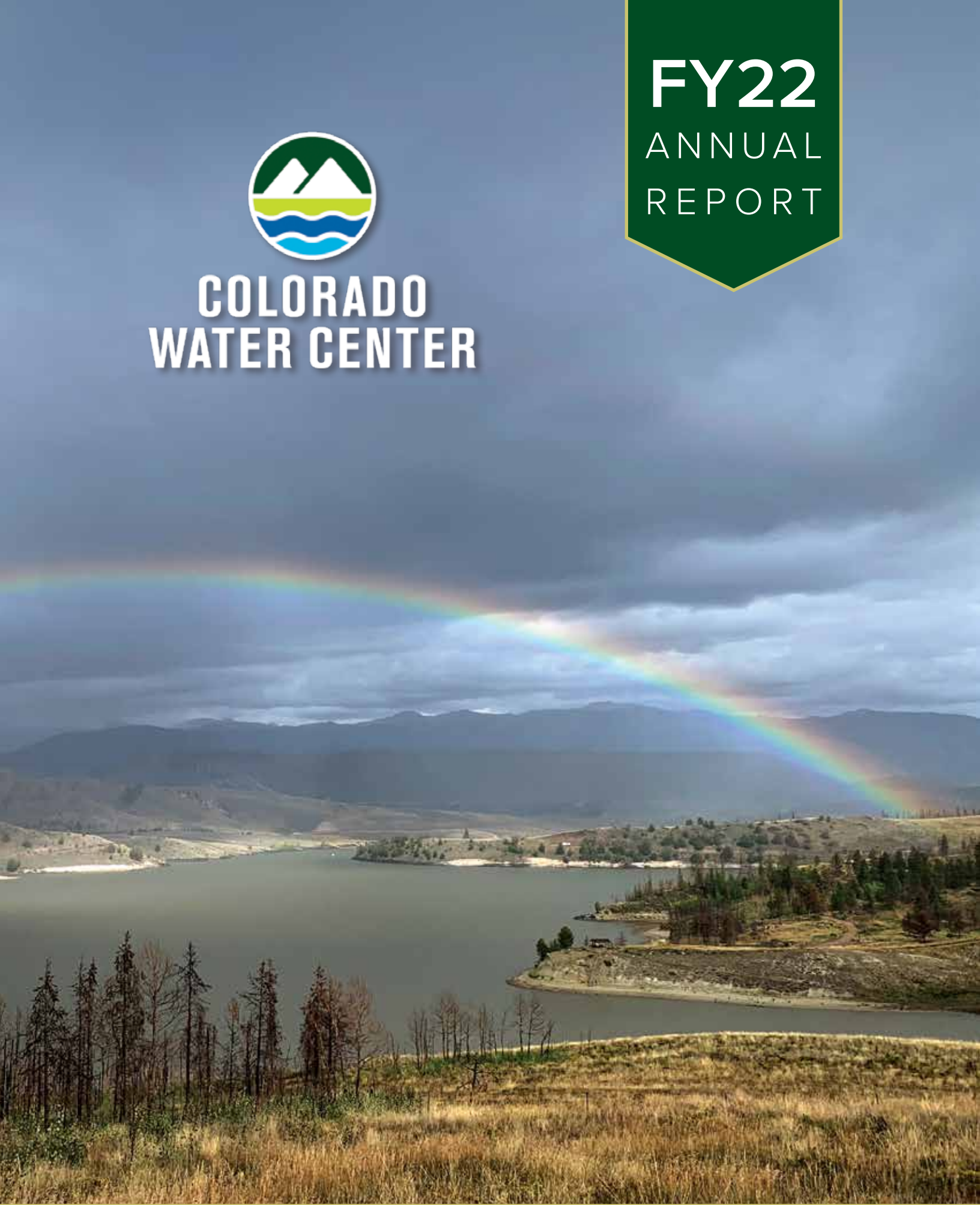


COLORADO STATE UNIVERSITY



# COLORADO WATER CENTER

FY22  
ANNUAL  
REPORT





# COLORADO WATER CENTER



@COWaterCenter



@ColoradoWaterCenter

## Who We Are

The Colorado Water Center (CoWC) is one of 54 Water Resources Research Institutes created by the Water Resources Act of 1964, as amended in 1984, which collectively form the National Institutes for Water Resources.

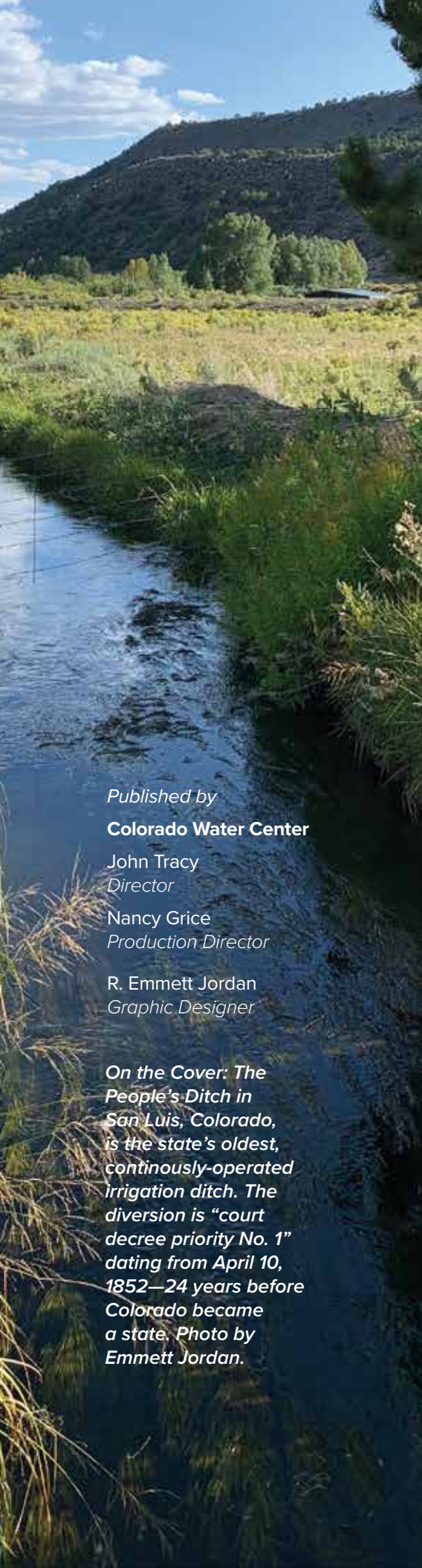
As a division under CSU's Office of Engagement & Extension, the CoWC aims to connect water expertise in Colorado's higher education system with the research and education needs of the Colorado water agencies and water users. The CoWC develops interdisciplinary research, education, and outreach programs to address complex and evolving water-related challenges in Colorado, the inter-mountain west region, and across the United States. We do so by working to develop collaborative relationships between higher education and water stakeholders, synthesizing water research findings to create knowledge that informs policy setting and decision-making, and inspiring the next generation of water leaders.

## Outreach and Transfer

The CoWC administers three CSU Extension regional water specialists across the agricultural regions of the state and supports a variety of websites that provide up-to-date water information that is a consistent source of knowledge to the professional water community, as well as the general public with an interest in water resource issues. Publications available on these sites include research reports and *Colorado Water*, a newsletter containing information on current research, faculty, staff, and students, program updates, climate, water history, Colorado State Forest Service (CSFS) updates, CSU Competitive Grant Program updates, and water-related events and conferences. The CoWC's outreach activities are conducted with other university centers, CSU Extension, the Colorado Agricultural Experiment Station, the CSFS, and the Colorado Climate Center. We work with a wide range of partners across the state that include water planning and management agencies, water suppliers, and NGOs.

## Training

One of the CoWC's primary missions is to facilitate the training and education of university students. To this end, the CoWC works with the U.S. Geological Survey and the Colorado Water Conservation Board to fund student interns, sponsor research grants, and manage student scholarships. Student researchers work with faculty members to gain valuable water expertise and knowledge of the research process.



# TABLE OF CONTENTS

- Message from the Interim Director ..... 2
- New Research ..... 3
- CSU Faculty Grant Program ..... 5
- CoWC Staff Updates ..... 6
  - Perry Cabot..... 6
  - Joel Schneekloth ..... 7
  - Brad Udall ..... 9
- Year in Review ..... 10
  - GRAD592 .....10
  - GES120 .....11
  - SWIM .....11
  - Published Reports.....12
  - Colorado Water .....12
  - The Current .....13
  - Social Media .....13
  - Events .....14
  - John Fetcher Scholarship Recipients ...15
- CoWC Staff..... 16
- External Advisory Board .....18
- CSU Faculty Executive Committee ..... 19
- Financial Summary .....20

Published by  
**Colorado Water Center**  
 John Tracy  
 Director  
 Nancy Grice  
 Production Director  
 R. Emmett Jordan  
 Graphic Designer

*On the Cover: The People’s Ditch in San Luis, Colorado, is the state’s oldest, continuously-operated irrigation ditch. The diversion is “court decree priority No. 1” dating from April 10, 1852—24 years before Colorado became a state. Photo by Emmett Jordan.*

## Message from the Director

This has been a year of significant change for the Colorado Water Center, the Colorado State University System, and within our society.

I believe the biggest change that all of us have felt this year is the move back to “normal” as the effects of the pandemic have eased. This has meant that we are finally able to attend meetings in person, seeing each with all of our senses, and being able to engage in discussions with people that we randomly run into at these meetings. While there was a great efficiency in meeting virtually over Zoom® or Teams® by not having to spend time traveling between meetings. There was also a loss of efficacy in expanding the diversity of people and groups engaged in these conversations by only being able to meet in a virtual space. We have already seen the benefits of in-person meetings with our first Water Literate Leaders meeting taking place in September, and with the Colorado River Symposium organized by Jennifer Gimbel being held at the CSU Lory Student Center in late September. I look forward to the Water Center developing and supporting conference, symposia, and events in the coming months and years, and I look forward to having a chance to randomly meet all of you at one of these meetings.

It has also been a year of significant change across CSU, with the completion of the CSU Spur Campus and changes occurring with much of CSU’s leadership at the University and College level. The final building to open on the CSU Spur Campus will be the Hydro building, in January of 2023. The Spur Campus will provide an opportunity for the Water Center to widen our programs and impact, and to directly address many of the pressing water issues facing urban front range cities, as well as to engage with a wider range of communities that have traditionally been underrepresented in discussions of the future of Colorado’s water resources.

Finally, there has been quite a bit of change within the Colorado Water Center itself. First, it was an honor to be selected as Director of the Water Center this year, and I will work diligently to maintain the reputation of the Center as one of the leading voices on water issues that affect Colorado, the nation, and the world. I took over for Jennifer Gimbell in mid-July of 2022, and I would like to thank Jennifer for leading the Water Center through both the transition in our leadership, and through the pandemic. Jennifer will still be working with the Water Center in a part time capacity, continuing her work in addressing the pressing issues facing the Colorado River.

A second change that has occurred in the water center is that a number of staff have moved onto new phases in their careers. After a stellar career in addressing how climate change is affecting western water resources, Brad Udall

retired at the end of the 2022 spring semester. Brad has graciously agreed to continue working with the Water Center as a part time scholar, with his work focusing on how climate change is affecting the hydrology of the Colorado River and its tributaries.

Julie Kallenberger has moved on from her position as Associate Director for the Water Center, to a new position with the School of Global Environmental Sustainability with CSU, and to starting up a new venture with Camp5 LLC. Julie will be missed by the Water Center, but she will still be an active voice in addressing Colorado water issues in her new positions.

Blake Osbourn has also transitioned to a new position with the Lower Arkansas Valley Water Conservancy. Blake’s work related to wildfire impacts on water resources will continue within the Water Center, and we look forward to collaborating with Blake in the future in his new position.

Finally, after years of very productive collaborations with Perry Cabot and Joel Schneekloth addressing agricultural water management challenges across Colorado, both are now officially part of the Colorado Water Center. Perry has a joint position as a Water Extension Specialist with the Water Center, and a Research Scientist with the CSU Agricultural Experiment Station, and will continue developing sustainable agricultural water management approaches for Colorado’s Western Slope Region. Joel is now a Water Extension Specialist with the Water Center, and his work will continue to focus on improving the efficacy of water management in irrigated and dryland cropping systems in the Eastern Plains of Colorado. I am very pleased that both Joel and Perry have become part of the Water Center, and look forward to working with them to build connections across CSU, the state and the region to help them expand the impact of their programs.

I am looking forward to moving past this year of change, and focusing the coming years on working with Colorado’s water resource stakeholder communities, faculty, researchers, and extension specialists in growing our programs and impacts, and creating a “new normal” for the Water Center.



John Tracy

A handwritten signature in blue ink that reads "John C. Tracy". The signature is written in a cursive, slightly slanted style.

John Tracy, Director

# FY22 New Research



Steamboat Springs Ski Resort. Photo © likoper - stock.adobe.com.

## USGS/NIWR

**A Combined Machine-Learning and Kriging Surface Temperature Approach for Crop Water Stress Mapping**

*José Chavez, Colorado State University*

**Post-fire sediment retention to enhance watershed resilience to wildfire, Colorado Rocky Mountains**

*Sarah Rathburn, Colorado State University*

**Pop-Up Hyporheic Zones: A New Technology for Cleaning Urban Drift in Colorado**

*John McCray, Colorado School of Mines*

**Recovery of semi-arid grassland plant populations and communities from extreme drought**

*Melinda Smith, Colorado State University*

**Lab and Field Evaluation of Biopolymers to Reduce Seepage in Colorado Irrigation Canals**

*Melinda Smith, Colorado State University*

**Forest Fire Influences on Snowpack Timing**

*Steven Fassnacht, Colorado State University*

**Cameron Peak Fire effects on snowpack and streamflow across an elevation gradient**

*Stephanie Kampf, Colorado State University*

**Examining nuance in variability of climate-hydrological trends over the Upper and Lower Colorado River Basins**

*Steven Fassnacht, Colorado State University*

## Stay Up-to-Date!

Subscribe to our e-newsletter, *The Current*, or our print newsletter, *Colorado Water*, for updates on research, water-related news, jobs, funding, scholarships, and more!

[watercenter.colostate.edu](http://watercenter.colostate.edu)

## USGS/NIWR Student Research

**Assessing Depositional Patterns and Sourcing of Floodplain Large Wood on the Colorado Front Range**

*Katherine Lininger (PI), Molly Guiney, University of Colorado, Boulder*

**A Genetic Assessment of Cutthroat Trout Movement Across the Continental Divide: "A Grand connection or not?"**

*Yoichiro Kanno (PI), Audrey Harris, Colorado State University*

**Snowpack Accumulation Model: Accounting for the Effects of Snowfall Induced Landscape Resurfacing**

*Steven Fassnacht (PI), Alex Olsen-Mikitowicz, Colorado State University*

**Evaluating the Future of Colorado's Outdoor Ice Rinks in a Changing Climate**

*Steven Fassnacht (PI), Megan Sears, Colorado State University*

**Steamboat Resort Recreational Impacts on Streamflow**

*Stephanie Kampf (PI), Marielle Sidell, Colorado State University*



The South Platte River near Denver. Photo by MarekPhotoDesign.com - stock.adobe.com

## CSU Faculty Grant Program

Assessing the state of knowledge on the nature, extent, and impact of water salinity in the South Platte River Basin

*Allan Andales, Colorado State University*

Stakeholder-driven Outreach to Enhance Agricultural Producer's Resilience to Drought and Climate Uncertainty

*Christina Welch, Colorado State University*

Providing Bilingual Rain Garden Resources to Colorado Communities

*Jessica Thrasher, Colorado State University*

Multidisciplinary approach to investigate the role of drainage from high-elevation wetlands in maintaining baseflow in headwater streams

*William Sanford, Colorado State University*

Evaluation of proximal- aerial- and Spaceborne-based remote sensing estimation of Crop Biophysical Characteristics and Water Use

*José Chavez, Colorado State University*

Envisioning the Future of Colorado's Climate and Water

*Pat Keys, Colorado State University*

## CWCB

Winter Pea Crop Rotations as an Approach to Make Summer Irrigation Water Available for Temporary Water Sharing Arrangements

*Davis, Jessica/Cabot, Perry/Mooney, Daniel, Colorado State University*

Literature review of instream flow approaches to protect fish in Colorado

*Kanno Yoichiro, Colorado State University*

Modeling the Long-term Hydrological Effects of Post-fire Rehabilitation Techniques in Two Experimental Watersheds in Colorado: A Preliminary Assessment-Colorado School of Mines

*John McCray, Colorado School of Mines*

Calibrating 2D hydraulic models using end-members of watershed response to wildfire

*Ryan Morrison/ Ellen Wohl, Colorado State University*

Integrating Bioenergy Crops with Alternative Transfer Methods to Reduce Agricultural Water Use, Maintain Agricultural Production, and Improve Rural Economics

*Jason Quinn, Colorado State University*

Effects of post-fire mulch applications on long-term watershed recovery

*Anthony Vorster, Colorado State University*

# FY22

## CSU Faculty Competitive Grant Program

[watercenter.colostate.edu/grants/](http://watercenter.colostate.edu/grants/)

### **Effects of the Cameron Peak Fire on stream-riparian food webs along an elevational gradient**

*Dan Preston, Colorado State University*

### **Fire, Fungi, and Flora: How plant and soil microbial succession drive hydrologic processes post-fire**

*Camille Stevens-Rumann, Colorado State University*

### **Knowing Rivers for Life: Toward an ethic for flowing waters**

*Kurt Fausch, Colorado State University*

### **Writing Water: Engaging underserved youth and adults through critical literacy and water education**

*Tobi Jacobi, Colorado State University*

### **River investigators: Connecting youth and families to the Cache la Poudre River**

*Nicole Stafford, Colorado State University*

### **Using water isotopes in Colorado and New Mexico to understand hydroclimate in the Southwest: Implications for understanding and harnessing the geological record of past climate**

*Jeremy Rugenstein, Colorado State University*

### **High elevation fire controls on reservoir and river algae blooms**

*Matthew Ross, Colorado State University*

*Cameron Peak Fire burn scar and recovery, Rocky Mountain National Park. Photo by Emmett Jordan.*





# FY22 Staff Updates

## Emphasis on Water Resources for Western Colorado Research Center

*Perry Cabot, Research Scientist and Extension Specialist, Colorado Water Center*

### INTRODUCTION

The Colorado Water Center (CoWC) partners with CSU Extension (CSUE) and the CSU Agricultural Experiment Station (AES) to serve stakeholder interests in the Upper Colorado River Basin and the counties of Colorado's Western Region. The WCRC-Grand Valley (WCRC-GV) concentrates on the research and extension mission of these campus partners through: (1) innovative irrigation technologies; (2) sustainable water resources management; (3) alternative cropping systems, and; (4) crop consumptive use evaluation. Projects are undertaken at the WCRC-GV when they meet specific criteria guiding its mission and goals. Producer support, extramural funding, faculty and extension engagement, publishable results and progressive thinking, for example, are highly important features of the work at the WCRC-GV.

### HIGHLIGHTED RESEARCH AND EXTENSION PROJECTS

The coordinated efforts between the CoWC, CSUE, and AES have supported projects that focus on water issues shared by the missions of these partners.

In the area of innovative irrigation technology, the WCRC-GV has undertaken a large project entitled "Arti-

ficial Intelligence for Sustainable Water, Nutrient, Salinity, and Pest Management in the Western US," in partnership with the USDA National Institute of Food and Agriculture, University of California at Riverside and Kansas State University. This project demonstrates the CSU commitment to agri-technology through precision agriculture (PA), digital agriculture (DA), artificial intelligence (AI) and big geodata analytics. Agriculture in the West faces rapidly increasing pressure from changing climate, competition for resources, and uncertain global markets that threaten rural prosperity due to reduced profits, harsher growing conditions, and environmental degradation. The guiding principle of this project is that leveraging advances in AI, DA, big geodata analytics and other supercomputing technology, can contribute to advancements in US agriculture by prioritizing resource optimization and sustainability.

In the area of sustainable water resources management, we continue to utilize drip irrigation to the greatest extent possible and cover crops that requires less water and provide an opportunity for soil rehabilitation. While cover-cropping is not directly profitable, reducing the pressure on the soil resources sets them on a long-term sustainability pathway.



Figure 1. Aerial view of the Western Colorado Research Center at Grand Valley field where Overhead Linear Move System is being installed.

In the area of alternative cropping systems, the WCRC-GV is focused on winter cropping systems that would allow producers to rest soils—and perhaps even lease water—during the hot summer months, while farming more novel winter crops such as pulses, triticale and Kernza® (*Thinopyrum Intermedium*). Several projects have been undertaken in support of this goal, such as “Improving Environmental and Economic Sustainability Outcomes through Incorporation of Pulses into Irrigated and Dryland Crop Rotations” funded by the ARS Pulse Crop Health Initiative and “Winter Pea Crop Rotations as an Approach to Make Summer Irrigation Water Available for Temporary Water Sharing Arrangements” funded through the Colorado Water Center, and “Developing Best Management Practices for Organic Chickpea Production, funded by the Colorado Department of Agriculture.

*Conserved Consumptive Use Evaluations.* The CoWC continues to be the lead for a collaborative project, entitled “Evaluating Conserved Consumptive Use in the Upper Colorado,” which completed a third year of remotely sensed estimations of conserved consumptive use, strategies for reduced consumption, economic considerations, forage yield and quality impact of reduced pasture irrigation, and producer engagement. In partnership with the Desert Research Institute and Utah State University, research began in the summer of

2020 after conservation measures were implemented. Project field work involves treatment parcels where irrigation is changed compared to historical practices (either reduced or stopped completely) and reference parcels where past irrigation patterns are unchanged. Nine landowners participated in the Project, enrolling a total of 1,142 acres in treatment and another 405 acres as reference fields. Beginning in 2021, parcels were returned to normal irrigation with monitoring that will continue through 2023.

Changes in crop consumptive use (CU) that result from reduced irrigation drive the full range of impacts investigated in the Project. In this Project, modeled estimates of ET made by OpenET ([www.etdata.org](http://www.etdata.org)), a new and innovative remote sensing application, were compared with measurements made onsite by sensitive field equipment (eddy covariance and soil moisture monitoring). Remotely sensed estimates of crop water use have tracked closely with measurements made on the ground, suggesting remote sensing approaches may provide a more cost effective and scalable tool to support water conservation activities and programs. During at full-season of irrigation curtailment, fields exhibited a range of 42-45% reduction in CU, but also began to recover in 2021 and 2022 despite the period of heavy stress brought on by lack of water in 2020. □

---

## Water Management Issues in NE Colorado

*Joel Schneekloth, Water Resources Specialist, Northern Region*

Efficient Water Management is a constant issue within Colorado for both irrigated and dryland production. From 2021 to 2022, we began several projects looking at water conservation and management for both irrigated and dryland production systems. Several of these projects have been with the “push” from producers and companies within NE Colorado.

### ALTERNATIVE CROPS

Finding new crops that can work in a limited irrigation and dryland practices are important in systems for Colorado. The major factors for irrigation in the Ogallala Aquifer region are diminishing well capacities, and in alluvial aquifer systems is potential limited water allocations due to drought. We began an irrigation/water response of cowpea (black eyed peas) project in 2021 and continued it in the 2022 growing season.



*Assorted cowpea varieties. Photo by Roemj9999/Wikimedia Commons.*

Cowpea, which originates from the sub-Saharan region of Africa, are noted for their drought tolerance. Little information can be found about their water response functions as well as effective water management techniques when limited water resources are available. Research began in 2021 on the water use of cowpea under 4 water management strategies ranging from dryland to full water. Two

limited irrigation strategies were also incorporated into the research looking at the response of cowpea to water during the reproductive growth stage. These two irrigation strategies were 4 and 8 inches of water applied over a 4-week period after flowering began.

Results from 2021 show that cowpea do not respond positively to fully watered crops in regard to grain yield. Crop water use (ET) was maximized at 18 inches; however, grain yield was optimized at nearly 15" of ET. The additional ET resulted in greater vegetative growth with no increase in yield compared to a limited irrigation strategy. The yield ET relationship of cowpea was very similar to that of proso millet which is a commonly grown dryland crop in the region with a similar response of yield per inch of ET as well as water needed to see the first increment of grain yield (Figure 1).

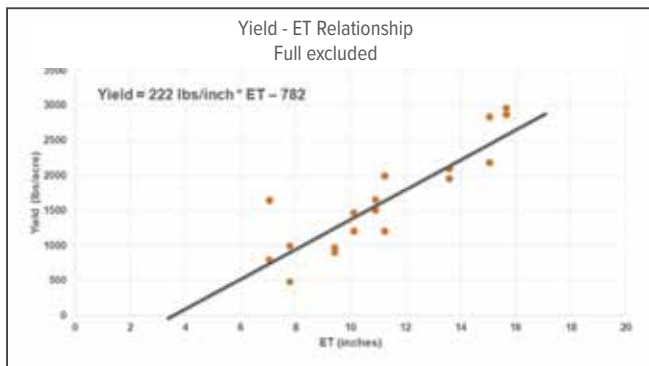


Figure 1. Cowpea Yield versus Crop Evapotranspiration

Under typical water management strategies, dryland production typically has the greatest utilization of soil moisture followed by limited irrigation strategies while full irrigation management utilizes the least stored soil moisture. Dryland cowpeas utilized the greatest amount of soil moisture compared to irrigated strategies (Figure 2). However, the limited irrigation strategies of 4 and 8 inches of water applied used less soil moisture as compared to full irrigation. These unique differences could lead to further reductions in irrigation applied without impacting

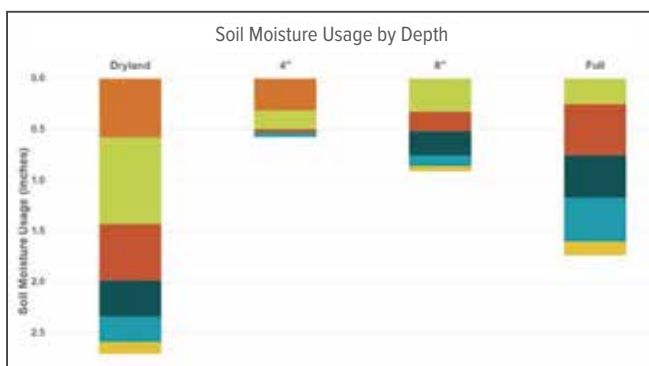


Figure 2. Soil moisture utilization of cowpea by depth for 4 irrigation strategies.

grain yields. However, a secondary impact is that more soil moisture is available after harvest that could be utilized by a crop such as winter wheat planted after cowpea.

**PRECISION FARMING – WATER MANAGEMENT**

A secondary study for dryland precision management was looking at the impacts of plant populations and in-season precipitation. With declines in the Ogallala Aquifer, there is a transition of irrigated acres to dryland production. The effect of changing plant populations on moisture availability is not well understood in the High Plains agricultural regions of Colorado. This study was constructed to look at differences in the beginning stored soil moisture and in-season precipitation for different plant populations. However, the precipitation in the study area was well above normal for the study period, which eliminated any differences in the stored soil moisture.

The early above average moisture conditions were followed by near record dry conditions in June, July and August. With below average precipitation, lower plant populations yielded greater than higher populations (Figure 3). As moisture increased, yields increased.

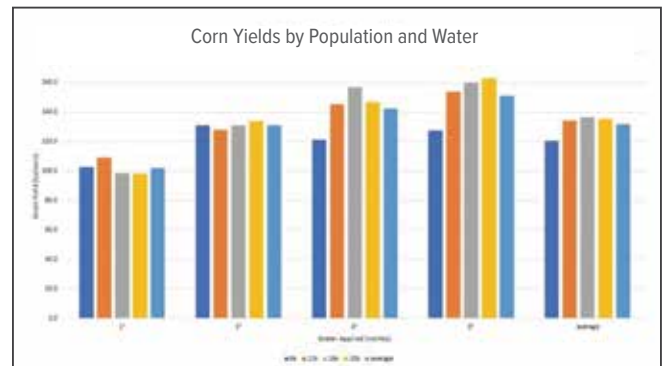


Figure 3. Grain yields of dryland population by water applied.

Explanations of this are with more limited water, lower populations utilized less water during the vegetative growth stages which left more water for the reproductive stages. However, as water applied increased, the increase in vegetative growth allowed for more potential grain with more ears available. The lower populations could not increase kernel set or number of ears per plant to offset the increased number of plants.

Increasing the knowledge of how corn responds to water availability with low populations has increased the knowledge of placing the correct populations by water availability within the field. Choosing the correct population then becomes an economic analysis within the planting decisions. □

## Continuing Crisis in the Colorado River

*Brad Udall, Senior Water and Climate Scientist Scholar*

### INTRODUCTION

The ongoing Colorado River drought continues to be the focus of my work. Runoff in 2022 was again well below normal, similar to the runoff seen in 2020 and 2021. The result of these successive years with well below average runoff is that Lake Powell and Lake Mead are not at less than 30% capacity, and with a continuing declaration of a Tier 1 shortage condition. The ongoing flow and reservoir declines have sparked intense interest from stakeholders, the press, and the public. My report below is broken into sections on Publications, Outreach and Teaching, Grants, Press Contacts, and Service Activities.

### PUBLICATIONS

John Fleck and I wrote “Managing Colorado River Risk” which appeared in *Science* in May of 2021. With Connie Woodhouse, I published “Upper Gila, Salt, and Verde Rivers: Arid Land Rivers in a Changing Climate” in *Earth Interactions*. In June of 2022, with Kevin Wheeler and others, I published “What will it take to stabilize the Colorado River?” in *Science*. I submitted a manuscript with David Bahr on Colorado River Compact call probabilities in the 21st century. I wrote the forward to an upcoming 2022 book that celebrates the 100th anniversary of the Colorado River Compact. I co-authored a white paper on how Reclamation’s 24-month systematically underestimates future Colorado River risk by using inflows that are too high.

### OUTREACH AND TEACHING

During Fiscal Year 2022, I made approximately 15 presentations on the state of the Colorado River to a number of entities including the Colorado River Water Users Association, the Colorado Water Conservation Board, CSU Ag Experiment Stations, the National Academy of Science Water Science and Technology Board, the Northern Colorado Water Conservancy District and to two different University of Colorado audiences. In addition, I taught three guest lectures at CSU: one for Sybil Sharvelle’s Food, Energy and Water course; one for Howard Ramsdell’s Water Sustainability in the Western US; and one for Jennifer Gimbel’s graduate seminar. We also continue to build [www.coloradoriverscience.org](http://www.coloradoriverscience.org) website in collaboration with Julie Vano of the Aspen Global Change Institute and

Jeff Lukas of Lukas consulting. This is a science resource focused on the Colorado River for the public, press, decision makers and other scientists to use to learn more about the Colorado River.

### GRANTS

I submitted a \$260,000 grant with NOAA’s Colorado River Basin Forecast Center and the Southern Nevada Water Authority to the Department of Interior’s Climate Adaptation Science Centers to investigate ways to improve CBRFC’s Colorado Water Supply Forecasts. It was, unfortunately, not funded but generated many good ideas about how to improve these forecasts. We will find another opportunity to pursue funds for these worthwhile ideas in the coming year.

### PRESS CONTACTS AND MEDIA APPEARANCE

Depleted reservoirs resulting from water overuse and reduced Colorado River flows have generated significant interest by the press related to my work. I was featured in a CBS News 60 Minutes segment on the river in the fall of 2021, and re-broadcast in the summer of 2022 summer. I was also on a PBS Live special on the Colorado River on November 10th, 2021. The National Public Radio live show, *The Takeaway*, had me on as a guest in August of 2021. My work was also featured in the *Arizona Daily Star*, the *Nevada Independent*, *Inside Climate News*, *CNN*, *Colorado Public Radio*, the *Salt Lake Tribune*, *Buzzfeed*, *Denver Post*, *Aspen Journalism*, and other outlets. I also interviewed the author Paolo Bacigalupi (“*The Water Knife*”) for the Colorado Foundation for Water Education’s book series with the Denver-based bookstore *The Tattered Cover*.

### SERVICE ACTIVITIES

Internal to Colorado State University, I served on the search committee for the Deputy Director of the Colorado Water Center, I currently serve on CSU’s Western Water Policy Institute design committee, I am a active participant with the CSU’s Climate Adaptation Partnership (CAP) and Climate Response Working Group and participated in the Working Group’s spring 2022 seminar. External to Colorado State University, I reviewed several manuscripts for peer-reviewed publications; was a reviewer for NOAA’ Regional Integrated Sciences and Assessments (RISA) program. □

# YEAR IN REVIEW



Presentations by:

Jennifer Gimbel, Colorado Water Center  
Jill Oropeza, Fort Collins Utilities  
Carmen Farmer, Colorado Open Lands  
Anne Castle, Getches-Wilkinson Center  
Sean Chambers, City of Greeley  
Peggy Montano, Trout, Raley Law Firm  
Mazdak Arabi, Urban Water Center at CSU  
Greg Peterson, Colorado Ag Water Alliance  
Rio de la Vista, Salazar Rio Grande del Norte Center, Adams State  
Ronda Lobato, Costilla County Conservancy District  
Esther Vincent, Northern Water  
Brad Udall, Colorado Water Center

## GRAD592

The CoWC organizes and conducts a graduate level course offered in the fall at CSU. GRAD592 is taught by Jennifer Gimbel, CoWC's Senior Water Policy Scholar, and hosts interested students in a variety of degree fields and academic ranks.

Described as an interdisciplinary water resources seminar, GRAD592 offers its attendees the opportunity to learn from and engage with distinguished lecturers from a variety of fields on the basis of each semester's theme.

In fall 2021, the course theme was "Western Water Law, Policy, and Institutions" and covered a multitude of sub-topics including:

- Federal and State, Regional and Local Water Law and Institutions
- Environmental Aspects of Water Policy and Politics
- Recreation: Water Law and Policy
- State Water Administration
- Science and Water Policy
- Reserved Water Rights
- Municipal Water Policy and Politics

While offered for school credit at CSU, the course is also open to the public and welcomes anyone who wishes to educate themselves on the issues and challenges that Colorado water managers and users face.

There were approximately 40 attendees from the base of 17 students.

To learn more and watch previously recorded lectures, please visit [watercenter.colostate.edu/grad592](https://watercenter.colostate.edu/grad592)



**COLORADO  
WATER CENTER**  
COLORADO STATE UNIVERSITY

# GES120

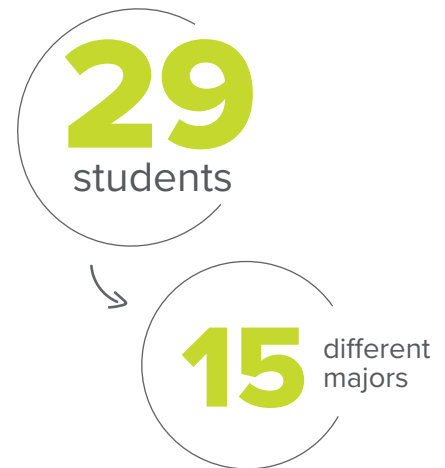
## Water Sustainability in the Western U.S.

The Colorado Water Center and the School of Global and Environmental Sustainability collaboratively offer GES120 each fall semester. This offering provides a multi-disciplinary overview of the issues surrounding the biggest challenges to the sustainability of life in the West. Students from all disciplines are welcome to take this course, with the only prerequisite being an interest in learning about water as a critical resource that has defined the development of the Western United States, and will shape its future.

This course covers a wide range of topics including:

Learn more about this course at [watercenter.colostate.edu/ges120/](https://watercenter.colostate.edu/ges120/)

- » The role that water plays in supporting human populations, agriculture, and wildlife;
- » The history of water development in the West;
- » The processes that govern water allocation;
- » How infrastructure allows water to be moved and used;
- » Challenges to the sustainability of water resources; and
- » Population growth, climate change, and other impacts on water quality.



## Sustainable Water Interdisciplinary Minor Program

Training future water experts

Issues surrounding water supply, water quality, and ecological water relationships are increasingly important as population growth continues and water uses multiply. The complexity of these issues, and competition among various water users, demands that students interested in pursuing careers in water gain a broad introduction to the issues while specializing within a particular discipline. CSU has considerable water resource expertise in many academic fields.

The Sustainable Water Interdisciplinary Minor (SWIM) offers undergraduate students, regardless of their major, an opportunity to gain a deeper knowledge of the many dimensions of water management. SWIM students will complete 21 credits (minimum of 12 upper-division) in core and elective courses that are particularly relevant to today's water manager. Completion of the program is certified on the student's academic record.

Learn more at  
<https://watercenter.colostate.edu/swim/>

*"I especially enjoyed taking the Land Use Hydrology course because our weekly field trips were always so memorable. We traveled to several water infrastructure sites on campus or within the Fort Collins community and listened to a variety of stakeholders speak from organizations who prioritized water sustainability."*

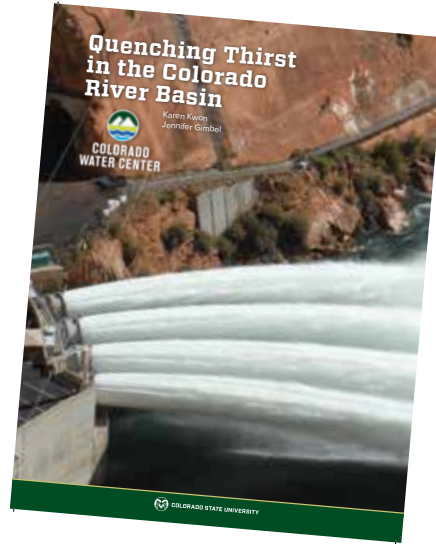
—Kristin Karashinski, 2022 SWIM Graduate

# PUBLISHED REPORTS

Educating the public on recent research

For an archive of publications, please visit [watercenter.colostate.edu/publicationsdatabase](http://watercenter.colostate.edu/publicationsdatabase)

The CoWC has published hundreds of water-related research reports and studies dating back to 1965. CoWC reports for all funded projects are available for public access on the CoWC website. The following types of publications are in addition to the *Colorado Water* newsletter and *The Current* e-news, which frequently include summaries of research projects and their impacts on Colorado water managers and users.



- » Completion Reports
- » Information Series
- » Technical Reports
- » Special Reports
- » Open-File Reports
- » Water in the Balance

## Colorado Water CoWC's Print Newsletter

For an archive of newsletters, please visit [watercenter.colostate.edu/colorado-water-archive](http://watercenter.colostate.edu/colorado-water-archive)

Hard Copy Subscribers

**1,850**

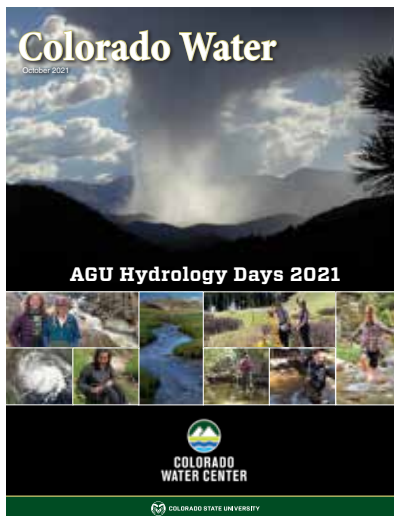
e-Readers

**1,035**



Subscribers

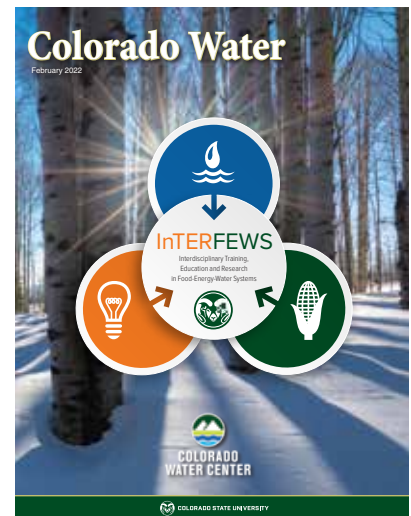
**2,885**



**Vol. 38, Issue 2**  
AGU Hydrology Days 2021



**Vol. 39, Issue 1**  
Research Reports



**Vol. 39, Issue 2**  
InTERFEWS

# The Current

CoWC's monthly e-newsletter

For an archive of e-newsletters, please visit [watercenter.colostate.edu/the-current-archive](http://watercenter.colostate.edu/the-current-archive)

The Colorado Water Center (CoWC) connects with the community through our e-news, *The Current*, with a readership of 1049 subscribers. Over the past year, CoWC published 12 issues that featured water-related updates including outstanding university researchers in Spotlight articles, important events, new data tools, educational resources, funding and scholarship opportunities, and much more. 18 students and 10 faculty and staff were showcased throughout the year for their contributions to water research and teaching. Several of those researchers were funded through the CoWC's various grant programs. These conversations shed light on what motivates their cutting-edge science and the impact they

are working to achieve. All share a passion for improving how water resources are managed and conserved. CoWC made deeper connections through these informal interviews, which allowed for sharing more personal experiences beyond the data and research.

We've also had opportunities to spread awareness of new data tools and other resources. Among several new projects shared are CLASIC (Community-enabled Lifecycle Analysis of Stormwater Infrastructure Costs) ([clasic.erams.com](http://clasic.erams.com)), a screening tool utilizing a lifecycle cost framework to support the feasibility and planning of stormwater infrastructure prepared by our partners at CSU's One Water Solutions Institute and sponsored by The Water Research Foundation; as well as the new interactive map with drought information statements developed by NOAA's National Integrated Drought Information System. The Current also featured a two-part series on the important and timely work of the CSU COVID-19 Wastewater Sampling Team and accompanying research.

**SUBSCRIBE** to *The Current* to keep up with the Colorado water community  
[tinyurl.com/TheCurrent-subscribe](http://tinyurl.com/TheCurrent-subscribe)

## SOCIAL MEDIA

Connecting with Colorado water managers and users

Follow the CoWC on all your favorite platforms:  @COWaterCenter   @ColoradoWaterCenter

Platform	Total Posts	Engagement <i>(Likes, Comments, etc.)</i>
Twitter	441	1,230
Facebook	98	174
Instagram	84	909

Total Cross Engagement  
?

Total Cross Posts  
?

**Net Social Media Audience Increase**  
**+?%**



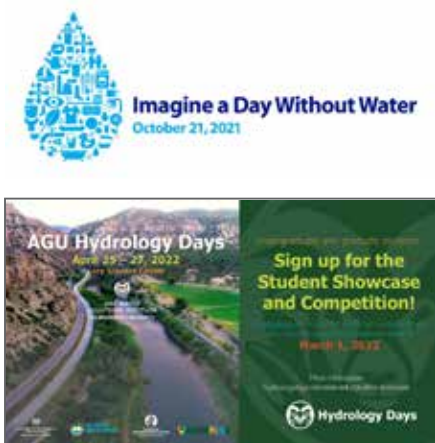


# EVENTS

Engaging current and future water leaders

The Colorado Water Center (CoWC) sponsored, co-hosted, and partnered on several water-related events throughout the past year. The lifting of most health restrictions allowed our team to be a part of more events and support multiple others. Events were promoted through social media platforms, CoWC publications, electronic emails, and by sharing information at other events and meetings. CoWC co-hosted the yearly “Imagine a Day Without Water” celebration in partnership with CSU’s One Water Solutions Institute on October 21st, 2021. We were very impressed by the reach of our booth. The student community truly took an interest in learning about the different “water costs” everyday items may impose on our planet’s resources. First and foremost, we succeeded in generating interest in our educational programs, such as GES 120 and GRAD 592. We believe our success at this event was directly due to our exciting booth we shared with SOGES at the Fall 2021 Ram Welcome Student Fair. It is essential to represent our work and mission to all new. The goal going forward will be to cater to a more diverse set of students (disciplines and backgrounds alike). Student engagement is highly encouraged at CoWC hosted and partnered events. CoWC regularly supports students to

attend events—like AGU Hydrology Days—by covering their registration fees. The Hydrology Days event, as well as CSU Earth Week, were both held in-person and were a great success. Over 110 participants, representing 15 organizations across three states attended the three-day conference last week. With over 70 research presentations from 36 PhD students, 22 Masters, 5 Undergraduates and seven faculty, staff, or external researchers, this was another impressive event. For Earth Week, we partnered with ASCSU and put together 3 fantastic events. An educational tour of the brewing facilities on campus for students and staff where we learned of the role brewing companies and water play in the socio-economic and political scene of the beautiful state of Colorado. A movie screening of the documentary of Watering the West free to attend. And finally, a water career panel for undergraduates and graduate students. This last event was perhaps our most successful, according to the feedback from attendees; the event followed the concept of speed-dating but for professional networking. The students left feeling encouraged and with new connections. We aim to have career panels and networking opportunities become more regular in our event calendar.



## SNAPSHOT Hydrology Days

**3** Days

**>70** Research presentations  
 from **36** PhD, **22** Masters, and **5** Undergraduate students, and **7** faculty, staff

**110**  
 Participants

**15**  
 Organizations  
 Across **3** States

# UPPER YAMPA WATER CONSERVANCY DISTRICT JOHN FETCHER SCHOLARSHIP 2021-2022 AWARD RECIPIENTS

The Colorado Water Center partners in supporting the John Fetcher Upper Yampa Water Conservancy District Scholarship each academic year.

The Upper Yampa Water Conservancy District provides two \$2,000 one-year scholarships for full-time university student(s) who are pursuing a water-related career in any major at a public university within the state of Colorado. The Colorado Water Center administers the scholarship.

This year’s scholarship recipients are Kaydee Barker and Daniel Cleveland.

### Kaydee Barker

Kaydee Barker is an accomplished student researcher and community volunteer who was motivated by firsthand experience to learn about the effects of climate change and mitigation. Kaydee earned an AA in Business from Colorado Mountain College in Steamboat Springs and balances her time between an impressive array of student organizations, classes, and research projects. She is a Western Slope native and has a personal appreciation for the value of water in Colorado communities.



Kaydee Barker

There are few people who are as passionate about the environment as Kaydee. Not only is she actively involved in environmental research, but she is also involved with several environmentally-oriented student organizations such as the Society of Women Environmental Professionals (Vice President), Watershed Club, the Society for Ecological Restoration, and Strategies for Ecology Education, and the Diversity and Sustainability Club. Outside of that, Kaydee loves outdoor recreation activities such as kayaking, swimming, and fishing.

Kaydee has returned to school at Colorado State University in Fort Collins and is pursuing a BS in Ecosystems Science and Sustainability with a minor in Soil

Science. Currently, she is working with Dr. Jill Baron, the Cortufo Soil Ecology Lab, and the Paustian Soil Lab, all at CSU. We are extremely interested to learn where Kaydee’s research takes her!

### Daniel Cleveland

Daniel Cleveland is a seasoned engineer who has spent the past five years working extensively on agricultural water projects all around the world. Graduating with a BS in Engineering from the University of Tennessee at Knoxville, Daniel combines technical knowledge with a passion for natural resource work that has taken him from India to Sweden to the Philippines and three different US states.



Daniel Cleveland

Daniel’s belief in the importance of effective and sustainable water management drove him to leave a successful career in engineering and devote his life to sustainable agriculture and water management. Daniel is particularly interested in ecosystem resilience and how to ensure that watersheds can deal with ecological stress and climate change. He is currently working on restoring the land around Utterback Ranch, located just north of the Yampa River on Tow Creek.

In order to continue working towards his career aspirations, Daniel has enrolled in Colorado State University’s Graduate Program in Ecology. Daniel spends his time working with Dr. Paul Evangelista and the Natural Resource Ecology Laboratory, and he hopes that his work will lead him to work to benefit those in stressed watersheds, especially watersheds that support indigenous and marginalized communities. We are excited to see where Daniel’s work takes him next!

Congratulations to this year’s Yampa Scholarship recipients. To learn more about the scholarship program, visit [watercenter.colostate.edu/john-fetcher-scholarship](http://watercenter.colostate.edu/john-fetcher-scholarship)

# FY22 CoWC Staff



**Ally Altimore**  
Accounting Intern



**Perry Cabot**  
Research Scientist & Extension Specialist (Western Region)



**Theresa Centola**  
Water Research Assistant



**Cameron Denison**  
IT Technician Intern



**Emma Enebo**  
Program Assistant



**Nora Flynn**  
Agriculture Water Specialist



**Jennifer Gimbel**  
Interim Director



**Nancy Grice**  
Assistant to the Director



**Thomas Heydman**  
?



**Brannon Hughes**  
Program Assistant



**Emmett Jordan**  
Graphic Designer



**Julie Kallenberger**  
Associate Director

**Courtland Kelly**  
?

**C-hamp Lindahl**  
Program Assistant



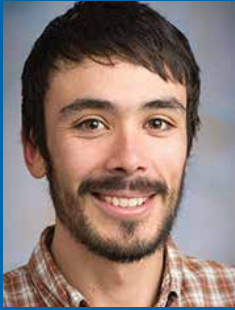
**Melissa Mokry**  
Editor



**Panagiotis Oikonomou**  
Affiliate



**Jake Ornes**  
IT Technician Intern



**Blake Osborn**  
Water Resources Specialist  
(Southern Region)



**Joel Schneekloth**  
Water Resources Specialist  
(Northern Region)



**Molly Smith**  
Accounting Procurement  
Intern



**Swee Tee**  
Water Research  
Assistant



**Brad Udall**  
Senior Water & Climate  
Scientist/Scholar

# CoWC External Advisory Committee



**Jim Broderick**

Executive Director,  
Southeastern Colorado  
Water Conservancy  
District



**Deb Daniel**

General Manager,  
Republican River Water  
Conservation District



**Alexandra Davis**

Division Manager,  
Aurora Water,  
City of Aurora



**Heather Dutton**

Manager,  
San Luis Valley Water  
Conservancy District



**Matt Ely**

Director,  
USGS Colorado Water  
Science Center



**Kate Greenberg**

Commissioner,  
Colorado Department  
of Agriculture



**David Kanzer**

Deputy Chief Engineer,  
Colorado River District



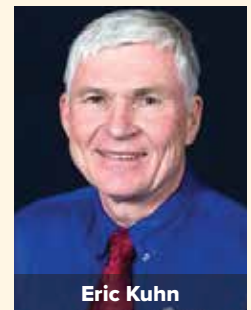
**Eugene Kelly**

Professor, Deputy  
Director, Asst. Dean for  
Extension; AES, College  
of Agricultural Sciences



**Ken Knox**

Director of Water  
Resources, Extraction  
Oil & Gas



**Eric Kuhn**

Retired,  
Colorado River District



**Matt McCombs**

Director,  
Colorado State  
Forest Service



**Rebecca Mitchell**

Director,  
Colorado Water  
Conservation Board



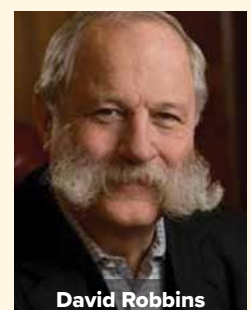
**Chris Piper**

Legislative Liaison and  
Policy Analyst, Colorado  
Energy Office



**Kevin Rein**

State Engineer &  
Director, Colorado  
Division of Water  
Resources



**David Robbins**

President & Co-Founder,  
Hill & Robbins, P.C.  
CoWC External Advisory  
Board Chair



**Nicole Rowan**

Director,  
Colorado Department  
of Public Health &  
Environment



**Travis Smith**

Western Water  
Conservation Coordinator,  
National Wild Turkey  
Federation



**Eric Wilkinson**

Policy Advisor,  
Northern Colorado Water  
Conservancy District

# CoWC CSU Faculty Executive Committee



**Peter Backlund**

Assoc. Director School of Global Environmental Sustainability



**Troy Bauder**

Asst. Deputy Director, Agricultural Experiment Station



**Kevin Bestgen**

Sr. Research Scientist, Dept. of Fish, Wildlife, and Conservation Biology, Warner College of Natural Resources



**Rob Ettema**

Professor, Dept. of Civil and Environmental Engineering, College of Engineering



**Chris Goemans**

Assoc. Professor, Dept. of Agricultural Resource Economics, College of Agricultural Sciences



**Neil Grigg**

Professor, Dept. of Civil and Environmental Engineering, College of Engineering



**Kelly Jones**

Assoc. Prof., Dept. of Human Dimensions of Natural Resources, Warner College of Natural Resources



**Stephanie Kampf**

Professor, Dept. of Ecosystem Science and Sustainability, Warner College of Natural Resources



**Eugene Kelly**

Professor, Deputy Director, AES, College of Agricultural Sciences, Associate Dean for Extension



**Stephanie Malin**

Asst. Professor, Dept. of Sociology, College of Liberal Arts



**Jeff Niemann**

Professor, Dept. of Civil and Environmental Engineering, College of Engineering



**LeRoy Poff**

Professor, Dept. of Biology, College of Natural Sciences



**Howard Ramsdell**

Assoc. Professor, Dept. of Environmental and Radiological Health, College of Veterinary Medicine and Biomedical Sciences



**Patricia Rettig**

Head Archivist, Water Resources Archive, CSU Morgan Library



**Bill Shuster**

Master Instructor, Dept. of Management, College of Business



**Pete Taylor**

Chair, Professor, Dept. of Sociology, College of Liberal Arts

# FINANCIAL SUMMARY

Reporting Period: July 1, 2021 - June 30, 2022



**COLORADO  
WATER CENTER**

## SUMMARY BREAKDOWN

**CoWC Base Funding      \$ 742,354**

CoWC RESEARCH FUNDING SOURCES

DOI-USGS-104B,C,G:	\$720,187
Other DOI-USGS:	\$31,625
Other State:	\$144,041
CSU OEE Faculty Research Support:	*\$154,581
<b>Total</b>	<b>** \$1,050,434</b>

ACTIVE PROJECT TYPE

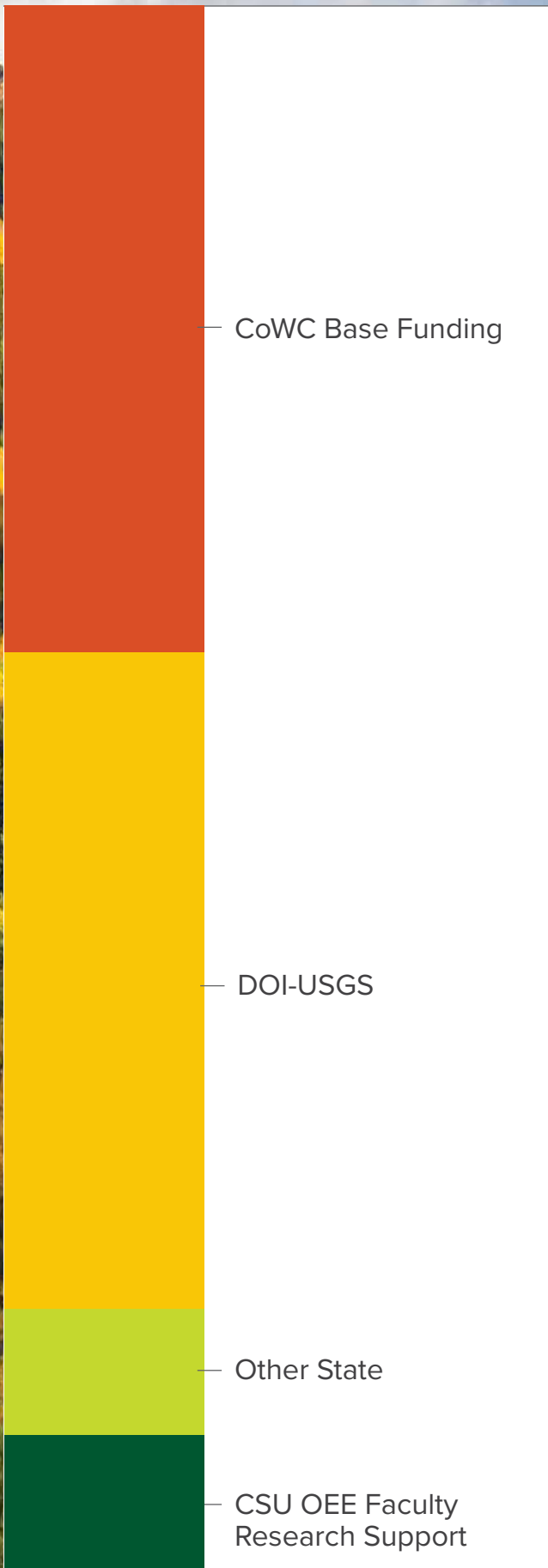
Research	21
Outreach	2
Tech Transfer	1
<b>Total</b>	<b>24</b>

STUDENT DEGREE LEVEL ON PROJECTS

Undergraduate	23
Graduate	8
Masters	9
Ph.D.	3
<b>Total</b>	<b>43</b>

\*CSU OEE Faculty Research Support of \$154,581.00 is included in the FY22 CoWC Base Funding of \$742,353.61.

\*\*Multiple research projects being conducted during a multi-year timeframe can cause overlap in funding.







**COLORADO  
WATER CENTER**  
COLORADO STATE UNIVERSITY

1033 Campus Delivery  
Fort Collins, CO 80523-1033  
970-491-6308 [watercenter.colostate.edu](http://watercenter.colostate.edu)



**ENGAGEMENT  
AND EXTENSION**  
COLORADO STATE UNIVERSITY

