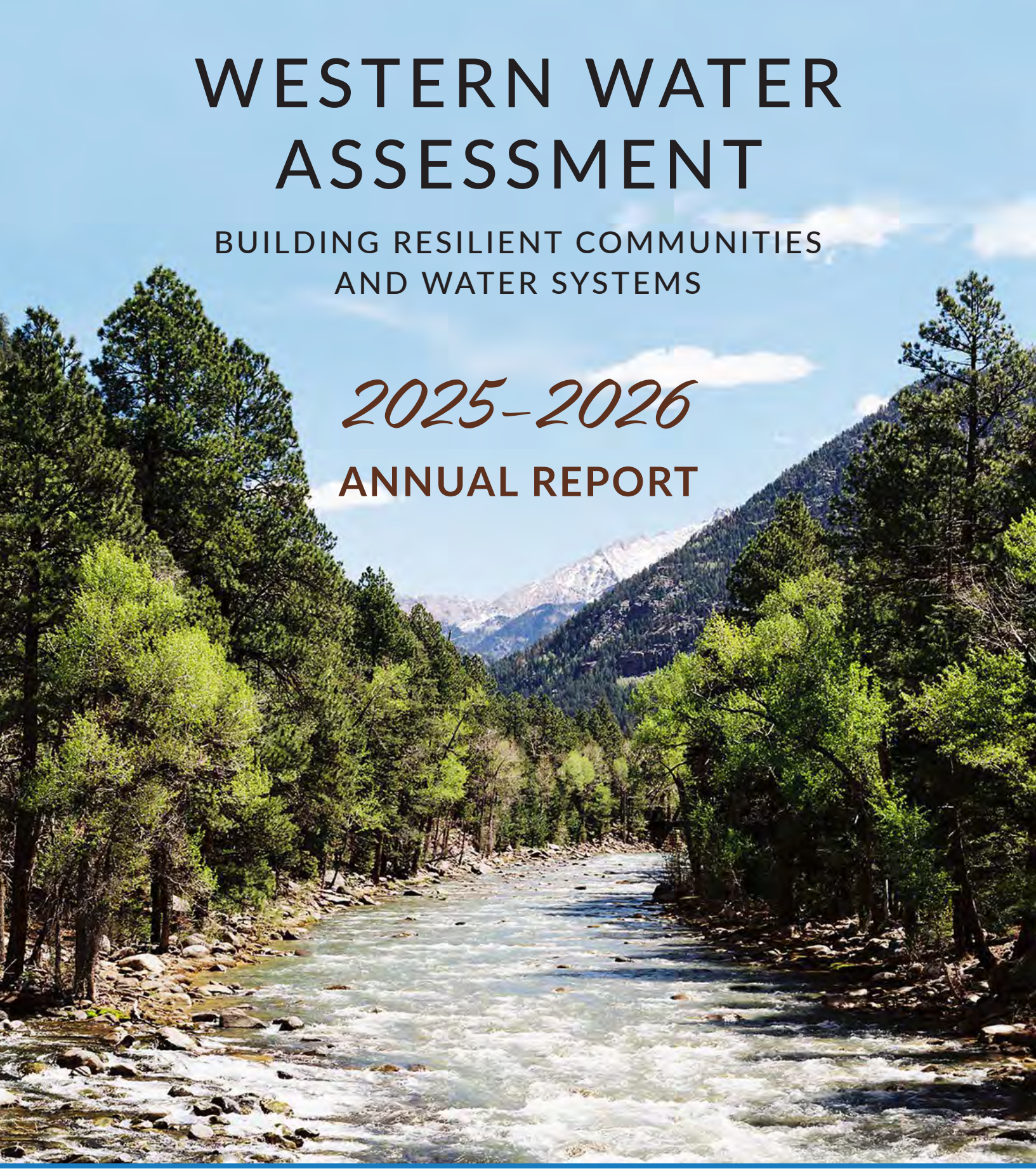
WESTERN WATER ASSESSMENT

BUILDING RESILIENT COMMUNITIES AND WATER SYSTEMS



2025–2026

ANNUAL REPORT

WESTERN WATER ASSESSMENT
A NOAA RISA TEAM

CIRES

University of Colorado Boulder

THE UNIVERSITY OF UTAH®

NOAA RISA
Regional Integrated Sciences and Assessments

UNIVERSITY OF WYOMING

WESTERN WATER ASSESSMENT
A NOAA RISA TEAM

Cooperative Institute for Research in Environmental Sciences (CIRES)
University of Colorado Boulder

University of Utah

Haub School of the Environment
University of Wyoming

wwa@colorado.edu
wwa.colorado.edu

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Principal Investigators
Ben Livneh, University of Colorado Boulder
Benét Duncan, University of Colorado Boulder

Co-Investigators
Karen Bailey, University of Colorado Boulder
Corrie Knapp, University of Wyoming
Noah Molotch, University of Colorado Boulder
Court Strong, University of Utah

Annual Report Staff
Benét Duncan, Editor and Writer
Ethan Knight, Writer
Ben Livneh, Director
Ami Nacu-Schmidt, Layout and Design

Cover photo: Animas River in Spring, San Juan National Forest, Colorado. Photo credit: Nels Bjarke.

CIRES

RISA Regional Integrated Sciences and Assessments

University of Colorado Boulder

THE UNIVERSITY OF UTAH®

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Carbondale, Colorado. Photo credit: Ethan Knight.

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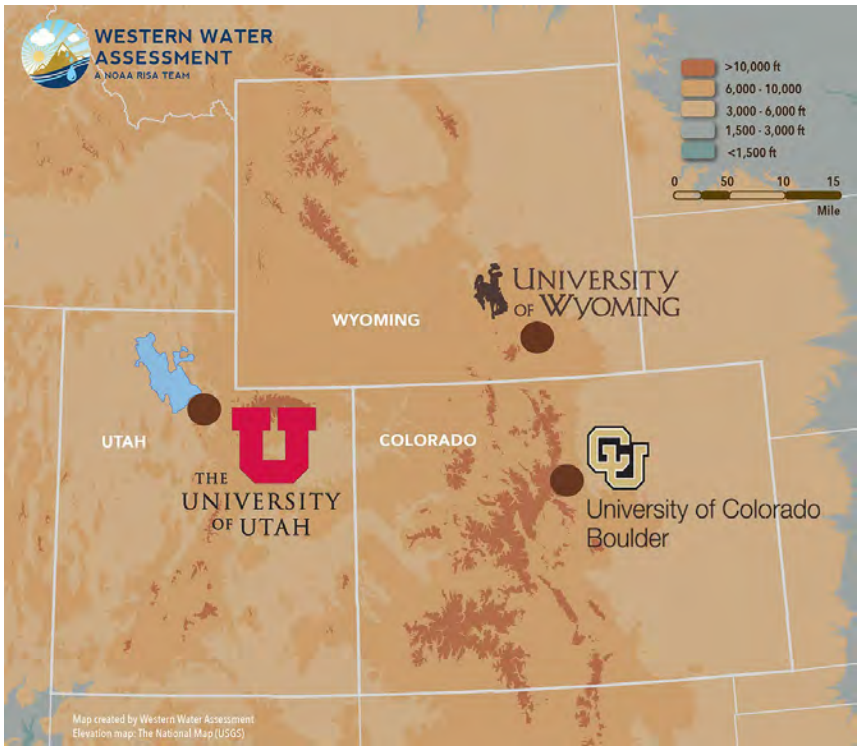
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Hidden Falls, Grand Teton National Park, Wyoming. Photo credit: Nels Bjarke.

ABOUT WWA

The **Western Water Assessment (WWA)** is a university-based applied research program that addresses societal vulnerabilities to extreme weather and natural hazards, particularly those related to water resources. We work across *the Intermountain West*—Colorado, Utah, and Wyoming—and we are based in the **Cooperative Institute for Research in Environmental Sciences (CIRES)** at the **University of Colorado in Boulder**, CO, the **University of Wyoming** in Laramie, WY, and the **University of Utah** in Salt Lake City, UT.



WWA's mission is to conduct innovative research in partnership with decision makers in the Rocky Mountain West, helping them make the best use of science to manage for natural hazard impacts.

For over 26 years, WWA has partnered closely with communities, resource managers, and other decision makers in the Intermountain West to empower them to make the best use of science to understand risk, and to plan and manage for impacts of extreme weather and other natural hazards like wildfire, flooding, and drought. We harness expertise across the physical and social sciences to meet partner needs in ways that can immediately inform their operations and decisions.

Our mission is to build local, state, and regional resilience to linked hazards, with a particular focus on small rural communities and utilities. Our research projects fit within two themes—resilient water systems and resilient communities—and bring together a wide range of expertise from across our project team. In addition to our innovative research projects, ongoing research connection activities help us to collaboratively identify needs and opportunities with our partners, and program evaluation activities help us to track our impact. Through this thoughtful approach to projects, we are advancing resilience science from theory to practice.

Our work draws on the wide range of scientific expertise on our team, which includes experts in geography, usable science, atmospheric science, hydrology, and evaluation. This unique combination of skills, combined with our 26-year history of research and partnerships, allows us to make an impact at a time when extreme weather events, natural hazards, and societal stressors are challenging the resilience of the Intermountain West like never before.

WWA is one of several teams in the NOAA-funded **Regional Integrated Sciences and Assessments (RISA) program**. This annual report details accomplishments and impacts of projects supported by our most recent NOAA RISA grant, which covers 2021-2026.

2025-2026 BY THE NUMBERS

A key component of community-engaged resilience research is assessing how effectively we are communicating and connecting with our partners and stakeholders. Our outreach and communications efforts are designed to connect with a broad network of partners and stakeholders, sharing valuable research and resources. Here are key metrics from our digital and in-person engagement this year.

SOCIAL MEDIA

	New Followers	Total Followers
Twitter / X	**0**	**1,086**
Facebook	**+28**	**645**
LinkedIn	**+208**	**608**
Instagram	**+45**	**264**
Theads	**0**	**400**
Bluesky	**+46**	**219**

Total New Followers Across Accounts **327**

WEBINARS, WORKSHOPS, & PRESENTATIONS

- **3** Webinars
- **3** Workshops
- **3** Convened Conference Sessions
- **40** Presentations
- **49** Total Events

WWA WEBSITE

Page Views
100,063
Website Users
34,135



NEWS & RESEARCH

- **12** Research Publications
- **12** Intermountain West Dashboard Briefings
- **2** Rapid Assessments
- **1** Hazard Summary
- **1** Water Year Summary

68 Media Mentions

3 Datasets & Other Content

MAILING LIST

New Subscribers **+31**

Total Subscribers **1,515**

The continued growth on LinkedIn reflects our focus on engaging with professionals and partners in the water resources and scientific sectors. Steady growth in engagement on all other social media platforms is attributed to strong attendance at our webinars, workshops, and presentations, along with media coverage of our research publications and expert contribution to regional hazard assessment.

WWA TEAM AND PROGRAM ORGANIZATION

WWA is part of the Cooperative Institute for Research in Environmental Sciences (CIRES) at the University of Colorado Boulder (CU Boulder); the University of Wyoming; and the University of Utah. WWA is led by our Director **Ben Livneh** and Managing Director **Benét Duncan**, with guidance from the Principal Investigator (PI) group, the External Advisory Board, and the full-time program staff team, which focuses on program management, research development and synthesis, and coordination of partnerships.



Our Staff Research Scientists – **Seth Arens**, **Katie Clifford**, and **Nels Bjarke** – each bring topical expertise from a range of disciplines to their conversations with local communities, state agencies, and other partners. Communications Lead **Ethan Knight** ensures that we connect with partners and the broader public by implementing the WWA communications strategy and developing outreach materials like our recent WWA impact video series. The strategy aligns core communications goals with key sectors and spans a range of communication channels, including email outreach, quarterly newsletters, our website, social media, and in-person or virtual meetings. We continue to use our communications strategy, website, and other engagement to help us strengthen relationships and share resources with partners across the Intermountain West.

Our broader network of investigators and partners comes from universities and government institutions across our region and provides a wide range of expertise. The WWA External Advisory Board consists of experts from across the science-policy landscape and provides critical programmatic guidance to the core staff and PIs. Taken together, this network represents a broad base of expertise and relationships that enable WWA to meet partner needs and advance scientific understanding.

PROGRAM STAFF



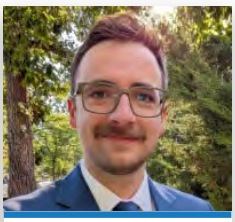
BEN LIVNEH
Director



BENÉT DUNCAN
Managing Director



SETH ARENS
Utah Staff Research Scientist



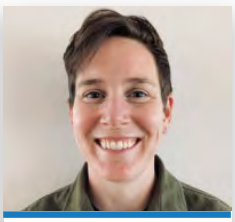
NELS BJARKE*
Hydrologist and Staff Research Scientist



KATIE CLIFFORD*
Lead Social Scientist and Staff Research Scientist



ETHAN KNIGHT*
Communications Lead and Scientist



SKYE NILES*
Postdoctoral Researcher (through July 2025)

PRINCIPAL INVESTIGATORS

- Ben Livneh (Program Director; Co-lead PI)
- Benét Duncan (Managing Director; Co-lead PI)
- Karen Bailey*
- Corrie Knapp*
- Noah Molotch
- Court Strong

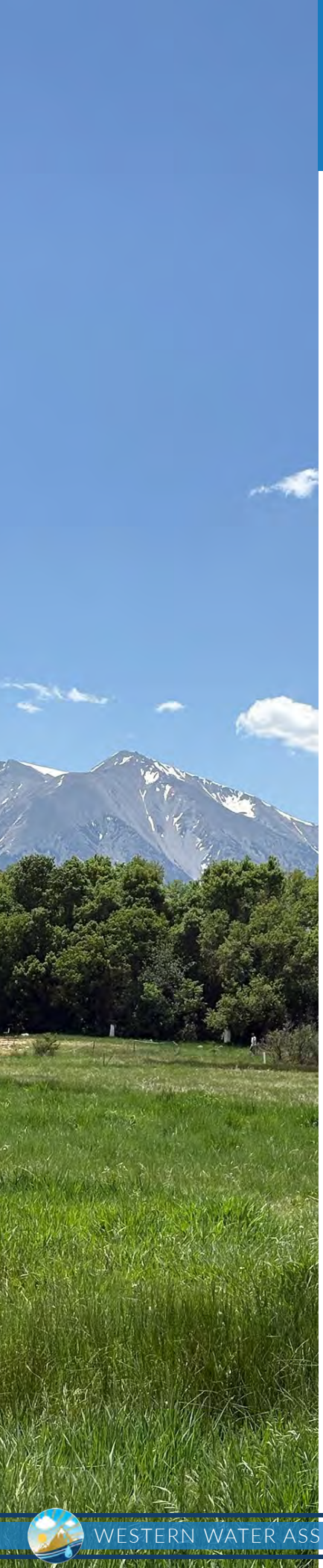
EXTERNAL ADVISORY BOARD

- Kathy Jacobs, Chair (Univ. of Arizona)
- Richard Moss (Princeton Univ. and Pacific Northwest National Laboratory)
- Mark Shafer (Southern Climate Impacts Planning Program)
- Michelle Stokes (Colorado Basin River Forecast Center)
- Peter Backlund (through November 2025; Colorado State Univ.)
- Marguerite Harden (Colorado Resiliency Office)

INVESTIGATORS, STUDENTS, AND PARTNERS

- Mariam Asaba+
- Jeremy Barroll+
- Natalie Bennett+
- Kaitlyn Bishay+
- Nathan Boyer-Rechlin+
- Carli Brucker+
- Warren Cook+
- Leah Dory+
- Gillian Gallagher+
- Emma Galofré García+
- Anne Gold
- Kristiana Hansen
- Jacob Hochard
- Kris Karnauskas
- Joseph Kasprzyk
- Steve Miller
- Logan Mitchell
- Parthkumar Modi+
- Ami Nacu-Schmidt
- Shadia Nagati*
- Dustin O'Brien+
- Christine Okochi
- Ginger Paige
- Luca Palasti+
- Madeline Pernat+
- Emily Peters+
- Imtiaz Rangwala
- Danya Rumore
- Matthew Sabin+
- Valentina Serrano Salomón+
- Sydney Smith+
- Prasad Thota+
- Emma Tyrrell+
- Alec Wallen+
- Emily Ward
- Savanna Wolvin+
- Matthew Woodland+
- Heather Yocum

* Indicates early career + Indicates current or former student



FEATURED ACCOMPLISHMENT

ENHANCING DROUGHT PREPAREDNESS IN RESEARCH AND PRACTICE

The Intermountain West is facing unprecedented drought conditions driven by the 2025-2026 winter snow drought, which is the worst on record for the region. During this time, the WWA team has been engaged in multiple efforts to support regional drought response and preparedness, aligned with our mission to provide usable science to local, state, and regional water management entities. We are harnessing the WWA team's expertise in hydrology, usable science, and co-production, and leveraging our new and ongoing partnerships to connect research to operations and advance both research and practice.

The WWA team has supported municipal and state water managers directly by providing scientific expertise to support the translation of existing scientific literature and methods directly into operational decision-making frameworks. In Colorado, **Nels Bjarke** has worked directly with municipal water supply agencies for communities like the City of Golden (CoG) to assess how hydrometeorological data can support their efforts to improve and validate water conservation measures. This process involved collaborating with CoG personnel to develop models to link their operational decisions, municipal water use observations, and best available predictive modeling research to improve certainty in their conservation decision-making process. In Utah, **Seth Arens** has collaborated with the Utah Division of Water Resources (DWR) to provide scientific expertise and help convene a drought tabletop exercise that allowed the state to test its drought response plan and enhance preparedness for droughts like the region is facing this year. During this process, **Arens** collaborated with drought experts to provide scientifically robust scenarios that the DWR could use to prepare for droughts of different forms, ensuring flexibility and comprehensive drought preparedness. Finally, drought research by **Bjarke**, **Duncan**, and **Livneh**, in partnership with the NOAA National Centers for Environmental Information, led to the development of a **live web tool** that provides historical perspectives on drought severity, as the Intermountain West region has experienced several dry decades. This research supports ongoing efforts to utilize regional operational expertise of partners to improve drought early warning at a time when drought conditions are among the worst on record for the region.

In addition to direct collaborations with operational decision makers, the WWA team published a "rapid assessment" of the 2025-2026 regional snow drought and served as topical experts to provide critical context about the severity and impacts of drought conditions. **Seth Arens** (Arens, 2026b) led development of the ***2025-2026 Extreme Snow Drought in the Intermountain West Rapid Assessment***, which provides a synthesis of the hydrometeorological drivers of the existing drought, an overview of the drought's severity and historical context, and tracks initial impacts of the drought on water management decisions. This and other rapid assessments developed by WWA during the reporting period were made possible because of the WWA staff research scientists' ability to author the reports within a short timeframe so that they are timely, and because of the WWA team's deep and regionally specific expertise. **Arens** and **Bjarke** have provided drought expertise for the media, and for scientific and decision-making partners. For example, they provided context about regional drought impacts at broadly attended webinars hosted by **WWA** and the **National Integrated Drought Information System (NIDIS) Intermountain West briefings**. These presentations and assessments have garnered significant media attention and provide broad public awareness and education about the impacts and need for drought response and resilience-building.

Mount Sopris near Carbondale, Colorado. Photo credit: Ethan Knight.

RESEARCH HIGHLIGHTS

RURAL COMMUNITY WILDFIRE RECOVERY

Katie Clifford is working with **Christina Greene** and **Rebecca Patterson-Markowitz** at **CLIMAS** (a partner RISA team in the Southwest), on a project to help build local capacity for wildfire recovery in rural communities. They are collaborating with local experts in rural communities in Colorado and New Mexico that experienced significant wildfire events in the past five years, including the East Troublesome Fire that largely impacted Grand County, CO. During the past year, the project team led an interactive timeline mapping exercise with wildfire-impacted communities at the Fire Adapted Colorado conference. They also established a partnership with the Colorado Resiliency Office and are planning to co-host a peer-to-peer workshop in fall 2026.

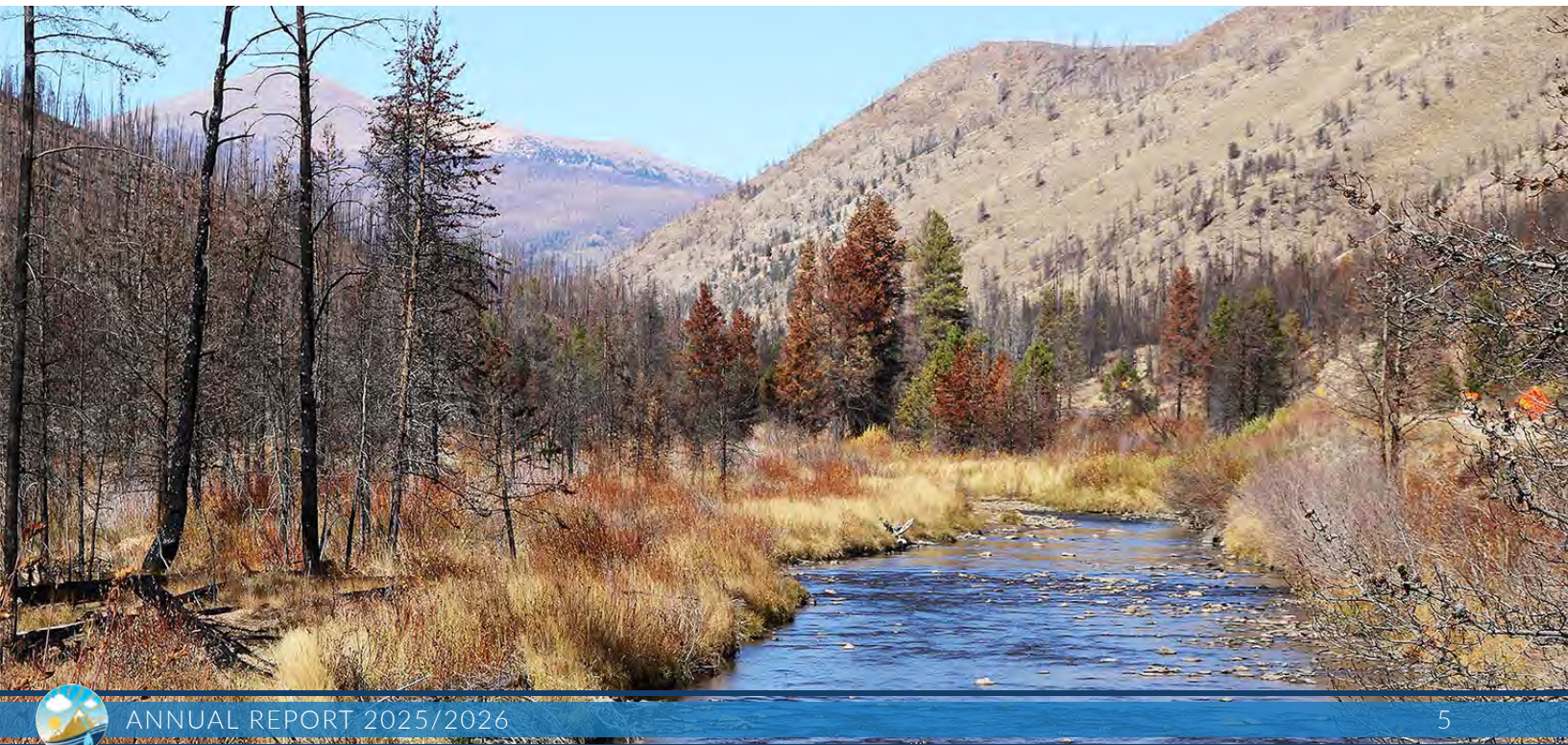
INTERMOUNTAIN WEST DASHBOARD AND BRIEFINGS

Work continued in 2026 with the **Intermountain West Dashboard** to keep it updated with the most current and usable hydroclimate data for the western U.S., focusing on Colorado, Utah, and Wyoming. **Ethan Knight** and **Seth Arens** published monthly briefings summarizing weather, water, and forecast conditions, and **Arens** led the development of a summary of the 2025 water year conditions.

RAPID RESPONSE REPORTS AND ANNUAL HAZARDS SUMMARY

Interest from partners about extreme events and their impacts spurred a new focus to provide rapid expert information about extreme hazard events immediately after their occurrence. **Nels Bjarke** and **Seth Arens** developed rapid response reports of two hazard events: a major flooding event in southwest Colorado in October 2025 (Bjarke and Arens, 2025), and the extreme snow drought across the Intermountain West during the winter of 2025-2026 (Arens, 2026b). The reports summarized the extent and magnitude of the events, causes of the events, and immediate impacts. A third report, the ***2025 Intermountain West Hazard Summary***, was published in early 2026 and provided information about the extent, magnitude, historical context, and impacts of hazard events, including drought, flooding, tornadoes, and wildfire in Colorado, Utah, and Wyoming (Arens, 2026a). All reports are publicly available on the WWA website at **wwa.colorado.edu/resources/hazard-assessments**.

Wildfire damage caused by the 2020 East Troublesome Fire near Willow Creek in Grand County, Colorado. Photo credit: Jeffrey Beall/Creative Commons.





Dry winter mountains, Rocky Mountain National Park, Colorado. Photo credit: Nels Bjarke.

EXPLORING SENSE OF PLACE AND RURAL COMMUNITY RESILIENCE

Karen Bailey, graduate research assistants **Natalie Bennett** and **Warren Cook**, and undergraduate student **Dustin O'Brien** continued research into the impacts of *sense of place* on rural community resilience. **Bailey** obtained funding through the **CU Population Center Rapid Response Grant program** to fund the development of quantitative instruments to explore sense of place and drought in Colorado. A survey has been drafted, and the research team is awaiting approval from municipal authorities to deploy it in summer 2026. **Bailey** had preliminary discussions with Friends of the River Uncompahgre, Rim-to-Rim Restoration, Colorado West Land Trust, Uncompahgre Watershed Partnership, Glen Canyon Conservancy, Glen Canyon Institute, and Thornton Water to better understand ongoing activities and potential for future partnerships. The research team worked with partners at Rim-to-Rim Restoration in Moab to deploy a draft survey exploring barriers to community resilience related to wildfire and flooding. Additionally, grant proposals were developed for submission to NOAA and NSF to expand this work.

REFLECTING ON 26 YEARS OF PARTNER-DRIVEN RESILIENCE RESEARCH



Ben Livneh worked closely with current and former WWA colleagues **Andrea Ray**, **Lisa Dilling**, **Katie Clifford**, **Nels Bjarke**, **Eric Gordon**, **Seth Arens**, **Ethan Knight**, and **Benét Duncan** to identify lessons from WWA's 26-year history as a program as part of a peer-reviewed publication in a special issue of the journal Climatic Change. The theme of the special issue was University-Based Climate Services for the Public Good and the paper (Livneh et al. 2026 **doi:10.1007/s10584-026-04159-8**) was an invited contribution. It explores WWA's origins as a NOAA RISA program and how program priorities have shifted to reflect the changing needs of regional, state, and local partners. It also highlights our role as a pioneer in the field of usable science. That is, the study of how and why people use science to inform decisions, and how to design science in ways that directly reflect partner needs and priorities.

ADVANCING UNDERSTANDING OF WESTERN HYDROCLIMATE



Court Strong and colleagues published a new paper focused on western US hydroclimate (Cleveland et al. 2025 **doi:10.1029/2024JD043026**). This work directly connects the Upper Colorado River Basin and Interior Southwest to a predictive understanding of the North American Monsoon, which is a key warm-season water source for the region. This research opens the door to using spring Colorado Plateau soil moisture and snowpack as practical indicators for summer precipitation timing. This peer-reviewed publication enhances the credibility of the methods and supports broader uptake of related tools and recommendations. The paper and WWA's Experimental Winter Precipitation Forecast Tool together have increased regional awareness of precipitation-trajectory uncertainty, aiding partners like Salt Lake City Department of Public Utilities (SLCDPU)'s understanding of risk and framing adaptation choices.

SUPPORTING RESILIENT PLANNING AMONG REGIONAL WATER PROVIDERS



Ben Livneh led a series of project activities that culminated in three research papers. The first paper from **Livneh** and graduate student **Kaitlyn Bishay** (Bishay et al. 2026 **doi:10.1175/JHM-D-25-0101.1**) looks at how satellites can help us predict water supply. This is especially relevant for WWA because the research team explicitly looked at 'unmonitored' watersheds as well as monitored ones. Importantly, the unmonitored watersheds represent places where under-prepared communities may not have access to gauged snowpack, and so this satellite-based water supply information work could help support their water management contexts.



The next paper from **Livneh** and graduate student **Parthkumar Modi** (Modi et al. 2025 **doi:10.5194/hess-29-5593-2025**) compared the forecast skill for water supply versus the potential economic value that those forecasts would be worth. This research shows that high forecast skill does not directly translate into high forecast value, shedding light on better ways to develop forecast evaluation metrics to more closely align with the ways that forecast information is used in decision making. In particular, reservoir management and other water supply decisions are often triggered by thresholds, i.e., water supply falling below a specific level, or streamflow below a drought threshold, whereas forecasting metrics are often 'continuous', i.e., not concerned with thresholds. Reconciling these differences has the potential to make high forecast skill more economically valuable.



The final paper from **Livneh** and graduate student **Madeline Pernat** (Pernat et al. 2025 **doi:10.1016/j.ejrh.2025.102548**) quantified whether it's more important to have a better model versus having better observational data in making water supply forecasts, ultimately pointing to the need for better data.

POST-WILDFIRE WATER QUALITY IN THE WESTERN U.S.



Graduate student **Carli Brucker** and **Ben Livneh** completed the first large-scale assessment of post-wildfire water quality last year. They analyzed over 100,000 water quality observations from 538 basins in the western US – 245 of which had experienced wildfire – to identify trends in post-wildfire water quality, an issue of major concern to water managers in the region. The analysis found that water contaminants like carbon and phosphorus are elevated for 1-5 years after a fire, while nitrogen and sediment are elevated even longer, for up to 8 years after a fire. **Brucker** and **Livneh** (Brucker et al. 2025 **doi:10.1038/s43247-025-02427-6**) finished the project by publishing a paper in *Nature Communications Earth and Environment* about this work.



Frozen Chasm Lake in Rocky Mountain National Park, Colorado. Photo credit: Nels Bjarke.

NEW AREAS OF FOCUS AND PARTNERSHIPS

As a program, WWA strives to advance partner-driven research, synthesis, and outreach activities that help to build community and water system resilience. Over the past year, we have expanded our work in several exciting ways thanks to local and state partnerships and other collaborations.

ENGAGING WITH THE COLORADO WATER CONSERVATION BOARD

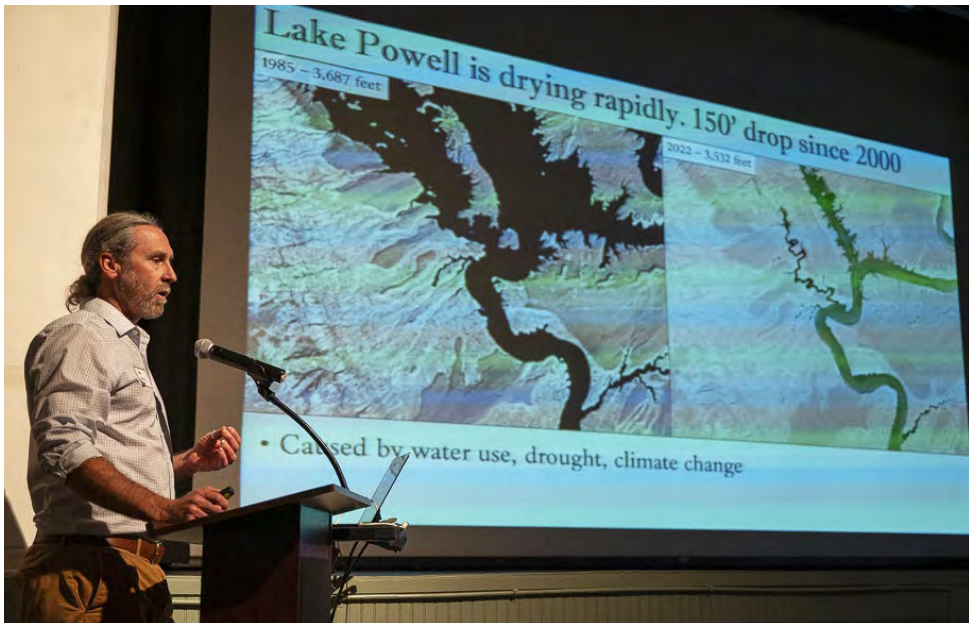
The WWA team has developed new relationships with statewide and regional water management entities in Colorado under the organization of the Colorado Water Conservation Board. **Benét Duncan**, **Nels Bjarke**, and **Katie Clifford** have been collaborating with the members of the CWCB Water Supply Planning Section team to author an updated synthesis report on the risks and impacts of hazards like drought, extreme heat, flooding, and wildfire on the water sector. At the regional level, **Bjarke** has been working with individual roundtables, the CWCB regional watershed management boards, to support the implementation of current hydrologic research to inform priority setting for long-term water supply management. **Bjarke** has collaborated directly with members of the Southwest Basin Roundtable and the Southwestern Water Conservation District to provide scientific synthesis of future water availability projections and emerging management practices to allow for science-based planning procedures in the regional 2030 Water Plan process. **Clifford** also served on the advisory council for CWCB's Water Secure Communities task force to help advise the state's programmatic efforts over the 2025-2026 year.

DROUGHT PLANNING WITH THE CITY OF GOLDEN

In the winter of 2025-2026, **Nels Bjarke** began working with the City of Golden municipal water management agency to evaluate water usage and help validate water-saving measures implemented by the city. A challenge that Golden and other municipal water suppliers face is the year-to-year variability of water use that varies with year-to-year variability in hydrometeorological conditions. This ongoing research involves iteratively collaborating with Golden to develop a modeling framework that will allow water use management personnel to "normalize" water-use data from year to year based on observations and modeled precipitation, evapotranspiration, vapor pressure deficit, and temperature. Normalized water-use data will make it possible for Golden and other municipalities to evaluate the efficacy of water conservation measures, which is a vital component of resilience building to increasingly frequent drought conditions across the Intermountain West. The results of this partnership will be improvement of regional municipal water saving measures and the development of a modeling framework that will be generalized for use by other regional water supply management entities.

PLANNING FOR WILDFIRE

During fall 2025, WWA began to engage with potential partners in the Park City, Utah area on the compound hazards of wildfire and poor air quality. The Summit County Health Department invited **Seth Arens** to speak in their Science Speaker Series about the impacts of wildfire on air quality in Summit County. Summit County is adjacent to the urban airshed of Salt Lake City and can experience poor air quality related to urban air pollution in Salt Lake City and regional air pollution originating from wildfire smoke. Later in fall 2025, **Arens** met with the Summit County Health Department to discuss future opportunities related to air quality and wildfire impacts. **Arens** also met with the municipality of Park City and discussed their needs for current information about near-to-medium term changes in wildfire risk and forest health.



Seth Arens speaking at the 2025 Rivers of Change Symposium, Glen Canyon Institute, Utah. Photo credit: Glen Canyon Institute.

RURAL COMMUNITY RESILIENCE ASSESSMENT

Corrie Knapp and research assistant **Mariam Asaba** continued their research to better understand the resilience of rural communities in Wyoming, and to inform the development of the **Center for Rural Community Resilience & Innovation (CRCRI)**. **Knapp** and **Asaba** conducted 37 interviews with rural community leaders across the state of Wyoming. All of the data were analyzed, and a draft report and factsheet were written to summarize findings. The draft report and factsheet are currently under review.

CRCRI leadership is using their findings to design programs, write grants, and provide preliminary pilot data for other efforts to support rural communities across Wyoming. It is already shaping a preliminary funding call that the CRCRI team is designing, informing capstone projects, and laying the foundation for future applied summer research opportunities for students.



Spruce Mountain, Colorado. Photo Credit: Ethan Knight.

STATE AND LOCAL ENGAGEMENT

Partnerships, outreach, and engagement are central to WWA, as they enable us to center partner priorities and needs in the work we do. This allows us to maximize our impact and help municipalities, resource managers, and state and federal agencies build their own preparedness. Over the past year, the WWA core staff team and PIs have particularly focused on partnerships with state agencies and local communities, helping them to build their own preparedness to hazards like wildfire, drought, and flooding.

TESTING THE UTAH DROUGHT RESPONSE PLAN

Through continued conversations with a longtime partner, the Utah Division of Water Resources (UDWR), WWA learned of UDWR's immediate need to test the Utah Drought Response Plan in advance of worsening drought conditions in 2025-2026. **Seth Arens** started a collaborative effort with the **National Drought Mitigation Center (NDMC)** at the University of Nebraska-Lincoln for the UDWR to conduct a drought tabletop exercise in March 2026. The exercise tested the Utah Drought Response Plan by convening all designated persons from Utah state agencies responsible for drought response and working through actions that each agency would take under three drought scenarios. Utah was in severe to extreme drought in March 2026 when the meeting was convened, and current conditions served as one of three drought scenarios used to test state agency actions during drought. A report was written in collaboration with NDMC, and discussions are underway about continuing work by trying to focus more state resources on long-term drought mitigation activities rather than short-term response actions.

SUPPORTING WATER PLANNING IN SALT LAKE CITY

During the reporting period, **Court Strong** and **Seth Arens** continued updating WWA's Experimental Winter Precipitation Forecast Tool to reflect feedback from partners at the Salt Lake City Department of Public Utilities (SLCDPU). Updates include a new option to use seasonally forecasted sea surface temperatures (SST) data, categorical forecast ranges (e.g., above/near/below average), and a modernized CIRES-developed web interface. **Strong** continued detailed analysis of future summer precipitation trajectories for the Great Salt Lake Basin. Results show model divergence (some model ensembles project large increases while others project large decreases by 2100). A manuscript from the research team remains under co-author review.

Meetings and demonstrations of the Experimental Winter Precipitation Forecast Tool with SLCDPU have resulted in a commitment to operationalize the tool within their workflows, continuing the partnership that WWA has with SLCDPU. In early fall 2025, WWA began working with CU CIRES IT to develop a new, more usable version of the Experimental Winter Precipitation Forecast Tool. The tool will be operational by November 2026 to capture the first forecast period of the 2027 water year.

Additionally, **Seth Arens** was invited to speak at a public speaker series sponsored by the Salt Lake City Public Library. In the July 2025 event hosted at the University of Utah Natural History Museum, a panel of speakers discussed water challenges facing Utah and the West. Approximately 200 people attended the event and helped forward SLCDPU's effort to educate the public about water and hazard challenges facing Salt Lake City.

UT STATE HAZARD MITIGATION TEAM

WWA's **Seth Arens** continued work as an active member of the Utah State Hazard Mitigation Team, a group of state, federal, and university organizations in Utah that meets quarterly to coordinate on hazard planning and response.

CO RESILIENCY OFFICE AND FACO COMMUNITIES

As part of her collaborative project on rural community wildfire recovery, **Katie Clifford** is partnering with the **Colorado Resiliency Office**, which provides guidance and support to communities to help them build resilience to wildfire and other challenges. They are leveraging the CRO's Wildfire Recovery Peer Exchange to connect with impacted communities and have identified under-researched aspects of rural community wildfire recovery that are informing the state's approach to helping rural communities prepare for and recover from wildfire events.

MOUNTAIN TOWNS 2030

In response to regional partners' expressed needs to further understand wildfire risk, **Katie Clifford** and **Nels Bjarke** have continued to engage with the Mountain Towns 2030 (MT2030) network to connect communities with the best available science for wildfire risk assessments. MT2030 is a network of mountain communities across the western U.S. that leverages the geographic, environmental, and economic similarities between member communities to build resilience to hazards and join in setting common goals for adaptation. During the summer of 2025, **Bjarke** and **Clifford** hosted a webinar for MT2030 to connect with member communities about wildfire risk. Following this webinar, **Bjarke**, **Clifford**, and WWA graduate student **Natalie Bennett** attended the MT2030 annual conference in Fort Collins, CO to host a workshop in partnership with wildfire resilience practitioners and emergency responders. During this workshop, **Bjarke** and **Bennett** served as featured panelists and convened a group of invited speakers to answer audience questions about wildfire preparedness, strategies for community resilience, and resources for actionable wildfire management.



Nels Bjarke and Katie Clifford represent WWA at the Mountain Towns 2030 Conference in Breckenridge, CO in October 2025. Photo credit: Katie Clifford.



MAKING AN IMPACT

WWA is committed to maximizing the utility of our research and other program activities, ensuring that our work has a tangible positive impact on our partners. During the reporting period, partners from communities, state agencies, water providers, and resource management agencies shared about the continuing impacts of their collaborations with WWA. Many of these impacts are highlighted in quotes and videos on the WWA Impacts webpage at **wwa.colorado.edu/impacts**.

ENHANCING COMMUNITY HAZARD PREPAREDNESS

Since 2018, WWA has led hazard planning workshops in partnership with rural communities across the Intermountain West. Each workshop is co-designed with community leaders and WWA staff research scientists to help communities understand the risk of a particular hazard like drought or flooding, and to identify specific public and private-sector actions they can take to prepare. In follow-up interviews, current and former community leaders from Cortez, CO, Carbondale, CO, and Lander, WY shared more about the impacts of these workshops. For example, Cortez, CO launched regular drought planning conversations across municipal departments and a public water conservation program, and Carbondale, CO made infrastructure investment decisions to ensure they had access to their full water supply. Lander found value in convening conversations across municipal departments, helping the community to navigate major flood infrastructure decisions. More details about these impacts are available in videos on the WWA impacts webpage (**wwa.colorado.edu/impacts**).

INCREASING UNDERSTANDING OF REGIONAL SNOWPACK FOR WATER MANAGERS

Noah Molotch, along with research scientist **Leanne Lestak** and PhD student **Emma Tyrrell**, continued their work to improve the predictability of spring streamflow and summer wildfire vulnerability by providing **spatial maps of SWE at unprecedented levels of accuracy**. The spatial maps of snow water equivalent (SWE) data generated under this project was co-produced with the water management community, building on long-term collaborations with US Bureau of Reclamation offices (USBR), the NOAA-NWS Colorado Basin River Forecast Center, the NRCS, and several local and state agencies, municipalities, and public utilities. In this context, the SWE data products are distributed to the entities noted above and are distributed to more than 120 USBR staff. Importantly, the project work has enabled analysis of water supply conditions within stakeholder-defined watersheds and reservoirs of interest, allowing for utilization by smaller water management areas. Data developed by this project have provided direct benefit to US Bureau of Reclamation and other water entities in the context of characterizing water supply conditions within river systems that feed reservoirs across the WWA region.

Snowy peak from Emerald Lake, Rocky Mountain National Park. Photo credit: Nels Bjarke.

Although the mechanistic analyses linking snow drought to wildfire vulnerability remain ongoing, the project's datasets and scientific outputs have already transitioned into operational use within water management settings and are informing stakeholder discussions surrounding preparedness and resilience planning. The ongoing 2026 snow drought affecting much of the central Rocky Mountains has further highlighted the need for decision-support information that can anticipate how snow deficits may propagate through mountain ecosystems to influence water supplies and wildfire potential. By improving understanding of these interconnected hazards and providing accessible, management-relevant information, this project is helping partners better anticipate emerging risks, prioritize preparedness activities, and strengthen resilience to future weather extremes.

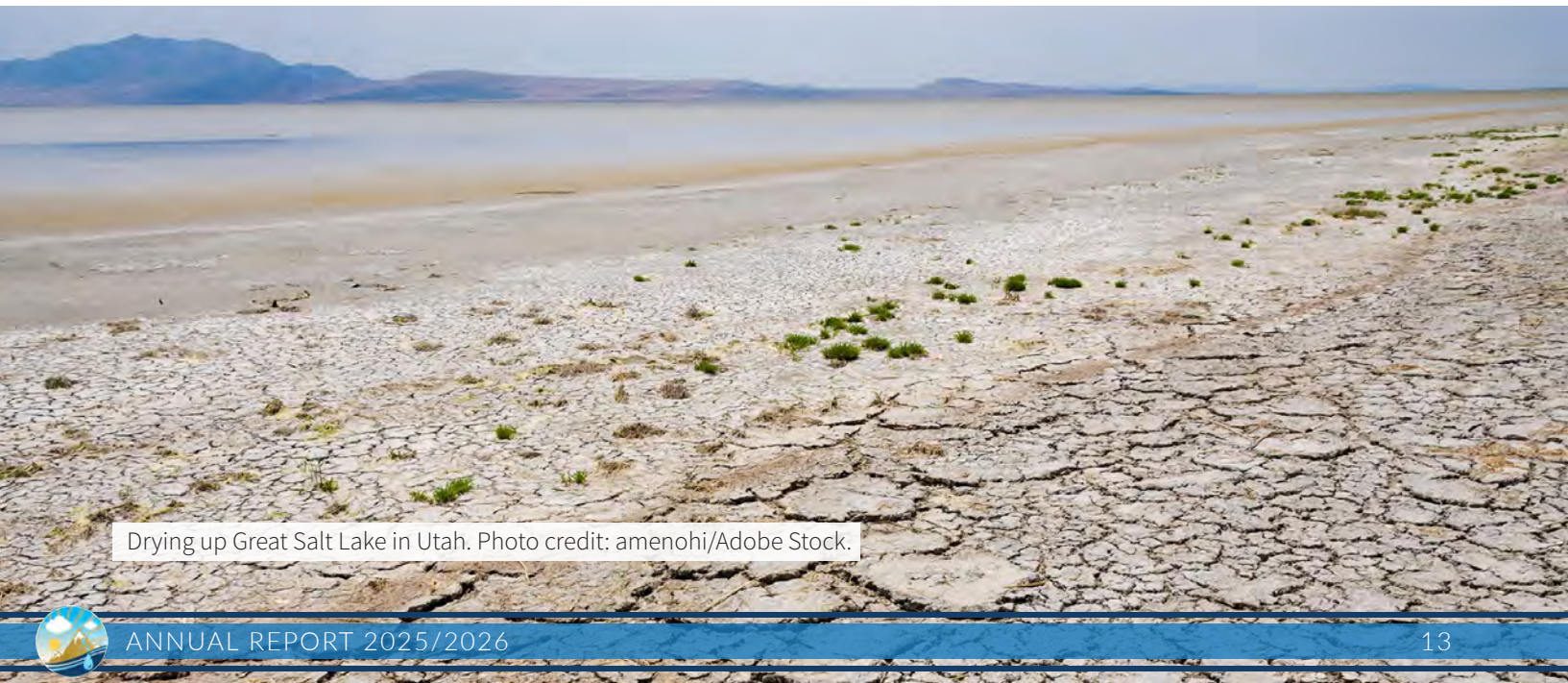
IMPACT STORIES

IMPACT STORY 1: UTAH DROUGHT TABLETOP EXERCISE

WWA provided capacity and resources to the Utah Division of Water Resources (UDWR) at a moment when the state was experiencing drought conditions, and the unfolding snow drought during early 2026 promised additional challenges to state drought planning and response efforts. UDWR approached WWA with an urgent need to assess the effectiveness of the Utah Drought Response Plan and needed help planning and convening a drought tabletop exercise. While WWA's expertise with drought runs deep, WWA sought out experts in conducting drought tabletop exercises and developed a collaborative project with the **National Drought Mitigation Center (NDMC)** to develop and convene a drought tabletop exercise for UDWR.

The exercise, held in March 2026, convened all appropriate representatives for state agencies responsible for drought response and tested the state's drought response plan under three drought scenarios. The first drought scenario considered current drought conditions during March 2026 (severe to extreme drought covering all of Utah) while the other two scenarios used plausible but increasingly extreme potential drought scenarios.

The outcome of the exercise included a list of actions that each state agency would take under increasingly severe drought conditions. The project occurred at an especially valuable time for UDWR as already severe-to-extreme drought conditions in March continued to deteriorate as the snow drought and March heat wave fully impacted conditions. The drought tabletop exercise gave state management agencies a trial run of how to respond to current drought conditions and what actions might be taken if drought worsened. Drought did in fact continue to worsen, and the Utah Drought Task Force recommended to the Governor of Utah that a drought emergency be declared. On May 21, 2026, Utah Governor Spencer Cox declared a drought emergency for all 29 counties in Utah.



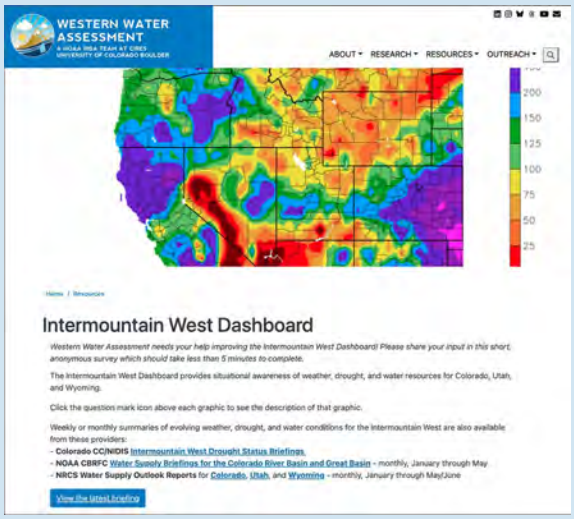
Drying up Great Salt Lake in Utah. Photo credit: amenohi/Adobe Stock.

IMPACT STORY 2: SYNTHESIZING HAZARD INFORMATION FOR BROAD PUBLIC USE

Established in 2013, the **Intermountain West Dashboard (IMW Dashboard)** is WWA's oldest online tool and is the most used resource on WWA's website, seeing nearly 12,000 page views and 2,400 active users during the reporting period. The WWA team also provides a monthly IMW Dashboard Briefing that summarizes weather and hazard conditions from the previous month.

During the reporting period, WWA provided additional hazard-focused resources including an annual summary of hazards in the Intermountain West and rapid response reports for major hazard events. The rapid response reports are designed to help communities and organizations involved in hazard response and planning, and they quickly provide detailed information about the extent, magnitude, causes, and immediate impacts of significant hazard events as they unfold. Significant weather and hazard events often serve as a focusing point on community efforts to mitigate the impacts of hazards and better plan for future hazard events.

The WWA team published three reports in 2025-2026 that provided additional, specific information about hazard events. The reports landing page on the WWA website (**wwa.colorado.edu/resources/hazard-assessments**) was highly visited, with nearly 3,000 page views and nearly 1,000 active users. The three hazards-focused reports include:



Praise from users during this past year included:

> **"I have been receiving your monthly briefings, which I find have kept me abreast of the ongoing aridification of the Intermountain West... The service you provide policy makers and citizens alike are invaluable."**
> **– Dick White, email testimonial**

> **"The Western Water Assessment has been an essential part of my communication to my students and the public concerning drought and snowpack conditions in the western U.S. The summaries provide a beneficial basis for future water planning and use. Thank you for providing this important service and source of information."**
> **– David Kreamer, email testimonial**

1. In early 2026, **Seth Arens** led the development of a summary of the significant hazard events that occurred in the Intermountain West during 2025 (Arens 2026a).
2. In October 2025, **Nels Bjarke** led the development of a rapid assessment of a major flooding event in Southwest Colorado (Bjarke and Arens 2025).
3. In June 2026, **Seth Arens** led the development of a rapid assessment about the 2025-2026 Extreme Snow Drought in the Intermountain West (Arens 2026b).

IMPACT STORY 3: CU BOULDER WATER FELLOWS PROGRAM

The **Colorado Water Fellows Program** advances the next generation of water leaders by training and connecting college students to careers and professionals in the field of water resources. From August 2025 – May 2026, WWA hosted a second year of the Colorado Water Fellows Program at CU Boulder. **Ethan Knight** coordinated the CU Boulder Water Fellows Program with Water Fellows Program Director **Aditi Bhaskar**, Program Associate **Leah Dory**, and Program Advisors **Benét Duncan**, **Ben Livneh**, and **Paul Lander**. The second cohort of the Colorado Water Fellows at CU Boulder included six undergraduate students from a range of academic departments, including environmental studies, biology, computer science, chemical and biological engineering, and environmental engineering. Fellows during both years

of the program hailed from a range of places, including Boulder, Colorado Springs, Denver, Nederland, Thornton, and Grand Junction, CO, and beyond.

Funded by the Colorado Water Conservation Board, the Water Fellows program is headquartered at Colorado State University, with fellows hosted at CU Boulder, Colorado State University, University of Denver, Metro State University, Colorado Mesa University, and Fort Lewis College. This academic-year-long program is designed to advance workforce development, preparing students for careers in the water field and connecting them to opportunities working with water professionals and researchers. This includes attendance at water conferences, field trips, and monthly meetings that delve into critical topics. The emphasis on a broad, interdisciplinary understanding of water-related issues prepares the Water Fellows to navigate the complexities of the field. This approach ensures that the Water Fellows not only receive theoretical knowledge but also gain practical experience, enhancing their readiness for impactful contributions in the water sector. WWA will host the third cohort of Water Fellows starting in fall 2026.

A few quotes from our exit survey, exemplifying the impact of this program on these students and their upcoming water careers:

"Great program!!! I received multiple internship offers after networking with people at the conferences."

"Any meetings with professionals sharing what they do for work was extremely valuable as we got to learn about career paths."

"This experience gave me a much better perspective on water careers: what I like, what I don't like, what's available, and where I should look for jobs."

"Building relationships with professionals in an industry I hope to be in was great for building a foundation of confidence for when I graduate."

Past fellows have expressed feeling more connected to their peers and the broader Water Fellows network, as well as expanding their professional networks in the water sector. Fellows are also able to improve their resumes with career development specialists and strengthen their professional networking skills at conferences, monthly meetings, and more. In the exit survey for our second cohort of fellows, most fellows rated the program very highly and would recommend it to other undergraduate students wanting a career in water.



Participants of the Colorado Water Fellows Program. Photo credit: WWA.

PROGRAM EVALUATION

During the 2025-26 performance period, WWA continued to implement our program evaluation plan. **Benét Duncan** and **Katie Clifford** worked closely with Investigators **Anne Gold**, **Emily Ward**, and **Christine Okochi** to lead the evaluation activities with support from **Ethan Knight**. Drawing from a framework developed by **Gigi Owen** and **Alison Meadow** at the CLIMAS Southwest RISA team, our evaluation approach includes ongoing tracking and evaluation of our program impact, tracking communications and outreach metrics, and an evaluation of our internal program operations. This rigorous and connected evaluation approach is designed to ensure that our program activities remain closely aligned with stakeholder needs, and to track our effectiveness in meeting program goals and building community resilience in the Intermountain West.

WWA's evaluation activities are guided by the following questions:

- WWA RISA program-level evaluation:
  - To what extent is WWA reaching its key audiences and goals?
  - In which ways does WWA prioritize reaching rural communities in their work?
  - In which ways do WWA activities impact its stakeholders and audiences such as project partners, event attendees, and communities?
  - How could WWA activities and offerings be improved?
- WWA project-level evaluation:
  - To what extent are WWA projects reaching their project goals? In which ways are WWA projects reaching their key audiences and building relationships, partnerships, and networks?
  - How does WWA project work communicate usable science and in which ways does it impact communities?

Duncan and **Knight** developed a survey for users of the **Intermountain West Dashboard**, WWA's most-used online resource. During the reporting period, we received 13 survey responses, with a total of 103 responses since we started the survey in 2023. Results indicate that the dashboard is a popular tool for professionals working in a range of sectors, particularly federal agencies, the private sector, and state agencies. Most respondents work in water information provision, water supply planning, agriculture, and communications and outreach in Colorado and Utah. Users frequently consult the dashboard for its comprehensive array of weather and water data tools, particularly the NRCS current snowpack maps, U.S. Drought Monitor maps, and High Plains Regional Climate Center (HPRCC) precipitation maps. Most respondents access the dashboard at least once a month and regularly read the monthly briefings, and they consider the dashboard to be of high importance. Users noted the value of the WWA Dashboard in providing all the data sources in one place, as well as helpful interpretation of ongoing conditions in monthly briefings. Users noted that the combination of these is not readily available on other platforms. One respondent shared, "By providing such an array of relevant maps/information from the most trusted sources, all in one place, the Dashboard saves me SO much time when I need to quickly assess conditions and outlooks for a particular region or state, or when I need to prepare a presentation for an outreach talk for clientele in my region. Thank you and please continue providing this essential resource!"

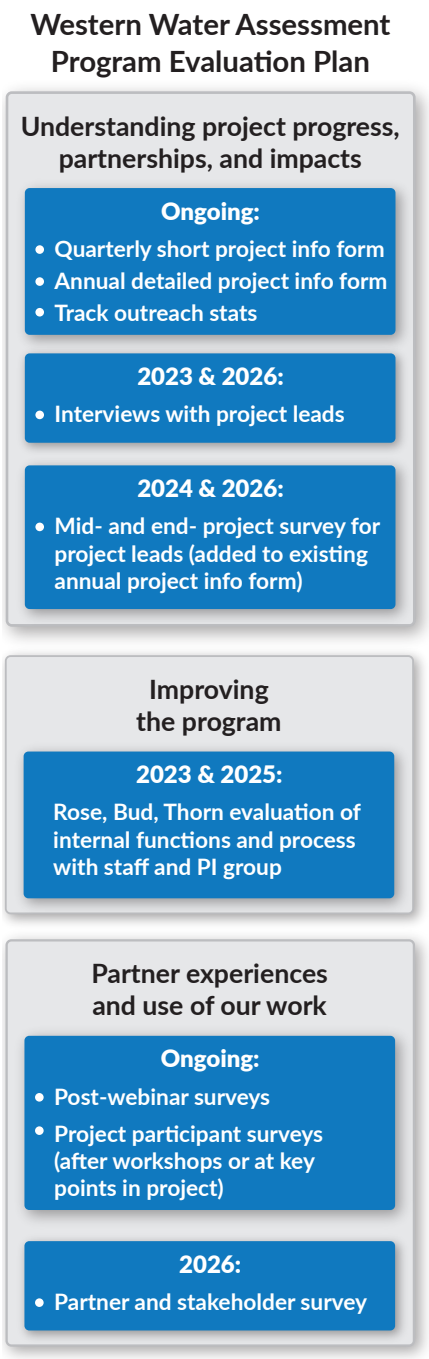


Figure 1: The components of the WWA Program Evaluation Plan.



Moraine Park in Rocky Mountain National Park, Colorado. Photo credit: Nels Bjarke.

SMALL GRANTS PROGRAM

WWA's NOAA RISA funding supported the competitive Adapting to Change in Wyoming small grants program, which was led by **Corrie Knapp** in partnership with **Benét Duncan**, **Katie Clifford**, and **Ginger Paige**. In 2023, communities across Wyoming were invited to submit short applications for projects that would help their communities build resilience to hazards like drought or wildfire, and three projects were funded at $30,000 each.

In the Town of Jackson, the small grants funded project incorporated a broad range of perspectives into resilience planning, energy, housing, and transportation planning efforts.

In a project led by the Wyoming Outdoor Council (WOC), the small grants funded local efforts that have scaled up to create local resilience plans for cities like Lander and Cody, Wyoming, and a collaboration network and event in 2025. Funding also allowed partnership with the City of Cheyenne to support resilience planning.

Led by Greater Yellowstone Coalition (GYC), the small grants funding supported two years of a successful and Tribal-led youth-elder camp that was well attended and supported by many local and Tribal partners. It has built momentum for future iterations of the camp and solidified community networks to support ongoing efforts. By piloting the camps, GYC and other associated non-profits such as the Wind River Buffalo Initiative have been able to show success and secure funding for future years of the camp.

In June 2025, all three projects completed work and submitted final reports to **Knapp**. Through the Adapting to Change in Wyoming program, WWA has helped to increase preparedness and support collaboration and learning in communities across the state. If we were to continue this work, we have learned a range of lessons, including the need to support small rural communities in writing funding applications, and the need to work with university departments to ensure that funding is able to be disbursed to communities as easily as possible. We provided opportunities for applicants to work with WWA team members in developing their project applications, and we worked closely with the University of Wyoming finance team to help funded teams to navigate the university funding process, and both efforts were very helpful.



Bison herd in the Grand Teton National Park, Wyoming. Photo credit: Nels Bjarke.

LOOKING TO THE FUTURE

Building on the progress described in this report, WWA is strategically focused on three key initiatives for the coming year, which will further advance our partner-driven research and expand our regional impact. During the coming year, WWA will advance user-driven projects that build community and water system resilience to compound hazards in the Intermountain West. We will also continue to expand our connections with regional partners, with an emphasis on serving local and state partners, including rural communities. Three initiatives are highlighted below:

PROVIDING TECHNICAL SUPPORT SERVICES FOR COMMUNITY HAZARD PLANNING

As the Intermountain West region faces the impacts of historic snow drought, regional planners and municipal water managers are actively balancing the need to respond to the short-term urgency of diminished water supply and plan for long-term water infrastructure management and water resource conservation. During the coming year, the WWA team will continue to engage with regional partners to provide technical science support for management practices and retain flexibility to respond to needs as they arise during the current water shortage and season of increased wildfire risk. This initiative includes working with municipal water agencies like Denver Water, City of Golden, and Salt Lake City Department of Public Utilities to provide scientific support for drought assessment, water conservation efficacy evaluation, and further support research for operational water supply predictability. Further technical science support includes providing scientific synthesis for state and regional management entities such as the Colorado Water Conservation Board, the Southwest Basin Roundtable of Colorado, emergency management, and state engineers and departments of natural resources in Wyoming and Utah.

TRACKING CONTINUED IMPACTS OF EXTREME SNOW DROUGHT

In response to the extreme snow drought in the Intermountain West during 2026, WWA will follow up on its rapid response assessment of snow drought by continuing to track the impacts of drought as the summer and fall seasons unfold. The information gathered over the coming months will be crucial to understanding the full impacts of the 2026 snow drought and will be used in a summary report of 2026 hazards in the Intermountain West.

WORKFORCE DEVELOPMENT

Over the coming three years, WWA will leverage funding from the **Colorado Water Conservation Board (CWCB)** in partnership with the Colorado Water Center at Colorado State University to continue the Colorado Water Fellows Program at CU Boulder (see Impact Story 3). The program will be led by **Benét Duncan**, coordinated by **Ethan Knight**, with support from graduate student **Leah Dory**. We will support five CU Boulder undergraduate students who are interested in water careers as Water Fellows each year. Water Fellows will be selected through a competitive application process, and each receive a $1,000 stipend for their full participation in the program. In previous years of the program, WWA has seen overwhelming interest from CU Boulder undergraduate students, with approximately 50 applicants per year. It is clear that the program is filling a critical need for students and helping to build the next generation of Colorado's water workforce.

WWA will also continue training graduate student assistants (GRAs) across multiple institutions and disciplines, immersing the next generation of applied scientists in the translation of hazard risk into decision-relevant support. Our PI group provides unique opportunities for graduate students to engage in research with direct, tangible impacts on the decisions that water managers, community leaders, and other partners make.

WWA Staff Research Scientist **Nels Bjarke** is also hosting a community college student researcher through the CIRES Research Experiences for Community College Students (RECCS) program. The student will learn applied research techniques and support data analysis to advance **Bjarke's** NCEI-supported work on drought non-stationarity.

REFERENCES

1. Arens, S., 2026a. 2025 Intermountain West Hazard Summary. Western Water Assessment. **wwa.colorado.edu/sites/default/files/2026-02/2025IMWHazardSummary_FINAL_021026.pdf**.
2. Arens, S., 2026b. 2025-2026 Extreme Snow Drought in the Intermountain West Rapid Assessment. Western Water Assessment. **wwa.colorado.edu/sites/default/files/2026-05/2025-2026_Extreme_Snow_Drought_in_the_Intermountain_West_FINAL_5.14.2026.pdf**.
3. Bishay, K., Livneh, B., Pflug, J., and Rajagopalan, B., 2026. Examining the Potential for Remotely Sensed Snow Information to Predict Seasonal Water Supply across Dimensions of Aspect, Elevation, and Slope. Journal of Hydrometeorology. Volume 27, Issue 2. **DOI: 10.1175/JHM-D-25-0101.1**.
4. Bjarke, N. and Arens, S., 2025. Rapid Assessment of October 2025 Flooding in Southwest Colorado. Western Water Assessment. **wwa.colorado.edu/sites/default/files/2025-10/Pagosa_Springs_Rapid_Assessment%E2%80%93Final_Publication_102225.pdf**.
5. Brucker, C.P., Livneh, B., Rosario-Ortiz, F.L., Yao, F., Williams, A.P., Becker, W.C., Kampf, S.K., and Rajagopalan, B., 2025. Wildfires drive multi-year water quality degradation over the western United States. Communications Earth & Environment, Volume 6, Number 489. **DOI: 10.1038/s43247-025-02427-6**.
6. Cleveland, Z., Laguë, M., and Strong, C., 2025. North American Monsoon Response to Antecedent Soil Moisture and Snow in the Colorado Plateau. JGR Atmospheres, Volume 130, Issue 16. **DOI: 10.1029/2024JD043026**.
7. Livneh, B., Ray, A.J., Dilling, L., Clifford, K., Gordon, E., Bjarke, N., Knight, E., Arens, S., Clark, M., and Duncan, B., 2026. Bridging science and action: the Western Water Assessment's evolution in the provision of climate information. Climatic Change, Volume 179, Number 115. **DOI: 10.1007/s10584-026-04159-8**.
8. Modi, P.A., Carbone, J.C., Jennings, K.S., Kamen, H., Kasprzyk, J.R., Szafranski, B., Wobus, C.W., and Livneh, B., 2025. Understanding the relationship between streamflow forecast skill and value across the western US. Hydrology and Earth System Sciences, Volume 29, Issue 20. **DOI: 10.5194/hess-29-5593-2025**.
9. Pernat, M.R., Kasprzyk, J., Zagona, E., Walker, S.D., and Livneh, B., 2025. The relative importance of model type and input features for water supply forecasting in snow-dominated basins of the southwestern US. Journal of Hydrology: Regional Studies, Volume 60. **DOI: 10.1016/j.ejrh.2025.102548**.



WESTERN WATER ASSESSMENT

A NOAA RISA TEAM

Western Water Assessment
Cooperative Institute for Research in Environmental Sciences
University of Colorado Boulder
University of Utah
University of Wyoming

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