



# THE SUNDIAL

SPRING 2023



CANYONLANDS  
RESEARCH CENTER

## Check out the New CRC Web Site



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The Canyonlands Research Center has a new online presence! The updated web site provides an overview of the research and programs in progress this year, as well as information on the CRC's location, history, partners and our science leadership team. You can also visit the site to learn more about the CRC research facilities, fellowship opportunities and our expanding NATURE (Native American Tribes Upholding Restoration and Education) Program. Check it out today.



CRC WEBSITE

Learn more at [nature.org/canyonlands](https://nature.org/canyonlands)



CANYONLANDS  
RESEARCH CENTER

The mission of the Canyonlands Research Center (CRC) is to facilitate research, education and collaboration for understanding the interactive effects of land use and climate and developing management solutions that meet human needs while maintaining ecological viability on the Colorado Plateau and in semi-arid lands worldwide. The CRC is based at The Nature Conservancy's Dugout Ranch — a gateway to Canyonlands National Park. Spanning over 3,000 square kilometers, the CRC's study area is comprised of lands managed by the USDA Forest Service, Bureau of Land Management and National Park Service.

### We Thank Our Collaborating Partners!

The Nature Conservancy 



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# RESEARCH DIRECTOR'S REPORT



With bittersweet feelings, the CRC team is saying goodbye to Dr. Nichole Barger, who has expertly served as the CRC Research Director for last seven years. Dr. Barger is transitioning into a new position with The Nature Conservancy (TNC) as Deputy Chief Scientist, working with TNC's Chief Scientist Katharine Hayhoe. In her new role, Dr. Barger will be leading TNC's global science team, which has a wide range of expertise in spatial science, climate science, and economics. She'll also be helping to forge into new areas such as the social and behavioral sciences.

Under Dr. Barger's leadership, the CRC research program enjoyed major advances, including the establishment of a fellowship program and the development of NATURE, the Tribal student leader program, as well as the launch of several key agricultural research initiatives. Dr. Barger's many talents and her friendship will be sorely missed, and we know that part of her heart will always belong to Utah's Canyon Country.

As we say goodbye to Dr. Barger, the CRC team is thrilled to welcome Dr. Mike Duniway, a soil scientist with the U.S. Geological Survey, who has stepped forward to serve as the new Interim Research Director. Nationally recognized for his research in human managed systems, Dr. Duniway has served on the CRC Science Committee since it was formed and has led several research projects at the CRC on soil, vegetation, drought and grazing.

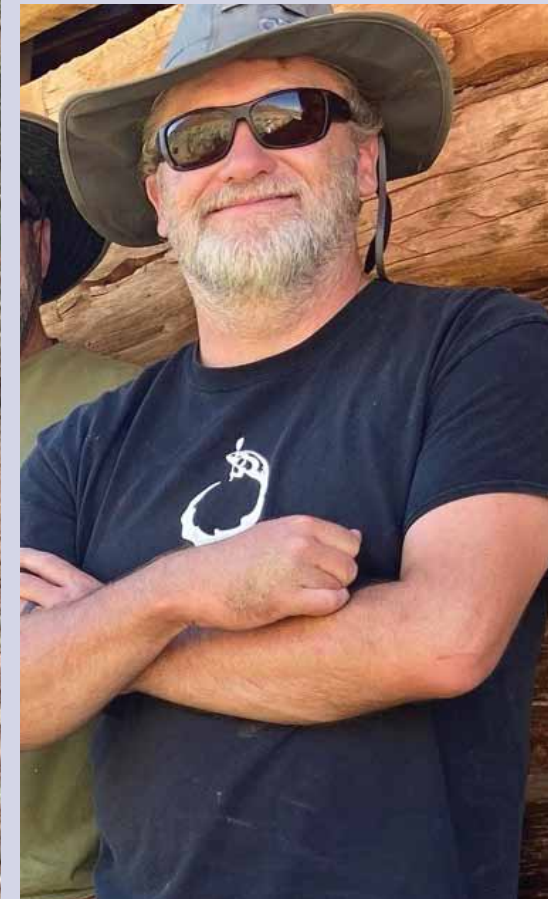
Dr. Duniway notes he will strive to keep the CRC on track in its mission to engage federal and Tribal partners in research efforts. "I'm very excited to be serving as the interim Research Director," says Dr. Duniway. "Dr. Barger has done a fabulous job and is a very tough act to follow. The landscapes of the CRC have been my scientific 'home' since returning to the U.S. Geological Survey in Moab in 2011, and I look forward to the opportunity to help shape the work we do at the CRC over the next year and beyond."



Nichole Barger, former CRC Research Director



Mike Duniway, Interim CRC Research Director



# SCIENCE HIGHLIGHT



## *Exploring Beaver Benefits*

At the Dugout Ranch, the home base for the CRC, two creeks—Indian and Cottonwood—wind through the red rock and high desert grasslands on their way to the Colorado River. The creeks provide 42 miles of riparian habitat near the ranch—a precious source of diverse vegetation and wildlife in this arid region. But, like many Western waterways, these creeks and their valuable habitat face new risks and pressures as the impacts of climate change increase.

A new CRC project led by William (Wally) Macfarlane is exploring the use of a natural ally in the defense of riparian areas. Macfarlane, a geospatial scientist with the Department of Watershed Sciences at Utah State University, is leading a team of scientists and partners in a large project to restore beaver activity in streams and riparian areas on the Dugout Ranch. Macfarlane hopes that his beaver-based restoration tactics, such as beaver translocations and beaver dam mimicry, will help reverse channel incision, reconnect floodplains and sustain healthy riparian areas.

When functioning well, riparian areas are critical for both nature and people. They help to improve water quality and provide a wealth of plant and animal habitat. Yet across the country, our riparian ecosystems are degraded

and vulnerable. To restore them, more scientists, landowners and land managers are turning to a low-cost, natural helper: the beaver. Once prevalent on all North American streams, beaver populations were decimated by the fur trade in the 17<sup>th</sup> century, followed by decades of pollution and habitat loss. Today, they're making a comeback—often with a helping hand from humans.

Why beavers? Beavers create a complex system of dams, ponds and wetlands that enhance water quality and keep more water in the soil. Beaver activity can also help recharge ground water aquifers and reduce the risk of flooding.

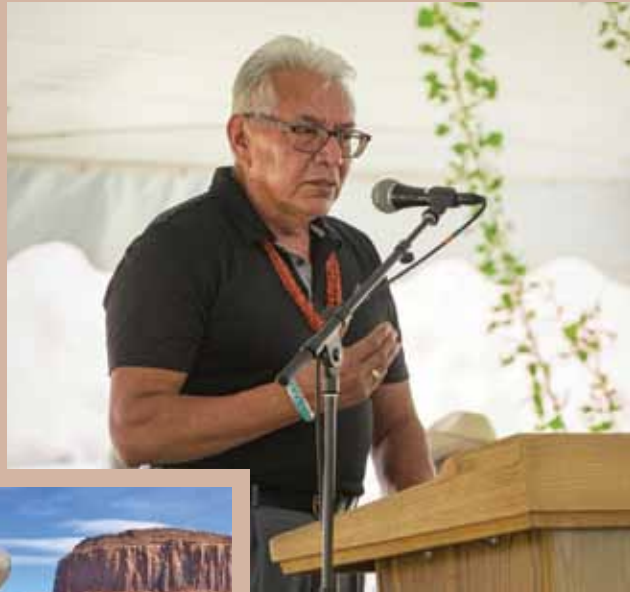
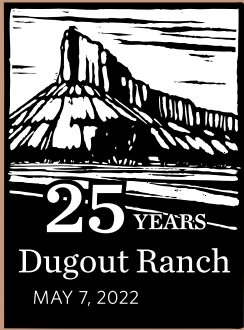
“There are beaver at the Dugout now,” explains Macfarlane. “We have seen small dams that look like they are getting blown out frequently. One of our hopes is that the beaver dam analogs, or BDAs, will attract beaver dam building and allow for more robust dams that will persist longer.” Designed to act like a beaver dam, a BDA is a short-term structure made of wooden posts pounded into the streambed, then packed with dirt and woven willows.

Macfarlane and his team know where to build the BDAs thanks to a conservation, restoration and monitoring plan he helped create for the Dugout Ranch in 2021. The plan prioritized where beaver-related restoration projects could be implemented to maximize benefits. His team also plans to monitor the instream and riparian response to their efforts.

While this project focuses on restoring the creeks at the Dugout, Macfarlane is seeking larger, regional impact through education and outreach. His team will host a workshop at the CRC for regional landowners, academic institutions, restoration practitioners and land managers to showcase this restoration project and promote riparian restoration practices for desert environments.

“I’m really excited to be conducting this project on a working ranch at the Dugout,” says Macfarlane. “Through the CRC, we can share our results widely and build best management practices that work here, because beaver mimicry is a rather new approach in these more arid systems.”

OPPOSITE: View of beaver dam analog in Indian Creek: Wally Macfarlane; Courtesy Wally Macfarlane; North America beaver © Tim Lumley



# OUT ON THE RANGE



## Celebrating 25 Years of Protection for the Dugout Ranch

In May 2022, The Nature Conservancy (TNC) and CRC partners celebrated the 25th anniversary of TNC's purchase of the Dugout Ranch, which serves as the home base for the CRC. At this memorable gathering, Sally Jewell, former U.S. Secretary of the Interior; Woody Lee, Executive Director of Utah Diné Bikéyah; and Jennifer Morris, CEO of TNC; joined many other national, regional and local leaders to honor the Dugout Ranch's conservation legacy and the growing collaboration that continues to drive the CRC.

Back in 1997, the scenic, historic Dugout Ranch was at risk of being sold for development or subdivision. Instead, thousands of Utahns rallied to help TNC work with the Redd family to acquire and protect the property. The Dugout spans 5,207 private acres, with an additional 335,030 acres of adjacent public grazing allotments—including 42 miles of river corridor and precious habitat for rare species and abundant wildlife. The largest private inholding in Bears Ears National Monument, the ranch is

located at the gateway to the Needles District of Canyonlands National Park and is a place long valued and stewarded by many Indigenous peoples, including the Ute and Diné.

TNC's purchase of the Dugout provided a crucial foothold for conservation and research in the heart of the Colorado Plateau. Many public and private partners joined TNC in recognizing the need to capitalize on the ranch's scientific value to achieve a much larger impact. Years of field research revealed the ranch and surrounding lands provided the perfect setting for a research center devoted to the health of resources and communities on the Colorado Plateau. In 2009, the CRC officially launched as a collaborative effort among TNC, universities and public agencies to make key advances in climate science and sustainable land use. The CRC's founding partners included the Bureau of Land Management, the U.S. Forest Service, the National Park Service, the U.S. Geological Survey, Utah State University and the Utah Division of Wildlife Resources. In the fall of 2009, TNC purchased the Dugout Ranch's cattle herd to use as a research tool in developing solutions for sustainable grazing.

At the Dugout 25<sup>th</sup> anniversary celebration, a range of scientists, ranchers, Tribal members and community leaders discussed the protection of the ranch, the evolution of the CRC and the importance of collaboration. "It was wonderful to celebrate the remarkable 25-year partnership between TNC and the Dugout Ranch last spring," says Mike Duniway, interim research director for the CRC and ecologist with the U.S. Geological Survey. "This partnership with the Dugout was the first step in the formation of the CRC and provides a unique opportunity to for CRC researchers to conduct critical and cutting-edge science on the Colorado Plateau."

Today the special lands and waters of the Dugout Ranch remain protected, and the CRC is thriving as a unique platform for climate science, dryland ecology and regional conservation solutions. As climate pressures intensify, the CRC looks forward to expanding even more, to become a catalyst for systemic change in the way we manage and use drylands. CRC partners are working to demonstrate that conservation actions and well-managed grazing can deliver landscape, economic and social resiliency at a broad scale.

OPPOSITE: clockwise, L to R: Woody Lee, Science panel: Mark Brunsen, Kari Veblen, Mike Duniway and Sue Bellagamba; Dugout tent; Jennifer Morris; Sally Jewell and Mark Maryboy. © Stuart Ruckman

# FIELD NOTES



## Study Tests New Options for SW Ranchers

For ranchers in the Southwest, change is unfolding rapidly on many fronts. The expectations and demands of beef consumers are shifting and the impacts of climate change on the range are growing. New ideas and practical, data-based solutions are in demand.

That's why the Sustainable Southwest Beef Coordinated Agriculture Project (CAP) is so important. Through CAP, the Dugout Ranch at the CRC is one of five ranches where scientists and ranchers are researching novel strategies for enhancing sustainability of beef cattle ranching.

"We're trying to keep ranching and rangelands ecologically and economically healthy as climate, markets and policies change," explains Sheri Spiegel, a rangeland management specialist with the USDA-ARS Jornada Experimental Range.

Spiegel and her team are working with Matt Redd, Director of the CRC and the Dugout, to have the CRC's Dugout

Ranch supply cattle for a 5-year study that compares the feedlot performance and meat quality of Raramuri Criollo and Angus. The ranchers' experiences, along with the rangeland health outcomes of raising these cattle using precision technologies, will be part of a long-term study on ranch sustainability, which will inform ongoing models and studies of food chain options.

"We're thrilled to have the Dugout Ranch and the CRC as one of our major partners," says Spiegel. "The work happening here is allowing us to beta test important technologies with respect to the Criollo cattle and precision ranching."

Using GPS collars, Spiegel and Redd are tracking and comparing the movement of Criollo cattle to the Angus, to see where and how they forage and how they impact the land. In addition, Redd and his team are experimenting with ranch technologies such as virtual fencing, body condition scoring with artificial intelligence (a way of measuring the cow's body fat), and sensors to monitor trough water levels. Spiegel hopes to share the

CRC's lessons learned as a way to help other ranchers make use of technology to prevent herd losses and save money.

"The great thing about this study is that it involves a growing group of diverse ranchers throughout the Southwest, all collaborating and helping to inform our research decisions," explains Spiegel. "There's so much interest in this work. We're seeing a lot of ranchers seeking solutions to climate change." Spiegel notes the CRC and Dugout will soon also be testing a new sustainability indicator system, which will enable the team to better understand how the use of these new technologies and practices impacts other outcomes: from a rancher's bottom-line to the surrounding environment.

## Comparing Criollo and Angus *An Up-Close Pasture View*

For Maria Stahl, her current Criollo cattle research project at the CRC is all about exploration: "I think a really important outcome will be to figure out where adopting Criollo into producer herds will be most useful."





GPS sensors are used to track cattle movements.  
© James Q Martin

Stahl, who's working on her PhD at Utah State University, is studying 20 Criollo cows and 20 Angus cows in one particular pasture at the CRC. Her work is part of the larger investigation of whether Criollo, a breed that originates in an isolated region of Mexico, could put less stress on the arid ecosystem than traditional European cattle breeds.

Stahl and her team are using pedometers and GPS sensors to track the cattle movements and they're also gathering in-depth field data on the vegetation in the pasture where the herd is grazing. Their findings will help determine if the Criollo

will venture farther from water sources and will graze on more shrubs—making them better suited to the landscape that's evolving in the Southwest.

"We're building on the Criollo research that's already happened at the CRC," explains Stahl. "These Criollo have been at the Dugout and CRC for four or five years now, so we're assuming they've had more of a chance to settle in and become used to the terrain."

Unfortunately, climate change—in the form of drought—has impacted Stahl's studies. "Due to a lack of water this past year, the cows couldn't stay in the pasture as long as we'd hoped, and our data collection was interrupted. We're working with the CRC team now to adapt and extend our study into additional pastures."

But what Stahl and her team have already found is a growing appetite for their results. "Last spring, we attended the Southwest Sustainable Beef Conference at the CRC, and everybody was talking about Criollo," says Stahl. "From local producers to scientists to government land managers

to Tribal leaders—people were open-minded and curious about how to make ranching more sustainable in the face of climate change."

As Stahl moves forward with her project this spring, she hopes her contributions will add to the growing cache of knowledge about heritage genetics, and she can't think of a better place for this conversation to happen than at the CRC.

"I feel so lucky to be doing my research here at the CRC," says Stahl. "This place allows for really diverse stakeholders to have a meaningful dialogue about how ranching might adapt and thrive, and that's really powerful."



Criollo studies at the CRC are part of research underway throughout the Southwest. © James Q Martin

# OUTREACH

## Tribal Leadership Program Expands in 2023

### *Welcoming new NATURE students and instructors*

What started with just a few Tribal students—who exchanged knowledge, shared cultural experiences and gained science skills at the CRC—is now a growing and dynamic initiative. The NATURE program (Native American Tribes Upholding Restoration & Education) is set to welcome 10 students this summer, and it will unfold under the new leadership of two professors from Fort Lewis College in Durango.

An immersive, paid, 7-week summer program, NATURE is co-led by the CRC and Utah State University-Blanding, and is designed to support the next generation of Indigenous leaders from the Four Corners Region with skills in the field of natural resource management. Students spend time in the classroom and in the field, interacting with some of the leading Indigenous and non-Indigenous scientists and practitioners working in the region.

“The program has been a huge success and our students so far have been inspiring trailblazers who helped us reflect, improve and set new goals,” says Kristen Redd, the CRC’s Program Manager. “We are thrilled to reach more participants this year, offer deeper program experiences and welcome our new professors!”

This year’s NATURE program will be led by Dr. Ross McCauley, chair of the Biology department and curator of the Fort Lewis College Herbarium, and Dr. Aurea Cortés-Palomec, a senior lecturer in the Fort Lewis Biology Department. “Together we are bringing 30 combined years of teaching and research experience in higher education,” explains Dr. Cortés-Palomec.



Dr. Ross McCauley and Dr. Aurea Cortés-Palomec will lead the NATURE program this year.  
Photos courtesy Dr. McCauley

“Incorporating hands-on learning and research into education has been a hallmark of our work, and we have mentored over 45 undergraduate theses, an experience that we hope to share with students in the NATURE program as they complete their capstone projects.”

In the past, NATURE students have completed real-world activities and projects focused on climate change science, restoration practices and research on Indigenous foods. This year’s participants will also focus on the critical challenges surrounding rivers in the arid West.

“The NATURE program is an exciting opportunity to make connections to the unique natural communities of the Colorado Plateau,” said Dr. McCauley. “It allows students to explore the biology of these lands while understanding their cultural connection and ability to be stewards for future generations.”

As climate change and other disturbances continue to impact this region, programs like NATURE are all about finding innovative solutions from diverse voices and

perspectives to restore lands, waterways and communities to be healthy and resilient. For participants, the program aims to offer benefits that last beyond graduation.

“The program involved a lot of outdoor learning which can benefit my daily life, especially when living on a reservation. It has taught me a lot about finding different ways to take care of the land,” said Verna Thompson, a Hopi Tribe member and 2022 NATURE program graduate.



NATURE students in 2022. © Kristen Redd/TNC

## A SPECIAL THANK YOU



© George Krawcliw

We are pleased to recognize Kristine Crandall for her important gift to the CRC in support of the NATURE program. Kristine has been a TNC member since 2014,

she is a member of the Utah Chapter Board of Trustees and a Legacy Club member. As an enthusiastic admirer and student of desert ecosystems, Kristine appreciates the work being done at the CRC on ground-breaking scientific research to inform the sustainability of arid lands. Creating partnerships is one of Kristine’s favorite things about TNC, and the NATURE program is a great example.

**Major funding generously provided by:**



To learn more or support the CRC, contact:  
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Jorge Rojas. © Simon Blundell

## CRC Launches Artist-in-Residence Program

This year, a new kind of investigation has been unfolding at the CRC—one that applies an artistic lens to the scientific work underway here on climate and sustainable land use. Jorge Rojas, as the

CRC's first artist-in-residence, is exploring this unique landscape and its challenges through visual art, research and social engagement. His art offers another important way to communicate and share the CRC's mission.

"I'm so excited about this new program and Jorge's involvement," says Kristen Redd, the CRC's program manager. "By creating a space where art and science are

encouraged to collaborate, we hope to give both methods a more powerful and substantive means to communicate science and land issues with a diversity of people, voices and perspectives."

The CRC artist-in-residence program will serve one artist per year and encourage artists to engage with CRC researchers, join them in the field and delve into research materials and questions. The artists will also be encouraged to work in collaboration with local communities, art programs, non-profits or school groups for their final project and presentation.

Rojas is excited to help the CRC kick off its new program. A multidisciplinary artist, he is a performer, curator and educator from Morelos, Mexico now based in Salt Lake City, Utah. His work has been exhibited nationally and internationally and is included in multiple public collections. Rojas was named one of Utah's most influential

artists by Artists of Utah/15 Bytes in 2019, and he also recently served as director of learning and engagement at the Utah Museum of Fine Arts.

"I'm very excited and honored to be the inaugural artist-in-residence at the Canyonlands Research Center," says Rojas. "For my residency, I have the amazing opportunity of collaborating with Dr. Sasha Reed, a renowned research ecologist. We will be using her research on biological soil crusts as the basis for our collaboration. An added bonus has been getting to work with Dr. Reed's amazing team of scientists, each contributing to the project their own creativity and expertise." The CRC team is pleased to announce that the Biocrust art project, an immersive, multimedia and interactive experience, will be exhibited at the Utah Museum of Contemporary Art from January to June 2024.