THE SUNDIAL

FALL 2024

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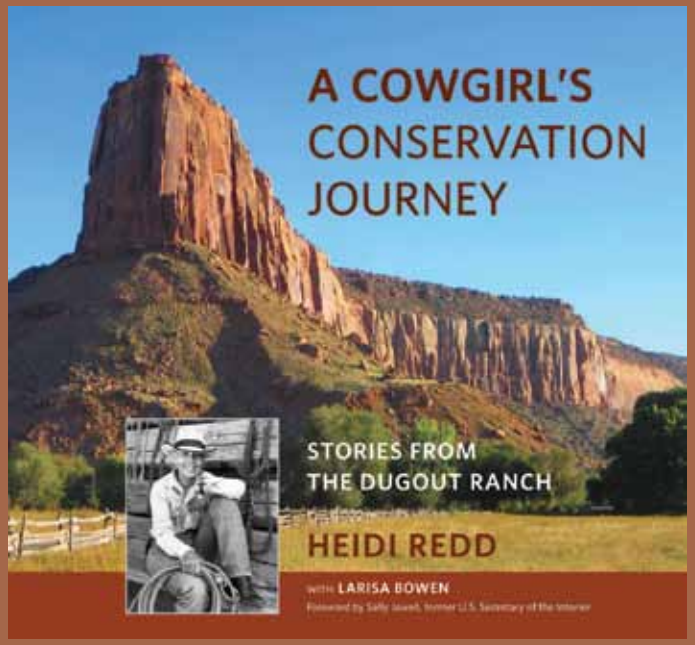
The Dugout & CRC Feature in Heidi Redd's New Memoir



The Nature Conservancy (TNC) teamed up with iconic Utah cowgirl Heidi Redd to publish a beautiful new book featuring stories from Heidi's life full of adventure at the historic Dugout Ranch. *A Cowgirl's Conservation Journey* details Heidi's life-changing partnership with TNC to save this special place and also highlights the launch of the Canyonlands Research Center program. Book sales support TNC but are not tax-deductible.

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The mission of The Nature Conservancy's Canyonlands Research Center program (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 program is based at The Nature Conservancy's Dugout Ranch — a gateway to Canyonlands National Park. Spanning over 3,000 square kilometers, the CRC Study Area is also comprised of lands managed by the USDA Forest Service, Bureau of Land Management and National Park Service.

Collaborating Partners

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IN THIS ISSUE

COVER: © Ted Wood

RESEARCH DIRECTOR'S REPORT

"One of TNC's goals for the CRC is to work collaboratively with scientists as well as public land and natural resource agencies."

All summer, researchers and their student field crews have helped to further the mission of the Canyonlands Research Center program, which is to drive climate science research forward and develop sustainable land management solutions for Utah's canyon country. Some of their work is featured in this issue of The Sundial, including new studies on desert plants and water use, sagebrush restoration and promising "precision ranching" technologies.

One of The Nature Conservancy's goals for the CRC is to work collaboratively with scientists and public land stewards to make the best scientific knowledge accessible to public land and natural resource agencies that make critical land management decisions for our region. We created the Canyonlands Research Center as a consortium that includes the Utah Department of Natural Resources and three large landholding agencies: the Bureau of Land Management, the National Park Service and the USDA Forest Service. Along with our science partners—the U.S. Geological Survey, Utah State University, Northern Arizona University and New Mexico State University, Jornada—we are excited about opportunities to learn from and share knowledge with agency managers. Our biennial Colorado Plateau Science and Management Forum, which took place in March, and which you can learn more about on the back cover, is just one example of how TNC's CRC program is finding ways to connect and problem solve with regional stakeholders.

Collaborating with public land managers is especially important for us because the Dugout Ranch is the largest private inholding within the Bears Ears National Monument. As the monument's management plan is now in development, we've welcomed the opportunity to share our thoughts about their proposed direction and look forward to working side-by-side with monument staff in the future.

Finally, as this is my first newsletter as science director, I should briefly introduce myself. I retired in July after 32 years as a professor at Utah State University, where I studied human interactions with nature. I am new to this role but have been involved with the CRC since its beginning, and I'm excited to do more on behalf of this vital effort.

Mark Brunson,
CRC Science Director,
Canyonlands Research Center

Professor Emeritus,
Environment and Society,
Utah State University

TNC's Management Team

Sue Bellagamba, *Canyonlands Regional Director*

Matt Redd, *CRC and Dugout Ranch Director*

Kristen Redd, *CRC Program Manager*


Lookies

SCIENCE HIGHLIGHT

Secrets of the Soil: Revealing How Desert Plants Will Respond to Climate Change

The natural world is full of mysteries that humans have yet to solve. That's what excites Dr. Andrew Kulmatiski, a soil ecologist and associate professor at Utah State University. He's exploring the complex world below ground—a realm where scientists are still making discoveries about how plants, soils and climate interact. "We know so little about what is going on below ground," says Dr. Kulmatiski, "even though in arid systems, more than half of a plant's biomass is beneath the soil."

For the past year, the arid soils at and near the CRC Study Area have been the site of Dr. Kulmatiski's latest research project: to predict how plants in the West, especially plants important to ranchers, such as forage grasses and trees, will respond to climate change in the next century. To make these predictions, Dr. Kulmatiski is using technology and approaches that are—quite literally—groundbreaking. He puts it this way: "we inject a kind of tracer or 'dye' into tiny holes at different soil depths to describe how much water different species can absorb from different soil depths."

Tracers, Dr. Kulmatiski explains, are "a way of seeing the invisible." In this case, it means seeing beneath the soil's surface and into a plant's roots. Tracers are often dyes, but here Dr. Kulmatiski is using stable isotopes to track water uptake. If he understands where different species absorb water and how they can move their roots over time, he can estimate how much water each species can absorb in different climates on the landscape or in response to anticipated climate changes.

Dr. Kulmatiski pioneered this type of detailed approach and modeling and is one of the few people using it around the globe. His methods help to shed new light on systems that are unexpectedly difficult to study. By using tracers and modeling to gather in-depth information on a plant's water uptake, Dr. Kulmatiski protects the roots while gaining valuable insight into its life cycle…and its future.

"Water uptake determines how much a plant can grow," he says, "it dictates which species coexist, how much water reaches the atmosphere or aquifer, and how plants will respond to climate change." In the West, climate change is delivering warmer temperatures and bigger rain events, which are impacting many different elements of the region's ecosystems—including the way water moves through soil and into plants. What's clear is that in this era of climate change, there will be winners and losers in the plant world. Some species are likely to have root distributions that benefit from these changes while other plants decline. For arid land ranchers who rely on specific warm and cool season grasses to sustain their herds, knowing which plants will thrive, and where, is crucial.

This spring Dr. Kulmatiski's team will kick off their second season of this four-year research project, conducting sampling at sites at the CRC Study Area as well as in central Montana, and Bishop, California. In addition to sharing results, Kulmatiski and his colleague Kyle Palmquist will also produce maps of anticipated forage and woody plant responses to climate change for sagebrush systems across the West.

OPPOSITE: Dr. Kulmatiski and his team collecting soil samples. Credit: Andrew Kulmatiski

OUT ON THE RANGE

Testing the Promise of Modern, Real-Time Ranching

In the arid lands of the Southwest, people have long had to adapt and evolve to survive. Ranchers and farmers in the region face limited resources, extreme weather and unpredictable markets that can negatively impact the most well-run operations. Today, climate change has upped the ante, layering on new and more challenging uncertainties for both ranchers and the lands and waters on which they rely. But what if technology could help mitigate some of the impacts of climate change on the health of western rangelands and arable lands? Through TNC's CRC program, a team of ranchers and scientists are testing remote sensing technologies that could help livestock operators be more nimble, responsive and effective at managing their herds and sustaining the long-term health of the range.

"We're seeing a growing need for real-time monitoring on both private and public lands in this region," said Matt Redd, CRC and Dugout Ranch Director. "Ranchers can use new remote-senor technologies to control their cattle through a virtual fence system or even to monitor soil and vegetation conditions and water availability. Having access to this kind of data allows them to make adjustments quickly."

Putting these technologies to the test at the Dugout, Redd receives a steady flow of data from LO RA WAN towers that communicate with the sensors and gauges he and his team have set up. The towers provide real-time information on a range of ranch happenings, from the movement of individual cows to the amount of precipitation falling in remote areas of the grazing allotments. Redd and his partners at New Mexico State University and the USDA's Southwest Sustainable Beef Coordinated Agriculture Project are also testing virtual fencing, which uses LO RA WAN to communicate with GPS collars on cows to control their movement and lessen their impact on the region's grasses.

"Ranchers in arid environments must continuously hone their knowledge and skills to maintain their rangelands in healthy condition and stay in business over the long term," explains Sheri Spiegal, who leads range management research at the USDA. "Adaptive management, informed by ongoing data collection, is one of the primary skillsets needed." Spiegel is using the Dugout and the CRC program as one of five ranches in the Southwest where the USDA is helping scientists and ranchers research novel strategies for enhancing the sustainability of rangelands and livestock.

"We're also working with the Utah Department of Agriculture and the Colorado River Authority to test these same types of products and technologies on our arable land at the Dugout," notes Redd. "This allows us to fine-tune how much water we're using and to ensure we are being as efficient as possible. By refining our management, we can sustain productivity, conserve water and maintain water resources for people and nature."

It might not be a crystal ball, but having access to detailed, up-to-the-minute data does give ranchers and public land managers a powerful new tool to strategize and plan in the era of climate change. The CRC team and its partners hope to share their findings as a way to help other ranchers make use of this technology to keep rangelands healthy and productive.

OPPOSITE: Inset: Matt Redd and his team in front of the LO RA WAN instrument. Larger image: Installing the LO RA WAN at the Dugout. Credit: Matt Redd/TNC

FIELD NOTES

Josh Day and team survey big sagebrush. Credit Jack Van Allsburg.

Seedling Survival: Studying How to Save Sagebrush on the Colorado Plateau

Josh Day knows the rapid loss of big sagebrush on the Colorado Plateau is a major concern. As a PhD student in ecology at Utah State University, he's been making the long drive from Logan, Utah, down to Utah's southeast canyon country for several years—seeking clues to the decline of this vital plant system. "I've been monitoring research plots in the areas surrounding the CRC Study Area," explains Day, "trying to understand the drivers of sagebrush die-offs in the region."

Every year, we lose another 1.3 million acres of sagebrush habitat in the United States. This loss matters to all of us—threatening biodiversity, hurting ranchers and weakening rural economies. Healthy native sagebrush lands are the West's vital nesting grounds and migration corridors, essential to a range of bird species and other wildlife such as pygmy rabbits, mule deer and pronghorn. More than 350 species, like the Gunnison sage grouse and greater sage-grouse, can survive nowhere else.

As the CRC's most recent Research Fellow, Day is now diving deeper into his search for answers to sagebrush losses on the Colorado Plateau—and trying new experiments to understand how soil texture and depth affect sagebrush establishment, and ultimately, restoration efforts. "Scientists know a lot about restoring big sagebrush in the Great Basin," notes Day, "but we know a lot less about whether those restoration and management strategies are going to work for sagebrush on the Colorado Plateau, where precipitation patterns are different and conditions are warmer and drier."

Building on past studies, Day and his team are now applying different precipitation treatments to a garden of sagebrush seedlings they planted at the CRC research site last May. They'll monitor how sagebrush growth and survival respond to different

Sagebrush. Credit Matt Lavin

monsoonal precipitation patterns and winter drought, as well as how winter herbivory might alter those effects.

"We go in and manually add water to the plots in different amounts depending on the treatment we want to apply," Day explains. "For example, we can simulate a normal precipitation pattern versus a droughted winter precipitation pattern." Not surprisingly, a typical field day for Day's team involves filling many carefully measured watering cans. Thanks to funding from the CRC Fellowship, Day is now also able to run chemical analyses on leaf tissue from the sagebrush to better understand their responses to the various watering treatments.

Day hopes to have initial results soon, and his findings could help further inform restoration efforts throughout the Colorado Plateau. For example, past research suggested that land managers in this region should consider planting sagebrush in coarser, shallower soils in wet years and also use cages to provide shade and protection for seedlings. The results from Day's CRC tests could offer more tactics for managers seeking to help new sagebrush establish. "What we've found so far," Day says, "is that water limitations may be trumping the effects of all the other variables we are exploring. In this region, the future of sagebrush will likely be determined by the future climate, and we need to understand how that will work." For the species and communities dependent on sagebrush lands in places like southeast Utah, new answers can't come soon enough.

Day's sagebrush garden. Credit Maria Stahl.

Josh Day and his research team in the field. Credit Jack Van Allsburg.

OUTREACH

Jorge Rojas. © Simon Blundell

Q & A with CRC Artist-in-Residence Jorge Rojas

This past year, the CRC launched its Artist-in-Residence program, and artist Jorge Rojas and ecologist Dr. Sasha Reed embarked on a special creative journey. The two collaborated on the creation of a unique audio-visual installation that captured the value and vulnerability of biocrust. Featuring Indigenous, scientific and environmental perspectives, the installation was on display for four months at the Utah Museum of Contemporary Art in Salt Lake City. The visual portion from the Biocrust Project is now on display at the Bears Ears Educational Center in Bluff. We asked Jorge to share his reflections on the experience.

What is your favorite memory from the program?

It has been a great honor to be the inaugural artist in residence. Some of my favorite memories include going on amazing hikes in the desert with Kristen Redd to learn about biocrust and shooting video for the project in Canyonlands and Moab with Kristen, Sasha, and the filmmakers from Blank Space. The entire residency felt like being part of a super smart and creative family.

What did you love, and what were the challenges?

This experience has been one of the best residencies I've participated in and surpassed my hopes and expectations. Getting to launch our project at the Utah Museum of Contemporary Art and sharing it with thousands of people was exceptional and felt like the ideal culmination of our work. With any major project, there are always challenges, but any challenge creates opportunities for creativity and solution-finding—areas in which all of our team members excel.

What do you hope visitors took away from your art installation? I hope that anyone who saw our exhibit will be inspired to think about our connection to the land, our role in taking care of it, and gain an appreciation for the beauty, importance and complexity of biocrust and the critical roles it plays in sustaining the world's ecosystems and protecting human health. I think visitors will also appreciate the multitude of voices and perspectives this project provides, including Indigenous, scientific, environmental and artistic.

What is something you learned or found surprising?

I learned that biocrust is a complex community of organisms working together, nurturing, and depending on each other to support life in drylands worldwide. The more I learned about biocrust from Kristen, Sasha, and the team of scientists we worked with, I realized that this project was just a different way for me to think about my work with communities and bringing people together around a cause or an idea to create something bigger than ourselves.

The art installation focused on biocrust, the desert's living "skin," which plays a vital role in dryland ecosystems. Credit: Zachary Norman, © UMOCA

Rojas (left) poses with CRC program manager, Kristen Redd (middle) and Dr. Sasha Reed (right) with U.S. Geological Survey. Credit Lu Wei.

Why is the CRC Artist-in-Residence Program important?

This program is essential because it brings together artists and scientists to collaborate and make work that looks at and addresses real issues while engaging with and educating audiences of all ages about ecology and climate solutions. I truly believe that collaboration between artists and scientists is the best way to address, raise awareness, and come up with solutions to many of our world's problems.

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Transformative Collaboration

Every two years, the CRC program sponsors the Colorado Science and Management Forum to share current scientific and practical knowledge about topics of concern to land managers. This year's highly successful event was held March 12th at Colorado State University's Western Colorado Research Campus in Grand Junction. Attendees explored two central issues: management strategies for pinyon-juniper woodlands and virtual fencing.

Managers know the expansion of pinyon pine and juniper into new sites can degrade watersheds and wildlife habitat. But long-term drought, wildfire and the decline of the woodland-dependent pinyon jay have led some to wonder if woodlands need more protection. Forum presentations aimed to help land managers balance the conservation of woodland habitat with other natural resource objectives. Speakers included ecologists Miranda Redmond and Ali Urza, U.S. Fish and Wildlife Service pinyon jay expert Scott Somershoe, Ian Barrett from the Bureau of Land Management in Colorado and Daniel Eddington with Utah's Watershed Restoration Initiative.

The forum also featured discussions on virtual fencing —a technology that potentially could be used to manage livestock distribution to protect sensitive areas such as streambanks and restoration sites at lower cost than physical fences. The Colorado Plateau's rugged topography, however, makes virtual fencing difficult to implement. Retta Bruegger and Hannah Kersting of CSU Extension described studies of virtual fence use in their state, and a rancher panel from Colorado and Utah (Sean Ivins, Robbie LaValley, Justus Redd and Lowry Redd) shared their real-world experiences.

This year's forum also served as the 2024 annual meeting for the Colorado Section of the Society for Range Management (SRM). Partnering with CSU Extension and Colorado SRM helped the CRC team reach a broader audience and identify the best speakers for the event.