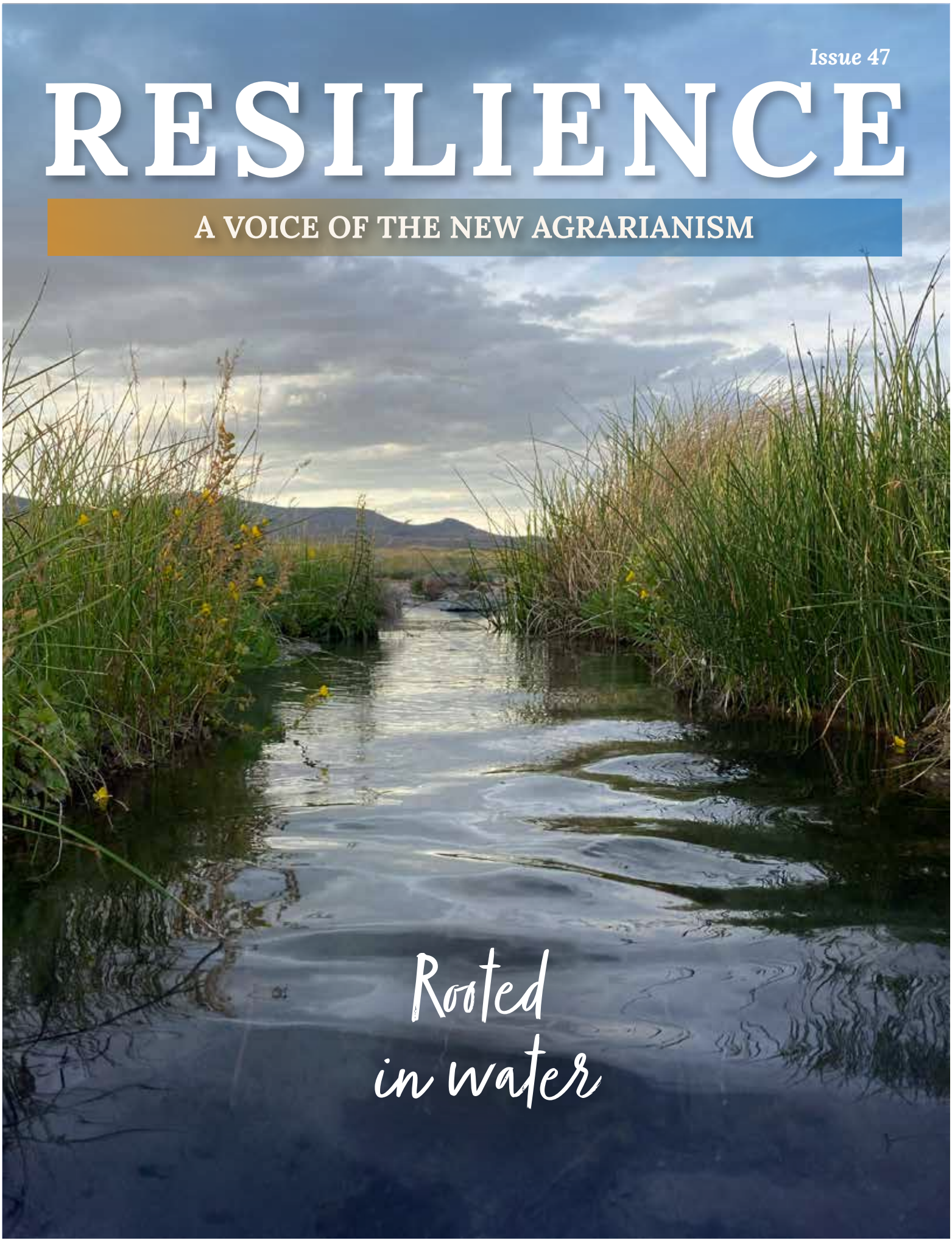
Issue 47

RESILIENCE

A VOICE OF THE NEW AGRARIANISM



Rooted in water

Editor's Note

Dear *Resilience* readers,

In all of the conversations I had with the writers included in this issue, I could feel the anxiety. They were concerned about the drying West that we're experiencing. They wondered what was going to happen to their crops, to their livestock, to their livelihoods as drought, fires, and increasing temps become more prevalent. A slow march toward…uncertainty. "Climate grief is overwhelming, in part, because it is ongoing. Losses are cumulative. We have already lost so much, we hardly dare fathom what's to come," writes Maud Powell in her piece on page 24.

But what I was unprepared for was when the discussion expanded to hope followed by action. Farmers talked about how they are being creative on their land, paying attention to the shifts in their local ecosystems. They highlighted how communities are coming together to figure out what could be done about water table levels that continue to lower. It was encouraging to hear about stewardship practices rooted in centuries of culture *and* modern innovations rethinking reuse, efficiency, and equity.

This issue of Resilience epitomizes the Radical Center: where perspectives vary, but a common interest draws us to learn from each other and take action. Quivira does not specifically endorse the opinions shared in this issue, but we wholeheartedly encourage this type of important dialogue. When it comes to water, it's imperative that we try to understand all viewpoints and interests to navigate toward solutions, together.

After you read these stories, I encourage you to connect with organizations who are highlighted on the map on page 50; learn a new conservation method or participate in a restoration project or find resources to help you make change on your land. Water connects past wisdom to future survival. It asks us to think beyond ownership and toward responsibility. How will you be involved? "Resiliency in ag is not just practices. It is the mindset that we take into life every day," writes Rafael Rovirosa in his piece on page 74.



Anica Wong

Editor

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Contributors

Dr. Perry Cabot is an Extension professor based at the Western Colorado Research Center, which is a unit of Colorado State University that comprises the Agricultural Experiment Station and the Office of Extension and Engagement. His research program focuses on innovative irrigation technologies, sustainable water resources management, alternative cropping systems, and crop consumptive use evaluation in the Upper Colorado River Basin. He received his Ph.D. in agricultural engineering and land resources from the University of Wisconsin-Madison and his bachelor's degree in civil engineering from Colorado State University.

Indigenous/French intermedia artist **Megita Denton** hails from Texas and spent many years embedded in the Pacific Northwest region and cultures. Born on her grandmother's couch in Galveston, Texas, Denton has been living and creating unconventionally ever since. Her intermedia practice is grounded in the land, motivated by connection, and envisioned for positive social impact. Denton's recent site-specific public works are the next evolution of a practice that includes film, sound, metal and mixed media sculpture, painting, woodworking, fiber arts, photography, projections, large scale public murals, performance, light composition, resilient landscape design, and artistic research.

Dr. Ladona Clayton, a 32-year veteran of educational leadership, made a career transition in October 2021 to lead the Ogallala Land & Water Conservancy, where she currently serves as executive director. Her work in water grew out of her service as a Clovis City Commissioner and has evolved into a full-time commitment, one in which she works alongside farmers, ranchers, and landowners to conserve groundwater in one of the most water-stressed regions of the country. She has served on the City of Clovis Water Policy Advisory Board, the Eastern New Mexico Water Utility Authority, the governor's New Mexico Water Policy & Infrastructure Task Force, and she currently serves on the executive committee of the New Mexico Water Ambassadors and is a member of the Groundwater Alliance.

Maximiño Manzanares Shay is the child of Andie and Davíd Manzanares. They were born and raised in O'ga P'ogeh Owingeh and now live with their family in their great-grandparents' home in Los Silvestres, Abiquiú. There, they and their family are parciantes of La Acequia Abeyta y Trujillo. Maximiño is an alum of NMAA's 2023 Escuelita de las Acequias and is a current student at Stanford University, where they are majoring in comparative studies in race and ethnicity and minoring in theater and music. Maximiño loves sunflowers, atole with sugar and honey, and making music with their friends and family.

Maud Macrory Powell lives and writes in southern Oregon. She works as a faculty member for Oregon State University Extension, runs a small organic farm with her family, and produces community theater in the Applegate Valley. Her debut novel, "City of Grit and Gold," was published by Allium Press in 2017 and she has written for numerous publications including Oregon Humanities, Health Affairs Journal, and Reckoning Press.

Keegan King brings nearly 20 years of political and public policy experience to his role as the founder and Executive Director of the Native Land Institute. A proud member of the Pueblo of Acoma tribe, he has built a career specializing in government affairs and advocacy.

Ashley Masenheimer serves as the project and operations manager at the Ogallala Land & Water Conservancy. She holds a bachelor's degree in business administration and brings a diverse background in project management, education, and agriculture. A sixth-generation farmer from Georgia, Ashley is passionate about supporting landowners and helping conserve water for future generations.

Naomi Mora is 19 years old and from Las Vegas, New Mexico. She is currently the Project Coordinator for the Mora YCC and a student at Luna Community College. She aspires to become a healthcare professional while focusing on her New Mexican culture and traditions. She hopes to give back to her community, support others on their journeys, and encourage the younger generation to become more involved with their roots and where they come from.

Rafael Rovirosa is a fourth-generation pecan farmer in New Mexico's Mesilla Valley, where he runs Stahmanns – the world's first irrigated commercial pecan orchard – and farms roughly 5,000 acres of pecans, pistachios, and, someday soon, truffles and pine nuts. He serves as president of the board of the Elephant Butte Irrigation District, where he helped lead the collaborative turn that contributed to resolving the long-running Rio Grande dispute among Texas, New Mexico, and Colorado.

Amy Smith Muise is an instructional designer at the Learning Games Lab, Department of Innovative Media, Research & Extension at New Mexico State University. She enjoys translating specialized research and educational content into engaging multimedia to reach diverse audiences in natural resources and STEM education. Her special interests include rangeland health and water science. She lives on a cow-calf ranch in Otero County, New Mexico.

Renée Rhodes is a storyteller and communicator with the WATER Institute at Occidental Arts & Ecology Center. She works alongside co-directors Brock Dolman and Kate Lundquist, and Beaver Coexistence Program manager Grey Hayes, Ph.D., who build momentum for innovative, science-based solutions that empower community-based watershed literacy and action. The team's current Beaver Coexistence Training and Support Program builds watershed resilience by facilitating beaver coexistence education and implementation across California.

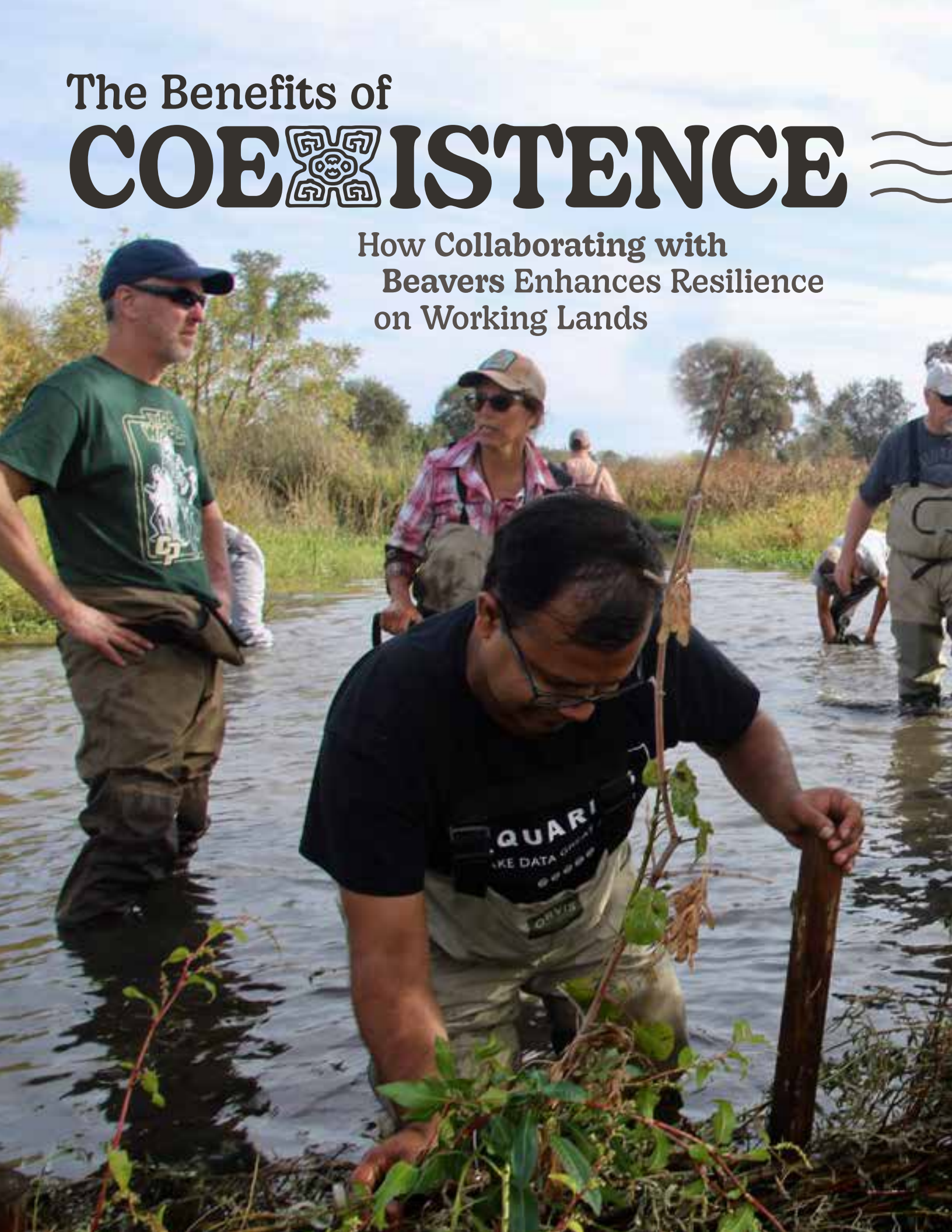
Olivia Romo is a bilingual poet, water rights advocate, and passionate storyteller from Taos, New Mexico. She holds dual bachelor's degrees in English and Chicana/o studies from the University of New Mexico. Currently based in Santa Fe, Olivia serves as a field representative for U.S. Senator Martin Heinrich for Northern New Mexico in areas such as agriculture, healthcare, housing, and education. Olivia's work masterfully intertwines art and activism. Through her poetry and dynamic public engagement, Olivia mobilizes New Mexicans in the protection and uncertainties of their land, water and culture.

Cassandra Waterman is an educator and the communications and outreach director at the Dry Farming Institute. Her work exists at the intersection of agriculture, community, and place. Originally from the Bahamas, Cassandra has built her career on the belief that education is most effective when it is grounded in the experiences, relationships, and land of the people it serves. She holds a Master of Science in agricultural education and has experience in dry-farming research, facilitation, and conflict resolution. Her mission is to connect with and amplify the voices of growers as they adapt to new realities.

Sally Wier is the Senior Conservation Project Manager for the San Luis Valley at Colorado Open Lands, with a focus on groundwater conservation and aquifer sustainability. She has over 16 years of experience working in environmental education, land management, conservation, and stewardship programming across the West. When she's not at work, you will find her backpacking and climbing in her beloved Sangre de Cristo Mountains, mountaineering on glaciated peaks, Nordic skiing, reading, or gardening on her eight acres in the San Luis Valley.

The Benefits of COEXISTENCE

How Collaborating with Beavers Enhances Resilience on Working Lands



by Renée Rhodes and the WATER Institute team



Just over a decade ago, Weygandt Doty Ravine was an annual grassland dotted with a few scarce trees, bone-dry grasses by summer, and a deeply incised, ruler-straight stream that channeled water quickly off the land. The 427 acres in the Sierra foothills of Placer County exemplifies California's summer-dry, Mediterranean climate.

After a century of stream channelization and floodplain control, the ranchers leasing the pasture and the landowners, Placer Land Trust, saw that they had an opportunity to enhance the land holistically for multiple benefits, leading to

>>>

simultaneous support for ranching, floodplain connectivity, fire mitigation, habitat health, and water storage. But first, Placer Land Trust had a problem, or at least what initially felt like a problem: beavers. The beavers of Weygandt Doty Ravine were felling trees the land trust had recently planted as a part of their restoration efforts. At that time, lethal trapping was lauded as the only solution, especially in Placer County, which ranks among the highest in California for lethal beaver management.

In 2014, Placer Land Trust decided to team up with the U.S. Fish and Wildlife Service to find a different solution. Eventually, the team understood that these rogue sawyers were actually felling trees in a legacy floodplain. From there, the focus was shifted away from planting new trees and toward floodplain reclamation, with the beavers leading the way.

The problem beavers actually became the solution for this severely dehydrated floodplain, and this shift in land management yielded big results in record time. When lethal trapping ended, strategic sections of levee were removed, and beaver coexistence and process-based restoration began, Weygandt Doty Ravine saw an 1,800 percent increase in wetted land in just a few years. With increased water, the same place became abundant with willows, cottonwoods, and new stream channels, weaving water throughout a lush and reconnected floodplain. This, in turn, extended the grazing season for ranchers, increased forage, and provided fire refuge for cattle with modest cost and effort.

In the years since Weygandt Doty Ravine's success, beaver restoration and coexistence practices have gained radical momentum in California and across the arid West, inspiring visionary partnerships along the way. New resources and policies have increasingly come into effect, minimizing human-beaver conflict and ensuring that nature-based solutions are accessible to the communities most impacted by beaver activity and climatic shifts.

Creative Cooperation Through Coexistence

"Our team sees the outstanding success of beaver coexistence at Weygandt Doty Ravine as a great model for what is possible when people with different ideas about land use come together to find common ground and innovative solutions to shared problems," said Brock Dolman, co-director of the WATER Institute.

Dolman's co-director, Kate Lundquist, added that "Over the past 10 years, we have seen more leaders across the arid West begin to include beavers in their land management approach. It has been inspiring to see Californian ranchers adopt these strategies as well."

In many ways, this creative cooperation between ranchers, a land trust, a federal agency, small nonprofit groups, a process-based restoration design company, and the beavers created new pathways forward for other beaver restoration and coexistence programs.

One such example is our own California Beaver Help Desk. In the fall of 2025, we launched the help desk — in partnership with the Beaver Institute and with funding from the California Department of Fish and Wildlife — to easily connect landowners with free, rapid site assessments, financial cost-sharing assistance, and a workforce of Certified Beaver Coexistence Professionals who can readily install coexistence devices for landowners experiencing human-beaver conflict.

Pierre Paquelier is a great example of this kind of practical beaver coexistence work. When beavers started felling massive Valley oaks on his horse ranch, Paquelier knew something had to be done.

"I try to be a good steward of the land, and so at first, I was excited to see the beavers, but when they started chewing old, 25-inch diameter oak trees, I was not really excited about that," shared Paquelier, a landowner stipend recipient.


NORTH AMERICAN BEAVER
CASTOR CANADENSIS





These trees provide shade for his horses and Corriente cattle. Shade and temperature regulation are non-negotiables on a ranch like Paquelier's; situated along California's Tuolumne River in the foothills of the Sierra Nevada, summer highs average 93 degrees and can get up to 110 degrees at times. The cooling impact of these trees reduces heat stress, dehydration, and insect activity for his animals.

The trees were important, but Paquelier knew the beavers were beneficial as well, so when he heard about the California Beaver Help Desk, he decided to give coexistence a try. After receiving a cost-share assistance stipend, he hired a Certified Beaver Coexistence Professional who then designed a custom solution that worked best for Pierre, his land, and his animals.

"[With the stipend] we protected 50 large oaks with cages and 30 young trees with a 5-6 inch electric fence. The fencing is a solar unit, so it's pretty inexpensive and flexible compared to a permanent fence," said Paquelier.

With falling trees or flooding roadways, time is of the essence when working on these types of projects. "California's coexistence professionals are usually available for next-day site visits and can provide custom solutions that really take landowner concerns into account," said Grey Hayes, Ph.D., who manages our Beaver Coexistence Training and Support Program and the California Beaver Help Desk.

For Paquelier, the coexistence implementation was quick and effective. "So far, everything is working pretty well. The beavers are shy, so I rarely see them, and we haven't had any more tree chewing. When I was installing the cages, I did hear one slapping its tail on the water to warn of danger." Then he laughed. "Probably, I was the danger."

Coexisting on Working Lands

Coexistence projects come in a variety of shapes and sizes depending on the site, available resources, and landowner needs. These cost-effective and time-tested solutions are designed to mitigate damage without giving up the water, forage, and wildlife habitat benefits beavers can provide.

At Weygandt Doty Ravine, Placer Land Trust had the resources to prioritize large-scale, holistic floodplain restoration, to great effect.

Their ambitious project involved enhancing and expanding beaver habitat and restoring the historic floodplain. First, they breached old levees to reconnect the floodplain. Then, collaborators employed a suite of process-based restoration techniques to reinstate natural river and floodplain processes and make the beaver complex more resilient to high flows. Here, that looked like reinforcing beaver dams with posts and adding hand-built, instream structures to increase the wetland area and encourage continued beaver activity.

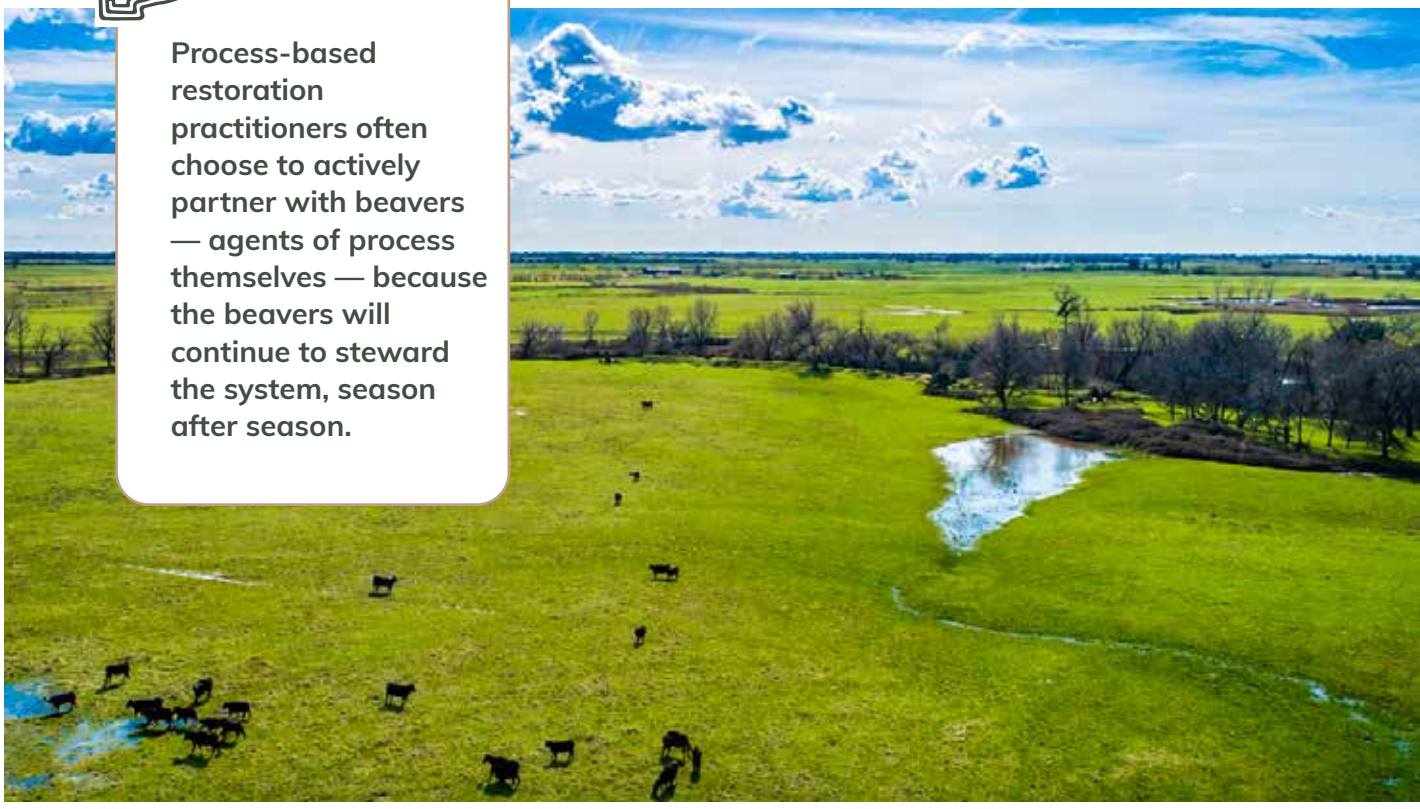
Process-based restoration practitioners often choose to actively partner with beavers — agents of process themselves — because the beavers will continue to steward the system, season after season.

The additional water this restoration brought to the landscape called for tangible adaptation. In response to these growing wetlands, fences were moved back from the flood zone, and the rancher lessee adapted their grazing management practices.

With the dramatic increase in water on the land, there are honest challenges and real benefits of an extended grazing season, increased high-quality forage, and the availability of fire refuge.

“In the winter, we do have to plan more regarding cattle movement between pastures since the water levels are higher and make cattle rotation to the next pastures impossible at times,” said Tracy Schohr, whose family leases the Weygandt Doty Ranch (and a UC Cooperative Extension Livestock and Natural Resource advisor).

Process-based restoration practitioners often choose to actively partner with beavers — agents of process themselves — because the beavers will continue to steward the system, season after season.







But in exchange for these adaptations, Schohr also said, “When we consider disaster preparedness for farmers and ranchers, we ask ‘Where is your retreat zone?’ If there was a fire here in June and we still had cattle there, gates could be opened, and cattle could enter the wetted pasture/riparian area, and they should be safe from the fire. When beavers re-wet the floodplain, it can be a fire resilience strategy just like irrigated pasture.”

She also noted that in the riparian areas where beavers modified hydrology, there is more sub-irrigation, and ponding creates more reliable water in some pastures. “This beaver modification allowed us to keep the cattle at the site longer, extending our grazing days, providing high-quality forage at the end of the season, and improving control of non-native annuals through grazing. When we are able to better control the non-native annuals we can create habitat for other species such as raptors, hawks, burrowing owls and native plants,” said Schohr.

Over the past eight years, studies have revealed the outsized impact beavers have on their home watersheds. We now have data that shows how much beaver dams and their associated ponds help mitigate the impacts of drought and wildfire by increasing surface water and groundwater storage, regulating flood waters, and creating green ribbons of fire-resistant riparian corridor. Beaver-wetted areas can slow an active wildfire and serve as critical fire refuges for animals — including livestock — to escape. As an added bonus, these wetlands can help support grazers and browsers after a wildfire, as they are often the only habitat remaining.

Coexistence Makes Good Cents

Alongside these known benefits for working lands managers, there is also another factor highlighting beaver coexistence as a practical choice: lethal trapping of beaver doesn’t always work.

For the past nine years, our partners at the Beaver Institute have been working nationwide to implement beaver coexistence devices. The institute's first-of-its-kind study demonstrated that coexistence techniques cost significantly less than beaver removal. The study monitored 55 beaver-conflict sites in the town of Billerica, Maine, from 2000 to 2019 and found that sites using nonlethal beaver management saved local taxpayers $7,740 yearly, compared to trapping. Beaver trapping costs $409 per site per year, while the sites managed with coexistence devices average $229 per site per year.

Similarly, the transformative restoration at Weygandt Doty Ravine modeled how responsible use of public funds can deliver significant results in record time. Major increases in wetted land were achieved in a span of just a few years, and the initial stream restoration was achieved for a modest budget of $58,000, with a large portion of that amount spent on the backhoe needed to breach the levees. Funding sources for the restoration and the levee removal included the U.S. Fish and Wildlife Service and the California Waterfowl Association through the North American Wetland Conservation Act. The Sportsman’s Legacy Foundation also worked with local Lincoln High School to install 12 wood duck boxes in the restoration area.



As we understand more about beaver behavior, landscape benefits, and the affordability of nonlethal approaches, coexistence is often more practical and efficient than trapping.

For individual landowners, beaver coexistence projects cost just a few thousand dollars, with a growing number of cost-share assistance programs available in many states.

As we understand more about beaver behavior, landscape benefits, and the affordability of nonlethal approaches, coexistence is often more practical and efficient than trapping. As public opinion on beaver management shifts, we’re happy to see more landowner support resources emerging across the country. The New Mexico Beaver Project, Beaver Coexistence



Northeast Oregon Coalition, and the ongoing development of beaver management plans across the country balance the benefits of beaver coexistence with needs to mitigate infrastructure damage.

We're encouraged by nimble examples of everyday coexistence, accessibly scaled for individual landowners, such as on Paquelier's ranch. We're also inspired by the ambitious example set at Weygandt Doty Ravine, which brought together unlikely collaborators to find bold solutions for a severely dehydrated landscape experiencing a stacked crisis: diminishing cattle-grazing feasibility, increasing climate risks, and disappearing riparian habitat.

As our own emerging California Beaver Help Desk gains momentum, we're seeing increased demand. We are receiving calls and conducting coexistence site assessments each week from more landowners like Paquelier. We've also heard from almond growers, duck hunting clubs, wetland managers, Tribal nations, flood control managers, ranchers, and state and federal agencies, all looking for coexistence support.

Humans and beavers share a unique capacity to engineer our home ecosystems. As we gain a better understanding of the benefits beavers bring, we are also beginning to thoughtfully engineer our relationship with this important keystone species. Through creative coexistence and responsive funding we can balance for the needs of conservation and agriculture alike. When we work with beavers, the benefits begin to flow. New channels emerge from degraded streams, and forward-thinking collaborations flourish. Both restore the water that we all rely on.



FOR OVER 500 YEARS, LAS ACEQUIAS HAVE FLOWED THROUGH NEW MEXICO. Today, these waters are threatened by climate disruption, disasters, infrastructure failures, aging community leaders, and industries that want our water. The struggles we face as acequieros and stewards of the land and water give us a unique perspective and capacity to address these issues from inside the problem. As land-based people, we shoulder the responsibility to steward acequia traditions and work toward a brighter vision of healthy families, healthy watersheds, healthy rivers and acequias, healthy communities, and healthy lives. These solutions are only possible through investment in a new generation.

NEW MEXICO ACEQUIA ASSOCIATION BEGAN ESCUELITA DE LAS ACEQUIAS AND ACEQUIA YOUTH CONSERVATION CORPS TO PREPARE THIS NEXT GENERATION.

Escuelita de las Acequias is a service learning and leadership development program that honors the wisdom, knowledge, and capacity inherent within our communities. Acequia Youth Conservation Corps provides local youth with mentorship and practical skills to steward our watersheds. The authors below, Maximiño Manzanares Shay and Naomi Mora, participated in these programs and give us hope for our future. As you read their words, remember: we rely on las acequias for our culture and lifeways, as well as our material existence and survival.



FOR THE Love OF THE Land

By Naomi Mora
New Mexico Acequia Association

I didn't grow up using the word *querencia*, but I felt it long before I knew its meaning. I felt it in San Miguel and Mora County, where my family's roots run deep, and along the Rio Gallinas, where I spent afternoons picking up trash on the riverwalk and fishing with my dad and sister. I finally learned that this feeling of love and responsibility for the land had a name – *querencia* – when I joined the Acequia Youth Conservation Corps.

My name is Naomi Mora. I am a New Mexico native from Las Vegas with roots in Trementina, Sapello, and Mora. My earliest memories aren't of playing sports or going to school. They're of waking up before sunrise to pick piñon in Gallinas Canyon with my grandma and older sister, walking the acequias while my grandma told us how she grew up tending to the land with her brothers, driving north to Sapello with my dad to load the truck with firewood for the winter, and heading east to our family's ranch in Trementina to feed the cattle, play with the horses, and ride four-wheelers.

As I got older, my connection to land and water changed. It wasn't just family stories and fun chores that passed the time – it became a responsibility. I wanted to live out my role in my communities.

In eighth grade, as the pandemic began, my sister and I joined Keep America Beautiful, a nonprofit focused on ending littering, improving recycling, and promoting beautification. We spent afternoons after school and Saturday mornings tending to the Rio Gallinas. It was sad to see how much trash covered the riverwalk and floated in the water that supplies our city. Many times, we filled my dad's truck bed with bag after bag of trash.

Even after the program ended in our area, we kept walking the river with trash bags and gloves in our pockets. When I was a freshman in high school, we joined the Acequia Youth Leadership Institute (YLI). This program transformed how I viewed my culture. I used to think New Mexican culture was mostly family and church, ranching, the famous question – red or green? – and hot air balloons in the sky. Now I know it's much more.

Family and church are still at the center of who we are, shaping our values, celebrations, and how we care for each other. Ranching is how a lot of us make a living and provide for our families. But the land is just as important. It provides the water that lets us ranch, grow food, and gather herbs for *remedios* passed down through generations. Through YLI, I learned about our deep history – often skipped in classes – and the many influences that shaped us. Our adobe homes, old churches, and plazas reflect our history and our bond with the land. I also came to value our unique Spanish-English dialect, which carries our stories, humor, and identity. Together, YLI showed me that New Mexican culture is beautiful, rich, and more complex than I ever imagined.

With this deeper appreciation, I was given the chance to work in the acequias themselves, cleaning ditches and waterways, and finally

making a clear difference in the places that raised me. For the past three years, I've been part of the Acequia Youth Conservation Corps, which I joined as a junior in high school. By my second year, I became program coordinator. That role strengthened my own connection to the land while helping others discover theirs. I guided younger crew members as they explored who they are, where they come from, and how their stories are tied to water, soil, and tradition.

Our workdays are long and demanding. Under the hot sun, we shovel, rake, cut weeds, and remove debris from the acequias, doing the same tasks our ancestors did. We get tired, and sometimes the sun feels harsh. But at the end of the day, when we watch the water flow freely and see the gratitude of community members whose fields and homes depend on that water, every drop of sweat feels worth it. That's *querencia* — for the love of the land.

These experiences have shown me how important it is to get the younger generations engaged with their culture. We need to bring them out into the acequias, let them feel the mud under their boots, place a shovel in their hands, and teach our traditions in a real, hands-on way – away from constant screens. At the same time, we can use technology to our advantage: to share our stories, map the acequias, and educate others about water, land, and community. By blending the work of our ancestors with today's technology, we can inspire younger generations to protect these waterways and ensure that acequias continue to flow.







Our Relationships Are Everything

Reflections on My Familia, NMAA's Escuelita de las Acequias, and Our Future Generations

By Maximiño Manzanares Shay
New Mexico Acequia Association





Buenos días les dé Dios. I hope that you, your families and communities, and all your loved ones are taking care. My name is Maximiño Manzanares Shay. My mom and dad are Andie and Davíd Manzanares, and I am the grandchild of Barbara and Brian Shay and Fidelia Eleanor and Herman Manzanares, Sr. I am very grateful for this opportunity to share some stories from my family about our relationships with and through las acequias.

I was born and raised in O'ga P'ogeh Owingeh and now live with my family in my great-grandparents' home in Los Silvestres, Abiquiú. My family and I have been *parciantes* of La Acequia Abeyta y Trujillo for multiple generations – from my great-great-grandma Nievecitas, great-grandpa Maximinio, and great-grandma Rosana to my primos hermanos' children. My great-grandpa Maximinio and grandpa Herman were actively involved in the Abeyta-Trujillo Acequia Commission throughout their lives. Continuing these traditions, my dad and his brothers and sisters have actively taken care of our acequia throughout their lives, and they are passing down these lifeways to my primos hermanos and me so that we may pass them on to our future generations.

The Abeyta-Trujillo Acequia, and the Río Chama from which it flows, have continuously given life to our *huerta* (garden), our fields, our *arbolera* (orchard) and, therefore, us! In this way, our community's acequia is one of our first, oldest, and dearest relatives. They have watched and helped us all grow up over the generations – from the annual *limpias*, plantings, and harvests to family reunions and other heartfelt community gatherings. And they continue to give us life and to teach us how to be true, loving relatives. When we say, "*agua es vida*," we feel it and mean it with all our hearts.

I grew up in a large musical family rooted in unconditional love. It is such a blessing to get to learn, participate in, and help keep alive the lifeways – whether on the acequia, in music, or in other intercommunal relationships – that my family and community have helped keep alive for generations.

Throughout my childhood and young adulthood, I participated in acequia lifeways, namely the *limpias*, primarily within the scope of my family and our acequia. Then, in 2023, my *maestra*, Soledad García, Ph.D. from El Guache, invited me to participate in New Mexico Acequia Association's 2023 Escuelita de las Acequias with her. Throughout la Escuelita, we co-cultivated our cultural knowledge, our leadership and "followship," and our intercommunal and intergenerational relationships. One of my favorite memories from la Escuelita was when we got to visit each other's home communities. For each *visita*, we planted and named a *capulín* (chokecherry) tree in honor of our relationships with each other, our ancestors and descendants, our acequias, and the waters and lands to which we are responsible. In Mora, we planted El Árbol de Querencia. In Valdez, El Árbol de Resistencia. And in Abiquiú, El Árbol de Continuación, in memory of my late tía Maxine Manzanares.

La Escuelita was especially formative and inspirational to me. By inviting, welcoming, and including me in this program, my maestres and hermanos opened the metaphorical *compuerta* (headgate) of my participation in intercommunity doings and gatherings, such as El Congreso de las Acequias and the Ówingeh Táh Pueblos y Semillas Gathering & Seed Exchange. Further, the co-learnings and co-becomings from la Escuelita have been integral in shaping how I strive to show up in other (inter)community doings, like getting to help facilitate the revival dances of Los Matachines del Pueblo de Abiquiú for the first time in almost 80 years. Through the integral



support and guidance of our relatives from Los Matachines de Alcalde, we were able to embark on and realize this intergenerational and intercommunal endeavor, together. My experiences in la Escuelita were deeply interwoven into how I strived to co-create our *juntas* (meetings) and *prácticas* (practices) together, such that they intentionally honored all of our relations, from our ancestors to our descendants, and everyone's unique *dones* (gifts) and wisdom.

One of the main teachings that la Escuelita continues to offer is that our relationships – with the land, with the water, and with each other – are everything. When I think about the future generations who will inherit these lifeways, I think about when my great-grandparents and their children planted the trees in our *arbolera*. They planted these trees not for themselves but so that their future generations could enjoy the fruit, play in the branches, and rest in the shade.

In constellation with this story, intercommunity programs like la Escuelita are a profound way to engage our youth and support them in being caretakers of the land and water. It is essential to invite, welcome, and include youth in these doings, whether within their families or other intercommunity endeavors. When we intentionally include our youth, we create the space for the magic of their relationships with the land, water, and each other to naturally emerge. Then, together, we can earnestly co-cultivate these lifeways that were passed down to us with intentionality, care, and love for all those who will come after us.



HARVESTING GRIEF

BY
MAUD POWELL

"FINDING MEANING IN GRIEF DOES NOT MEAN WE'RE OVER THE LOSS OR OKAY WITH THE LOSS; IT MEANS WE CAN FIND A WAY TO HONOR THE LOVE, EVEN IN OUR PAIN."

—DAVID KESSLER

Streaks of wet dirt mark the floor beneath our circle of chairs—a sure sign of farmers gathering during the Oregon winter. A vegetable grower laments the missing crawdads she once hunted with her father in Lake Washington as a child. A farm intern chokes up about a news story on rainwater no longer safe to drink. An older cattle rancher talks about relationships lost to the politics of climate change. "My nephew doesn't call anymore," his voice strains, but he tries to make light. "At least he's stopped asking for money."

I sit with these farmers, asking them to share their most personal climate losses. There's the beloved hydrangea that perished in the heat dome of 2021. The centuries-old Western hemlock, shading generations of family picnics, that finally succumbed to beetle damage. Fireflies in the Midwest are now uncommon, one woman says.

"The most magical part of childhood…nearly gone."

The lake where one rancher brought his kids to fish is now too warm to sustain vertebrates. I talk about leaving our farm, Wolf Gulch. Like waves pounding the shore, the losses are relentless, one after another, lined up beyond the horizon. We sit in collective heartbreak and I wonder if this gathering is helpful, healing. Afterall, my own climate grief feels oppressive at times.

My husband Tom and I first learned to farm in India's high desert in 1997. Our host family irrigated fields of barley and potatoes from ancient ditches fed by glaciers. We fell in love with agriculture and, soon after, settled in southern Oregon to start a farm. Our vision: to create a profitable business on marginal land — land on the edge — knowing that property with reliable water and fertile soil was becoming scarce. Humans need to get scrappy, we reasoned, and in our heady idealism, we thought we'd lead the way. We also believed that environmental problems could be traced, at least in part, to the hyper-mobility of our culture. It's easier to wreck your own backyard if moving is always an option. We vowed to pick a piece of ground and root down for the long haul.







We bought property in the Siskiyou Mountains, rough with steep slopes, weeds and brush. Wolf Gulch, the land's water source and namesake, was intermittent, running underground for long stretches of the creek bed. Though the property was not considered farmland, we forged ahead. We dug three large ponds to collect winter rains and designed a gravity-fed irrigation system that required no electricity. Our daughter, Grace, was six months old when we moved there. Four years later, I gave birth to our son, Sam, in the bedroom of our house.

We embraced permaculture and applied its principles to our new farm. Permaculture, a holistic, nature-centered approach to stewarding property, aligned with our practical, ecological worldview. We purchased a subsoil plough and ripped furrows in the fields so the soil could hold more water. We learned to plough along the slope's contour to encourage moisture to fan along the furrows and keep the soil in place.

Each fall, we seeded cover crops to help the soil hold more water. Thick, viny mats of crimson clover, hairy vetch, milky oats, and annual ryegrass blanketed the ground all winter, then, by late spring, decomposed into mounds of rich humous.

That first fall, Tom and I found the property's largest incense cedar. I craned my neck to see its tippy-top. Elegant branches of lacy needles dappled sunlight hitting the ground. We potted up scores of saplings from under its generous canopy and replanted some on a landslide to restabilize the hillside. Others went in hedgerows between the farm fields, a few into the ground torn by the heavy equipment used to build our ponds. Before long, that single incense cedar's offspring grew all over the property, providing shade, habitat for songbirds, refuge from the wind, and a toehold for the soil.

Each fall, we seeded cover crops to help the soil hold more water. Thick, viny mats of crimson clover, hairy vetch, milky oats, and annual ryegrass blanketed the ground all winter, then, by late spring, decomposed into mounds of rich humous. Within 10 years of production, our fields, once a heavy red clay, boasted a foot of black topsoil. Tom began to refer to the soil as his third child.

"Your favorite?" I teased.

We planted trees between fields to shield crops from the drying north wind. Hedgerows of conifers, fruit trees, and nitrogen-fixing shrubs provided food for us and the birds, as well as glorious summer shade. Permaculturalists call this 'stacking functions' — one design feature that offers multiple, interconnected functions and benefits, creating a sort of ecological poetry. It's an approach that is efficient, true and, in the end, beautiful.

Before we bought the property, Tom noticed a red fir growing in a gully. Red firs typically grow at higher elevations, above 4,000 feet, so it seemed out of place — a break in the forest's pattern. I loved imagining how the fir came to live near our valley floor. I told Sam and Grace this story:

Perhaps a hundred years ago, a young woodrat lived on neighboring Red Mountain. One summer, a forest fire burned through her home as she was eating the seeds of a red fir cone. She fled the mountain with the cone in her mouth and found refuge on the slopes of the Little Applegate River. Once she saw the abundance of madrone berries, she dropped the fir cone. A seed from that cone grew into our beautiful tree.

Then came our first brush with drought. In 2001, the valley received a third of the average winter rainfall. Our ponds dried and cracked, rendering them useless as sieves. We invested in plastic pond-liners, an expensive but foolproof solution to the cracks. We transitioned to irrigating with drip tape, which uses about 30 percent of overhead irrigation. The pond liners worked, and we were back in business.

In those early years, I spent hours walking the landscape. I longed for intimacy with place. In 2003, Grace and I discovered western columbine growing under the incense cedar. It was the only native columbine I'd seen growing on the property, so I made a habit of walking there each spring when it was in bloom, usually a week after lupine appeared along the ditch trail.

For the 25 years we lived at Wolf Gulch, we grew organic food for thousands of people and trained dozens of new farmers. We raised our children and created vast networks of human, animal, soil, and plant communities. In the winters, I directed community theater and organized neighborhood musical events in our little valley. Some winters brought less than average rainfall, but we'd made our farm resilient. Or so we believed.

Then several winters of low rainfall and months of record-breaking temperatures ensued and the creek dried up completely. Tom kept the crops irrigated by shortening watering intervals and harvesting early. We transitioned from growing vegetables for a Community Supported Agriculture program to growing vegetable and flower seeds, both of which need less water in late summer. We chose the seed varieties labeled drought-tolerant. We adapted. We made do.

The next few winters passed without much rain. April, notoriously damp and cool, teemed with brilliant, sun-drenched days above 80 degrees. While acquaintances marveled at the dreamy weather, a pit lodged in my stomach. One night that month, lying in bed, Tom told me that some of the trees in our forest were stressed. Drought and beetles.

"The incense cedar and red fir are both dead," he said, voice flat.



We began to notice scores of Douglas firs dying in the woodlot. I prayed for a wetter May. One blustery Wednesday afternoon, we received a tenth of an inch of rain.

I had stopped visiting those trees once the kids grew into teens, preferring instead to hike up on the ditch trails. But they held such fond memories and were fixtures in Sam and Grace's early childhoods. It was like the news of losing close relatives.

We began to notice scores of Douglas firs dying in the woodlot. I prayed for a wetter May. One blustery Wednesday afternoon, we received a tenth of an inch of rain. June 2021 marched in with the ponds lower than ever and alarming forecasts. An unprecedented heatwave arrived. Medford hit 117 degrees. Atmospheric conditions created huge areas of sweltering heat trapped under a high-pressure "dome." For 25 days straight, the high temperature did not fall below 95.

Tom moved into triage mode, stretching the last of our water to keep plants alive. We took unheard-of measures — using a domestic well to irrigate commercial crops and buying water from town. Trucks rumbled up our half-mile driveway to deliver a few meager inches to the ponds. Farming is notoriously hard. We always knew that. Add drought and relentless heat, and the work becomes demoralizing and untenable.

In July, Tom leaned against the kitchen counter. It was after dark. He looked depleted.

"It's too hard," he said. "I think we need to move if we want to keep farming."

I'd thought the hardest parts of our work were over — raising kids and building a business. We'd invested everything into our family, farm and land. Now what?

I wanted to persevere as we always had. In August, I lay awake wondering how we could store more water. Maybe we could collect rain from our roofs during the winter…but the tanks only hold 2,000 gallons each. What if we pumped rainwater from the tanks into our ponds all winter long, every time they fill? I shook Tom awake, eager to talk. He was confused and groggy until I explained my idea.

"It's a good idea," he said. "But I already do that."

Our neighbors rallied around us, offering leases, leads on property, and boundless empathy. Still, I remained terrified. All the work we'd done to protect and steward Wolf Gulch, the lengths we'd gone to store water — none of it could shield us from climate collapse. We were left with the difficult question of where to call home.

Meanwhile, in India, the farmers who mentored us were no better off. They faced the disappearance of glaciers that fed their ditches. Our grief, shared with farmers around the world, means less food security everywhere, and the unraveling of once-vibrant agricultural communities.

The mental health impacts of climate change on the general population are well-documented, but with little attention on rural, agricultural populations. Also, farmers are less inclined to seek out support and mental health services than the general population. Yet we are perhaps the most vulnerable to climate anxiety and grief — our attention is fixated on the weather. We spend our days interacting with plants and animals, and notice even subtle changes in the environment. We also suffer from excessive heat, more extreme weather events, and wildfire smoke.

Grief most commonly involves the loss of a loved one. In complicated deaths like murder, accidents, and suicide, grievers often experience anger, powerlessness, and regret. Why did this happen? What could I have done to prevent it? Ecological losses are similarly complicated. One moment we rage at politicians and oil companies, the next, we feel guilt for personal choices, and the next, abject horror in the face of scientists' predictions. Parents and grandparents agonize over the losses to come.

Tom and I grappled with our future while the heat dome held fast. We had to face it: the forest was dying. The creek would not return. We needed to leave. I learned that British Petroleum knew and intentionally covered up the severity of climate change for thirty years. Rage. Then, guilt: Wolf Gulch was on hospice, and we were abandoning it to face its end alone. Only heartless cowards leave a person on

their deathbed. I could barely keep track of my internal landscape — the cascade of emotional states shifted by the hour.

Some griefs are more acknowledged than others. All cultures have rituals for the death of a family member. Of course, this doesn't make the loss of a loved one easy, but the social support provides a space and tools for the griever. Other losses are not as communally acknowledged, do not have avenues for expression or even a shared vocabulary. This is known as disenfranchised grief. Climate grief is considered a disenfranchised grief because in most cases, social and cultural supports for processing it does not exist. We are in new territory.

My dear friend Zoe, a mental health counselor and staffing manager for a climate foundation, offered to lead a ceremony at Wolf Gulch before we moved. Twenty close friends and neighbors gathered at our house and hiked to the dead incense cedar in silence. We took turns sharing memories about our time on the farm. Zoe led me through a ritual of shattering a ceramic bowl with four hammer blows, each blow representing a specific loss — the loss of my children's home, the loss of land that fed us, the loss of trees, and the loss of the creek. I kept the shards, and next year, I will reassemble them using gold glue in the Japanese tradition of Kintsugi. Kintsugi represents non-attachment, acceptance of change, and taking the pieces of our grief and reassembling them with care and beauty.

Climate grief is overwhelming, in part, because it is ongoing. Losses are cumulative. We have already lost so much, we hardly dare fathom



what's to come. Climate therapists encourage grievers to break through the numbness by articulating one specific loss. Focusing on a single grief — giving space to acknowledge both the gratitude and grief for a place, plant, or animal, is a way to catch the tail of the massive climate grief beast. From there, we can begin to feel more, connect with others, and act.

During the ceremony, we honored the red fir and the incense cedar. Those trees helped me find my bearings in a sea of Douglas fir and ponderosa pine. They'd sparked my imagination and my children's. The cedar had become a snag, home to millions of insects and dozens of birds. Grace, now a biologist managing piñon pine forests in northern New Mexico for climate adaption, cored the cedar and told us its life story in rings, precipitation, and heat units. The fir is now a nurse log. In the coming years, plants will sprout along the decomposing bark of its flank. My friends and neighbors thanked us for the chance to acknowledge climate loss in community. I was heartened by the honest expressions, deep sense of solidarity, and ritual.



The month before we moved, my childhood best friend Jess asked me to send her a Ziploc of Wolf Gulch soil. Jess teaches ceramics in a small town in Vermont. A few weeks later, she mailed me back a vase made from the soil. The vase's outside is rough, simple, and scored, the inside beautifully glazed with swirling green and blue. It sits in the windowsill of our new farmhouse.

Back in our circle, the farm intern wipes his face and looks around. His eyes say it all. "This is so much. Too much, maybe."

A natural human response to unresolved loss is "numbing out" and paralysis. Let's face it — climate change is terrifying. So the impulse to close our eyes is understandable. But researchers tell us that people who speak openly about their climate distress are more resilient, more likely to act, and benefit from connecting to others. We need to find ways to talk about it. Especially farmers.

I switch gears.

"We're all resilient," I say. "Or we wouldn't be here in this room. We wouldn't still be farming."

The flower grower says she lobbies her county politicians. "Local is where we can make a difference."

The vegetable grower uses breathing techniques to regulate her nervous system. One man plants native trees to feel better.

"I go to the gym," a beekeeper quips.

An urban farmer engages in guerilla wildflower planting, throwing handfuls of seed into empty

lots and waiting to see what emerges in spring.“ It gives me hope for unexpected outcomes,” they say.

A grower from the Hudson Valley confides that she plants “joy patches” around her farm – aromatic herbs like lemon balm and rosemary that compel her to stop during the work day, pick a stem, roll it between her fingers, and smell the fragrance.



Another woman tells us a story: she had been farming with a group of friends in California in 2016 when a catastrophic wildfire scattered them to different places. Whenever she smells smoke and her lungs ache, she texts her friends from those days. It’s her cue to stay in touch.

The rancher admits that he sometimes hugs his cows for solace.

We are in this together, and we’re more resilient when we speak openly about how climate change is affecting us.

In 2020, David Kessler added a sixth stage to the lexicon of grief: meaning-making. Kessler argues that finding meaning beyond the stages of grief most of us are familiar with — denial, anger, bargaining, depression, and acceptance — can transform grief into a more peaceful and hopeful experience.

Holding climate grief conversations with other farmers has given me a chance to transform my loss into something vital. The response has been overwhelmingly positive; any reluctance to talk quickly melts into connection and empathy. After the gatherings, farmers exchange numbers and ask when we can meet again. By sharing the specificity of our love — for fireflies, crawdads, hydrangea, an ancient incense cedar — and by witnessing each other’s loss and resilience, we find greater meaning in our grief and harvest the energy we’ll need to keep farming.

A grower from the Hudson Valley confides that she plants “joy patches” around her farm – aromatic herbs like lemon balm and rosemary that compel her to stop during the work day, pick a stem, roll it between her fingers, and smell the fragrance.

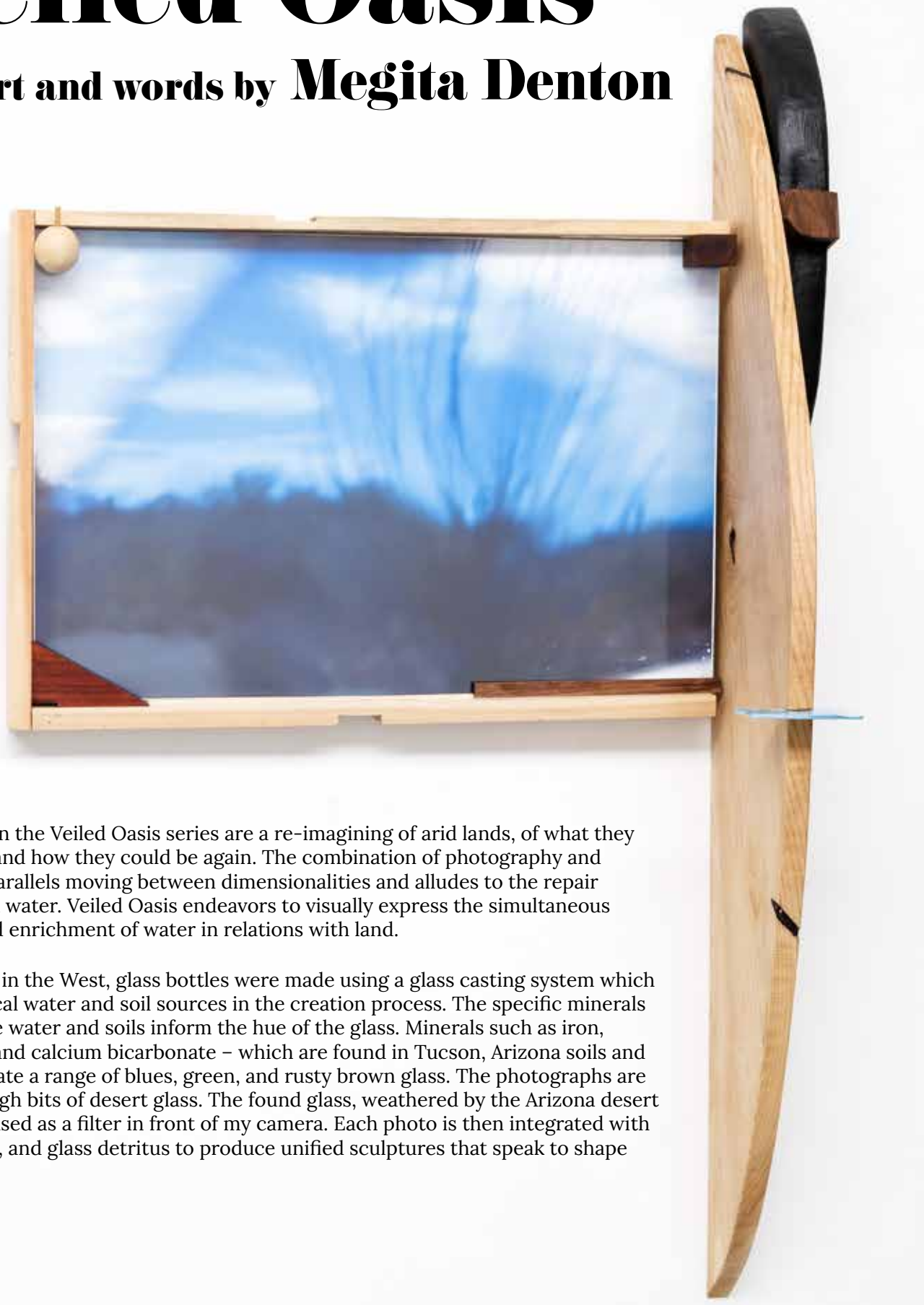
Tom reminds me that Wolf Gulch was never ours, that we took on the exquisite burden of stewarding it for 25 years, but of course it will carry on without us. The land will be there long after we are gone. We leased farm property from friends down the road, moved closer to town, and plan to sell Wolf Gulch next spring. We are still farming.

Now it’s Grace who tells me a story, a new narrative about how the forest is not dying but changing. The red fir and incense cedar may have died, but others will come to replace them in time. Animals, like the woodrat from Red Mountain, and the wind, will carry the seeds and acorns of piñon pine, manzanita and black oak — trees that are better suited to heat and drought. They will take root and build lives at Wolf Gulch. The forest is adapting. There is a new generation leading the way.

This piece was originally published in Reckoning, a nonprofit, annual journal of creative writing on environmental justice.

Veiled Oasis

Art and words by Megita Denton



The works in the Veiled Oasis series are a re-imagining of arid lands, of what they once were and how they could be again. The combination of photography and sculpture parallels moving between dimensionalities and alludes to the repair of land with water. Veiled Oasis endeavors to visually express the simultaneous filtering and enrichment of water in relations with land.

Historically in the West, glass bottles were made using a glass casting system which used the local water and soil sources in the creation process. The specific minerals found in the water and soils inform the hue of the glass. Minerals such as iron, limestone, and calcium bicarbonate – which are found in Tucson, Arizona soils and water – create a range of blues, green, and rusty brown glass. The photographs are taken through bits of desert glass. The found glass, weathered by the Arizona desert climate, is used as a filter in front of my camera. Each photo is then integrated with wood, foam, and glass detritus to produce unified sculptures that speak to shape and land.

I am viewing Veiled Oasis as an extension of my work. My work is site responsive, collaborative, and research based, designed to balance the gravity of today's socio-political situations with elements of play, rest, empathy, and curiosity. My offer to view, interact with, share, and be in conversation with my work is an invitation to experience the interconnectedness of all beings that allows the intellect to be the framework to connect to the heart.

Within my artistic process, I am reasserting my belief that artists have a social, moral, and spiritual responsibility to speak and react to the times in efforts of powerful positive change.





Over the course of my years as a farmer, land steward, and consultant, I have seen Water – as a gift and a resource – becoming rarer and rarer as the living realities of our collective climate crisis play out. Veiled Oasis re-imagines the Tucson, Arizona landscape as a gesture of contemplation, new possibilities, and alternative ways of viewing Water.

With these sculptures, I am hoping to re-create and restore human connection to the natural world, by drawing on my Indigenous perspective and my knowledge of the land. Making work that speaks of the traditions of the past and responds to the challenges of the present, I try to locate our evolution and survival in our care of the land that offer alternative perspectives on the future.



THRIVING WITH Less Water

By
Cassandra Waterman,
Amy Garrett, and
Gabrielle Roesch-McNally

When you picture the maritime Pacific Northwest, you likely picture rain and a lush emerald landscape nourished by rivers, streams, and coastal fog. That image exists, but it belongs to our wet season. By midsummer, unirrigated land takes on the amber and golden hues of dry hay.

The Willamette Valley, where the Dry Farming Institute is based, receives about 40 inches of precipitation per year. What that number obscures is where and when those inches fall; almost none of them arrive in the summer. July and August combined bring fewer than two inches of rain. That seasonal drought coincides with our peak water demand for growing crops.

Access to water is increasingly unpredictable, even here. Oregon operates on a water rights allocation system. During droughts and water shortages, irrigation districts implement mandatory shut-offs. Growers may legally hold a water right and still lose access when it matters most. Reduced snowpack compounds the problem; less winter accumulation means less water availability when summer crops need it most. Climate change is accelerating both trends: longer droughts, earlier cutoffs, and a shrinking window between the last rainfall and the first heat spells.

For growers already navigating tight margins, that uncertainty can be insurmountable.

WHO WE ARE: THE DRY FARMING INSTITUTE

The Dry Farming Institute began where good work often does: with someone listening.

An extension agent heard the consistent refrain from farmers of wells drying up sooner, dry seasons starting earlier, and historically marginalized growers finding that land with water rights was financially out of reach. From that listening, a single question emerged: how do we grow food with less water? Instead of trying to solve it, we sat with the weight of the gap between what could be and what is. We looked to growers who were already practicing dry farming and using less water as teachers. We gathered their stories, trialed drought-tolerant varieties, and researched climate analogs – the regions most similar to our own – where communities grow food successfully without irrigation.

Two things emerged from those early days: the Dry Farming Collaborative, a community of practice built around participatory research and shared learning, and the Dry Farming Institute, a nonprofit created to be nimble enough to meet community needs as they arise. We do not position ourselves as the experts. Instead, we are committed to a non-hierarchical, shared-learning model that leads with curiosity, flexibility, and deep collaboration.

Our mission is to empower growers to thrive with less water.



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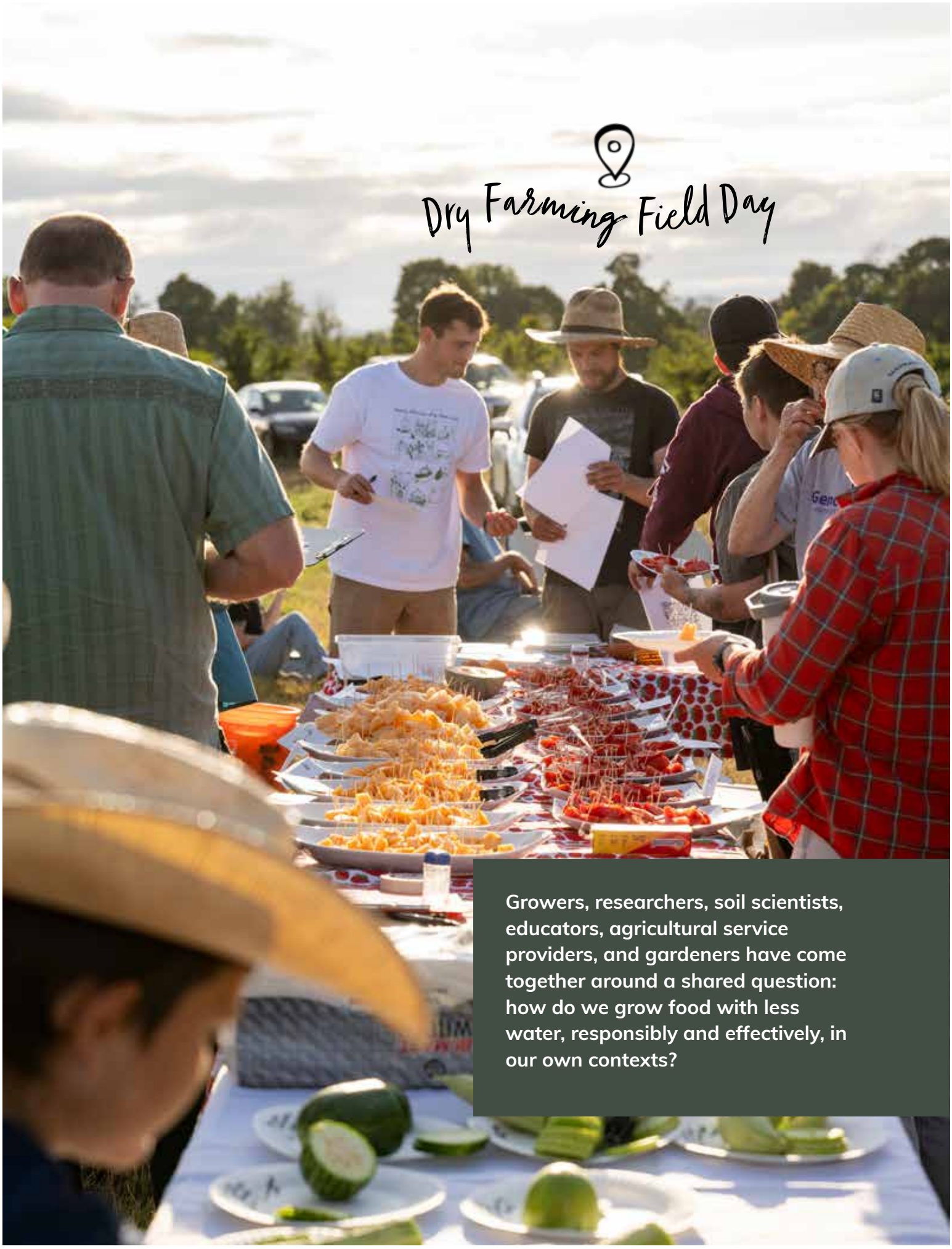
WHAT WE MEAN BY DRY FARMING

The term “dry farming” is a bit of a misnomer. It does not mean growing crops without water; it means prioritizing agricultural resilience – where stable, economically-viable farms operate with limited water to sustain growers, communities, and the natural world.

We define dry farming as crop production without irrigation during the dry season in the Pacific Northwest. This practice relies on soil itself as a water storage vessel, capturing winter rains and holding moisture for crops to access through the dry months. It means paying close



Dry Farming Field Day

Growers, researchers, soil scientists, educators, agricultural service providers, and gardeners have come together around a shared question: how do we grow food with less water, responsibly and effectively, in our own contexts?

attention to soil depth, texture, and water-holding capacity, and selecting seed varieties known to perform under drought conditions, adjusting plant spacing, timing, and weed management to reduce competition and stress. The practice of dry farming requires presence and a willingness to learn what the land and the crops are telling you.

Dry-farmed crops may experience physiological stress and reduced yields. They also often develop intensified flavor and increased drought resilience – qualities strengthened over time by saving seeds from the most successful plants and replanting them in future growing seasons. The practice of dry farming invites growers to be attentive to place, in sync with ever-shifting conditions and the season's rhythm.

Dry farming is not a new practice. Communities across the globe have grown food with limited water for millennia in the Mediterranean, the Sahel region of Africa, and in Central Asia. Indigenous communities in the American Southwest are another living example of agrarian communities that have selected planting sites and cultivars, and developed practices responsive to their environments over generations. Growers in arid conditions have cultivated resilient cultivars long before modern institutions began formally researching them. It is our practice to learn from them.

The Indigenous peoples of this region, including, but not limited to, the Siletz and Kalapuya Tribes in the Willamette Valley, have maintained a deep relationship with native plants and foodways for generations despite their forced displacement. We have had the privilege of learning alongside these communities. Native plant communities demonstrate what it means to thrive in low-input systems. Their adaptability is not a coincidence. It is the result of a long-standing reciprocal relationship between community and place. This knowledge informs how we think about resilience, even when it doesn't fit neatly into our definition of dry farming.

HOW WE WORK

Our work in the dry-farming landscape began at the Oregon State University Small Farms Program and later developed into its own organization. Our institute was born from a need to be more nimble, to follow the community rather than institutional structures. We continue to work closely with Oregon State University's Dry Farming Program, which brings formal research, data interpretation, outreach, and extension. We complement this work through community building, peer-to-peer learning, and storytelling.

The heart of this work lives in the Dry Farming Collaborative. Growers, researchers, soil scientists, educators, agricultural service providers, and gardeners have come together around a shared question: how do we grow food with less water, responsibly and effectively, in our own contexts? The collaborative is citizen science grounded in the agricultural community. Growers test strategies and varieties locally through participatory research.

For example, our case study participants are located throughout the maritime Pacific Northwest – from the border of Canada, all the way down to Grants Pass, Oregon. While each site was unique, participants used the same framework to assess soil, climate, microclimate, and water sources; they arrived at similar conclusions. They learned about their unique contexts and explored practices. Participants found soil moisture sensors illuminating, discovering that the soil was telling a different story beneath the surface, in the root zone. Two farmers, independent of each other, noted that 80 percent of the time they were wrong about when they needed to irrigate.

What works in one microclimate may not translate to another, but the lessons travel. Each participant's contribution builds confidence and demonstrates that adaptation is possible. Relationships and community are the infrastructure that supports us to thrive with less. Resilience emerges through reciprocity and relationships. We learn from failure, challenge our assumptions, and take risks.



Agriculture accounts for 70 percent of global freshwater use, which means the way we grow food is inseparable from the water crisis we face.

Our focus is on empowering growers to thrive with less water by leaning in, listening, and amplifying successful practices in partnership with our community of practice. How we work is our work.

WHY THIS WORK MATTERS NOW

Our past relationship with water can no longer guide our future. According to the United Nations, we have entered a new era of global water bankruptcy, coupled with accelerating climate variability. Agriculture accounts for 70 percent of global freshwater use, which means the way we grow food is inseparable from the water crisis we face. In Oregon and across most of the West, this constraint is tangible. We're experiencing longer droughts, reduced snowpack, and irrigation cutoffs arriving earlier each season.

This strain carries a real mental and emotional toll. We hear stories of farmers in our community who are stepping away from land that is no longer viable without irrigation. Grief, anxiety, and loss of identity result when a farmer's relationship to the land is severed.

While dry farming offers one potential hopeful path forward (to both keep farmers on their land and keep building healthy soil), it is not a universal solution. It does ask us to reflect on useful questions. What is our baseline? What crops and practices can sustain us with limited inputs? Understanding these questions builds resiliency and gives us real, tangible examples to learn from.

In the spring of 2025, we set out to grow a small patch of dry-farmed flowers among the rest of our crops. We nestled them into the soil and tended them, unaware that a lettuce seed had found its way into the mix. Lettuce is not a crop that we recommend for dry farming; their tender leaves struggle in heat,

bolting at any sign of drought or stress. And yet, our unexpected volunteer thrived in the summer heat, defying the odds and teaching us something valuable along the way. We saved seed from this teacher.

In Poulsbo, Washington, Jen Clark of Roots Farm experimented with dry farming on sandy soil, a soil that we typically advise against for dry farming, given its notorious inability to hold water. Through a no-till mulching practice, she successfully dry farms on her site. Her experimentation expanded our understanding of what dry farming can look like and created an entry point we hadn't imagined was possible.

In Willow Creek, California, Jacques Neukom dry-farms an impressive array of annual and perennial crops in a Mediterranean climate with limited water. He notably farms carrots, another crop we wouldn't have thought to recommend for dry farming. Jacque uses cover cropping to nourish the soil for the dry growing season ahead. He rips the soil to bring moisture to the surface, then seeds with an earth seeder into "cloddy" ground. Dry farming reduced weed pressure and soil compaction, which allows him to hand-pull beautiful 18-24", crisp, sweet carrots cleanly out of the ground at harvest. He noted that variety selection and preparation matter.

Resilience begins with our capacity to adapt and experiment. As an organization and community, we continue to return to this lesson.

CURRENT AND FUTURE PROJECTS

We focus on developing tools and resources that empower growers to tailor strategies to their unique contexts. In collaboration with our partners at Oregon State University and our regional agricultural community, we coordinate and participate in on-farm trials, host field tours and demonstrations, connect farmers and technical service providers, and elevate examples through storytelling and case studies.

Our current project, the Water Resilience Toolkit, asks growers to explore a process within their own context to examine site





suitability, varietal selection, plant spacing, phenology, weed management, and the role of soil as a water storage vessel. As the food sovereignty program manager working with us on a demonstration put it, "You have to think of the soil itself as your water-holding vessel more than anything. All your planning — field layout, crop selection, cultivation methods, timing — it all has to work together to make the most of that storage."

The toolkit is interactive, citizen-based agriculture. It fosters inquiry-based and participatory learning. Offering growers a roadmap with questions, considerations, and strategies that growers can adapt and implement in their own landscapes. Grower experiences will inform the toolkit and reshape future versions.

AN INVITATION

Water resilience in the West will not emerge from a single breakthrough or institution. It will grow through shared experimentation, reciprocal learning, and the willingness to experiment locally and share what works with your neighbor.

Resilience comes from approaching the work with curiosity rather than dogmatism and from allowing space to observe, experiment, collaborate, adapt, and, maybe most importantly, be surprised.

Our work evolves with every person who engages with it. Each conversation, experiment, and shared experience adds another thread to our rich tapestry. We have learned from collaborators across our network who have been doing this work long before we arrived at the question, and we're always looking for organizations doing this work in their own regions and partners who want to pilot the Water Resilience Toolkit in their own location.

We do not want to be siloed. Water resilience is a global conversation, and we are just one voice engaging in it. If you are growing food with less water, we'd love to hear from you. What are your challenges? What success have you had?

To learn more about the Dry Farming Institute and the Water Resilience Toolkit, visit dryfarming.org.

Building resilience on Western working lands.

QUIVIRA COALITION

We advance resilient agriculture and conservation through three interconnected priorities.







WORK THE LAND TOGETHER

Amplify local expertise and demonstrate resilient practices

CULTIVATE SKILLS

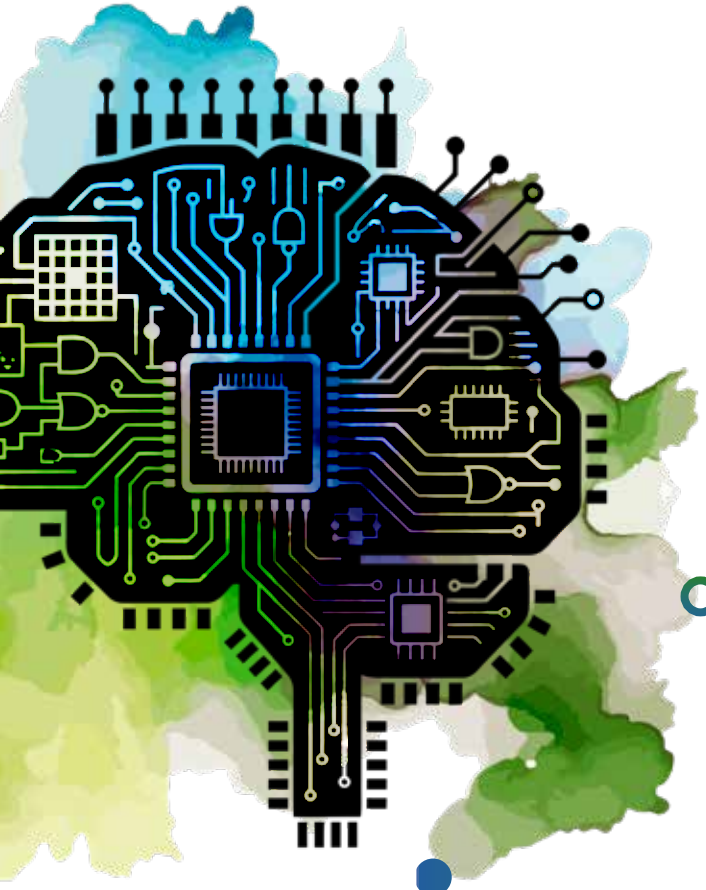
Train the next generation of land stewards

CONVENE COMMUNITIES

Convene stakeholders to share knowledge

By expanding the Radical Center and deepening relationships within it, we support land stewards along their regenerative journey as they adapt to changing conditions on working lands.

Learn more at quiviracoalition.org



Can Artificial Intelligence Preserve Stewardship *Without Replacing the Steward?*

By Dr. Perry E. Cabot and Eugene F. Kelly

Note to reader:

There are valid concerns about the resources used to store data that facilitates artificial intelligence. Important conversations are happening across the country to identify if data centers should be built, what locations are best for that type of infrastructure, what energy and water consumption is needed, and who is most impacted by this industry. At the same time, as responsible land stewards, we should be open to thinking about how this technology can be used to facilitate the work we do in regenerative agriculture. We encourage you to think about the questions posed in this piece.

Across the Colorado River Basin, agriculture increasingly operates within a reality that demands better prediction, optimization, and precision. As water supplies become less reliable, drought conditions more persistent, and the margin for inefficiency steadily smaller, an onslaught of variables can overwhelm even the most experienced farmer. In a region where producing food and fiber accounts for most water demand, even modest gains in irrigation timing, placement, and rates are worth pursuing for both agricultural viability and basin-wide water use efficiency.

At the same time, another fundamental reality accompanies the water scarcity of the Colorado River Basin: soil and water cannot be separated. Irrigation is not merely about crop and field management. It is about multiple ecological functions that underpin soil health and resilience. These considerations are increasingly inherent to the broader and growing conversation surrounding regenerative agriculture. They determine the connection between the soil water balance and its connection to drought response. Over-irrigation can leach nutrients, weaken soil structure, transport salts, and suppress the biological activity that allows plants to grow with fewer inputs. Under-irrigation, on the other hand, can stress crops, reduce root development, and ultimately diminish the soil carbon that helps the land hold onto water.

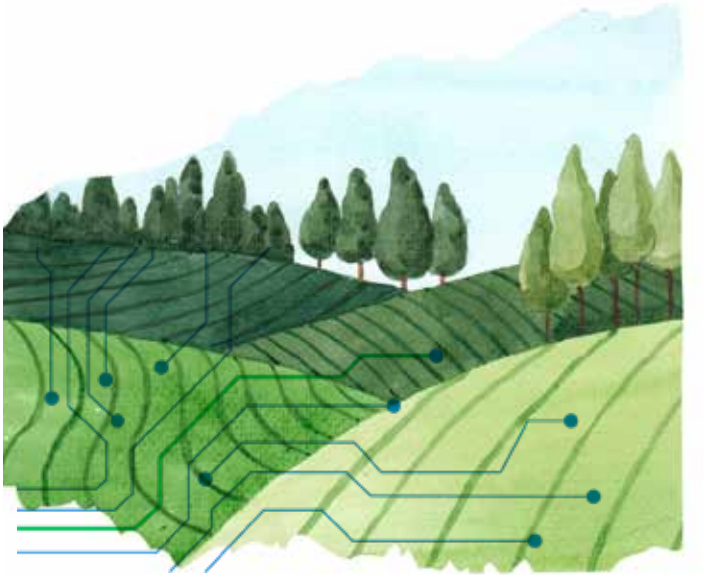
Predictive Agriculture and the Rise of AI for Irrigation Management

Getting irrigation right, then, is not just about optimizing water use. It is about maintaining the long-term value of the medium that stores water. This idea is at the heart of regenerative agriculture, which views farms not as simple production enterprises, but as interconnected biological systems where soil health, water management, and land stewardship are inseparable.

Managing these relationships unavoidably now requires more adaptive, predictive, and responsive approaches to climate variability, which drives conditions that make irrigation a particularly well-suited application of artificial intelligence (AI). Modern irrigation systems can utilize tremendous amounts of data: soil moisture measurements, evapotranspiration (ET) estimates, weather forecasts, drone imagery, salinity mapping, and years of historical crop response. A testament to continual advances in technology, the ever-evolving challenge of collecting this data is ambitiously met year after year. In agriculture, the frontier has now shifted to the need to interpret this data quickly and accurately enough to make informed farming decisions.

This is precisely the type of problem for which AI is tailor-made: environments where large sets of interacting variables must be analyzed continuously and where predictions improve through iteration and machine learning. Ever more, drought pressures mean farmers need to continuously optimize at more granular scales in time and space. Soil moisture changes hourly. Crop water demand fluctuates with temperature, humidity, wind, and solar radiation. Different soils within the same field hold and release water differently. Hewing to the principles of regenerative farming to protect generational soil health makes it even more complex. No matter how experienced an irrigator may be, they cannot continuously and simultaneously integrate this multitude of variables across an entire field, let alone their whole farming operation for an entire season and beyond.

Our research at the Western Colorado Research Center, funded by the U.S. Department of Agriculture, sits squarely at this emerging frontier of AI adaptation known as predictive agriculture. Rather than responding to what has already happened, predictive agriculture is about anticipating what crops need before they are stressed. Applied to irrigation, that means moving beyond reactive watering schedules toward precise, forward-looking prescriptions informed by soil conditions and crop dynamics. Our goal is not to remove producers from decision-making, but to develop tools that empower their judgement. Farmer knowledge and experience become part of the dataset, not something to be replaced.



Stewardship Beyond Optimization

Yet efficiency and precision alone are ultimately technical goals, the kinds that machines are engineered to achieve. To be sure, efficient irrigation works best in tandem with soil function, strengthening biological resilience, and reducing unnecessary stress on both water and land resources. In this sense, it can be argued that AI may support certain principles of stewardship. But stewardship itself reaches beyond optimization for something larger. It compels human judgment, accountability, attentiveness, and care for the long-term land health in ways that datasets and algorithms cannot. This is where a deeper question emerges: can AI preserve stewardship without replacing the steward?

A large body of research demonstrates that AI can improve irrigation decision-making. Our work seeks to determine whether AI can consistently generate irrigation prescriptions that are more accurate, timelier, and responsive to actual field conditions than conventional methods, and early evidence suggests that it can. In water-limited regions, these capabilities matter enormously, not simply for agricultural productivity, but for the long-term ecological viability of farming itself.

This is where AI's advance into agriculture invites deeper reflection. It may help solve real problems, yet many people instinctively fear that decision-making could become increasingly disembodied, distancing human beings from direct stewardship of the land.



Wendell Berry and the Question of Human Responsibility

The uneasiness surrounding AI is, at its core, a modern expression of a much older concern. Few writers explored that concern more thoughtfully than Wendell Berry. In 1987, he published an essay explaining why he would not buy a computer. The response was swift and in some cases hostile. Critics portrayed him as a wallowing sentimentalist, hopelessly resistant to progress. But of course, Berry's argument was never just about computers. It was about something larger: the tendency of modern techniques to replace human judgment, local knowledge, honed skillsets, and meaningful relationships with systems optimized for efficiency and scale.

For the devoted technocrat, it is easy to dismiss Berry's attitudes as the anachronistic musings of a reactionary. Underlying much of Berry's work was a deceptively simple – yet eminently responsible – question, which later became the title of one of his most profoundly important works; "What Are People For?" was published in 1990 when AI was largely in the realm of science-fiction. Industrial agriculture, Berry contended, blunts that question by treating human beings as inefficiencies to be engineered away, selling "the world to buy fire …our way lighted by burning men," challenging our thinking in his poem "The Want of Peace."

Berry's work repeatedly returns to the same essential question: What happens when technology removes the need for people to truly know the places they inhabit?

In agriculture, he believed industrialization had already answered that question poorly. Farmers who once understood the ecological rhythms of their land became increasingly dependent on generalized systems, purchased inputs, mechanization, and distant expertise. Knowledge rooted in observation and long familiarity with a place was gradually displaced by technologies designed to standardize and simplify farming across vastly different landscapes.

Now AI brings that question into a much more complicated territory because, unlike many technologies Berry criticized, it arrives at a moment when agriculture faces genuine ecological pressures that necessitate greater precision and prediction in order to remain sustainable at all.

Knowing the Field Versus Knowing the Data

Using the example of regenerative agriculture, being attuned to soil and water relationships is central to preserving the entire system. Regenerative farming depends upon biological interactions that are highly contextual and difficult to abstract. Soil biology responds differently across landscapes, as does water flow differently through different textures and

structures. Ecological resilience is inherently place-based, dependent on countless interactions that cannot always be reduced cleanly to universal prescriptions. Put more simply, good regenerative farming requires attentiveness.

This is consistent with the reasoning of Berry's intellectual project. In "The Gift of Good Land," for instance, he warns against "solving for patterns," an activity that may optimize one variable while damaging the larger ecological, and even social relationships that sustain life over time. Good solutions, he argued, strengthen the health of the whole system rather than maximizing a single output in isolation. That distinction bears a certain resemblance to irrigation management, where a succession of decisions can influence both immediate farm performance and the long-term ecological resilience of the system. The appeal of AI in this setting is obvious: it excels at identifying patterns, optimizing outcomes, and navigating levels of complexity that can overwhelm even experienced managers. Yet irrigation is not merely a technical exercise in optimization. Decisions about water also carry ecological and ethical dimensions that require judgment, memory, and attentiveness to place.

The Loss of Generational Knowledge

Here a central tension emerges. The question is not whether AI can optimize irrigation; it can and it will. The question is whether optimization diminishes the need for stewardship and the forms of knowledge upon which it depends.

An AI-driven irrigation system can react to every piece of data it is supplied. It can utilize infield soil moisture levels, crop-specific ET rates, infiltration patterns, canopy temperatures, and spectral signatures. It can optimize irrigation timing with remarkable precision. But the system does not know the field in the way a farmer does after decades of living with it, through memory, attentiveness, responsibility, and the long familiarity that comes from belonging to a place rather than merely managing it.

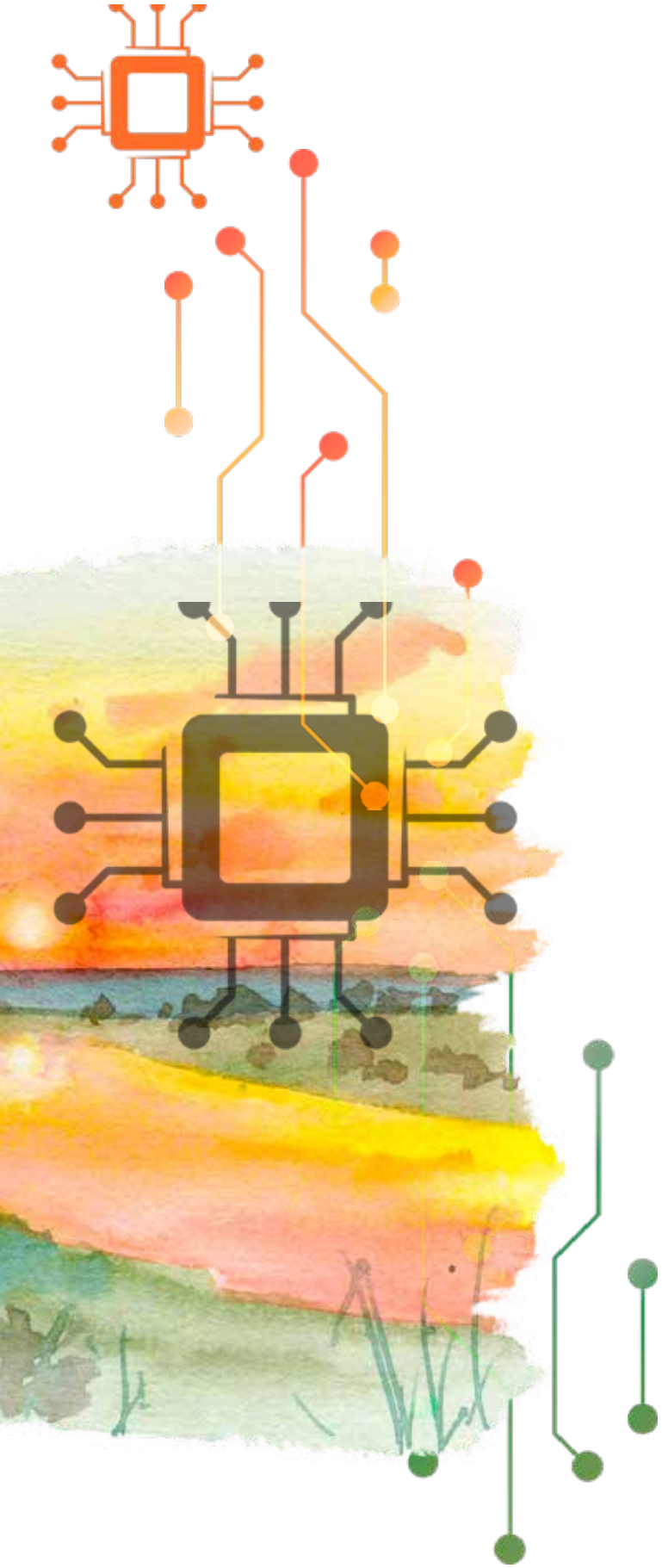
Can it notice that one corner dries faster after a windy spring? Does it remember how a field looked during the drought 15 years ago? It does not carry the accumulated intuition that develops slowly through repeated attention to a particular place over long periods of time. It certainly does not inherit observations passed between neighbors and family members over generations. The irrigation system knows the field's data, but that is not the same as knowing the field itself.

This contrast matters because Berry consistently warned that technologies become dangerous when they eliminate the need for the knowledge a problem once required. Herbicides reduced the need to understand weed ecology and crop rotations. Synthetic fertilizers reduced the perceived need to understand soil fertility and biological cycling. Mechanization reduced dependence on labor and local observation. AI represents the continued momentum of these progressions, because it can threaten the very habit of understanding what we think we actually know.

A system that helps a knowledgeable farmer irrigate more effectively may function as a valuable tool. Farmers have been early adopters of GPS guidance, remote sensing, variable-rate equipment, and advanced genetics, often for very pragmatic reasons: thin margins, weather risk, labor scarcity, and the need to do more with less. A system that makes it possible to farm without developing deep familiarity with the land, however, is something fundamentally different.

What Are People For In An AI-driven Agricultural Future?

Berry's concern has never merely been that technologies change how farming is performed. Better than any agrarian writer, he thoughtfully navigates the way they impact the relationship between people, land, and responsibility. A farmer remains accountable to a place in ways no algorithm can, much less a disembodied corporation that hosts an internet interface. The farmer lives with the consequences of decisions through drought, recovery, failure, and renewal. Stewardship, in Berry's view, is



not simply about technical competence. It is about membership, participation within a living community of soil, water, neighbors, and future generations.

Inseparable from Berry's case for membership, the loss of generational agricultural knowledge adds another layer of complexity alongside water scarcity itself. Across much of the West, experienced farmers are aging faster than they are being replaced, and with them disappears a lifetime of observations about the subtleties that define a place over decades. In some respects, this creates an opening to juxtapose AI with Berry's view of technology. To be clear, we do not suggest that Berry would see much virtue in AI itself; his skepticism toward technologies that distance human beings from meaningful relationships with the land and community is well established. Yet the connection, however fragile, is still worth contemplating if for no other reason than it can sharpen a research ethos. If AI can help preserve fragments of hard-won agricultural knowledge that might otherwise vanish – while still keeping farmers meaningfully engaged as stewards – then we believe that possibility deserves thoughtful consideration. Large language models and other conversational interfaces add another dimension to this possibility by translating complex subjects such as soil physics and hydrology into accessible, field-relevant guidance, potentially democratizing decades of scientific understanding and local observation. Indeed, this interaction between technological capability and human stewardship remains an important part of our broader research philosophy.

Artificial intelligence may offer one way to preserve fragments of that disappearing knowledge. Historical observations can now be stored, modeled, and incorporated into systems capable of quantifying long-term field patterns. Younger farmers entering agriculture without generations of inherited experience may gain access to guidance informed by decades of accumulated observations and environmental responses. In water-limited systems where mistakes can carry serious economic and ecological consequences, this possibility carries obvious value.

But even here, Berry's call for epistemic humility remains relevant. The danger is not simply whether AI can preserve observations. It is whether preserving observations becomes a substitute for educating and training observers. Pattern recognition is not the same thing as judgment developed through years of attention to a living landscape. The concern is not merely technological dependency. It is the fact that meaningful judgment ultimately requires accountability – to the land, to its long-term health, and to the consequences of decisions. At the utmost, it is precisely this accountability that compels the stewardship that will protect and sustain agriculture across generations.

Imagine the endpoint of this trajectory carried several decades forward, when AI systems manage irrigation autonomously. Irrigation remains within realistic constraints. Soil health indicators improve. Crop stress is reduced. By every measurable metric, regenerative outcomes are being achieved. One question will still linger: has the farmer gradually become more a monitor of systems than a participant in the farming itself?

There is no doubt that AI will prove extraordinarily useful in helping agriculture navigate increasingly difficult environmental realities. In places like the Colorado River Basin, precision irrigation and predictive management will likely become essential components of long-term agricultural resilience. Rejecting these tools outright would ignore the seriousness of the ecological and hydrological challenges facing Western agriculture.



The challenge is not whether AI can optimize irrigation systems. The challenge is whether agriculture can adopt these tools in a way that preserves human attentiveness, memory, accountability, and care that regenerative stewardship ultimately depends upon. These are very qualities upon which regenerative agriculture and stewardship together depend. Indeed, if accountability remains central to the responsible use of AI, then agricultural education plays a critical role. We do not regard this as merely philosophical. Rather, it has sharpened our own research and educational approach. As agricultural educators, we increasingly recognize that preparing future farmers, scientists, and engineers means helping them understand not only how to develop and use powerful technologies, but also how to exercise sound judgment and accept responsibility for the consequences of their decisions.

Berry's question therefore returns with renewed force: *what are people for within the future agricultural landscape*? This is ultimately a question of purpose, not nostalgia. If we employ AI merely to extract more from our resources – land, water, air, and even people – then we have answered that question poorly. The responsible use of AI depends upon preserving human accountability, because stewardship requires someone who remains answerable to a place, its long-term health, and the consequences of decisions made there. Without that accountability, optimization as a generalized goal does not help us judge what ought to be sustained or why.

Addendum

Wendell Berry passed away August 31, 2026. We extend our deepest condolences to his family. We wish to express our gratitude for his many decades of devotion to agrarian thought and emphasis on the love of the land.



Trials of the Pala

by Olivia Romo

"Those who are entrusted with the waters of the acequias must undergo trials of the pala: sudor, sequia, y honor para comer el fruto de su legado."

I began at the Nile

have been in the trenches with the workers and soldiers since the earliest of wars.

Some believe that an angel whispered into the ear of the first farmer to use the shoulder blades of his fallen ox to plow the land.

Yes, even our beloved *Santo* underwent challenges of drought, lost livestock, and battled with locust.

My career has been groundbreaking.

Charlie Carillo once said that there are three *palas* in everyone's life.

One, used to bury your *ombligo*

The one you use to work your whole life,

and the last in which they use in your burial.

Spade

Rounded

Square

Flat

Always ready.

En la primavera you can hear my song ringing in the ditches as I clash against rocks and roots.

La marcha de las palas!

When I say pala you say power

pala

power

pala

power



The farmer's grip is heavier,
his breath tight with worry.
The rains no longer know their seasons—
they vanish in heat or fall too fast,
turning my blade to mud and flood,
the fires turn soil to silt.

I labor in dust,
in heat that bends the horizon.
The farmer takes me up at dawn,
his hands worn as the handle's grain.
Together, we cleave the earth again.

We dig,
for those who dare to plant anew,
who bend, who toil, who see it through,
who shape the earth despite despair.

We dig,
not just to bury, but to raise,
to carve, to shape, to build, to save—
a blade of work, a prayer of praise.

I dig through history—
las reglas,
the Laws of the Indies,
the Quran,
dig through white papers, legislation, red tape all for our water to be free.

I dig for the truth.
We dig to the core.
Not gold nor ore,
agua y aceite,
sweat and blood.

Here we are, working our way down the ditch,
one shovelful at a time.
We toss the light dirt into the clear air.
We feel the cold on our faces,
and with every heave we disappear.
Vuelta—
Vuelta, demands the Mayordomo
and we become lost to each other
in these sudden clouds of our own making.
Regina Whitskunk reminds us that "in water we are surrounded,
we are safe,
pure and sacred."
Nunca le tapes la boca de la acequia, es como tapar la boca de tus hijos hambrientos.



Returning Rapids Project
Salt Lake City, UT

Bringing together researchers, scientists, river runners, and journalists to study the changes and share the story of the Colorado and San Juan Rivers.

Clark Fork Coalition
Missoula, MT

Uses community science programs to expand capacity for data-driven restoration projects and engage an interested public in hands-on river stewardship. Focuses on monitoring ecosystem function on tributaries to boost the health of the river through integrated restoration efforts.

Trees Water People
Mancos, CO

Native youth crews and local volunteers planted more than 600 culturally-significant plants and seeded two acres of eroded land along the Mancos river corridor; as well as increasing availability of culturally-significant plant species, the project supports the Ute Mountain Tribe's access to their ancestral lands.

Yurok Environmental Dept.
Klamath, CA

Water quality in the lower Klamath River has significantly improved since the removal of four upper dams, according to preliminary results collected by the Yurok Tribe. The tribe plans to add monitoring capabilities in 15 more tributaries with the goal of assessing drought resilience.

RiversEdge West
Grand Junction, CO

Restores riparian ecosystems through education, collaboration, and technical assistance.

Hermit's Peak Watershed Alliance
Las Vegas, NM

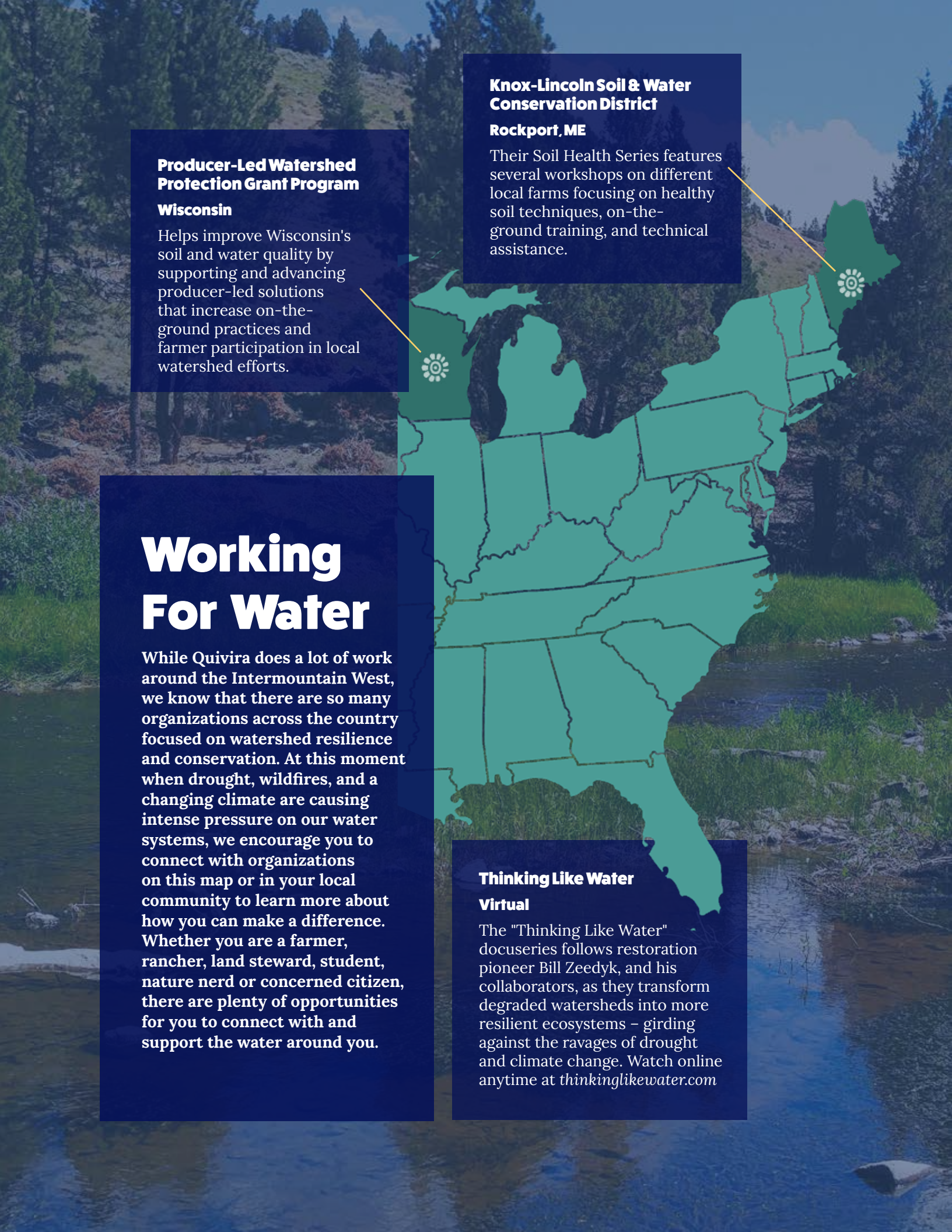
Works to protect and restore the ecological and cultural heritage of watersheds in the Hermit's Peak region through ecological restoration, environmental education, and community action.

Rio Grande Return
Santa Fe, NM

Restores riverscapes and ecosystems unique to the arid Southwest using low-tech and process-based methods to foster resilience, adaptive capacity, and stewardship.

Dixon Water Foundation
Decatur + Marfa, TX

Promotes healthy watersheds through regenerative land management, to ensure that present and future generations have the water resources they need.



Knox-Lincoln Soil & Water Conservation District

Rockport, ME

Their Soil Health Series features several workshops on different local farms focusing on healthy soil techniques, on-the-ground training, and technical assistance.

Producer-Led Watershed Protection Grant Program

Wisconsin

Helps improve Wisconsin's soil and water quality by supporting and advancing producer-led solutions that increase on-the-ground practices and farmer participation in local watershed efforts.

Working For Water

While Quivira does a lot of work around the Intermountain West, we know that there are so many organizations across the country focused on watershed resilience and conservation. At this moment when drought, wildfires, and a changing climate are causing intense pressure on our water systems, we encourage you to connect with organizations on this map or in your local community to learn more about how you can make a difference. Whether you are a farmer, rancher, land steward, student, nature nerd or concerned citizen, there are plenty of opportunities for you to connect with and support the water around you.

Thinking Like Water

Virtual

The "Thinking Like Water" docuseries follows restoration pioneer Bill Zeedyk, and his collaborators, as they transform degraded watersheds into more resilient ecosystems – girding against the ravages of drought and climate change. Watch online anytime at *thinkinglikewater.com*

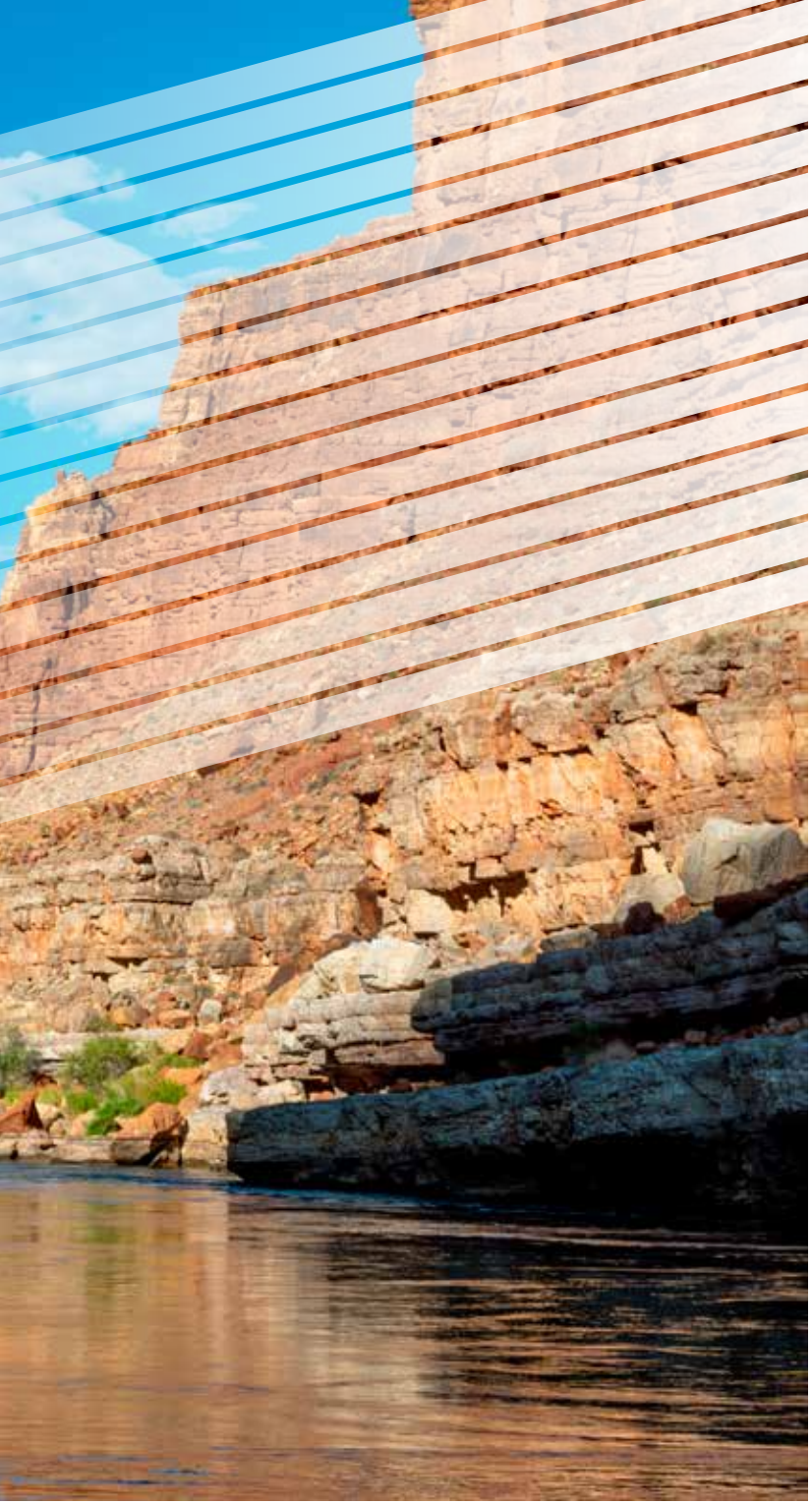


The POWER of the Colorado River

By Morgan Wagoner

The first time I truly understood the power of water, I was 11 years old. Despite having grown up boating on rivers all over the West, nothing quite prepares a kid for the moment a full-sized raft gets flipped like a pancake by Crystal Rapid in the Grand Canyon. That was decades ago, and I've spent my life since then immersed in water — its use and management, the species it supports, and the civilization we've built around it.

When I say water is powerful, I don't just mean it's heavy and therefore a physical force. I mean it's powerful in its capacity to bring life and vitality to an arid region. But not all water in the Colorado River Basin is wet, and not all stories about water involve waterways. As anyone who's worked with me knows, I often say the story of water in the West is not the story of water in rivers, it's the story of how



we use water on the land. It's an arcane system built on terms and concepts that feel opaque to most people: acre-feet, priority dates, interstate compacts.

In 1921, the seven states of the Colorado River Basin began negotiating how to divide the river's water among themselves. The Upper Basin states — Colorado, New Mexico, Utah, and Wyoming — worried that under prior appropriation, rapid development in California and other Lower Basin states (Arizona and Nevada) would consume all available water before they could grow into their own potential. The resulting 1922 Compact was intended to provide for the "equitable apportionment of the use of the waters of the Colorado River System."

But the agreement was fundamentally flawed from the start. The Compact allotted 7.5 million acre-feet annually to both the Upper and Lower Basins, and a 1944 treaty with Mexico committed an additional 1.5 million acre-feet — a combined minimum obligation of 16.5 million acre-feet. Even as negotiations were underway, scientists warned that tree-ring data showed the river historically yielded only 13 to 14 million acre-feet per year. Those warnings were set aside, baking over-allocation and legal uncertainty into the very foundation of Colorado River management.

A century later, the river's average annual flow has dropped to approximately 12 million acre-feet, while 40 million people and six million acres of farmland depend on both the water and the legal certainty the Compact was meant to provide. From households in Denver to lettuce fields in California's Imperial Valley, the river has been stretched to its breaking point. Climate change is bringing hotter, drier conditions across the river basin and compounding what was already an over-committed system and puts the whole structure at risk of collapse. Food production is a national security issue. Municipal water is fundamental to human health. And the river itself sustains a vast and irreplaceable ecosystem.

The people who grow food with Colorado River water are not abstractions. They are farmers and ranchers whose livelihoods and communities are deeply woven into the land and water they steward. They include Indigenous tribes and multi-generation farm and ranch families who have spent their lives learning and caring for these landscapes. When we remove water from the land, we lose something not easily replaced. The ecological consequences are severe — degraded soil health, increased dust, the spread of noxious

weeds — but so are the social consequences. "Dry-up," the conversion of irrigated farmland to unirrigated land, can lead to fields going brown, rural towns losing their economic foundations, communities contracting, and the end of a way of life.

The math is unforgiving. Since the turn of the century, climate change has already reduced Colorado River flows by roughly 20 percent, and projections show further decline. Lake Powell and Lake Mead, the two reservoirs that form the spine of the water management system, sit at less than a quarter and less than a third of capacity, respectively. A strong snowpack year in 2023 provided temporary relief, but the basin has remained in shortage for years. The question is no longer whether something will give. It's what will give, and who it will fall on hardest.

Before dams, diversions, and settlement reshaped the river, the Colorado ran 1,450 miles from the Rocky Mountains to the Gulf of California, spreading into a biologically rich delta that supported jaguars, the endemic marine totoaba fish, and the Cucapá people who had called its banks home for millennia. Along its course it nourished at least 30 Indigenous tribes and countless native species. The river was volatile, prone to extreme floods, severe droughts, and occasional course changes that sent it toward the Salton Sink, forming the ancient Lake Cahuilla and, eventually, the modern Salton Sea. Its waters ran red with silt, famously described as too thick to drink and too thin to plow. It commanded respect.

Today, the river no longer reaches the sea. The delta is largely dead. The nearly two million acres of wetlands that once thrived in Mexico are mostly dry, though conservation efforts have used agricultural drainage to partially restore the Ciénega de Santa Clara. Upstream, a series of dams impounds the river's flow, trapping sediment and submerging landscapes, habitats, and archaeological sites beneath reservoirs that shrink each year. The native freshwater fish — razorback sucker, humpback chub, Colorado pikeminnow — struggle to survive in a river transformed by development, its banks colonized by invasive tamarisk and



its once warm, turbid waters running cold and clear, better suited to the introduced predatory fish that now dominate them.

A failed river is one that no longer functions as a river, moving water, sediment, nutrients, and energy from headwaters to sea, connecting mountains to coasts, creating habitat along the way. Rivers are not pipes engineered solely for human needs. They are complex, living systems, and yet we have spent a century reducing the Colorado River to an accounting problem. This is not only a failed river but a failed management system, one that assigns no legal value to water left in the channel and all the things that water sustains. Under the prior appropriation doctrine, only water that is diverted and put to "beneficial use" is considered legally protected. Historically, leaving water in the river for fish, birds, riparian plants, and river ecology was not a beneficial use. It was waste.

One acre-foot equals roughly 326,000 gallons, enough to supply two average households for a year. But most Colorado River water doesn't go to households or industry. It goes to agriculture, to grow the food the rest of the country eats. Approximately 70 percent of basin water use is agricultural, which generates intense pressure to reduce that share. That reduction is coming. But it will not be painless: farmland will be fallowed, landscapes fragmented, rural communities strained. Tribal nations throughout the basin, many of which already face severe water scarcity and underdeveloped infrastructure, will feel those pressures acutely. Tribal water rights — some of the most senior in the entire system under the federal reserved rights doctrine established in Winters v. United States in 1908 — remain unresolved or inaccessible to tribes, even as junior users have built entire economies on water that was never legally available to them. That is a failure not of hydrology but of law: a century of deferred reckoning.

The intractable issues loom large over the basin: how do we protect the people and economies built on the river while also protecting the river itself? Does the river have a right to exist?

I've spent enough time in the canyons of the Southwest — listening to the cascading call of a canyon wren, watching ravens ride the thermals, following a great blue heron as it fishes the shallows, feeling the pull of current moving toward a sea I know it will never reach — to believe these systems carry something worth protecting on their own terms, that they have rights of their own. A river is not merely infrastructure. But rights without remedies are empty. The real question isn't only whether the river has rights; it's how we govern a system in which so many competing rights chase the same dwindling resource. The river and the species that depend on it require minimum flows, functioning sediment budgets, and periodic floods. The producers who rely on that water to feed the country have legitimate claims, too. The work is in the balance.

As the Colorado winds through its network of wild canyons and human infrastructure, it continues to shape the landscape. Its banks are not what they once were, colonized by invasive phreatophytes, bordered by farm fields, marked by the structures of a century of management. But coyote willows and cottonwoods still grow there. Mountain lions and desert big horn sheep still drink from it. Dozens of native species still depend on it, because a river is not a municipal supply system or an agricultural delivery mechanism. It is its own entity, and we all depend on it to live.

In a basin that is changing faster than its institutions can adapt, agriculture must continue, but in more efficient, more resilient forms, with landowners compensated for conservation rather than penalized for it. Tribal rights must be resolved and honored. Municipalities must reckon honestly with the limits of what the river can actually provide.

Most of all, the people who depend on this river must stop fighting over water that exists only on paper and start building the governance structures capable of managing the river as it actually is — reduced, stressed, but not yet gone. Still powerful in so many ways.







When the Wells Fell Silent

Farmers and Ranchers Choosing Water for the Future

By Dr. Ladona K. Clayton and Ashley Masenheimer

Before sunrise on the High Plains of eastern New Mexico, the land is quiet.

For generations, that quiet was broken by a familiar sound — the steady hum of irrigation wells coming to life across the fields. Long before the heat of the day arrived, farmers climbed into pickups and headed down dirt roads, checking pivots, and watching the first water arc across rows of corn, wheat, or sorghum. In the half-light of morning, fathers worked beside sons (and sometimes grandsons), learning the rhythm of land and water that shaped their family's lives.

Irrigation farming was more than a livelihood here. It was a way of life measured in seasons and wells, in harvests and droughts, and in lessons passed from one generation to the next. Many of the farmers who now steward this land grew up listening to the hum of the pumps and watching green fields rise from soil that would otherwise lie dry.

Water made that life possible.

Beneath the plains is the Ogallala Aquifer, a vast underground reservoir that has sustained communities and agriculture across eight states (South Dakota, Nebraska, Wyoming, Colorado, Kansas, Oklahoma, New Mexico, and Texas). Its water allowed families to farm the same ground previous generations had worked before them, building lives tied to the soil.

But over time, something began to change.

Wells that had once flowed strong began to falter. Pumps had to work harder. Water levels dropped deeper beneath the ground. Farmers who knew their land best could see it happening long before reports confirmed what they were witnessing.

The aquifer was declining.

For the families who farm this landscape, that realization carried a heavy weight. The same groundwater that sustained their crops also sustained their towns — and Cannon Air Force Base, which anchors the region's economy.

The question was no longer simply how to keep farming. It was how to protect the water that made life here possible.

For some, the answer required something few could have imagined: turning off the wells their families had depended on for generations.

One by one, irrigation systems that had once defined daily life fell silent.

The Life That Water Built

Before the wells fell silent, they shaped every part of daily life.

“My family has been farming this land since about 1917,” said Ricky Lockmiller. “Irrigation came along in the early ’60s, and from then on, it became a way of life.”

Irrigation shaped everything: what was planted, how days were spent, and how families worked together.

“There was a saying around here,” said Doug Reid, a local farmer. “It’s always time to change the water.”

Days didn’t follow a clock. They followed the movement of water — checking pivots, adjusting flow, keeping things running through heat, wind, and long nights.

“We’re third- and fourth-generation farmers,” said Danny Fish. “Irrigation wasn’t just part of what we did. It was our livelihood.”

“There’s nothing more satisfying than pulling in a good crop,” Terri Fish added. “That’s what this has always been about.”

When the Water Began to Fall

At first, the change was easy to miss.

A little less pressure. More time spent adjusting equipment. Pumps working harder to deliver what once came easily. Then it became harder to ignore.

“Our pivots just weren’t putting out the same amount of water,” Ricky Lockmiller said. “We were constantly repairing and upgrading just to keep enough pressure.”

“We weren’t pumping the same gallons per minute anymore,” Brett Lockmiller added. “It became clear the water was declining.”

For some, the evidence was undeniable.

Danny noted, “It used to take five wells to irrigate this ground. Now it takes 19.”

Farmers adapted by lowering wells, modifying pivots, doing whatever it took to keep going.

But the pattern didn’t change.

“We just kept needing more wells, more effort, for less and less return,” Danny added.

What they were seeing wasn’t a dry year. It was a finite aquifer being drawn down.

That realization led to a decision few had ever considered: to stop pumping altogether.

The Hardest Decision

For the families who chose to stop irrigating, the decision did not come easily.

“The hardest part was stepping away from what had always been our livelihood,” Sheryl Lockmiller said.

For Reid, the weight of that decision reached across generations. “The hardest part?” he said. “Convincing my sons.”

“Putting those wells into a permanent easement — that’s forever,” said Dustin, Reid’s son. After family discussions, they felt it was the right choice.

For the Fish family, it required time. “We had to really stop and think about it,” Danny said. “Turning off that last well wasn’t something we took lightly.”

But the alternative was harder.

Danny understood the stakes. “If we didn’t stop and the water ran out, we wouldn’t have anything anyway.”

Ronnie Montague, a local rancher, put it plainly. “We’ll have a hard time explaining to our grandchildren why we poured our drinking water onto the ground.”

Choosing the Future

For those who made that decision, the question was what came next.

Through the Ogallala Land & Water Conservancy, these landowners found a way to act on what they already knew had to be done. A voluntary, incentive-based approach provides

compensation for forgoing irrigation while allowing them to remain whole and continue caring for their land.

Since the program began, participating landowners have transitioned nearly 12,000 irrigated acres to non-irrigated use, conserving billions of gallons of groundwater each year.

“This wasn’t just about our farm,” Terri said. “It was about the future of this whole area. If the water dries up here, the community and the base would have to leave. And without the community, what do we have?”

Others saw it the same way.

“We could’ve kept pumping for another 10 or 15 years,” Brandon Reid said. “But then there’d be nothing left.”

Not for them. Not for anyone.

Over the past four years alone, nearly 37,000 acre-feet of groundwater (more than 12 billion gallons) has been kept in the ground by not pumping. More than $6 million has been invested through these agreements, allowing producers to make that transition without losing their operations. At the same time, ten conservation easements now in progress are working to permanently protect up to 80 percent of the groundwater beneath these lands.

What Stewardship Looks Like Now

The work didn’t end when the wells were turned off. In many ways, it was just the beginning of a shift.

The land looks different now. Fields that once depended on irrigation are changing. Some are returning to grass. Others are transitioning to dryland farming or grazing. The work continues in a new form.

“We’re learning how to work with the land instead of pushing it,” Brendon Lockmiller said.

“We knew the water was running out, and we had to do something,” Ricky added. “But this wasn’t just about stopping. It was about doing better with what we have.”

“Because of this, we’re able to keep our way of life—it’s just not the same as it used to be,” Brett said.

The wells are quiet now. But the land is not.

What They Are Leaving Behind

These farmers who made this choice have not abandoned their land; they have chosen to care for it differently.

“We’re making this choice so the land can stay in our family for generations to come,” Ricky said. “I believe my dad and granddad would support this decision. Taking care of the water — it’s just the right thing to do.”

“Most people will never understand how hard it was to turn the water off for the last time,” Danny said. “But it was the best decision we’ve made.”

He paused, then added, “We’ve got wells that had stopped pumping that now have water back in them. Hopefully these grands — the fifth generation — will be able to work this land and love it the way the generations before them have.”

Their measure of success has changed.

It is no longer only what can be grown in a season. It is what can endure beyond it.

What these farmers and ranchers are doing is not a return to the past, and it is not a rejection of it.

It is a decision shaped by experience, observation, and a responsibility that extends beyond their own operations.

They understand what is at stake.

And they are choosing accordingly.

The legacy they are choosing now is water for generations to come.



FIRST OF ITS KIND

By Sally Wier and Anica Wong



The San Juan Ranch in the San Luis Valley of Colorado has been through some pretty big transformations since George Whitten's grandfather bought the property in the early 1900s. Acres have changed hands and family members have come and gone. It saw incredibly profitable years when wool prices were high but then transitioned to cattle when sheep permits in the local mountains were lost and wool prices tanked.

The way water is used, stored, conserved, and allocated to landowners, ranches, and farms has also changed.

In the early 1900s, canals were built to help deliver irrigation water to farms and ranches across the valley. In 1938, with the establishment of the Rio Grande Compact across Colorado, New Mexico and Texas, water became more heavily regulated. Unfortunately, for many years Colorado did not deliver as required on that compact and was eventually sued by New Mexico. In the 1950s, the threat of the canals being shut off brought the community in the San Luis Valley together to develop a way to deal with the issue. At that time, they drilled wells into the aquifer under the valley and the state granted water rights for those wells; as the rivers started to dry up and deliver less water, the wells became important water rights.

"So we developed this whole agricultural community based on, to a large degree, groundwater. Everybody on the canal has the same priority. And so we learned to work together and then out of that formed the Rio Grande Water Conservation District that managed the whole basin," said Whitten. "Over time, it was apparent that we didn't have enough groundwater and that we had too many wells, not enough surface rights, and that we're in a drying time."

As the climate started to change and drought conditions became worse, it became clear within the last 10 years that the community needed to figure out a way to conserve or retire groundwater rights in the valley. Some farms utilized the Conservation Reserve Enhancement Program (CREP) through the USDA, which allowed them to retire their groundwater rights for 15 years in return for financial incentives; many thought that the climate would balance out after those 15 years and things would return to normal.

Of course, that wasn't the case.

"We're facing close to 100,000 acres of dry-up in the San Luis Valley right now of irrigated agriculture. And almost all of it is going to be high production, center pivot, very efficient vegetable and hay farming," said Whitten. "That acreage is just going to have to be retired in order to bring us anywhere near the balance that we need."

Something else needed to happen or the valley would be in trouble. That's where, in addition to CREP, several different groundwater retirement incentive programs came into play. The Rio Grande Water Conservation District, comprised of member-led subdistricts, self-imposed a tax on every acre foot of water that their members pump. Some of that money is then used to buy the groundwater rights from local farms and ranches, and the rights are retired forever, keeping the water in the aquifer. The retired water rights cannot be reallocated to another user. Similarly, in 2022, Colorado allocated special funds through Senate Bill 22-028 to help pay for groundwater right retirements.

Whitten sold about half of the San Juan Ranch's groundwater allocation to the Rio Grande Water Conservation District through the Senate Bill 22-028 program. Because of the regenerative agriculture practices and livestock management Whitten uses, the ranch still has enough water to irrigate – they have actually improved the land's productivity and water-holding capacity. Whitten points to the artesian wells on his ranch that haven't flowed for years that are now flowing year round; the aquifer pressure has been increased by almost four feet.









We, as a community, are trying to think through ways to have a 'restoration economy' or economic models on dry land that will keep things going in terms of economic viability. But we don't have a silver bullet and it's very much a work in progress.



Another groundwater retirement incentive program that's been created in the valley is the groundwater conservation easement, piloted by Colorado Open Lands. These easements are voluntary agreements that a landowner enters into with a land trust, such as Colorado Open Lands, to retire a portion, or all, of their groundwater rights for the purposes of aquifer recovery. Landowners are financially compensated through payments or tax benefits for their willingness to voluntarily forgo access to their irrigation rights.

Colorado Open Lands completed the nation's first easement of this kind in the northeastern part of the valley in 2022 on the 1,900-acre Peachwood Farms. "This easement effectively retired close to 1,700 acre feet of groundwater pumping annually. The Rio Grande Water Conservation District's Subdistrict 4, where the farm is located, was able to comply with state groundwater sustainability requirements as a result of the water retired through the easement. It means that other farms and ranches in the area remain viable and can continue to irrigate and be productive agricultural operations," says Sally Wier, senior conservation project manager at Colorado Open Lands.

Since the completion of this first groundwater easement, Colorado Open Lands has been connecting with other land trusts, groundwater management agencies, land management groups, and policy makers across the country to share information, guidance, lessons learned, and ideas to support others in the pursuit of using groundwater conservation easements as a tool in their communities. Aquifer sustainability is a significant issue in many geographies across the country, and Colorado Open Lands hopes that their work in the San Luis Valley can be replicated far and wide to aid in groundwater management challenges in many aquifer geographies.

The opportunity in the valley now will be to consider how regenerative agriculture tactics – like incorporating livestock and cover crops and the use of biochar – will support revegetating dry, mono-cropped land that has been retired through these incentive programs. Whitten has hope that through education and experimentation, community members can find out how to move forward with less water while also building healthy soil and robust local economies.

"We, as a community, are trying to think through ways to have a 'restoration economy' or economic models on dry land that will keep things going in terms of economic viability. But we don't have a silver bullet and it's very much a work in progress," said Wier.

There is optimism in the future of groundwater conservation and how it can support working lands and rural economies.

HELPING WATER-CONNECTED LANDSCA HEAL THEMSELVES

By Amy Smith Muise



APES

What does it mean to work against erosion, not directly at the site you are trying to protect, but upstream, where it's still possible to make a difference? Can a few people, with just the power of our hands and backs, do something to help water-connected landscapes heal themselves? These were the questions my family asked ourselves as we considered how to protect a vulnerable piece of rangeland at the outlet of a drainage in the Brokeoff Mountains of New Mexico.

The erosion's journey began with an old road. No longer navigable, but still showing up on maps and in some navigation apps, the road had sunk into the soft soil of the fan, and now channeled water along the boundary line between the neighboring allotment and ours. The diversions made by hunters and backcountry vehicles had created additional channels for floodwater, which now poured into a main arroyo from numerous surface paths during summer monsoons. Our sense of urgency about this site was due to the recent, fast widening of the arroyo, despite healthy grass cover in most years.

We had moved onto the allotment in early 2012, a time of drought, and it was several years before we saw the heavy streamflow that would begin to transform the arroyo. Back then, the old road, which had already sunken well below the level of the fan, was mostly intact except for a deep cut where Box Canyon drops into the limestone- and gravel-based arroyo that carries water north to a levy on an old farm field. This drainage runs a few times a year, based on rainfall in Upper Dog Canyon and flow from side canyons in the Brokeoffs. Dog Canyon is a long geological feature below the rim of the Guadalupe Mountains. (You may have seen it from the air if you fly out of El Paso to Houston or Dallas.) Hydrologically, it doesn't carry the main drainage from upstream – instead, that drainage passes through a narrow limestone canyon and empties onto this floodplain, before descending to Crow Flat proper. To the west is the site of a historical homestead, its well tower still visible. The landscape around this location is puzzling. Vegetation and soil seem to have diverged from the path of the water. A number of old and stout desert willows (Chilopsis linearis), plus more that are broken but still sprouting, persist all around the historical site. The soil here is a deep sandy loam, now almost completely cut off from the flow of the main drainage.

Some of you may be nodding along, here, especially if you've talked with Bill Zeedyk, read his writings, or watched "Thinking Like Water," a docuseries that highlights his work. But in 2012, to us, it was not a familiar story. We knew, from neighbors, that cultivated agriculture had been practiced here at one time, and that an adjacent section had been cleared and prepared for pivot installation (though never cultivated due to low flow from the well). Another section of land downstream, a private section of land, still held a pivot and was being cultivated until the turn of the century. So we considered that some human manipulation of the landforms might have diverted the main part of the Box Canyon flow eastward toward that irrigated farmland. That this was part of a common, tragic pattern of landscape shifts that had been underway in the Southwest for hundreds of years, we didn't fully understand.

By 2020, when my husband and I were talking about how to control erosion in this area, it was hard to know what had begun the problem, how these effects interacted, or which landscape change had caused which. But everyone could see that erosion was building upon itself and accelerating. At the edge of the arroyo, a 1950s sedan has been left near what had been the

roadway. As of 2016, it was embedded in an embankment. By 2023, that automobile was on a pedestal.

For those in some parts of the Southwest, Zeedyk-style structures – low-input erosion control dams – may feel known and common by now. For us, even in 2020, no one around us was using or suggesting them. We heard plenty of talk about wire-based sediment catchers (locally called horse trippers), and we were told about cement nets to place over eroded banks, about moving soil with heavy machinery. But low-input erosion control dams were not discussed; even when an idea seems to have gained a lot of steam and press, it's not necessarily part of the conversation everywhere!

Crucial to our next step was considering how the existing vegetation of the site was already doing a good job of trapping organic matter. Creosote bushes (Larrea tridentata), both dead and alive, were common on the site, and most had quite a bit of yucca fiber, old grass, sticks, and cholla stalks accumulated around them. In addition, grass growth across the site was vigorous in response to any kind of precipitation or surface flow. It seemed like the site had all the potential in place to heal itself, if we could just figure out how to slow the water before it got to the edge of the arroyo.

It was also clear that various changes had taken place at the surface of this land. A former owner had graded the ranch roads. The power company had recently bulldozed its right-of-way. On surrounding sections of rangeland, the Bureau of Land Management had carried out an effective brush control project that suppressed creosote bush and encouraged flourishing populations of Muhlenbergia, Sporobolus, and Setaria grasses. Vegetative cover of the site was excellent, but even so, where the drainage joined the arroyo, the banks were melting away like sugar.

Around this time, I learned about a workshop that Quivira Coalition was putting on at Fort Union Ranch, showcasing hands-on learning about what I thought of as "one rock dams" (having barely heard of them for the first time). My main exposure to this idea was through the Twitter account of Ariel Greenwood (*@grasslandgreenwood*), who had been posting gorgeous and contextual glimpses into her work restoring spring-fed sites on rangeland near Mora, New Mexico. I went up to Fort Union for the weekend without much sense of what we would be doing. The first morning we woke up to sleet and snow! Any precipitation is good precipitation. The rest of the weekend was even better. The group included all sorts of interests: graziers, ranchhands,







land managers, agency personnel, fish and wildlife specialists, wildfire recovery people, extension agents – a diversity of knowledge. The program itself jumped right into what I needed: theory and practice. I began to see the opportunity that we have, without disturbing the ground and with small amounts of manpower, to help water-connected landscapes heal themselves.

Our initial idea – that our drainage had gotten out of connection with the absorbent powers of turf and delta (soils and structures that are capable of holding and slowing water) – came to life in the examples we were shown. It was such a relief to have this intuition confirmed, that these places of chaotic erosion, where water is presently raging and destroying soil structures, often occur next to the historical, built-up, resting place of water. It was a memorable day that transformed my understanding of how water relates to rangeland soils and structures.

My children joke that the thing that scares me most – my bogieman – is erooossssiooon. When they were young – they say – if they jumped off a bank and kicked some dirt, that's the only time I got truly angry. But it had never really occurred to me that there was something I could actively do to help water restore its soil. I felt we were in a defensive posture. Don't overgraze. Don't overgrade. Maintain roads in a way that does not channelize. Don't drive off





road. All of these are good practices, but they are defensive practices. In that moment at Fort Union, in this hands-on workshop with expert people, it transformed my understanding of our ability to encourage healing actively.

This is not to say that careful management practices aren't already ongoing. Certainly, we always have the intention of healing actions toward land. This is the primary goal of most ranchers and land managers. Every day, across the West, ranchers are documenting and adjusting livestock patterns, making grazing plans that leave roots in the ground and leaf on the plant, timing consumption of grasses to the right windows of time. But these actions are about planning and protecting, tracking unpredictable precipitation and plant growth. Zeedyk structures were saying: we need to reunite the water with the soil it historically watered.

Coming back to the ranch after that workshop experience, I had something to propose. Rather than installing anything disruptive, rather than digging or using any man-made materials, we could use a rock source that was on site and create a landscape of media lunas and one rock dams across the fan of the drainage, without any greater disturbance. And we could do it not by directly addressing the extreme erosion downstream, but by working upstream, where channelization was less, to slow the flow of water and spread the flow of water at locations where we could still take mild action.

Just around this time, I had the great luck to meet the restoration ecologist Magda Garbowski, who had recently arrived at New Mexico State University. The erosion control structures piqued her interest. She introduced the idea to her restoration ecology class in the spring of 2025, who agreed to take a field trip to the ranch and spend a day helping us move rock to the sites and install the structures. To study the effect of these structures, we set up a paired experiment. Magda and I identified similar pairs of dry rivulets and randomized



them so that one would receive a treatment (a one rock dam or media luna), and one would be left as the control during the first season. (We intend to later install structures in all the rivulets, once we see what the data shows.) The 2024 winter had been very dry, and the region was classified as in extreme drought. Although the site had not been grazed for more than a year, what grass had been aboveground had mostly dried up and blown away, other than the larger bunchgrasses (mostly Sporobolus spp.). Looking carefully at the surface, you could see that there were still stolons of Bermuda grass and vine mesquite, and evidence of underground structures that were waiting to resume growth. But at a glance, the site looked pretty dismal. It looked pretty bare. And it was dusty and dry in March.

The students brought varied experience to the project. Some had never been on a public lands ranch or had never been this far from a city before. Others had ranch experience. Some were focused on restoration ecology, while others were interested in soil science, wildlife, rangelands, or animal science. Best of all, we had a couple of students whose weight training goals included lifting heavy rocks! It was a great spread of people. They moved material with enthusiasm, and they took time to lay the rocks just right. They showed great intentionality and care and problem-solving ability. The students worked in teams and helped each other cheerfully. They carried rocks in canvas bags and plastic feed tubs. They discussed, evaluated, and adjusted the structures to feedback. They installed markers and measured the height and width of structures. We had students rotating among tasks, so that everyone spent time carrying rocks, building structures, and taking measurements. Everyone was resourceful and hard-working.

The labor the students contributed to install these structures is something that would have taken my four family members months to do. We might have been able to get it done a bit at a time while keeping the other chores of the ranch going, but to put in 17 structures like that in one season is something that only a willing, sizeable group could accomplish. If it had been just us, we would not have had the structures installed in time to experience the next rain event.

And what a rain event it was.





In June 2025, devastating floods hit the Hill Country of Texas. In southeastern New Mexico, we caught the edge of that slow-moving storm system. It stayed and dropped six inches of rain within a week. Precipitation in June is unusual, but even stranger, this rain came slowly and gently, for the most part, saturating soil before running off. In our typical monsoonal system, we often experience rains that run off the surface before saturating the soil, channelizing flow without contributing a lot of moisture to other parts of the landscape. So this rain pattern looked unusual because of how much rain, and how gently it came. Slowly, Box Canyon ran water. Eventually, from this one weather system, it ran eight times, climbing to its banks, receding, running down to a trickle, and then (from rains upstream), rising again.

During some of the drier intervals, we were able to go to the study site and observe the water flowing through the treated and untreated rivulets. The low-input erosion control structures were underwater, but we could see where water was flowing across the study site and beyond. When the eighth run of the creek had subsided, we were able to look



around fully, and we realized that the creek had actually broken out of its bed, carved a new bank, and spread the old bank across the fan of the study site, a little to the southwest of before. The flood had deposited a large quantity of sand and some rock over parts of the study site. This was unexpected, and will probably make it hard to suss out how the 17 low-input erosion control structures affected the pattern of this deposition, or how they impacted how far stream flow carried that sediment. But imagine if those structures had not been in place!

I'm continuing to collect data on these sites, including both vegetative cover and soil moisture measurements. We expect that the coming season may reveal more about differences between the experimental sites and the control sites, as well as the ability of soil to hold water and produce forage after post-flood changes in composition. For now, 10 months later, the site remains almost completely covered by vegetation. This is amazing when you consider what it looked like in March of 2025, when the students helped us put in the structures. Cattle have grazed here throughout the fall and winter without harvesting more than half of plant biomass and without revealing bare ground. It's a hugely gratifying example of how resilient and productive these soils can be once they are reunited with water. It is also an example of how greater variability and greater intensity of precipitation is changing our ability to predict. It's hard to believe the absolutely bare, dry soil of spring 2025 has transformed into the fully-covered site that we see now. But people who are familiar with this site are not surprised. They have seen this happen before. They recognize the potential in places like this for ecological and livestock productivity. I understand that not every year will deliver the type of precipitation that creates these dramatic changes, but we have to have the sites prepared. We receive precipitation when it falls. Land stores that potential, and if we can add these techniques to our repertoire, and get used to these ways of thinking about the landscape, we can have it ready when that moment comes. We see the paths that water takes, and now we have a little bit of practice, some new techniques, and the confidence that small actions can enhance sites like these.

My advice for others interested in this type of action would be to attend a Quivira workshop or workday, watch videos, and read Zeedyk's work. Buy one of Quivira's erosion control fieldguides, a little laminated flipbook that shows construction techniques for low-input erosion control structures; they're well-illustrated, the instructions are clear and simple, and the flipbook is just the right size to put in the glove compartment of your UTV or pickup.

What else is important to remember as we do this work? Humility and care and caution, of course. First, do no harm. Work from the point of view of people who are on the land, who are watching the effects of wind and water and drought. Know that people on the land are constantly interpreting the shapes and changes of land in response to rain and surface flow – including the changes that are happening from the bigger, more dramatic rain events of recent years and those that are happening from the more prolonged, unprecedented dry spells that are affecting soil. For me, it was transformative hearing Zeedyk describe the theory and practice himself, talking through how the Fort Union team has been able to build up a one-rock dam or media luna layer by layer. Seeing these structures that were five, 10, 15 years old – how the team had added one more layer, one more layer, once each layer below had been sedimented in and revegetated. It really made clear that a person who is in place, a person who's returning again and again to the same drainage, to the same water flow patterns, has an opportunity over time to enable the water and the soil and the vegetation to heal itself. Just through time, just through small actions, at the right interval, with observation and humility.





ADAPTATION IS NOT A *Luxury*

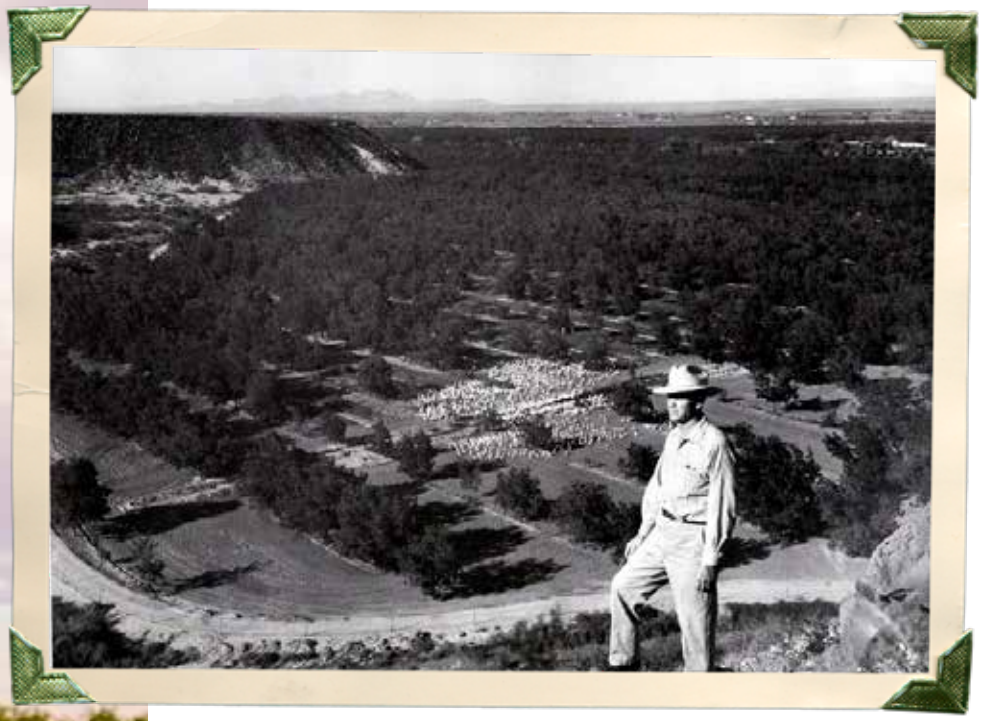
By Rafael Rovirosa

The water in our canal was muddy. It always had been. Every irrigation, every year, the water that came onto our fields was the color of the river that fed it. That was the water I knew.

Until the spring of 2003, when I was 14 years old, I came home from school to find the canal filled with crystal-clear water. I had never seen the bottom of the canal before when it had water in it. I asked my mom why the water had changed. She told me the reservoir was empty. It was the first time in 24 years that we had received anything less than a three-foot allotment from the river.

That was 23 years ago. Here in southern New Mexico on Stahmanns Pecan farm, we have not had consecutive full allotments since. It is impossible to know when this drought is going to end, but what I do know is that we cannot farm with the hope that it will end next year. My family has a deep history in the Mesilla Valley, where ingenuity, elections, and water go hand-in-hand.

This is part of our story.





THE PLUNGE

Deane F. Stahmann Sr. was an amazing farmer. In 1925, he purchased a piece of land from a man named Oscar Snow, who was very important in our community in the late 1800s. Oscar was one of the first graduates of what is now New Mexico State University and was the president of the First National Bank of New Mexico. His old brick house that still stands was used to hold meetings between people like Pat Garrett and other characters from the Old West. The farm was sold to Deane on a lease-to-own program but when Oscar saw how profitably my great-grandfather was running the farm, he demanded that Deane pay in full. Deane didn't have the money, so he went to a bank in El Paso and they lent him everything on the basis of his farming and business results and with just the land as collateral. Seven years after purchasing the farm, a truck broke down in Las Cruces carrying bare-root pecan trees. The driver frantically searched for someone to purchase the trees, as bare-root trees do not last long outside the ground. Despite having only been tested in small acreages by Fabian Garcia at New Mexico State University, my great-grandfather took the plunge and bought them. In 1932, Stahmanns became the first irrigated commercial pecan orchard in the world. A few years later, Deane saw declining levels in the reservoir and drilled his first well. This was one of the first agricultural wells in the Mesilla Valley. A decade later, Deane saw further declining levels at Elephant Butte Reservoir. As the only permanent crop farmer in the valley at the time, he considered it too great a risk to not be prepared for a serious drought. He installed sufficient wells to keep all the acreage irrigated in case surface water became scarce. Within a few years, his fears were proven to be true. We remained in drought throughout the '50s, all the way to 1978.

THE DISTRICT

The Rio Grande Project, one of the first large U.S. Bureau of Reclamation irrigation-only projects and home to one of the largest dams in the world at the time of its completion in 1916, is comprised of two irrigation districts - the Elephant Butte Irrigation District (EBID/ The District) in New Mexico and the El Paso County Water Improvement District Number 1 (EP1) in Texas. The District – which spans 106 miles between Caballo Dam and American Dam – began impounding water in 1913 and grew to serve 90,640 acres of irrigated agricultural lands. Today, the District delivers surface water to a variety of crops across the region including pecan, cotton, alfalfa, onion, lettuce, and most famously, green chile.

It's often said that whiskey is for drinking and water is for fighting. EBID is no stranger to drought or to conflict. In the '30s, Colorado was making short deliveries to the downstream states. This led to the negotiation and signing of the 1938 Rio Grande Compact. In the '50s, the project experienced its first major drought,



which lasted through 1978. Legal battles between all combinations of interested parties occupied much of these decades. One such combination was the farmers in New Mexico and EBID. My grandfather, Bill Stahmann, had taken the reins at the farm in the ‘60s. He too had a taste of good water years along with decades of drought. Tensions were high during the years of drought, as the two districts would search for discrepancies in how water was being shared vs. how it was supposed to be shared. For decades, Bill was one of the major leaders defending our water rights by exclusively funding attorneys that would fight for private property rights. The other major defender of our water rights has always been EBID.

Though both my grandfather and the District fought for the rights of farmers in the Lower Rio Grande, they did not always agree on the path forward. In 1975, EBID drilled wells to pump water into the district canal system to provide water to farmers who had not drilled wells. Bill, along with John Salopek, Jerry Franzoy, and John Clayshulte Sr., led a group of farmers who had invested in their own infrastructure and were opposed to paying for a collective well water program through EBID that would move water from wells drilled near their land to other parts of the valley. They called themselves the EBID Well Drilling Protest Group and they raised money and sued EBID to prevent the wells going in and being used. It was this group that coordinated an effort to run candidates for the board. Those candidates that Bill backed won; this type of grassroots election hadn’t ever happened before and he was way ahead of his time.

Then the snow came back; there were historically-high inflows to the reservoir due to large snowpacks in the ‘80s and ‘90s, and conflict simmered down. In the early 2000s, drought hit the region again and the battles came soon after. A lawsuit between Texas and New Mexico began in 2013, and the District has been working out how to split the water



delivered to Elephant Butte Reservoir for 26 years now. It has been constant fighting since then, which has bred a culture of isolation, conflict, and mistrust across the community. This included farmers with senior water rights, regulators at the state and federal levels, states themselves, irrigation districts, and other water users within each region.

In 2023, the recently-hired manager of the District was abruptly fired and two long-term board members resigned. EBID stakeholders were surprised and felt short-changed by the decision. After discussing options with other farmers in the valley, we decided that the best plan was to run a full slate of candidates for the board of EBID. At the start there was skepticism. Up until that point, the board had consisted of long-serving members who were entrenched in their positions, and farmers did not believe that we could flip the board. Despite some effort in recent years, competitive elections had not been held, let alone a slate of candidates completely replacing the incumbents, which hadn't been done since 1979 when Bill's candidates won. As the election approached, we named our group Reform EBID Now, and did voter outreach that had never happened before in the District. Turnout on election day seemed to be robust, and in the end, it would be the highest it had ever been. Once the votes started rolling in, we realized we had won big – by about a 40 percent margin. We flipped all seven available seats on a board of nine people.

Then the work started. There were many changes we needed to make to get the culture back on track. We started by increasing oversight of the organization by implementing a committee structure that permitted us to assign board members – based on their interests – to different aspects of the organization, putting the authority back in the hands of the farmers. We began a search for a new manager. We restructured the legal team so that multiple attorneys were responsible for different fields of law. We began building relationships with career government employees and elected officials. Within the first year, we had a new manager hired, the legal team remade, and the board more engaged than at any time in decades.

The effects have been profound. We settled Texas v. New Mexico and Colorado, a case that went all the way to the U.S. Supreme Court. In concurrence with changes at EBID, changes had been made within the State of New Mexico and the United States. This coalescence of collaborative personalities allowed a settlement to be reached and trial to be avoided. We continue to bring in funding from the state and federal government to construct infrastructure that builds resilience in our region. We have a team that works with lawmakers at the state and federal level to create good laws for long-term viability. Management of the district is rapidly modernizing, thanks to key hires in the finance and accounting departments. All of this allows the irrigation district to efficiently deliver surface water to our members, all the more important now as they face multiple battles out of their control.

THE HEADWINDS

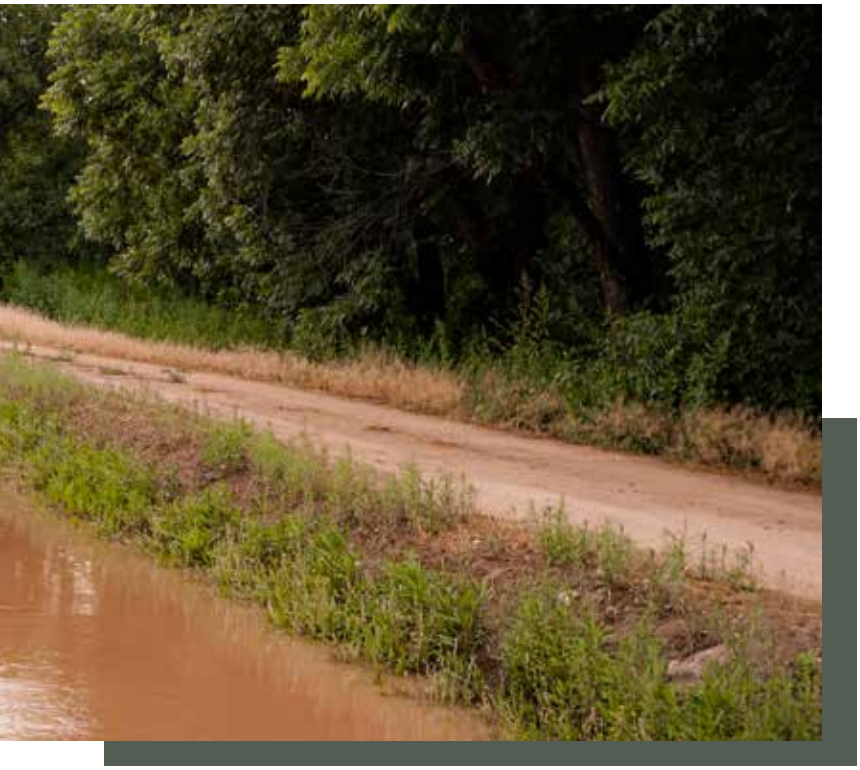
Farmers across the United States are facing existential challenges from many fronts. Trade policy affects us all; it makes everything we buy more expensive. Tractors cost nearly double what they did 10 years ago, even though general inflation has run well below that. Nitrogen fertilizer costs doubled. The price of PVC more than doubled during the COVID-19 pandemic and is still up by over 50 percent compared to 2020 prices. Countervailing duties imposed by the U.S. Department of Commerce at the behest of Mosaic make farmers in the U.S. pay substantially more for phosphate than our competitors elsewhere across the globe. We pay roughly 10 times more for labor than farmers in Mexico, yet there are no import restrictions on pecans coming into the U.S. In 2018, when the U.S. first put tariffs on Chinese goods, China retaliated with their own tariffs on U.S. goods; pecans were one of the tariffed products. Overnight, China went from buying nearly 100 million pounds of pecans to effectively zero, causing the price of pecans to fall by nearly 40 percent. China never came back and they never will; now China buys South African pecans. This story is common across many crops in the U.S.

In addition to issues with trade policy, inflation has an outsized negative effect on agriculture. Money from food inflation is rarely captured by farmers. It is used to offset increasing costs to all other steps in the supply chain. Many service providers increase their prices whenever their costs increase, but farmers can't do that. Instead, they either take lower profits, take on debt to survive until markets improve, or sell. The majority of farmers who sell are small family farmers. Consolidation in ag has happened at an alarming rate. Billionaires such as Bill Gates (280,000 acres) and massive investment firms such as PSP Investments (over 7 million acres) have the liquidity to acquire farms as they become available. That is not to say that investor-owned farms can't have excellent management teams. The farm my great uncle, Deane Stahmann Jr., planted in Australia in the 1970s is owned by PSP and managed by an amazing team that cares deeply for the land. Even so, this



creates a situation where long-term health of the land is disconnected from the needs of the beneficiaries; funds have a fiduciary responsibility to their investors and when the numbers don't make sense, they are obligated to move on. While family ownership is not a guarantee of good stewardship, it creates incentives that distant ownership rarely matches, such as generational time horizons, personal accountability, and a stake in what the land looks like in 50 years. Keeping farms in the hands of family farmers should be incentivized with fair tax policy by the federal government. Medium-sized, closely-held farms often shoulder an insurmountable tax burden when passing to the next generation, and this is often the trigger for family-held land to be sold to investment firms.

While ag water consumption has stayed flat since the '70s, inflows into our reservoirs have dropped precipitously. In the 25 years since we have been pumping groundwater to make up for lack of surface supply, our aquifers have dropped by about 20 feet, depending on where measurements are taken. Although the Mesilla Basin Aquifer beneath us is more than 2,000 feet deep, physical water is not our constraint. Legal water is. Compacts and court decisions



– not geology or hydrology – will determine how much groundwater we are allowed to use as surface supply continues to fall short. Substantial winter precipitation may one day return as it always has, but a hotter climate is a new reality we will be dealing with. This means that we will get less water in our reservoirs. More of the precipitation will fall as rain, the snow will sublimate, and the plants in our watersheds will consume more water during the summer months, leading to drier soils that absorb more of the water from the melting snow. This will lead to less water reaching our region, even if we do revert to wetter winters like we saw in the ‘80s and ‘90s.

THE ADAPTABILITY

To improve our ability to utilize surface water, we need to ensure our rivers are running efficiently. During drought, rivers become choked with sediment. There is not sufficient water moving at sufficient speed to move sediment farther downstream. It all eventually settles out and creates plugs, leading to flood risks and reduced conveyance efficiency. This means we have to move more water down the river per day in order to make a given delivery. The more inefficient conveyance is, the fewer days the river runs. We can improve our outlook by clearing sediment, moving the river to the lowest spot in the valley in the Middle Rio Grande, and by installing infrastructure improvements, such as lining our canals and automating our check structures.

In agriculture, with the exception of a few good years every couple of decades, we don't set the price. We take the price given to us by the market. In the short and medium term, this market is indifferent to what our input costs are. It doesn't care how hard it is to find labor or what our production is. The market is set by global supply and demand in the very short term. This balance dictates if we see prices below, at, or above our production costs. Unfortunately, if we get prices just at or below our costs, we pull trees out of the ground; it takes more money to maintain them than they are worth. We haven't seen this happen yet at any reasonable scale in the pecan industry, though we see it often in essentially every other crop. Pecans are a very long game since they don't reach maximum productivity until about 15 years after planting. Thus, the pecan farms that survive through the hard times are those that keep their productivity per dollar the highest. Farmers follow a highly-prescribed set of practices that give them the best shot at surviving the bad times. Don't get me wrong, it is not always bad to be a farmer, but the way the ag economy works is that you survive the bad times and boom during the few good years. Success in farming is a long game.

However, the landscape is changing. Can we succeed through continued incremental improvements? Or do we need to cut a path through uncharted territory? Each has its risks involved, and fortunately, collectively, we don't have to commit to one or the other, as long as we keep our minds open. My great-grandfather did this far before it was necessary. When he started planting pecans in the ‘30s, cotton was still white gold. There was no need to make big changes, but he did it out of curiosity. Today, the primary crop in the region is pecans. Cotton has diminished in profitability and the invisible hand has nudged growers toward the most viable options.

Today, I am experimenting with pistachios, truffles, and pine nuts – all three crops have the potential to be more productive with less water. Pistachios and truffles have been shown to generate more revenue per unit of applied water in other regions around the world. I am not sure if this will translate to southern New Mexico. This is the riskiest part of trying new things instead of focusing on incremental improvements to the already proven strategy. Truffles are the fruiting bodies of symbiotic fungi that live in the roots of trees. The fungus provides hard-to-extract nutrients from the soil, like phosphorus, to the tree in exchange for carbohydrates. There are many different types of truffles around the world in just about every region; in New Mexico, there are actually native pecan truffles. However, only a few European varieties are commercially sought after. The two species I grow are Perigord truffles, which grow on holly oak trees, and Bianchetto truffles, which grow on pine trees, in particular, Italian Stone pines and Loblolly pines. Italian Stone pines also produce pine nuts. This is the crop that is the longest shot, but we could have an interesting dual crop if successful. Irrigated and managed Italian Stone pines have not been tested in this region so anecdotal evidence that pine nuts come back empty could one day be a story that was disproven by an experiment.







While incremental improvements in pecan farming may be the best option going forward, I believe that it is necessary to survey the options we have. We don't know what the market is going to impose on us. We don't know how much snow we are going to get in the coming decades. What is certain is that if we see a substantial failure in either, we are going to need well-understood, prescribed paths before we are forced to take them. Just like Deane planted pecans decades before they were found to be optimal and drilled wells long before the first drought hit, I am determined to provide ways for farmers across southern New Mexico and the West to thrive in spite of our challenges.

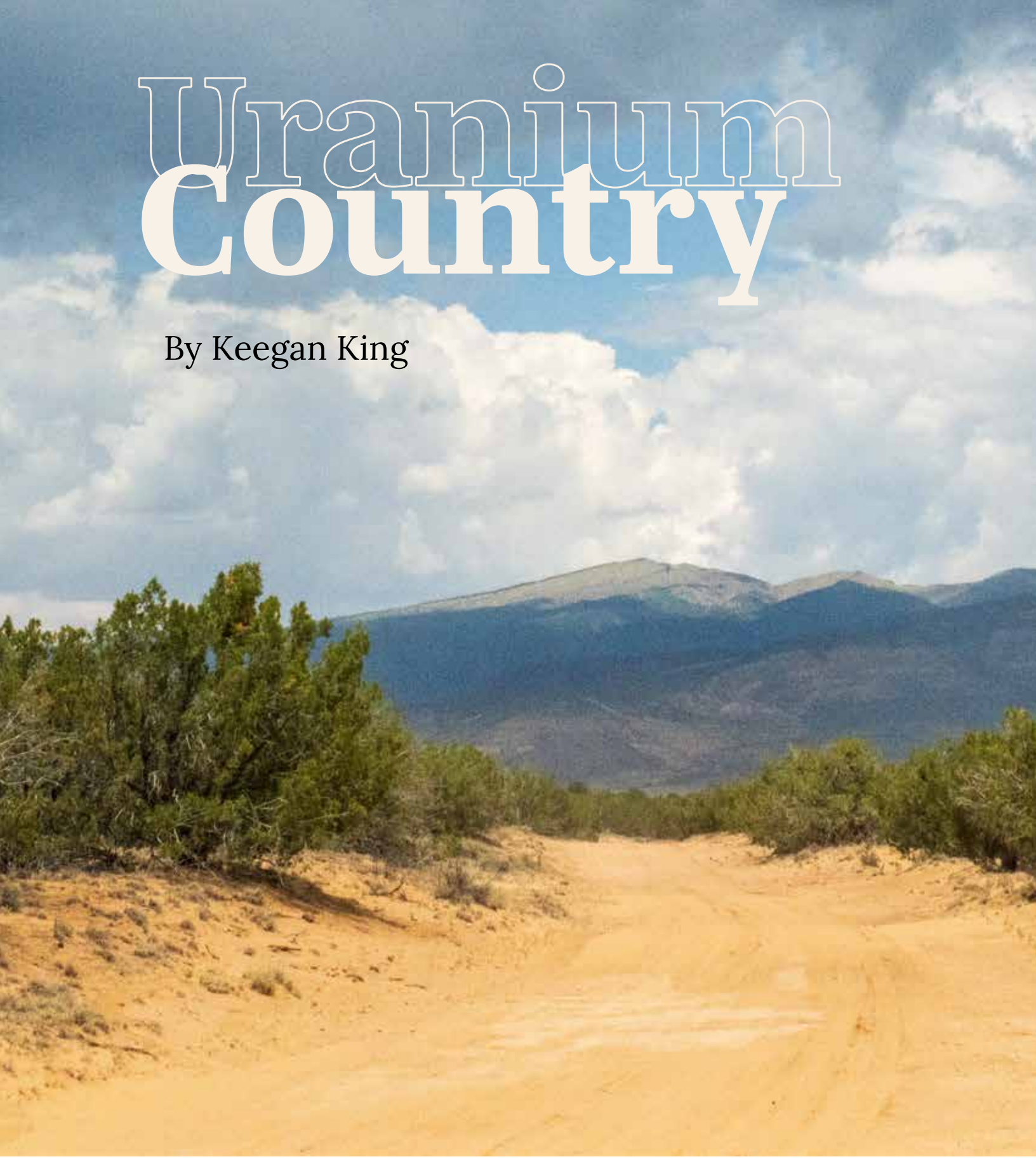
THE CALL TO ACTION

We are entering more difficult times in agriculture. Economics, policy, and the environment are all producing increasing headwinds for farmers. We must take each issue and contribute to finding a solution in a way that suits each of our particular interests and skill sets. If you prefer to work your farm to the best of your ability – as most farmers do – reach out to your neighbors, your local university, and your local extension. Talk about farming practices with them. Exchange ideas so that we can all farm better as a community. If you are a tinkerer or an experimenter, plant a new crop, try a new practice, put your out-of-the-box thinking to the test and share your results. For those of you who enjoy advocacy or policy, run for the board of your irrigation district. Competitive elections stimulate new ideas and reinvigorate institutions. Build relationships with your state and federal legislators. Give them information and ideas. Help them develop policies that make it easier to grow and stay viable. Participate in the legal defense of your rights. We all don't have to contribute to our community's resilience in the same way. Do what you like and what you are best at, and share it.

Resiliency in ag is not just practices. It is the mindset that we take into life every day. It is the strengthening of our collective bank of knowledge, the defense of our rights, the proximity of the owners of land to that land, the fortification of our ag ecosystem, the open-mindedness to search for and try new ideas, the foresight to see issues before they are immediate, and the preparation and ability to adapt. Adaptation is not a luxury. It is the price of continuing to farm. The question is not whether your land will be farmed. It is by who and with what water.

Uranium Country

By Keegan King





Part I — The Landscape

To get to Paguate, my grandfather drove us east from our home in Acoma across the villages of Laguna, toward the slopes of Mount Taylor, an ancient volcano that dominated the horizon and my childhood imagination. The western New Mexican land changed as we went: rolling grassland and cholla giving way to cedar-topped mesas, and then to the ponderosa peaks encircling the village. Paguate, or Guishti in the Keres language, is one of the six villages of the Pueblo of Laguna, secluded and tucked into a bowl beneath the mountain.

At the small man-made Paguate Lake, fishing felt less like an exercise in patience and more like high-stakes competition. My brother and I raced to bait our hooks first, cast first, and bring home the biggest fish. I still remember the smell of PowerBait – that neon pink and yellow putty we pressed around our hooks – garlic, and something chemical clinging to our fingers for days.

Once, with my line ready, I drew the pole back and flung it forward, only to feel the hook catch on something behind me. I thought it was a rock or weeds until my brother squealed. I had hooked him in the face. My grandfather, stunned for a moment, carefully removed the hook from his cheek. After everyone calmed down, we went back to fishing.

When we were lucky, we dropped stocked trout into a creel lined with newspaper and headed home. I assumed my grandfather, who had been raised a cowboy, would grill them when we got back. He kept an old hot plate on the porch for things my grandmother didn't want cooked inside the house.

But by dinner, the trout had disappeared.

Store-bought fish sticks had taken their place.

My grandmother must have known that our trophies were not worth the risk.



Part II — Growing Up Inside Uranium Country

By the time I was born in 1980, the last uranium boom in Grants and Milan was winding down. My father, my grandfather, and many men in our community had some connection to the mines. Operations surrounded Mount Taylor — from Ambrosia Lake to San Mateo, Milan, Rio Puerco, and the Jackpile Mine at Paguate — fed the boomtown economy of Grants. Working-class men and women from every race and creed filled crowded bars, busy shops, and neighborhoods built on uranium money.

People still speak with a complicated fondness about those years. There were good paychecks, new houses, cars bought with cash, and the feeling that something better was just over the horizon.

Then the stories would shift.

Someone would mention an uncle from the mines who later developed cancer. Families living near a pit mine now hauled drinking water because they no longer trusted their wells. Hunters talked about seeing deer or elk with strange growths.

Then someone would change the subject.

I heard stories about cave-ins and machinery accidents, but the one that stayed with me was quieter. My father once mentioned that miners carried dosimeters, small instruments intended to measure radiation exposure and signal when it was time to leave the mine.

He added, almost casually, that most men ignored them.

And even if they hadn't, they probably didn't work anyway.

The mines were not always visible from where we stood, but their presence was everywhere. They lingered in the water people wouldn't drink, the places they avoided during dust storms, and conversations that seemed to end right before anyone asked another question.

For years, that was how I knew the mines: not so much a coherent history, but as fragments.

Part III — Learning to See

As I grew older, those pieces slowly came together into something larger.

The familiar places of my childhood were all connected by uranium. Jackpile, the vast open-pit uranium mine overlooking the lake where we fished. Ambrosia Lake, where mines and mills stretched across the landscape on the road north to our ancestral home in Chaco Canyon. Milan, a railroad town that became one of the region's hubs for hauling uranium ore, where my mother loaded us into the station wagon for afternoons at the laundromat. If my brother and I behaved ourselves and she had a few dollars left over, we'd drive over to Grants to spend an hour at the roller rink before heading home. And Bluewater Lake, where we once watched a bald eagle fold its wings and fall from the sky before rising again with a trout clutched in its talons. My grandfather smiled and called it a good sign.

Today, I drink my morning coffee looking out my window toward Kaweshtima — Mount Taylor.

The mountain has never been merely a resource to us.

It has nurtured and protected our people through the ages.

Its springs and seeps fed dry farms at its base. Its valleys and peaks provided abundant game even when the low country struggled through drought.

It is a sacred landscape whose stories reach back long before statehood, before territorial status, to a time when great Indigenous civilizations ruled this continent — when international trade was done on foot, and the relationship between people and the mountain was one of reverence.

This land was never empty.

Against that backdrop, a different story arrived.

An abundant ore body.

A willing workforce.

A nation racing to fuel the nuclear age.

In my grandfather's generation, Pueblo farmers, Navajo sheepherders, Hispano cowboys, and white settlers became miners. Communities that had long depended on what could be grown from the land increasingly depended on what could be extracted from beneath it.

Years later, in my twenties, I began working as a community organizer. Some of my earliest meetings were with families living near abandoned uranium mines around Milan.

Decades after the boom had ended, many were still living with its consequences.

Some hauled their own drinking water.

Others stayed indoors when the wind picked up dust from capped waste piles.

I listened to stories from wives who washed their husbands' contaminated work clothes for years without knowing the risks.

I met families who unknowingly built homes from radioactive mine rock because it was free and readily available.

There was no single uranium story. Pueblo communities, Navajo families, mining towns, and the men and women who made their living underground carried different memories of the boom. For some, it was opportunity. For others, it was loss. For many, it was both.

Then my own family became part of the story.

We learned that my grandfather's lungs no longer functioned the way they should.

Years underground had left their mark.

Part IV — Provider and Poison

Cubero is a historic Spanish land grant not far from my home in Acoma. Known in the Acoma language as Morrinaatse – or "the milling place" – it was where farming families brought their harvests to be processed and traded. For generations, Pueblo and Hispano families shared these landscapes, sometimes in conflict, often in cooperation, bound together by the realities of making a living in a land that rarely gave more than it had to.

It produced a certain kind of person. Strong backs. Long days. People who understood that survival often depended less on comfort than on persistence. Whether tending sheep, hauling water, cutting timber, or working a distant field, there was dignity in difficult work. When the mines came, they were not seen as an intrusion by everyone. To many families, they were simply the next way to provide. The promise of a steady paycheck, a home, and the chance to stay rooted where generations had lived was difficult to refuse.

Today, it isn't hard to find people who remember those years with genuine affection. They remember busy storefronts in Grants, restaurants filled after shift change, a town growing, and the confidence that came with steady work. Some still speak fondly of the mines despite everything that followed. I've heard more than one person shrug and say, "We've all got to go somehow."

The mines remain. Some have been reclaimed, others only partially. Their presence lingers in the landscape, in questions about water, in fenced-off ground, and in stories passed quietly from one family to another. For many, the legacy is less a visible scar than a quiet uncertainty about what the future may hold.

That is the contradiction I have never been able to resolve. The same industry that helped families stay in western New Mexico also left behind burdens their children and grandchildren continue to inherit. The landscape became both provider and poison, and even now, those two truths are difficult to separate.



Part V — Inheritance

Humans are said to detect the smell of petrichor—the scent of rain on dry earth—with greater sensitivity than a shark senses blood in water. Whether or not that's true, it makes sense in a place like New Mexico.

Thousands of years of living with this landscape would make anyone attentive to the promise of rain.

A Catholic sister sat with me the night my grandfather died. It is our tradition that someone always remains with the deceased. She was from Mesita village and told me a story about being a little girl, waking before sunrise to help in her family's dry farm field. These fields depended not on irrigation, but on rainfall and a careful understanding of the land. She would gently turn the thin layer of soil dampened by the morning dew over the base of each young corn plant. Such a small act, but one that captured how precious water was to our ancestors. The work required equal parts faith and care. A child turning the earth before dawn could help determine whether there would be a harvest in October.

Today I find myself sitting in rooms where people ask familiar questions about the future of these same landscapes. The technologies have changed but the conversations are familiar; communities are asked to weigh opportunity against uncertainty, prosperity against permanence, and the needs of today against a landscape that will outlast all of us.

I carry into those conversations my grandfather, who worked underground so his family could remain where we've always been. I carry my grandmother quietly replacing trout with fish sticks. I carry the stories of families whose memories of uranium remain as divided as the landscape itself. And I think of a little girl in a cornfield before sunrise, carefully turning damp soil over a fragile plant because every drop of water mattered.

Perhaps that is what inheritance really is. Not certainty, but memory.

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