

PROCEEDINGS OF THE SEVENTH

Natural History

of the Gila

Symposium

February 22-23, 2018

Western New Mexico University

Silver City, New Mexico

EDITED BY

Heather Steinmann

Department of Humanities
Western New Mexico University

William R. Norris

Department of Natural Sciences
Western New Mexico University

Kathy Whiteman

Department of Natural Sciences
Western New Mexico University

2019

Table of Contents

<u><i>INTRODUCTION, by Roland Shook</i></u>	1
<u><i>Keynote Address: Natural History of the Gila Symposium</i></u>	2
<u><i>February 22, 2018</i></u>	2
<u><i>Garrett VeneKlasen</i></u>	2
<u><i>LIFETIME ACHIEVEMENT AWARD: JAMES "JIM" E BROOKS</i></u>	6
<u><i>CITIZEN SCIENTIST AWARD: RUSSELL KLEINMAN</i></u>	8
<u><i>FRIEND OF THE GILA AWARD: JACKIE BLURTON</i></u>	9
<u><i>CONSERVATION AWARD: A.T. AND LUCINDA COLE</i></u>	10
<u><i>LIFETIME ACHIEVEMENT AWARD: RANDY JENNINGS</i></u>	11
<u><i>EDUCATION AWARD: DAVE MENZIE</i></u>	13
<u><i>SESSION ABSTRACTS</i></u>	14
<u><i>The Costs of Being Cool: Panting Thresholds, Thermal Limits, and Evaporative Cooling in Southwestern Lizard Communities / Caleb Loughran</i></u>	14
<u><i>Conservation Efforts for the Chiricahua Leopard Frog in Southwestern New Mexico / Randy D. Jennings, Bruce L. Christman, and Michelle R. Christman</i></u>	14
<u><i>Trophic Discrimination Factors and Tissue Turnover Time in the Red Swamp Crayfish (<i>Procambarus clarkii</i>): A Controlled Feeding Experiment / Gregor Hamilton, Shane Benally, Seth Newsome, and Thomas Turner</i></u>	15
<u><i>The Southwest Seed Partnership Coming to the Gila / Melanie Gisler</i></u>	15
<u><i>Gila Region Sustainable Agriculture: The Next Steps in Research and Development / Richard Felger, Adrienne Booth, Gabriel Feldman, Xavier Khera, Tsama Pineda, Chelsea Ritchen, Sam Schramski</i></u>	15
<u><i>Storm Water Runoff in Downtown Silver City, New Mexico / Raven Jackson</i></u>	16
<u><i>A Cameo of Two Springs / Amber Caldewell and Joneen Cockman</i></u>	16
<u><i>Sands Draw Grassland Restoration Part II: Sediment Traps (Youth Outdoor Education) / Joneen Cockman</i></u>	17
<u><i>Grazing Permit Retirement in the Greater Gila Bioregion / Madeleine Carey</i></u>	17

<u>Environmental DNA: Monitoring Tool for Aquatic Species / Yvette Paroz</u>	17
<u>Gila Trout: Five Years since the Whitewater-Baldy Fire / Jill Wick, Dustin Myers, and Andy Dean</u>	18
<u>Spatial Variability in Stream Temperatures in Black Canyon: Implications for Stream Restoration and Gila Trout Recovery / John Moeny</u>	18
<u>Soil Type and Native Soil Inoculum Level Impacts on Chihuahua Scurfpea Germination Success and Growth / Heather White, Nicholas Havelock, and Kristin E. Haskins</u>	18
<u>Converging Interests in Conservation and Angling to Engage Citizen Science Support for Restoration of Native Gila Trout / Jeff Arterburn, James Brooks, Chris Canavan, Tyler Wallin, Colleen Caldwell, and Jennifer Frey</u>	19
<u>At-Risk Species Management and How the Coarse/Fine Filter Is Applied in the Gila National Forest Plan / Rene Guaderrama</u>	19
<u>An Overview of Forest Plan Revision on the Gila National Forest / Matt Schultz</u>	20
<u>Forest Planning in the Face of Change and Uncertainty / Nessa Natharius</u>	20
<u>An Overview of Select Birds of the Middle Gila Valley of New Mexico / Roland Shook</u>	20
<u>Raw Material Selection and Obsidian Procurement and Use at a Salado Site in the Upper Gila / Stacy L. Ryan, M. Steven Shackley, and Allen Denoyer</u>	21
<u>Natural History of the Wild Turkey in the Greater Gila Region / Scott P. Lerich</u>	21
<u>New Mexico's Gila River Basin Apportionment Made by Arizona v. California and Water Use Pursuant to State-Adjudicated Water Rights—Facts and Myths / Norm Gaume</u>	22
<u>Historical Availability of Gila River AWSA Water Legally Available for Diversion and Simulated AWSA Water Project Yield—Proposed New Mexico Unit of the Central Arizona Project / Peter Coha and Norm Gaume</u>	22
<u>Describing Over a Decade of Changing Habitat at the Iron Bridge / Martha S. Cooper</u>	22
<u>The Gila Wilderness: Defining, Redefining, and Managing Our First Wilderness Area and Its Cultural Resources / Wendy Sutton</u>	23
<u>History of the Gila River Basin Native Fish Conservation Program / William Stewart</u>	23
<u>Shake a Tail Feather: Investigating Turkey Remains at the Elk Ridge / Courtney E. Causey, Barbara Roth, and Darrell Creel</u>	23
<u>Mimbres River Habitat Restoration / Bryan Ferguson</u>	24
<u>The Relationships between the Gila National Forest and the General Public: Results from Public Meeting Input / Chris Armatas, Dr. Bill Borrie, Dr. Alan Watson</u>	24
<u>Gila Trout for the Future / Nathan Wiese</u>	24
<u>Native Fish in the Classroom: Using Gila Trout to Engage Youth / Angela Palacios James</u>	25

<u>Pecan Branches Win: Exploring Tillage and Mulch Treatments in Native Grassland Seeding for Southeastern Arizona / Joneen Cockman</u>	25
<u>Wilderness Management: Why and How / Eric Flood</u>	26
<u>Home Is Where the Hearth Is: The Pithouse to Pueblo Transition at the Elk Ridge Site / Danielle Romero, Barbara Roth, and Darrell Creel</u>	26
<u>Mimbres Exploitation of Native Copper within the Gila National Forest / Christopher D. Adams</u>	26
<u>A Natural and Unnatural History of Faunal Change in Southwestern New Mexico since AD 500 / Karen Gust Schollmeyer and S. O. MacDonald</u>	27
<u>Environmental Civilization / A.T. and Lucinda Cole</u>	27
<u>Not Quite Coalesced: Salado Settlements in the Upper Gila / Leslie Aragon</u>	27
<u>Monitoring Seeding Effectiveness as a Post-Fire Emergency Stabilization Treatment in Southwestern New Mexico for the 2014 Signal Fire / Nori Koehler</u>	28
<u>Public Lands: The Threats and the Opportunities / Jason Amaro</u>	28
<i><u>CREATIVE VOICES SESSION</u></i>	29
<u>To a Mimbres Woman, by Marty Eberhardt</u>	29
<u>A Stone in Our Pocket, by Sharman Apt Russell</u>	30
<u>Fragile Freedom: a Gila River poem, by Beate Sigriddaughter</u>	33
<u>Sand Hour Sand, by Leonore Hildebrandt</u>	36
<u>Gila New Year 2016, linked Haiku by Sylvia Ramos Cruz</u>	38
<u>Renaissance, Haibun for Anita Scott Coleman (1890-1960) by Sylvia Ramos Cruz</u>	39
<u>Javelina, by Karin Bradberry</u>	41
<u>Gila Fragments, by Robert Froese</u>	42

PROCEEDINGS OF THE SEVENTH
**Natural History
of the Gila
Symposium**

February 22-23, 2018

Western New Mexico University

Silver City, New Mexico

INTRODUCTION

by Roland Shook

The beginnings of the Natural History of the Gila Symposium date back to 2005. At that time the Gila Conservation and Education Center in Silver City, NM, formulated a plan to encourage the dissemination of knowledge focusing on the Gila River and the surrounding regions. Out of these discussions was born the first Natural History of the Gila Symposium in October 2006, held at Western New Mexico University. Owing to the success of the first symposium, additional symposia were conducted in 2008, 2010, 2012, 2014, 2016, and 2018. The eighth Natural History of the Gila Symposium is scheduled for February 2020.

Some of the earliest reports on the flora and fauna of the southwest are found in the 1848 chronicle of W.H. Emory entitled “Notes of a Military Reconnaissance from Fort Leavenworth to San Diego.” Emory joined General Kearny and the Army of the West to journey from Bent’s Fort in southern Colorado, to the Rio Grande in New Mexico. He followed the Rio Grande south then crossed New Mexico to the Gila River, and then followed the Gila to its junction with the Colorado River in Arizona. During this expedition Emory made careful notes on both the fauna and flora of the area.

Another source of historical information concerning the flora, fauna and culture of the regions around Silver City was authored by Daniel Ellis Conner entitled “Joseph Reddeford Walker and the Arizona Adventure.” Walker was an early explorer and mountain man and in 1861 Daniel Ellis Conner joined the Walker party to explore New Mexico and Arizona over a four-year period. These volumes are a prelude to the scientific work that has been presented at the Gila Symposia over the past several years.

As stated on the Symposium’s website (<http://gilasymposium.org>), “The Natural History of the Gila Symposium’s mission is to provide a venue for researchers, land managers, conservationists, and educators to meet and share information and ideas gathered from the Gila Region including watersheds and neighboring areas extending into southwestern New Mexico, southeastern Arizona and Mexico.”

If you read the introductions and papers in the preceding symposia, a common theme that is apparent is one of diversity. Diversity in subject matter presented, the scope of presentations, and the background of presenters. This diversity reflects, over a period of years, the presenters and organizers meeting the mission of the Symposium as originally stated.

I would encourage you to carefully peruse the articles in this seventh symposium, as well as, the previous six. Your reward will be an increased knowledge of this vast and fascinating area of the Gila River and surrounding regions.

If you have affection for this region of southwestern New Mexico, southeastern Arizona and northern Mexico, and want to influence future decisions, the Natural History of the Gila Symposium is a venue to present information that can mold these decisions. The best decisions are based upon the best information, and valuable data can be collected by a wide range of individuals from professional scientists, to citizen scientists to outdoor enthusiasts. Now is the time to get involved.

----Roland Shook, on behalf of Steering Committee Members: Wen-chi Chen (WNMU), Joneen (Jony) Cockman (BLM), Dustin Myers (USFS), Dave Menzie (NMENV), Corrie Neighbors (WNMU), William (Bill) Norris (WNMU), Theodore (Ted) Presler (WILL), Roland Shook (WNMU), Heather Steinmann (WNMU), Wendy Sutton (USFS), and Kathy Whiteman (WNMU).

Keynote Address: Natural History of the Gila Symposium

February 22, 2018

Garrett VeneKlasen

Executive Director, New Mexico Wildlife Federation

Conservation icon Aldo Leopold made the protection of this landscape a reality. He was ahead of his time in recognizing what was at stake in the Gila. One of the nation's last wild places - even in 1924 - Leopold saw the future. He knew that without action precious landscapes could be lost - he was the person to act. But Aldo, like Theodore Roosevelt and John Muir, knew he didn't have all the answers. In developing his philosophy and land ethic, Aldo noted that it was the end result of a life journey and not something easily explained. He recognized that the real story involved both man and nature, each shaping, protecting, and preserving the other.

Man's impact on the Gila landscape is clear. The cliff dwellings speak to our ancient presence. Less clear is the forest's impact on man, but that is a human shortcoming. Again, Leopold knew, "to those devoid of imagination a blank place [like the Gila] on the map is a useless waste; to others [it is] the most valuable part" Aldo was hinting at the way places change us both physically and spiritually. A feeling I'm sure many of us still grapple with today.

The plants and wildlife of the forest and rivers sustain each other in a great web of being. The grasses feed the elk and deer which in turn feed the bear, cougar, and wolf - which replenish the soil to start the cycle again. When mankind enters into this cycle we are at first shaped by it - we feed on the deer, trout and even the plants. The forest sustains us - makes us strong. But in our strength and often in our folly we sometimes begin to misshape the forest. We sometimes cultivate only the best plants, harvest the largest elk, and eliminate the competition from other predators. But again, this is a human shortcoming.

The destruction of the great grizzly bear and the Mexican grey wolves that once prowled this landscape was a mistake. We broke the web's being, changed the way the forest works, altered the life of an ecosystem and offered no apology. We were wrong. A healthy wild place needs its keystones. Today we're trying to right that historical wrong, but the forces of fear are strong. Wolves, cougars, jaguars and bears - these are not animals to fear, they are animals worthy of our respect. They play a critical role in the web of being. They must be restored to the landscape to make it, and us, whole again. We must once again begin to Think Like a Mountain.

These wild places also shape our souls. To paraphrase Leopold, the two dangers in not having places like the Gila are 1: thinking food comes from the store and 2: that heat comes from a furnace. It is in these wild places where man learns who he really is - has time to contemplate - to reflect - and to evaluate his place in the world. When modern life becomes too much our wild places revive us, they invigorate us, center us, humble us, connect us to a universal reality, and make our lives that much more meaningful. I have never seen the Arctic National Wildlife Refuge, but my soul is nourished that the place the native Gwich'in People know as "the place where life begins" exists. Perhaps that is the best way to think of our wild places - they are the places where life begins. That's why these places need protection.

The protection that we give our wild places needs to be balanced - a protection that preserves both the natural landscape and our access to it. The system of American public lands is just

such a protection. The heritage of all Americans is tied into these public lands. In response to England punishing those who hunted the King's woods and shot the king's deer, our forefathers created this system of public lands for all to use. America was not and remains no place for kings. The tyranny of a landed gentry or single ruler do not void the public rights. On our public lands we are free to fish, camp, hike, meditate, hunt, mountain bike, ride horses, watch & photograph wildlife and ultimately seek and find our true selves in these woods and upon these lands. These wild places are unique in the world--they make us American. But unless we protect our birthright we unfaithful stewards and the few will trample the rights of the many.

We see the spectre of the loss of rights in the recent events involving the family of Cliven Bundy. From Bunker Hill, Nevada to the Malheur National Wildlife Refuge in Oregon, the Bundy family and their corporate backers have proven themselves willing to use force to protect the rights of the few over those of the many. Calling themselves "patriots" these purveyors of fear and intimidation undermine the nation they profess to love. In the name of "the people" these thugs force people from their jobs, desecrate sacred Native American sites, hold our lands hostage and demand things of the very government they've chosen to assault. There's a word for people like that. We use it freely when talking about other parts of the world. These people are terrorists - domestic terrorists who seek to take away our rights through fear and intimidation. As if a gun and a distorted reading of the U.S. Constitution makes them the protector of our lands.

The Bundys, and folks like them, are trying to recover a mythic West; one that never really existed anywhere but in the American imagination. They have gone silent, for now. Like any good pirate they know when to attack and when to lay low. They also know that their time in front of the justice system only serves to increase their reputation, especially as they continue to beat the charges. But make no mistake, the Bundys will be back, and their band of robbers will be larger and more sophisticated next time around. And next time they plan an assault on our public lands, I will personally be there to peacefully but forcefully protest their charade. When that day comes I hope many of you here today will stand by my side.

But the real issue isn't the Bundys and their attempts to take from the American people what is rightfully ours; what has been enshrined in our history and law as public domain. The Bundys say they want to turn these lands back over to the American people. They aren't being honest - they want to turn the land over the special interests who simply want to exploit that which belongs to us all. And now, there are folks in Washington DC who are actively supporting the Bundys.

The folks who hailed the Bundys as patriots, and heroes when that group of angry men - armed to the teeth, and looking for a fight - took over the Malheur National Wildlife Refuge, are now in charge of the federal government. Those same people are now putting together plans that have the potential to transfer millions of acres to the states and ultimately private interests.

It's easy to forget now, but when the Bundy's rolled into Malheur and threatened an entire town, DC Republicans were oddly silent. The common story was that the Bundy's had legitimate grievances; that they may have even had good reason for doing what they were doing. This line of reasoning, prevalent among the American media, allowed the Bundys to cast themselves as peaceful protesters engaged in civil disobedience - no different than American heroes who stood up to the government in the past. It goes without saying but Ammon Bundy is not Martin Luther King.

The Bundys wrapped themselves in the flag and the constitution and said they were doing God's work on behalf of the American people. But they don't really want ALL of the American people to have a share of these national lands. They want greedy opportunists, like the granddaddy of this movement Cliven Bundy, to get access to more public land and its natural resources without having to pay for it.

Because special interests are angling for our public lands and exploiting OUR vast wealth of natural resources we must be vigilant. We all know the value of these places, we know what they provide us and the nation. We must stand up for the American people in the face of those who seek to take what's ours. That's exactly what I did when I went to Burns, Oregon and confronted these thugs face to face. As much as we protect our wild places, our wild places protect us.

For centuries, these forests protected us - we had no idea. These lands, the Gila among them, are the birthplace of our clean air and clean water. The natural life cycle of the forest provides us with the basis of life. The trees clean the air, the mountains produce the headwaters, the wetlands clean the water. Without these lands and precious natural resources, where would we be?

We now find ourselves in a time where even these basics are under attack. The Trump Administration has declared war on clean air, water, healthy landscapes and our precious threatened and endangered wildlife. We doubt the truth of the science, we chafe at the benefit of regulation, we take clean air and water for granted. This line of thinking is dangerous, it sees only economic benefits from the land. Again, Aldo was ahead of us when he said, "We abuse the land because we regard it as a commodity belonging to us. When we see land as a community to which we belong, we may begin to use it with love and respect."

Perhaps no quote better sums up why we are here. We all love this land. We all respect this land. We want our children to grow old WITH this land. Like Leopold, I don't have all of the answers, but I'm more likely to find them here than on the bottom line of a balance sheet.

The protection and preservation of our environment, native cultures and traditional land use values is a moral duty. It was handed down to us and we must hand it down to the next generation. In protecting the land we protect ourselves. These land nourish us just as we nourish the land.

We have a duty not only to our children but to the wildlife of the land, air, and water. We have a duty to the trees, the plants, and the grasses. Ladies and gentlemen we have a duty to the Earth. We are part of the earth and the part that we must play is that of the protector of the great web of being. Aldo was right when he said we must think ourselves as part of land. I am here today because I'm part of the land. I am here today to encourage you to think of yourself that way.

There are two ways to live: on the earth and with the earth. When we live on the earth we devalue and demean. When we live with the earth we value and preserve. We cannot rely anymore on government action. Today we take action and demand changes. Today we demand action. Together we can change the way we see this landscape, this river,

And so together we must tirelessly fight to protect the integrity of the magnificent Gila River - one of the last free flowing rivers in the West. We must stand up for the protection and restoration of iconic native wildlife like the Mexican grey wolf, the Gila trout and Chiricahua

leopard frog just to name a few. We must fight for our children's right to clean air and water. We as individuals (and as a united community) must peacefully confront the greedy opportunists - both individuals, domestic terrorists, corporate interests and the elected officials that foster their agenda. And we must acknowledge the reality of human-caused climate change and its catastrophic impacts on our future. We must demand that our federal and state elected officials pass legislation that protects land, water and wildlife integrity - that ambitiously ramps up renewable energy production and drastically reduces carbon emissions.

We are in a paradigm shifting moment in the history of not only this nation but of this planet.

I, like all of you in this room today, am a creature whose being is forged by my lifelong connection to - and experiences in - wild places. The wild world is my teacher, my church, my therapist, my soul food, a steadfast companion and priceless connection to a universal reality in an increasingly contrived world.

To paraphrase Walton, the wild world was my father's salvation. It is my salvation. It is my daughter's salvation and will be the salvation of her children's children."



Garrett VeneKlasen, Executive Director-New Mexico Wildlife Federation

Garrett was born and raised in Santa Fe, New Mexico and spent his childhood hunting, fishing, camping, and exploring with his father throughout the mountains, grasslands, deserts, and wetlands of New Mexico, Colorado, and Arizona. Before becoming the Executive Director of the New Mexico Wildlife Federation, he was the SW Director of Trout Unlimited's Sportsmen's Conservation Project as well as Trout Unlimited's New Mexico Public Lands Coordinator. Garrett also founded the New Mexico Chapter of Backcountry Hunters & Anglers. Garrett is a prolific outdoor writer and photographer and at one time hosted his own outdoor television show on ESPN ("Fly Fishing America"). His writing and photography have been published in Field & Stream, Men's Journal, Gray's Sporting Journal, Fly Fisherman, High Country News, The Angling Report, and Orvis News.

A former fishing and big-game hunting outfitter and guide in both New Mexico, Colorado, and abroad, he also owned and operated an outdoor travel agency for 22 years (InterAngler, LLC) that sent clients hunting and fishing around the world (specializing in trips throughout Central and South America). Following a year abroad in Spain through Syracuse University, Garrett received a bachelor's degree from the University of New Mexico with a major in Latin American Studies and a minor in Spanish & Portuguese languages. He is fluent in both languages.

LIFETIME ACHIEVEMENT AWARD: JAMES “JIM” E BROOKS



James "Jim" Brooks was born and raised in Morenci Arizona, and attended college at the University of Arizona. Jim began his professional career with the Arizona Game and Fish Department as a wildlife manager in the Blue River area, his childhood stomping grounds. Jim became the first urban fish program manager for AZGF as well as the only native fish biologist. Jim moved on to the U.S. Fish and Wildlife Service in New Mexico where he became the Supervisor at Dexter New Mexico. He transitioned to Project Leader of the NM Fish and Wildlife Conservation Office leader (which has had several acronyms FWCO, FRO, FAO and a short lived stint as Fisheries Assistance Group), where he settled in and lead recovery efforts for Threatened and Endangered fish throughout the state of NM for over 25 years, eventually retiring in that position.

Jim's 30+ years of conservation work and influence has helped to protect and restore rare, threatened and endangered fishes that inhabit the arid and often unforgiving southwest landscape. Conserving fishes in the southwest presents many challenges and obstacles, both natural and manmade, which Jim always tackled with passion and enthusiasm. Throughout his career he has been an integral part of the native fish programs on the Pecos, San Juan, Middle Rio Grande, and especially the Gila and the Gila Trout and Chihuahua Chub Recovery Team. Each of these programs has been highly contentious at one time or another, but Jim has always maintained his strong advocacy for doing the right thing for the species. Jim has had a stake in broader efforts as well including the development of the National Fish

Habitat Action Plan, the Western Native Trout Initiative, exploring native trout habitats in Mexico, and the development and instruction of the standard operating procedures required for the application of fish removal piscicides.

He has worked positively and productively with folks from all corners of the conservation world, including academics (individuals such as Minckley, Deacon, Hubbs, Mayden, and Turner), NGOs (such as The Nature Conservancy and Trout Unlimited), state agencies (such as AZ Game and Fish Department, New Mexico Game and Fish Department, Texas Parks and Wildlife, and Utah Division of Wildlife Resources), other federal agencies (like the Bureau of Reclamation, Forest Service, Corps of Engineers, and the National Park Service), and private industry (such as Marsh and Associates, American Southwest Ichthyological Researchers, and Biowest). Jim has also co-authored many publications on southwest fishes and their conservation.

Jim has devoted a huge part of his career towards improving the status of native fish and has logged many hours on the trails of the Gila Wilderness taking Gila trout from the brink of extinction to a more stable status. When the largest wildfire in New Mexico's history ravaged the Gila Wilderness in 2012, Jim was on the ground with evacuation crews packing in on mules beyond active fire lines, collecting irreplaceable Gila trout populations and flying them out to safety. Many people think it is ludicrous to risk your life for a fish, but when you ask Jim what he is doing, he always responds the same way, "Living the dream!" Even in retirement Jim continues to "Live the Dream," working tirelessly and devoting his time to the conservation and recovery of Gila trout and other southwestern species, working intimately with Trout Unlimited and State and Federal agencies.



CITIZEN SCIENTIST AWARD: RUSSELL KLEINMAN



Russ Kleinman practiced General Surgery for nearly 30 years driven by the sincere desire to help people in need. He endeavored to further the art of medicine by teaching surgical residents and medical students. After retiring from his surgical practice in Silver City, Russ became interested in botany. Since 2010, he has taught Plant Taxonomy at WNMU, hoping again to pass along his enthusiasm for science to his students. Russ developed the gilaflora.com website as a teaching aid for his students and a resource for the community. Russ is grateful to his wife Karen, and to his family, friends and teachers who have enabled him to achieve a degree of success. He continues to pursue his botanical studies with passion and hopes to excite many more students to careers in the natural sciences.

FRIEND OF THE GILA AWARD: JACKIE BLURTON

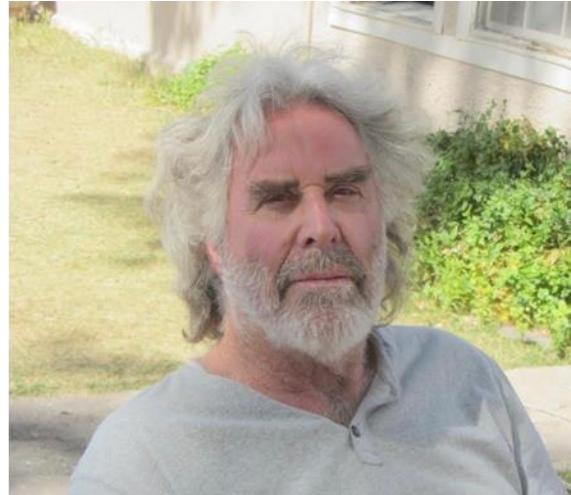


Jackie Blurton is an avid hiker and bicyclist. She received a Commercial Art degree from Wichita State University and worked as a graphic artist in Phoenix, AZ until she and her husband moved to Silver City in 1993 and purchased the Silver City KOA in Arenas Valley. She put her experience to work creating easy-to-print back-roads, bicycling, birding, and hiking guides for their visitors. The guides are available at the Chamber of Commerce and Murray Ryan Visitor Center. She was on the Silver City/Grant County Chamber of Commerce Tourism Committee and the Grant County Lodgers Tax Committee where she contributed articles, photos, and maps for tourism publications. For nine years she drew pen and ink illustrations of local flora and fauna for the weekly Silver City Daily Press article, "From Our Place to yours" in collaboration with Roland Shook and WNMU.

The Blurtons sold their business in 2013 and Jackie now participates on the Southwest New Mexico Audubon Society Board where she creates conservation activity booklets to give to children on Earth Day. "I try encouraging people to get out and enjoy nature and find their place in it. I would like them to feel at home and free to explore up a trail or stream, listen to the wind

in the pines or desert brush and realize that their connection with nature is a necessary part of their life. I want people to care what happens to our natural world and its communities of life."

CONSERVATION AWARD: A.T. AND LUCINDA COLE



The Cole's were married in 1972 and lived in Casa Grande, Arizona for 32 years before moving to the Pitchfork Ranch in 2004. Lucinda taught elementary school and operated her own health food store; A.T. practiced law, served on the Casa Grande City Council and Chaired the Arizona Humanities Council, Casa Grande Town Hall Board of Governors, Casa Grande Friends of the Arts and Pinal County Bar Association.

Retired from the classroom and courtroom, Lucinda and A.T. have been restoring the reach of the Burro Ciénaga and surrounding habitat on the ranch, introducing "at-risk" species in an effort to return the land toward its pre-settlement condition.

LIFETIME ACHIEVEMENT AWARD: RANDY JENNINGS



Randy D. Jennings was born 22 November 1954 to Anne M. and Clarence F. (Hickory) Jennings in San Antonio, Texas. There is some debate whether it was Randy who convinced his parents to leave Texas or the Air Force that was responsible for the move to Virginia, three weeks later. During the next 17 years the family continued to move throughout the southeastern United States with additional tours of duty in England and Germany. From the first through the twelfth grades Randy attended eight different schools. Throughout this time camping and fishing were favorite past-times.

Randy obtained a Bachelor's of Science in Zoology in 1977. Undergraduate mentors were Roy McDairmid, herpetologist, and Glenn Wolfenden, ornithologist. Shortly after graduation he worked at the American Museum of Natural History affiliated Archbold Biological Station outside Lake Placid, Florida where he worked on herpetologically oriented projects. In 1978 Randy took a position with the Florida Park Service at Hillsborough River State Park where he conducted among other things guided natural history walks and was a living-history interpreter of the Second Seminole War. In 1980 Randy moved to New Orleans and began working for the US Fish and Wildlife Service (through Tulane University) conducting aerial surveys for marine birds,

turtles, and mammals in near- and off-shore waters of the Gulf of Mexico and adjacent Atlantic Ocean.

In 1982 Randy moved to Albuquerque, New Mexico to pursue a Master's of Science degree at the University of New Mexico. Randy worked on biochemical and morphological variation in the Desert Tortoise, *Gopherus agassizii*, throughout its range in the Southwest United States and Mexico with advisors Tom Fritts and Jim Findley. In 1986 Randy continued at University of New Mexico pursuing a PhD on adaptive morphological plasticity of tadpoles of the Chiricahua Leopard Frog, *Rana chiricahuensis*, with advisors Howard Snell and Norman Scott, Jr. Randy's first trip to the Gila, where he eventually conducted studies for his dissertation, was in 1984 with a Herpetology Class from UNM. From 1987 through 1989 he traveled to five sites in the Gila Country on a bimonthly basis for his dissertation research. He completed that degree in 1991 and became the Curator of Herpetology at the Barrick Museum of Natural History at the University of Nevada, Las Vegas that same year.

In 1993 Randy moved to Silver City and replaced the retiring Bruce Hayward at Western New Mexico University as an Assistant Professor of Zoology. Since arriving at WNMU Randy has worked on long-term projects focused on Chiricahua Leopard Frogs, Gila Monsters, and Narrow-headed Gartersnakes. In 2005 Randy received the George Miksch Sutton Award in Conservation Research from the Southwestern Association of Naturalists. In 2016 Randy received the First Annual Charlie Painter Memorial Award for Excellence in Herpetological Mentorship from Southwest Partners in Amphibian and Reptile Conservation. During 25 years Randy has had the pleasure to work with the talented faculty of WNMU, many dedicated biologists and resource managers of the US Forest Service, US Fish and Wildlife Service, Bureau of Land Management, New Mexico State Parks, New Mexico Department of Game and Fish, and Arizona Department of Game and Fish. Randy is indebted to all these wonderful colleagues, far too many to list all of them, for enriching the time he has spent at WNMU and southwestern New Mexico.

EDUCATION AWARD: DAVE MENZIE



Dave Menzie grew up in Albuquerque and received his Bachelor's Degree in Geology from the University of New Mexico after discovering a fondness for geology field trips. Dave worked as a geologist for the NM Bureau of Mines & Mineral Resources at NM Institute of Mining and Technology, the USGS, and then at the White Sands Test Facility. In 1996, the New Mexico Environment Department - Surface Water Quality Bureau opened an office in Silver City. After seeing a small ad in the Albuquerque Journal, Dave applied and was later hired as a Mining and Geological Engineering Specialist. Dave became a storehouse of information from local mining and geology to water quality and changing trends in watershed management. Dave engaged many stakeholders in the area over the years with his knowledge, wit, and diplomacy. Education always has been a key part of his mission with numerous hours devoted at local symposiums, children's water festivals, monitoring projects with volunteers, and riparian restoration projects with Youth Conservation Corps. Dave always made time available for the intern in need of a project, the following up on an information request, or the site visit for a member of the public with a concern. Dave retired in 2014 from the Surface Water Quality Bureau after 18 years of service working for environmental health in southwestern New Mexico. While Dave has hung up his waders for a set of golf clubs, he continues to volunteer with groups such as the Silver City Watershed Keepers and guiding field trips exploring local geology. Ever the professional geologist, he still usually keeps at least one rock in his pocket.

SESSION ABSTRACTS

The Costs of Being Cool: Panting Thresholds, Thermal Limits, and Evaporative Cooling in Southwestern Lizard Communities / Caleb Loughran

In the American Southwest, environmental temperatures often exceed what is physiologically tenable for many reptilian species. When faced with extreme environmental temperatures, lizards must either retreat to thermal refugia or attempt to lower body temperature (Tb) through evaporative processes such as panting. To better understand the role of panting in body temperature defense against extreme environmental temperatures, we measured thermoregulatory performance for a variety of lizard species native to the Southwest. We used flow-through respirometry to measure standard metabolic rate (SMR) and evaporative water loss (EWL) at air temperatures (Ta) that ranged from 35°C to 50°C, while simultaneously monitoring Tb. We found SMR and EWL increased steeply following the onset of panting, with the ability to maintain a gradient between Ta and Tb strongly associated with EWL rate. Species inhabiting hot desert environments had higher panting thresholds, were much more efficient at dissipating heat, and tolerated higher Ta's and Tb's for longer periods than species adapted to more mesic environments. Identifying the onset of panting and the capacity for heat defense and its relationship to critical thermal limits should provide valuable insight into how climate warming may impact lizard activity and hence water and energy budgets under future climates.

Conservation Efforts for the Chiricahua Leopard Frog in Southwestern New Mexico / Randy D. Jennings, Bruce L. Christman, and Michelle R. Christman

Populations of Chiricahua leopard frog experienced declines and extinction from the 1970s through 1990s. The species was listed as threatened under the Endangered Species Act in 2002. By 2007 biologists and conservationists representing federal and state agencies, conservation organizations, universities, and private landowners produced the “Chiricahua Leopard Frog (*Rana chiricahuensis*) Recovery Plan.” Recovery criteria have guided conservation.

In southwestern New Mexico, amphibian chytrid fungus (Bd) was identified as a leading cause of decline and extinction. Propagules from extant populations were introduced into protected, man-made habitats (i.e., backyard ponds, stock tanks, and Ladder Ranch Ranarium) that

served as back-ups for wild populations. Subsequently, propagules from captive populations were translocated to augment source populations in the wild, to suitable natural habitats or to sites that previously supported frog populations. Frogs at Moreno Springs and Alamosa Warm Springs exhibited resistance to Bd, and were used in wild-to-wild translocations. Most translocations involved larvae (> GS 30). Success varied.

Molecular genetics of existing Chiricahua leopard frog populations in Arizona, New Mexico, and Mexico were initiated in 2008 and augmented in 2013. Results inform conservation strategies. Through these efforts, distinct genetic lineages have been preserved, while different populations sharing a genetic lineage have been combined to enhance genetic variability.

Trophic Discrimination Factors and Tissue Turnover Time in the Red Swamp Crayfish (*Procambarus clarkii*): A Controlled Feeding Experiment / Gregor Hamilton, Shane Benally, Seth Newsome, and Thomas Turner

Stable isotopes can be a powerful tool in discerning food web interactions. Trophic discrimination factors (TDFs) and tissue turnover time are important determinations before food web interactions can be understood, especially in omnivores. This study aimed to identify the TDFs and tissue turnover times of walking legs (non-diagnostic character) in an invasive omnivorous species to the Rio Grande, the Red Swamp crayfish (*Procambarus clarkii*). A controlled feeding experiment was performed, which consisted of two treatment groups fed diets differing in % protein content (high vs. low) and isotope values. Preliminary results indicate that walking legs contain on average 1:3 chitin:protein ratio. The high protein treatment had a faster estimated tissue turnover time (36.5 days) than the low protein treatment (57 days). The high % protein treatment showed a significantly lower mean TDF (2.3‰) compared to the low % protein treatment (0.4‰). Higher dietary protein quality was most likely the driving factor, rather than % protein of diet, in explaining the lower TDF of the high protein treatment. Future work can utilize results from this study to assess aquatic food web interactions in areas of the Gila River drainages with invasive crayfish populations.

The Southwest Seed Partnership Coming to the Gila / Melanie Gisler

In the Southwest, growing concern over erodible bare ground has led to an increased demand for habitat restoration and native seeds. Currently, commercially available sources of native seed are often cultivars (which tend to have lower genetic diversity) and/or originate from outside the ecoregions where seed is being planted (which increases the potential they will be maladapted to project sites). In 2015, the Southwest Seed Partnership (SWSP) was formed to address this need. The SWSP is a collaborative effort between federal agencies, non-governmental organizations, land managers, and farmers to improve the supply and diversity of native seed for New Mexico and Arizona and to advocate for a new industry standard. The 2015 National Seed Strategy offers a framework for implementation of this program. Activities include prioritizing native species for development, collecting and tracking seed, working with farmers to grow genetically diverse and locally sourced seed, and conducting research to improve restoration success. To date, our work has been focused in central and northern NM and AZ, but recent funding from the Forest Service Region 3 will allow the SWSP to expand to the Gila

National Forest in 2018, and also supports collaboration with native seed stakeholders in the Gila area.

Gila Region Sustainable Agriculture: The Next Steps in Research and Development /
Richard Felger, Adrienne Booth, Gabriel Feldman, Xavier Khera, Tsama Pineda,
Chelsea Ritchen, Sam Schramski

Our recent research and experiences demonstrate that big sacaton (*Sporobolus wrightii*), Apache redgrass (*Zuloagaea [Panicum] bulbosa*), and other Gila Region native perennial food plants are ideal candidates for water- and energy-conserving agriculture. The research group has carried out a series of experiments, living and otherwise, within the last decade. Conditions have ranged from field studies to cultivation and initial farming. Social research has been conducted as well, from a survey of potential farmers to group interviews and taste tests. *Z. bulbosa* and *S. wrightii* are particularly suitable given their nutritional content, culinary pliability, and ease of cultivation. Our presentation will focus on details of the additional research and development needed to bring these native food crops into commercial local and widespread agriculture. The topics discussed will include yields, sampling, storage, growing, harvesting, ethnobotany, education, and marketing. We will highlight our ongoing efforts and point out opportunities for additional collaborations in the Gila Region, from academic to nonprofit to small business sectors.

Storm Water Runoff in Downtown Silver City, New Mexico / Raven Jackson

Downtown Silver City has longstanding problems with storm water runoff, especially during intense monsoon storms that occur each summer. Storm water is one of the leading causes of surface water pollution that may eventually impact groundwater quality. This project, funded through the New Mexico AMP Undergraduate Research Scholars Program, has two immediate goals: (1) determining the degree of surface runoff during high-intensity storms based on percent of impervious surfaces and slope, and (2) measuring to what extent the storm water is impacting local surface water quality. ArcGIS will be used to analyze aerial imagery and elevation of the study area, which encompasses an area of downtown Silver City bounded to the north by Highway 180 and to the east by Highway 90, to calculate percent of impervious surfaces and slope. Rain data will be collected via a tipping rain gauge. Soil infiltration rate will be determined by using infiltration rings. This information will be plugged into a known equation for computing surface runoff. Soil and water samples from the same area will be collected both before and after monsoon season and will be sent off for lab analysis to see if the soil composition changes after exposure to monsoon runoff.

A Cameo of Two Springs / Amber Caldewell and Joneen Cockman

Springs inventory was conducted in the Gila Box Riparian National Conservation Area during summer 2017 in association with the Living Rivers program, which provides intensive riparian habitat assessment. The location of this spring system is of significant interest because it is

adjacent to the Morenci mine and the springs are in virtually pristine condition. A complex of rheocrene springs and hanging gardens, the drainage corridor appears to be a pathway to the upland for bears and bighorn sheep. A SEAP (Springs Environmental Assessment Protocol) evaluation concluded that the springs are in virtually pristine condition except for an absence of snails, reptiles, and amphibians. This presentation provides an overview of the springs and describes factors that work to keep the springs in good condition. This paper is being presented by one of the college students in the STEM Partnership facilitated by Eastern Arizona College and AZ BLM Safford.

Sands Draw Grassland Restoration Part II: Sediment Traps (Youth Outdoor Education) / Joneen Cockman

The Bureau of Land Management Safford Field Office manages a large area of highly eroded land in the San Simon Valley of southeastern Arizona. These fragile areas of deep sandy loams and silty soils parallel the course of the San Simon River. The heart of the San Simon Valley in Arizona north of Interstate 10 occupies an area of about 253 square miles. The author estimates that at least 25–50% of this area is in highly eroded condition. This land was once characterized by highly productive grasslands. Today vast open areas of completely denuded land are marked by gullies and deep arroyos. Piping and gullying is common and during heavy rainfall events sheet erosion can be dramatic. Some of these areas are saline. Surface water flow that is not caught by catchments flows into the Gila River.

The Sands Draw grassland seeding project was officially initiated in April 2013 when grass seed plots were installed to examine two tillage methods and three mulch applications. In 2015 sediment traps were added within each treatment. The latter was funded by the BLM Science program to study methods of reducing non-point source pollution associated with salinity and surface water flow.

Grazing Permit Retirement in the Greater Gila Bioregion / Madeleine Carey

Livestock grazing is, by far, the most ubiquitous use of public lands in the Greater Gila Bioregion. Livestock graze on nearly 90% of the public lands in the region and have an enormous impact on native species, water use, large carnivores, fire ecology, and aquatic ecosystems in the Greater Gila Bioregion. For the past 10 years, WildEarth Guardians has been pursuing grazing permit retirement in the Greater Gila Bioregion. Compensating federal grazing permittees to end their grazing on public lands is ecologically essential, economically rational, fiscally prudent, socially just, and politically pragmatic. It is an equitable way to overcome long-standing challenges between domestic livestock grazing and environmental protection, recreation, and other uses of public lands. This presentation will discuss the logistics, impacts, and reasons to use grazing permit retirement as a conservation and land management tool.

Environmental DNA: Monitoring Tool for Aquatic Species / Yvette Paroz

There are many streams that have records of spinedace or loach minnow and that either have not been thoroughly sampled recently or, even with thorough sampling with traditional methods, have failed to detect either spinedace or loach minnow. Further verification of presence/absence and a better understanding of distribution of these two species will help inform the priority for management actions. Species-specific eDNA markers were developed for spinedace and loach minnow by the USFS in 2016. Initial field testing of the markers in various-size streams indicates that these markers are sensitive enough to pick up low densities of these species in small- and medium-size streams. With the addition of this tool, multiple rapid sampling could be accomplished to significantly increase the understanding of and confidence in the current distribution of these species throughout the range. In addition, analysis for other native and nonnative species or diseases could be run concurrently, depending on the availability of markers for these species.

Gila Trout: Five Years since the Whitewater-Baldy Fire / Jill Wick, Dustin Myers, and Andy Dean

The 2012 Whitewater-Baldy Fire burned through a large portion of the current range of Gila trout and eliminated six of the 18 Gila trout populations that existed at the time of the fire. The following year the Silver Fire eliminated two more. Since the fires, management agencies have been successful in re-establishing Gila trout in three of those streams as well as three additional streams, constructed a fish barrier on Willow Creek, and begun a restoration project in Whitewater Creek. Due to these efforts, the status of Gila trout has rebounded to nearly what it was prior to the fire.

Spatial Variability in Stream Temperatures in Black Canyon: Implications for Stream Restoration and Gila Trout Recovery / John Moen

Black Canyon Creek is a Gila trout recovery stream on the west side of the Black Range mountains. Currently the creek is considered to be impaired by the New Mexico Environment Department due to stream temperatures that exceed the 23°C threshold. This presentation details a new stream temperature data-collection technique to record real-time, spatially explicit stream temperatures. The goals of the study were to better understand where Gila trout find cold-water refugia during periods of high temperatures. We found that the stream temperature varied from 19.3 to 27.8°C in a three-mile stretch during a single afternoon in July 2017. Our findings show that there are areas of Black Canyon that are likely uninhabitable to Gila trout during the warmest months of the year. The results also suggest that stream restoration strategies should focus on areas where cold water zones may be extended by riparian planting or geomorphic alteration to increase the total stream miles of suitable habitat during periods of high temperature. Similarly, stream restoration aim to improve trout habitat should avoid areas where stream temperatures cannot be expected to cool enough to provide suitable habitat during the warmest months of the year.

Soil Type and Native Soil Inoculum Level Impacts on Chihuahua Scurfpea Germination Success and Growth / Heather White, Nicholas Havelock, and Kristin E. Haskins

Chihuahua scurfpea (*Pediomelum pentaphyllum*) is a rare regional endemic that has been petitioned for federal listing and is a BLM sensitive species. Found only in Arizona and New Mexico, this drought-adapted, tuber-forming legume is vulnerable to range management treatments. We initiated a greenhouse experiment in October 2017 to examine propagation methods and soil microbe utilization. The experiment was a modified 2 x 2 factorial design, with soil type and native soil inoculum level as factors (n = 10). Seeds were wild-collected, cold treated then stored dry, and seed coats were scarified prior to planting. Soil types included: (1) standard greenhouse potting soil (Sunshine 4 Aggregate Plus), and (2) sterile sand (treated with a steam sterilizer). Native soil inoculum was collected from six sites (three Scurfpea-inhabited soils and three non-inhabited soils). Native soil inoculum was added at (1) zero addition (controls for sterile sand and potting soil), (2) 2 Tbs. per pot, and (3) 25% of the pot volume. Seeds were planted at a depth of 0.5 cm in 4" pots, and placed on a mist bench. Trays of pots were rotated on a weekly basis. Preliminary results indicate strong treatment differences. These data will be important for informing future management decisions.

Converging Interests in Conservation and Angling to Engage Citizen Science Support for Restoration of Native Gila Trout / Jeff Arterburn, James Brooks, Chris Canavan, Tyler Wallin, Colleen Caldwell, and Jennifer Frey

Willow Creek, tributary to the upper Middle Fork Gila River, was heavily impacted in 2012 by the Whitewater-Baldy Wildfire. Stream habitats were severely degraded by post-wildfire flooding and the resident fish community was suppressed. A cooperative multi-agency effort was initiated in 2013 to restore threatened Gila trout in Willow Creek, with goals of establishing a Gila trout population, improving stream habitat, and providing recreational angling opportunities. As part of this effort, a "citizen science" project to assess and monitor stream habitat conditions was initiated in 2016–2017 involving a local chapter of the non-profit conservation organization Trout Unlimited. Rapid assessment protocols with user-friendly data sheets were developed and on-stream training provided for volunteers. One objective of this work was to develop a user-friendly monitoring program that could be conducted by non-scientists, with the ultimate goal of providing federal and state management agencies with the empirical basis for use in habitat restoration projects, for use in both Willow Creek and other wildfire-impacted streams. This effort demonstrates the potential benefits of engaging communities and angling groups for watershed conservation projects, including access to federal and private funding sources.

At-Risk Species Management and How the Coarse/Fine Filter Is Applied in the Gila National Forest Plan / Rene Guaderrama

Through Forest Plan revision, plan components developed for ecosystem integrity and diversity are expected to provide for ecological conditions currently necessary, while also providing ecological conditions resilient to future changes to maintain the persistence of native and at-risk species within the plan area. At-risk species are federally recognized threatened, endangered, proposed, and candidate species, and species of conservation concern. Ideally, ecological conditions being managed for the Gila NF would move conditions toward those created under ecological processes and landscape disturbance regimes that occurred before extensive human alteration. Developing plan components for these conditions would be considered the "coarse

filter approach.” Managing for ecological conditions that occurred historically should provide conditions necessary for the majority of not only at-risk species that occur within the plan area, but all other native species that evolved in those conditions. However, when the evaluation reveals that these coarse filter plan components do not provide the particular ecological conditions necessary for one or more at-risk species, then additional species-specific plan components will be developed (i.e., fine filter approach). Using the coarse and fine filter approaches should ensure that the ecological conditions necessary to maintain persistence of native species are present within the plan area.

An Overview of Forest Plan Revision on the Gila National Forest / Matt Schultz

The Gila National Forest is currently revising its existing Forest Plan from 1986, which will describe the strategic direction for management of forest resources for the next 15 years. These plans are not site specific, but provide broad, overarching guidance for all management activities conducted on the Forest. Plan revision involves three distinct phases: (1) assessment of the ecological, social, and economic conditions and trends; (2) development of a revised plan; and (3) implementation and monitoring of the final approved plan. The Gila National Forest is in the middle stage of plan revision, where we will be collaboratively developing a draft proposed plan, a draft range of alternatives, and a draft environmental impact statement (EIS). Once finalized, all subsequent proposals, projects, and activities must be consistent with the approved Forest Plan. Monitoring is designed to provide feedback on plan implementation, and the plan is adaptive and amendable as conditions change over time. A variety of communication methods will be available to the public to provide input/feedback, collaborate, and stay informed about the status of the process. The Forest will continue to strive for a planning process that is inclusive, collaborative, and science based, to promote a healthy, resilient, and productive Gila National Forest.

Forest Planning in the Face of Change and Uncertainty / Nessa Natharius

Change and uncertainty are not new to land management, or to most aspects of the human experience. However, a sizeable body of science suggests that extent, magnitude, and rate of climatic change that we are likely facing may prove to be unprecedented. What this means for the Gila National Forest remains to be seen. Land management agencies and staff have very little influence over temperature and precipitation patterns, which are the primary factors governing ecosystems and species. However, management actions and inactions taken over the next few decades may influence the trajectory of the forest’s natural resources over the long term. Ultimately, the revised Gila National Forest Plan provides the framework for those management actions and inactions. This presentation provides a brief discussion of progress made to date by the Forest’s interdisciplinary team, including major themes influencing plan content for terrestrial, riparian, and aquatic ecosystems; watersheds; wildland fire and fuels management; and application of stakeholder input.

An Overview of Select Birds of the Middle Gila Valley of New Mexico / Roland Shook

The Middle Gila Valley of New Mexico (aka Cliff-Gila Valley) is known throughout the state for its rich bird diversity, with 327 species reported from the Valley and 239 species known specifically from the Gila Bird Area. The Valley is characterized by a mixture of lands predominantly owned or managed by the US Forest Service, The Nature Conservancy, and the U-Bar Ranch. Research has revealed that the Middle Gila Valley supports one of the largest populations of the federally endangered Southwest Willow Flycatcher in New Mexico, the largest population of the federally threatened Yellow-billed Cuckoo in the West, and the largest population of the state threatened Common Black Hawk in North America. This presentation will briefly discuss the methods used to obtain these results, the biology of these three species, the relationships between ranching and avian populations, and conservation implications.

Raw Material Selection and Obsidian Procurement and Use at a Salado Site in the Upper Gila / Stacy L. Ryan, M. Steven Shackley, and Allen Denoyer

Excavations conducted by the Upper Gila Preservation Archaeology Field School at the Dinwiddie site (LA 106003) provided the opportunity to analyze a large lithic assemblage from a 14th-century settlement in the Cliff-Gila Valley, New Mexico. Analysis focused on understanding the choices people made in selecting raw materials to meet their stone tool needs, and identifying how these choices compare on a site and regional level. Dinwiddie is located approximately 30 km from the extensive Mule Creek obsidian source, where at least four distinct source localities have been geochemically characterized through X-ray fluorescence spectrometry (XRF). Slightly over half of the bifaces and projectile points from Dinwiddie are obsidian, and source provenance of more than 350 artifacts shows an even distribution of material from the Antelope Creek and Mule Mountains localities, an unusual pattern for the region. Locally available chalcedony is also well represented in the tool assemblage, and some of this material may have been collected from the nearby Duck Creek drainage. This poster summarizes how the availability, location, and quality of these stone tool materials may have influenced the procurement and reduction strategies of the Dinwiddie residents, and the differences in obsidian acquisition patterns identified through XRF analysis.

Natural History of the Wild Turkey in the Greater Gila Region / Scott P. Lerich

Two subspecies of Wild Turkey (*Meleagris gallopavo*) occur in the greater Gila Region, the Merriam's Wild Turkey (*M. g. merriami*) and the Gould's Wild Turkey (*M. g. mexicana*). Merriam's Wild Turkeys are considered native to the southwestern United States, while Gould's Wild Turkeys are primarily a Mexican subspecies, reaching their northern range limit in the Sky Islands of southwestern New Mexico and southeastern Arizona. Origins of the Merriam's Wild Turkeys are complex and uncertain. Some propose that wild populations were established following semi-domestication by early Native pueblos, while others propose alternative sources of origin. Gould's Wild Turkeys, while common in the Sierra Madre, were nearly extirpated from the United States in the early 1900s. Recent restoration activities have reestablished populations in southeastern Arizona and supplemented the extant New Mexico population. I will discuss the uncertain history of Merriam's Wild Turkeys in the Southwest and specifically their presence in the greater Gila Region, as well as current status of the Gould's Wild Turkey in the United States.

New Mexico's Gila River Basin Apportionment Made by Arizona v. California and Water Use Pursuant to State-Adjudicated Water Rights—Facts and Myths / Norm Gaume

This paper presents a history of diversions, consumptive use, irrigated acreage, and irrigation water shortfalls that New Mexico has reported pursuant to the US Supreme Court's 1964 decree in *Arizona v. California*. The New Mexico Office of the State Engineer and the Interstate Stream Commission have paid for measurements, compiled data, and prepared annual reports at substantial public expense, but without any public release. This paper contains the first public summary of this information, which ISC made available to the author pursuant to decree requirements that records be maintained for inspection. In 1964, New Mexico was apportioned specific amounts of water for nine geographic areas comprised in the Gila River Basin. By 1968, New Mexico had adjudicated all Gila River Basin water rights and initiated annual decree compliance data collection and reporting. This paper explains New Mexico's decree apportionments to the nine areas of the Gila and San Francisco Basins in New Mexico, presents the history of water diversions, consumptive use, and irrigated acreage compared to the decree limits and water rights limits. It demonstrates that some popular stories of the decree and its impacts are the opposite of what the state's official data and other authoritative accounts show.

Historical Availability of Gila River AWSA Water Legally Available for Diversion and Simulated AWSA Water Project Yield—Proposed New Mexico Unit of the Central Arizona Project / Peter Coha and Norm Gaume

AECOM, a consulting engineering firm, simulated the water yield of alternative conceptual configurations of the NM Unit of the Central Arizona Project in fulfilment of its \$111,000 NM Interstate Stream Commission contract task. The NM Unit concept selected subsequently by the NM CAP Entity is considerably different from the modeled alternatives. AECOM's October 2017 report presented graphs of the availability since 1937 of water legally available for diversion pursuant to the Arizona Water Settlements Act (AWSA) and identified years with no available diversions. The authors have reviewed and operated the AECOM spreadsheet models. This paper presents their findings. First, AECOM's increased simulated diversion water availability, decreased number of years without diversions, and increased winter days with extremely low flows downstream from the NM Unit are due to simulated NM Unit diversions not available under the ISC's previous 150 cfs minimum Gila River flow criterion, which the NM CAP Entity and the ISC have silently abandoned. Second, the yield of usable AWSA water is very low due to the proposed NM Unit configuration's low volume of reservoir storage. AECOM's report explained neither of these facts that are directly pertinent to the viability of the selected concept.

Describing Over a Decade of Changing Habitat at the Iron Bridge / Martha S. Cooper

The Gila River's highly variable flow regime shapes and sustains riparian and aquatic habitat. The Iron Bridge Conservation Area, one tract of The Nature Conservancy's Gila River Preserve, was acquired in 2006 with the NM Department of Game and Fish. During the past 10 years, three additional contiguous properties have expanded this part of the Preserve to over 200 acres. Over the course of the last 12 years, the predominantly native vegetation has rebounded from decades of year-round grazing, showing dramatic increases in canopy cover. Data from long-term monitoring of groundwater dynamics, fishes, and birds will be shared, demonstrating the conservation values of this site in supporting the high biodiversity characteristic of the Cliff-Gila Valley.

The Gila Wilderness: Defining, Redefining, and Managing Our First Wilderness Area and Its Cultural Resources / Wendy Sutton

In 1924 the Gila Wilderness was established. Ideas of what wilderness is have changed since then, particularly with the passage of the Wilderness Act in 1964. On the Gila National Forest these changes are reflected in changing wilderness boundaries and management strategies. Wilderness boundaries were redrawn to exclude man-made features, some constructed by the CCC after designation. Historic and prehistoric sites associated with the wilderness (both within and immediately outside of it) and their management through time are physical manifestations of the national dialogue about what wilderness means to us. This poster will also discuss what we know about the archaeological resources within wilderness on the Gila National Forest and reasons why that knowledge is limited.

History of the Gila River Basin Native Fish Conservation Program / William Stewart

The Bureau of Reclamation's Gila River Basin Native Fishes Conservation Program was developed to partially mitigate impacts of the CAP canal on threatened and endangered native fishes of the Gila River Basin. The program focuses efforts on five primary conservation measures: (1) construction and operation of barriers to prevent the spread of nonnative fishes from the CAP to native fish habitats, (2) long-term monitoring of native and nonnative fish in the canal and surrounding areas, (3) recovery of native fishes through hatchery propagation and repatriation into the wild, (4) managing nonnatives and research to support that management, and (5) informing and educating the public about nonnative fishes. The conservation measures were established to help protect populations of several protected fish species, including spikedace, loach minnow, Gila topminnow, razorback sucker, and Gila chub. This presentation will provide an overview of the program's 23-year history.

Shake a Tail Feather: Investigating Turkey Remains at the Elk Ridge / Courtney E. Causey, Barbara Roth, and Darrell Creel

The function of animals in prehistory has been debated, whether they were used solely for subsistence or for a larger purpose. During the 1990s excavations at the Elk Ridge Ruin, a large Classic Period (AD 1000–AD 1500) pueblo in the Mimbres River Valley, the remains of five turkeys were recovered from Room 84. Recent excavations conducted by the University of Nevada–Las Vegas in conjunction with the Gila National Forest recovered the remains of seven

additional turkeys. Many of these specimens were found articulated and processing appears minimal. Cranial elements were also missing from many of the remains. Minimal processing may be indicative of a use unrelated to subsistence, such as the raising of turkeys in order to harvest their feathers as trade commodities. This poster uses the remains and contexts of these specimens to discuss the significance of turkeys to the site of Elk Ridge and possibly the larger Mimbres Valley.

Mimbres River Habitat Restoration / Bryan Ferguson

Historical changes in land and water use in the Mimbres Valley have reduced aquatic habitat diversity, resulting in limited habitat for native fish like the Chihuahua chub. In 2013 the Silver Fire burned the upper Mimbres watershed and subsequent flooding further impacted habitat in the river. However, post-fire flooding also appears to have eliminated nonnative predators from the Mimbres River system. In response to the recent habitat degradation, the Department of Game and Fish completed habitat restoration work on Department and The Nature Conservancy/New Mexico Energy, Minerals and Natural Resources Department property over the past two years. Habitat work was designed to benefit several Species of Greatest Conservation Need within the Mimbres River, including Chihuahua chub, Rio Grande sucker, and Chiricahua leopard frog. Improvements included installing rock and woody materials in the channel and floodplain, creating additional off-channel refugia and depressional wetlands, and realigning the channel to increase sinuosity. Early surveys show a potential increase in Chihuahua chub and Chiricahua leopard frog numbers. Habitat structures and fish populations will continue to be monitored over time.

The Relationships between the Gila National Forest and the General Public: Results from Public Meeting Input / Chris Armatas, Dr. Bill Borrie, Dr. Alan Watson

During the week of June 12, 2017, public meetings regarding the Forest Plan revision on the Gila National Forest were conducted. As part of that process, public input was gathered regarding the importance of benefits (e.g., livestock grazing, air quality, non-motorized recreation) derived from the forest, as well as the factors or influences (e.g., invasive species, conditions of roads and trails) most relevant to the provision of such benefits. This presentation details the results of a statistical analysis of input provided by 122 members of the public. Four typified relationships (archetypes) emerged regarding the importance of ecosystem services and the factors influential to their continued provision. The archetypes were dubbed the “environmental archetype,” “utilitarian archetype,” “water archetype,” and “motorized archetype.” In addition to a detailed description of each archetype, a discussion of the factors or influences that were found to be associated with each typified relationship is provided. For example, the water archetype considered unmanaged grazing and extended drought to be particularly concerning, while the motorized archetype was concerned with the roads and trails on the Gila National Forest in terms of their number, conditions, and access. Lastly, potential benefits for the purposes of forest planning on the Gila National Forest are discussed.

Gila Trout for the Future / Nathan Wiese

The Mora National Fish Hatchery has been rearing and releasing Gila trout for recovery since 2002. During that time, Gila trout were downlisted from endangered to threatened (2006). The hatchery employs numerous innovative techniques to ensure the survivability, genetic diversity, and health of Gila trout reared on-site. Since the program inception, the Mora National Fish Hatchery has released over 191,000 Gila trout back into the wild. Currently, the hatchery maintains five lineages of Gila trout: Iron Creek, Spruce Creek, Whiskey Creek, Main Diamond, and South Diamond lineages. Currently, four of the five lineages have successful captive broodstock populations founded from wild populations. Each broodstock individual is genetically selected to ensure diversity and inclusion of rare alleles. Wild broodstock are incorporated into the captive broodlines at least every three years to ensure hatchery-born fish match successful Gila trout from the wild. Recent infrastructure changes at the hatchery have improved Gila trout survival by 250%, providing eggs and fish for additional recovery efforts. These improvements will ensure that Gila trout are available when habitat is secured and wildfire restoration is needed.

Native Fish in the Classroom: Using Gila Trout to Engage Youth / Angela Palacios James

In 2011, the USFWS New Mexico Fish and Wildlife Conservation Office initiated the Native Fish in the Classroom (NFIC) program. The program goal has been to generate enthusiasm for natural resources and foster stewardship for native fish and their habitat, the Rio Grande. The NFIC program works with elementary schools by providing standards-based curriculum, aquariums, native fish, and technical support. By raising fish in the classroom, biologists hope to engage and connect students to real-life water quality, fish, and wildlife issues, while inspiring them to seek solutions. The culmination of the program is the end-of-year fish release. Biologists hope that students, by releasing fish that they have cared for into their local river, will be motivated to care for the river itself. Through partnerships with the US Forest Service and New Mexico Department of Game and Fish, the NFIC program expanded to the Gila River system utilizing threatened Gila trout. Gila trout fingerlings were introduced into two elementary schools (San Lorenzo and Jose Barrios Elementary) for the first time in January 2017. In May 2017, students released 29 Gila trout fingerlings and assisted with a scheduled stocking of 1,344 Gila trout into Lake Roberts and Sapillo Creek.

Pecan Branches Win: Exploring Tillage and Mulch Treatments in Native Grassland Seeding for Southeastern Arizona / Joneen Cockman

The Sands Draw Wildlife Exclosure Habitat Restoration–Grassland Seeding Project was officially initiated in April 2013 with the collection of pre-treatment baseline data. This project is one of several conducted by Arizona Bureau of Land Management (BLM) Safford Field Office in partnership with Eastern Arizona College (EAC). These partners joined through a Financial Assistance Agreement (FA) in 2012 to provide outdoor biology experiences and internships for college interns. College, high school, and middle school students participated in this project from 2013 through 2017, assisting in installation of research plots and collection of data. The native grass seed project was funded by National Environmental Education Foundation (NEEF), National Fish and Wildlife Foundation (NFWF), and BLM science funds for salinity and

non-point source pollution. The research examines two tillage methods (imprinting versus drilling) and three mulch applications (gravel, pecan branches, and gravel/pecan branch mix). The paper discusses the results of the research to date and the role of the students in this project.

Wilderness Management: Why and How / Eric Flood

Each individual's personal concept of what makes a place a wilderness is a subjective one, and it varies greatly according to individual life experiences and perceptions. In the context of what we are discussing here, the term Wilderness refers to federal public lands that have been designated by Congress through passage of law. These types of protected areas were originally established by the Wilderness Act of 1964, through which Congress provided a legal definition of designated Wilderness and direction on how it is to be managed by the federal land management agencies, including the Gila National Forest. This presentation is a brief introduction to how federal land agencies manage wilderness, and the reasons why.

Home Is Where the Hearth Is: The Pithouse to Pueblo Transition at the Elk Ridge Site / Danielle Romero, Barbara Roth, and Darrell Creel

The transition from pithouses to pueblo rooms in the Mimbres Valley was long thought to have been a rapid shift. Using archaeological evidence from excavations at NAN Ranch, Harry Shafer posited that transitional pithouse structures existed in the Mimbres Valley during the late Three Circle phase (ca AD 900s) and that this architectural change would have been a multi-generational process. During the 2017 season at Elk Ridge, a Classic Period (AD 1000–1130) pueblo located on the Gila National Forest, a transitional pithouse was discovered beneath an Early Classic pueblo room that had later been turned into a ramada surface. The south and east walls of the pithouse were reused as the walls of the pueblo room, indicative of a connection between the two households. This poster examines the architecture and artifacts recovered from the pithouse and pueblo room in order to provide information on chronology, household activities, and abandonment activities leading to the pueblo construction.

Mimbres Exploitation of Native Copper within the Gila National Forest / Christopher D. Adams

The discovery of a native copper nugget at a prehistoric Mimbres site within the Gila National Forest initiated an archaeological investigation for copper artifacts at other Mimbres sites. This preliminary investigation involved looking at a number of Mimbres sites within the Gila National Forest using the latest in metal-sensing technology and documenting the geographic distribution of native and/or worked copper artifacts. This is the first formal archaeological investigation that has looked for evidence that the prehistoric Mimbres people were exploiting the native copper between AD 950 and AD 1130. This presentation will present the results of the discovery of

native copper nuggets, worked copper nuggets, copper fetishes, copper pendants, and more importantly, copper bells. The copper artifacts were found at both Mimbres pithouses and Classic Mimbres pueblo sites in southwestern New Mexico.

A Natural and Unnatural History of Faunal Change in Southwestern New Mexico since AD 500 / Karen Gust Schollmeyer and S. O. MacDonald

An important intersection between archaeology and the study of natural history lies in understanding the long-term processes of human-environment interaction that affected local biotas in the past and have shaped contemporary landscapes. This study integrates information from archaeological faunal assemblages and historic and modern data from the major watersheds of southwestern New Mexico—specifically, the upper Gila-San Francisco and Mimbres drainages—to examine changes in the status and distributions of animals and their environments over the past 1,500 years of human occupation. Using this approach we seek to clarify the roles played in this region's contemporary faunas and landscapes by the presence and activities of pre-Hispanic farmers, the subsequent effects of Europeans and their livestock, and concurrent climatic factors. Contributing a clearer understanding of changes to local faunas and their environments over long periods of time can assist contemporary restoration efforts by providing more realistic benchmarks for emulating prior states of land health.

Environmental Civilization / A.T. and Lucinda Cole

We have damaged the planet critically, and because of this destruction we live in the most important moment in human history. Yet personally, what can we do about it? When humankind finally settled down after eons as hunters and gatherers, we began to farm, settling into what became known as agricultural civilizations. Several thousand years later we discovered coal, triggering the Industrial Revolution, and an industrial civilization followed, burning fossil fuels so aggressively that the planet has become dangerously overheated. We are in the midst of the sixth mass extinction of species, killing life at one thousand times normal rates. What now? Why not an environmental civilization? And why not climate gardens and habitat restoration as a means of personally lessening the legacy load of 410 parts per million of CO₂ now?

Not Quite Coalesced: Salado Settlements in the Upper Gila / Leslie Aragon

Most 14th-century Salado settlements in the Upper Gila watershed comprise separate room blocks in both planned and ad hoc configurations. These spatial arrangements suggest that integration, and by extension coalescence, was never fully achieved despite occupation spans of more than a century. This poster examines ceramic and other material culture variability among room blocks within four settlements to identify social and cultural differences that persisted until depopulation in the early 15th century. Of particular interest is evidence for the

co-residence of various immigrant and local groups who maintained deeply ingrained traditions while closely interacting with each other on a daily basis.

Monitoring Seeding Effectiveness as a Post-Fire Emergency Stabilization Treatment in Southwestern New Mexico for the 2014 Signal Fire / Nori Koehler

The Signal Fire started on May 11, 2014, and burned approximately 5,500 acres in the southern portion of the Gila National Forest. A Burned Area Emergency Response (BAER) team was assembled to assess post-fire conditions and resulting risk to human health and safety, property, cultural resources, and natural resources, including soil productivity and hydrologic function. Treatments were recommended where emergency conditions existed. A three-year effectiveness monitoring study was initiated to determine effects from post-fire aerial seeding on erosion rates and species diversity. Two monitoring plots, one seeded and one non-seeded, were established on similar sites just after the Signal Fire. Results indicate that aerial seeding in the Southwest can reduce post-fire erosion rates. Seeded annual grasses can become established the first year due to southwestern summer rainfall patterns on higher-elevation slopes. These annual grasses can provide effective cover both the first year as canopy cover and the second year as litter. This study found greater species richness in the natural recovery area. Conclusions from this monitoring indicate two different post-fire states: a more stable, less diverse state on seeded areas; and a less stable, more diverse state in areas of natural recovery following three years of monitoring.

Public Lands: The Threats and the Opportunities / Jason Amaro

The Gila National Forest is my personal ranch and you are welcome to recreate on it! Every citizen—left wing, right wing, Republican or Democrat—owns an equal share of 650 million acres of public lands. The West has recently been subject to the Sagebrush Rebellion 2.0. This campaign calls for the transfer of federal lands to state trust lands and then for the eventual sell-off of our lands. We will discuss how federal lands became federal lands and how state trust lands became state trust lands. We will also look through the binoculars of a sportsman at the differences between federal and state trust lands.

CREATIVE VOICES SESSION

To a Mimbres Woman, by Marty Eberhardt

I see your thousand-year-old thumb print
On the plain brown potsherd.
My own thumb fits perfectly
In the curve you left.
Other more elegant pottery bits
Lie among rocks and junipers
On this hill of dry grasses.
Red-on-white interwoven geometry,
A tasseled quail,
Designs fine as any
In the art galleries of the town.

But it is this plain brown piece that draws me.
My thumb seeks the curved place, again.
I see you forming the pot
From coils of clay,
You look out over fields of corn and beans
In the valley below.
Then, as now, a red-tailed hawk dips,
A horned lizard scurries under a stone
That forms the village wall.
Beyond the fields
Green cottonwoods mark the river
Between jagged hills.
The wind shakes their leaves like a gourd rattle.
In the quiet between gusts,
The river rushes below, monsoon-strong.

It is in these wild places,
Where our thumbs
Feel the curve of another's hand,
Places free from cement, neon, asphalt, smog,
And deadened water,

Across years,
Across cultures and countries,
Beyond all reason,
We find each other.

A Stone in Our Pocket, by Sharman Apt Russell

Wilderness burns. Nearly 300,000 acres of the Gila National Forest and Gila Wilderness burned in the 2012 Whitewater/Baldy Fire in southwestern New Mexico. Other wildernesses in the American West have burned in the recent past and more will burn in the future—ignited by dry winters and dry springs and a summer spark. I am turning in a circle. A dark circle of broken trees like ship masts. Or knives jabbing at the sky.

A white-nosed coati watches me watch him. Dark eyes, masked face, that long nose and thick beautiful red-gold coat with a banded tail. What a decorative animal. And confident, not going anywhere, sitting in the branches of a hackberry. Coatis travel in matriarchal troops, bossy moms and aunties and a dominant female leader, talking to each other—chittering, churring, barking. At some point, juvenile males are probably happy to leave this family group and happy again to return in the mating season. I suspect this coati is such a bachelor male, weighing some twenty pounds, making something in my chest bloom, an effervescent excitement—giddy and yearning at the same time. I always feel this way meeting a coati. For decades, coatis have been expanding their range, up from the tropics and through Mexico, establishing themselves in the Gila watershed. This is their home now. Mine, too, I tell the coati. I always talk to the coatis I meet. Hello, aren't you beautiful?

The burned spruce in the Gila Wilderness won't return, not for thousands of years. Instead, aspen are growing dog-hair thick, taller every day. Overnight, a ponderosa pine forest shifts to scrub brush like New Mexican locust and Gambel's oak. Wilderness burns. Wildness remains. As climate change sweeps like a broom across our deserts and forests, gathering river systems and spruce into a refuse pile, brushing up species like spotted owls and leopard frogs, as we see landscapes we love wither and char, wildness remains—in particular, the wildness honored, promised, protected, managed, betrayed, and adored in the American wilderness system.

Along the sandy banks of the Gila River, a Western red-bellied tiger beetle lifts on long legs—stilting—in order to get a fraction further from the hot ground. Tiger beetles have large protruding eyes and heavy mandibles that they scissor like a chef sharpening his knives. Spotting a spider or ant, they run after their prey, grab and stab and dismember, drench the victim in digestive juices, and suck up the puree with a straw-like mouthpart. Tiger beetle larvae are equally predacious. After hatching from tiny eggs, the tiny grubs dig a vertical tunnel with tiny sharp mandibles. Two hooks on their backs anchor them firmly inside their burrow, and from

this position they lunge out like B movie monsters, catching even smaller insects. Eventually the larvae pupate into adults. Thousands of Western red-bellied adult tiger beetles swarm this riverbank where I stand, their heads and thoraxes iridescent in the sun, their wing covers brown with six creamy dots. Each beetle is only a third of an inch long. I'm glad for that.

Where I live in southwestern New Mexico, environmentalists have spent years preventing a diversion on the Gila River, the Southwest's last free-flowing river. They keep in check the ambitions of the international mining company which owns the majority of water rights in the Gila Valley. At this moment, they are working to prevent Holloman Air Force Base from developing a new Military Operations Area above the Gila National Forest and Wilderness. They go to meetings with county commissioners and local agencies. They drive up to Santa Fe for meetings. They meet with each other. The environmentalists I know hardly have any time to spend in the Gila Wilderness, which remains what designated wilderness was meant to be: a place to visit only. A place to hold in your mind. A touchstone. A stone from the river.

If you live in or near the desert, you know thorns. It's not a hate/love relationship. You just really hate the way cat-claw acacia rakes your skin. You dislike the jab of a prickly-pear in your ankle. You rightly fear tumbling down a slope and jamming your knee into a cholla cactus.

Intellectually, you know that thorns protect a plant from being eaten by animals. The New Mexican locust has a pair of stiff, stout, curved thorns at the base of its leaves. Take that, cow. And deer. And Pleistocene camel. Large thickets of this locust burst out in the spring with fragrant masses of fleshy pink-to-purple blossoms, luxuriant clumps clearly in the pea family—and you think suddenly that you are in a garden, not the Gila Wilderness. You put some of this beauty in your backpack, remembering that the Mescalero Apache used to eat these flowers in stews or raw in a salad. In the coming years, you'll be seeing more plants like the New Mexican locust, with strong underground root systems that sprout soon after a forest fire. Likely, these plants will also have thorns.

As a nature writer, I've promised myself again and again not to bring up the hoary old figures of Henry David Thoreau and Ralph Waldo Emerson and John Muir. Enough with those guys. We need the voices of the 21st century now, not the 19th. Still, I can't help but mention here a common misquote. Thoreau didn't say, "In wilderness is the preservation of the world," as some people still think. He said, in wildness. In wildness is the preservation of the world. And now we ask ourselves in this rapidly changing world—what is the meaning of wild? What will preserve us?

The grasshopper mouse creeps from her burrow in the crepuscular evening or under the buttery moonlight or glitter of stars—hoping for a scorpion. Finding one, she rushes and pounces, front paws extended. The scorpion lashes. The mouse leaps up. The scorpion stings. The mouse tries to bite off that stinging tail. Lashing, biting, stinging, leaping. In picoseconds—trillionths of seconds—proteins in the mouse's nerve cells are binding with the scorpion venom and blocking the pain signal. More lashing, more biting, more stinging, more leaping.

After the struggle, or perhaps before, the mouse lifts up her head in the iconic pose of a wolf howling, and then she does howl, a high-pitched screech and celebratory exult: this is my

scorpion. She may also howl as a territorial warning: this is my land, and not just a pocket mouse kind of land, but as much as twenty-five acres: all mine. Sometimes a male will howl, too, as a love song, although love is edgy since partners sometimes kill each other. Every day is edgy for grasshopper mice, who range from Mexico to Canada, living in harsh arid places, getting all or most of their water from meat. This seems to be working well. The four-million-year-old fossil of a grasshopper mouse looks much like a grasshopper mouse today.

Wild landscapes seen and unseen. A Gambel's oak has a root system that goes ten feet down and weighs two hundred pounds. In the language of coatis, a churr means "sweetling." Nerve cells open to receive scorpion venom, and proteins enfold that chemical in unexpected embrace, all happening on a scale of time and matter that leaves us dizzy. Wild landscapes, everywhere, carried home, put in a salad. So we learn to live in this new world. So we carry the Gila Wilderness, a stone in our pocket. So we talk to ourselves and the animals and plants we meet: hello, aren't you beautiful?

Fragile Freedom: a Gila River poem, by Beate Sigriddaughter

Lizards tend to wander
into my poems, though not this winter
when the cool of morning bites
my ankles at the first astonished step
across the water.

Later I relax in the sun. Love
should never need to be defended.
I love you, slim river. It's that simple.

A cymbal-voiced bird calls
into the many layers of
your one thousand and one sounds
that move me with the unsurprising
yearning for freedom, for you,
and for me, to be as we are,
unchanneled and unchained
to the convenience
of those with extravagant agendas,
electronic billboards, military
overflights.

I look at your green mirror, your
white-whisper dance. You remind me
of everything in me
that doesn't want to be tamed.

Listen, you sing,
like a child's laughter. Just rush
into your destiny. This water
is not made with tears,
but with sturdy splutter of presence.
Sometimes a low sound, like a gong,
calls me home to juniper reality.
Other times a splash of bright

exuberance entralls.

Could be we will all in time
be redirected for the convenience
of those who want more
cities, money, gadgets, gear,
as we have been redirected
so many times before. I too
am guilty of wanting things
I could live without: sequins,
T-shirts, fireworks, and incense.

Your easy acceptance of how
things are moves me, and how to
adjust reality and chisel stone.

I feel more volatile. It is
my nature to spit and sputter
when forced to go against my soul.
I am still angry at my chains, even
as freedom is scarier than I thought
and I believe
we shouldn't have to live in fear.

There is a branch of deadwood,
partly submerged, reaching out,
an open claw of peace.

How patiently you carry life to all
in need, like that cymbal-voiced bird.

A great theme in my life
has been my huge thirst for freedom.
In my sweetest intonation, I know
all this is a gift, life, eyes, strength
to walk an hour to be with you here.

Do you know about death,
that ending that moves toward us?
Do you even need to know?
Or would you simply recommend
to trust all obstacles?

A while ago a butterfly flew by.

Another bird voice now, this one
a rasp, a rattle. Freedom has so many
voices to do what must be done.

I can hear your hymn of freedom
to be who we are, to sing
what we sing, to bend around
obstructions in patience, to look
for the easiest path which sometimes
is to carve a canyon over time.

Rocks keep raking your wild
water with exquisite melodies.
A duck swims by. My light hair
drifts with the mellow wind. Gray
leafless cottonwoods gather
as an escort for your current.
All things change, must move
from one now to the next.

I do take this world
personally. That is who I am
in juniper green, New Mexico blue
sky with cotton white clouds.
Yellow cholla fruit and mesquite
seeds all imitate blossoms
in the soft light of the winter sun.
Bare branches reach up high,
as star-petaled sycamore leaves,
brown on the ground, whisper
with the willow leaves
above the white hair of your
waterfalls.

My you keep frothing fearlessly.
May your way be loud and long.
Teach me your rhythm of knowing
when it is time to change,
to save the world, to celebrate,
to carve, if necessary, canyons.

Sand Hour Sand, by Leonore Hildebrandt

The desert times, foothills endure. We are hurried, having a little to lose. To gain? Near the Catholic church, the oldest graves are marked by circles of stone. A small plate: "Viola Bell, daughter of Chas. & Alpha Stephens." Born 1896, died 1899. Silver Cell Mine. Rich Gulch. At the camp, five miners burrow into the hill, move the crushed debris into barren mounts. Bird song rises into morning.

Spring. Cottonwoods cover their stems with stubby green. Petroglyphs face the sun—dragonfly's wing, scorpion's hook. Sheltered by its carapace, tortoise shuffles through sagebrush, always beyond our reach. At dusk, owl bulges its chest, calls out from a boulder. Its long black eyebrow-feathers ruffle in the wind. Bear Creek Trail, Twin Sister Mountain. On a grave marker we read, "Nothing survives except the rock—Geronimo."

Colonel Baylor orders Thomas Maston, "Kill them anyway you can—make them drunk, poison them, or shoot them on sight." Zeno's absurdity—Achilles can never outrun the tortoise—between them always appears a newer, smaller gap. At the arasta, a mule walks in circles, pulling a beam, grinding the gold-flecked stone. Listen to the ring of pick-axe and shovel. Miners, brides, infants—time washes, grain by grain, the letters on the headstones.

Junipers mist the air with pollen while Geronimo, kneeling with gun, poses for photos. The Mexican boy he abducted finds that horse meat "tastes good when hungry." A woman, lamenting her wild heart's forced silence, throws a little milk into the fire. Walnut Springs, Whiskey Creek. Add the small steps, follow the tortoise. It is mere play—space without time. A loose logic. An hour without bricks and mortar.

Gold speckles on the path, the sun's quick spark on rock. Tortoise creeps along the mind-space of the impossible. Rock wren, black-throated sparrow, Gambel's quail. After the passing of her oldest daughter, Teofila Gutierrez dies of grief. Adobe and wood. At seventeen, she married. "To this union there were born seven children, of whom six survive, none of them grown." The crunch of our boots carries far into the canyon.

Infinite pursuit—blaze a trail for the mule trains loaded with silver and gold. Build a saloon from tall pines, let women fall in and out of favor. "The merchants appear to be doing a fair business.

Tidwell & Skillcorn pay their workmen such proportions of their wages as they require in goods at their own store." Zeno challenges, and we concede. Horn silver feels soft to the teeth, a cake of pure beeswax.

Cherry Creek Road. Cross Mountain. Engines rumble the mine shaft. We hear the shouts of workmen at the arastras "giving impulse to their lagging steeds." On a log fallen across the path, hundreds of black ants throng the brittle wood, each busily on its way. Julia Light Menges walks pregnant across the Texas Panhandle, "faster than those old oxen." Sometimes when the caravan makes camp, she can look back and see where they stopped the night before.

Wooden pegs hold down the frame of the schoolhouse. Wild poppies and sage. The town sends "a posse of about forty, twenty mounted and twenty in wagons." We are busy, computing the infinite sum while tortoise—mere inches ahead—slowly pushes forward, placing each scaled leg. Indian ricegrass, black grama. Thomas Maston dies of his wounds—run your fingers over the headstone—"he led settlers in defense and repulsed 400 Apaches led by Cochise." A grand sky, cumulus gathering thunder.

Sand, loose rock, thorns—we have chosen a dangerous ascent. Wind gusts up the steep slope. Fine gravel snakes like a roadway in the river bed, flanked by pale green. Salt cedar, shrub live oak, coyote willow. Don Santiago Brito finds placer gold in a dry wash, "one of the most noted and richest deposits." Sculpted by water and blowing sand, cliffs drop to the canyon floor in one piece. Exposed to light, horn silver turns brown or purple.

The body at rest—listen to the rooster's tremble. Then we are in motion again, hustling on. Fourth of July festivities: "Free-for-all foot race, prize \$5.00." Brandy from peach and apricot. Mules haul lumber and firewood from steep mountains to the fort. We follow the ruts incised in stone, deep troughs worn into the volcanic cap. Contests play out in three dimensions plus time—Warm Springs Apaches, Buffalo Soldiers. A fine wind moves through the valley.

Note: "Sand Hour Sand" incorporates quotes from *In Pinos Altos, Once Upon a Time* by Jody Lyons-Cline, including archival material from *The Enterprise*, Silver City, NM.

Gila New Year 2016, linked Haiku by Sylvia Ramos Cruz

skirting white mountains
above ponderosa pines
in the clouds

mist rolls off edge
unveils precipice below
eyes on heaven

sharp slippery turn
deer, turkey, javelina
scamper two by two

plume of winter's breath
forest creatures stay warm
frozen in time

sun-singed snow melts
turns piñón to Waterford
ice sculpture

Palace Hotel
early 20th Century chic
not yet dead

man and woman wake
watch night merge into dawn
embrace new day

narrow canyon trail
beneath winter bone-blue sky

pine-scented silence

Ancient Puebloans
inhabit caves stained by smoke
time does not erase

Renaissance, Haibun for Anita Scott Coleman (1890-1960) by Sylvia Ramos Cruz

We drive past Kingston on NM152 in the rarified air of the Mimbres Mountains. Snake curves abound above precipices obscured in layered mist. Views stop time. Up, up, up we climb skirting silver-white mountains, above snow encased ponderosa pines, in the clouds. Climb until we see a sliver of Himalayan-blue heaven. Sun singes frigid air, crystallizes snow, forges forests into Waterford sculpture gardens.

The way down, equally breath-taking. Just before San Lorenzo, wild turkeys amble along the side of the road. Farther on, a leash of deer forage under snow-shrouded piñón and juniper. And, to our surprise, coming out of a sharp slippery turn, we scare a pair of baby javelinas. They slide and scamper up the snowy bank to safety.

The Santa Rita open-pit copper mine looms on the left. Quarter mile-deep iridescent green-gray gash in the breast of Mother Earth. Bleeding over 200 million pounds of cobre al año. At her canonization Saint Rita was named Patroness of Impossible Causes. (Is saving the environment una causa imposible?) Among Catholic laity, Santa Rita is also patron of abused wives and heartbroken women. (Is ridding the world of violence against women impossible?) What to make of those two, hopefully incongruous, titles? Anyway, what, exactly, does a santa patrona do?

Once in Silver City, we check into the Palace Hotel—turn of 20th century charming. Flowered wall paper, lace curtains, black and white hexagonal tiles in the bath, steam radiator clanks. Then, we go explore.

At the Visitor Center (corner of Broadway and Hudson—streets I knew well in New York) we find a Historic New Mexico Women road marker for Anita Scott Coleman. Her name and work new to me.

She was born in Guaymas, Sonora, Méjico—mother a freed slave, father a Buffalo Soldier. Grew up in a ranch near Silver City. Attended New Mexico Teacher's College. Writer of essays,

short stories, poetry. Part of the Harlem Renaissance, though never in New York. Her words celebrate black culture, honor black women's lives, inveigh against racial and social injustice, sing of the "Land of Esperanza"—the promise the southwest holds for "every man be he white or black."

Her loving and tender poems, "Black baby" and "Portraiture," inspire me. I tease two haiku from their words.

my black baby
his eyes like coals
like diamonds

black men are tall trees
standing after a fire
roots thrust deep

Night arrives crisp, starry, redolent of cedar smoke. Perfect end to a new year full of incident. Tomorrow, we'll hike Gila cliff dwellings in the sky.

Ancient Puebloans
tamed canyons, slept wrapped in clouds—
what were their dreams?

Glossary

cobre al año – copper per year

Harlem Renaissance – African American artistic movement in the 1920s that celebrated black life and culture.

javelinas – peccaries

piñón – type of pine

santa patrona – patroness saint

"The Land of Esperanza" – "The Land of Hope" (title of her essay on Arizona and New Mexico)

una causa imposible – an impossible cause

Javelina, by Karin Bradberry

We nestled under the willows
on a sunny December day
like a family of javelina.
Walking upriver, we'd inspected beaver dams.
Amazed by their industry, then sated by lunch,
we nestled under the willows.
We'd shuffled through the dusty leaves,
seeking a suitable spot to lie down
like a family of javelina.
Watching a crested kingfisher
on the banks of the Gila River,
we nestled under the willows.
Overcome by quiet warmth,
we fell into gentle snores
like a herd of javelina.
No boundaries between us,
three sisters, a mate and a son,
we nestled under the willows
like a family of javelina.

Gila Fragments, by Robert Froese

At some point he has finished sleeping. His eyes open to the half-light. There is a pause now against the shapeless day. The world at this instant might produce almost anything.

A ground dove, not far off, is sweetening the air with its call, again and again. Farther down the slope, another vies. Unhurriedly, back and forth, they keep this up. And then, in the distance, a third. Perhaps a fourth.

He lies as if limbless. There seems to be something---some residual ingredient of the night. Whatever it is may be hidden beyond the blue ripstop fabric he is zipped-up in. Through the triangle of bug netting inches from his face, he appraises the brightening sky. Then close by, a quick sound. A lizard outside skitters up the tent wall, its silhouette ascending then stopping, aligned with a seam.

Peeling open his blanket as though turning a page, he sits up. He dresses quickly, unzips the tent netting, pulls on and laces his boots, and steps out onto the gravel. There, outside the tent walls, the crunch of the ground fresh under his feet, he looks out over the valley. All around him, like some impenetrable species of forgetfulness, is the panorama he has been inhabiting for the past two weeks. On his left the wall of the mesa rises, luminous in the dawn, its base blackened by the cavity of the rockshelter. His eyes move inevitably east and then south, where the land plummets and rolls and crests and slides, descending ever away into desert. It feels oddly easier looking downhill than uphill. He tries to quiet his breathing, which seems at this moment too loud.

What is left of the night air, captured now by the day, is aromatic, almost damp. He cannot quite yet see the sun, but its early light seems to have tinged all the visible world with cinnamon. There is no breeze. Except for the continuing calls of the doves and the chirps and wing-flicks of cactus wrens and flycatchers in the brush, the entire landscape of scrawny, thorny vegetation is inanimate as stone. He glances back at the seam of his tent. The lizard is gone.

A gray lizard on a gray outcrop puffs its throat and does a series of quick push-ups in the sun. Everywhere one looks there is a lizard at dozy-eyed attention. They are the antennae of the desert.

Where does the heat come from? Not from the sun, it seems. Or anywhere else, for that matter. Rather it is more like the original condition from which everything here arises. Amidst all this essential inertness one survives by shallow breaths. Now and then, unexpectedly, some movement occurs. An insect and its quick shadow launch themselves in the wind, rattle and buzz, and then disappear. The moments come and go like still frames of always uncertain duration, bounded by what seem like lapses in memory.

Late in the day. On his way up the steps of the Winnebago---just behind Gary---he pauses, turns, and looks east out across the valley. As though, out there, something might be going on, as in fact something is. Against the broadly softening light of evening, a dark anvil of cloud has thrown a patch of the southern valley deep in shadow. Further north, an iron-grey ceiling truncates a section of the San Andres Mountains. Strewn across the broad sky, rain showers hang like pennants not quite reaching the ground. From here on the upper bajada, all of this is arrayed in perfect stillness, perfect silence. And despite these local machinations of clouds, the overall effect is sunny.