

7th Natural History of the Gila Symposium
Program
Schedule and Abstracts



February 22-24, 2018
Western New Mexico University
Silver City, New Mexico

Natural History of the Gila Symposium

Mission Statement

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.

Partners for this symposium include: United States Forest Service, Bureau of Land Management, Native Plant Society of New Mexico – Gila Chapter, New Mexico Environment Department and Western New Mexico University.

Gila National Forest Service funding allows everyone to attend the Natural History of the Gila Symposium **FREE OF CHARGE**.



7th Natural History of the Gila Symposium

Program at a Glance

Thursday 22 February

- Noon – 1:00 Registration in the foyer Global Resources Center
- 1:00 – 1:20 Welcome: WNMU President and USFS Representative
- 1:20 – 2:05 Keynote Speaker: Garrett VeneKlasen, Global Wildlife Adventures
- 2:15 – 5:30 Concurrent Sessions: Resource Management, Botany, and Zoology
- 5:30 – 7:00 Social (Sunset Room 2nd floor of WNMU Student Center)
- 7:00 – 8:30 Creative Voices (Miller Library Commons)

Friday 23 February

- 8:00 – 9:00 Awards Ceremony: Blurton, Coles, Kleinman, Brooks, and Jennings
- 9:00 – 9:45 Keynote Speaker: Esteban H. Muldavin, Natural Heritage New Mexico
- 10:00 – 11:35 Concurrent Sessions: Policy, and Education
- 11:40 – 1:00 Lunch on Your Own
- 1:00 – 4:30 Concurrent Sessions: Resource Management
Posters: Archaeology and Hydrology

Saturday 24 February

- 8:00 - noon Field Trips

Social: Thursday 22 at 5:30-7:00 PM

Sunset Room on the 2nd floor of the Thomas B. McDonald Memorial Building
(WNMU Student Center)

No charge – a \$5 donation is welcome. Pick up a “ticket” at the registration table.

Meet friends old and new. The WNMU catering will host a delicious assortment of tappas. Make this your dinner! A cash bar of beer and wine is also available. Follow up with Creative Voices right next door!

Creative Voices: Thursday 22 at 7:00-8:30 PM

Miller Library Commons (one floor up from the Social)

Local and regional authors will share their work.

Field Trips: Saturday 24 at 8:00 AM - Noon

Meet at the WNMU Fine Arts Center Parking Lot

Off-Campus Food and Entertainment

Check for maps in the foyer of the Global Resources Center.

WNMU Cafeteria, 2nd floor Student Memorial Building

Burgers, Brownies & Beer, Oh My!

Diane's Restaurant, Parlor or Bakery

Fry House

Jalisco Mexican Food

Mi Mexico Viejo

Nancy's Silver Café

Coffee and Tea: Javalina's, Tranquil Buzz, Jumping Cactus

Tapas Tree Grill

Two Brothers' BBQ

Vickie's Deli

Little Toad Creek Grill

Q's Southern Bistro

The Grinder Mill

2018 Planning Committee Members

Wen-chi Chen - Western New Mexico University

Joneen (Jony) Cockman – AZ BLM Safford

Dave Menzie – New Mexico Surface Water (retired)

Dustin Meyers – USFS Gila NF

Corrie Neighbors – Western New Mexico University

William (Bill) Norris – Western New Mexico University

Theodore (Ted) Presler – Retired, Silver City Thespian

Art Telles – USFS Gila NF

Roland Shook – Retired, Professor Emeritus WNMU

Heather Steinmann – Western New Mexico University

Wendy Sutton – USFS Gila NF

Kathy Whiteman – Western New Mexico University

Recognition of Student Presenters

Although not specifically stated in our mission statement, the mentoring and nurturing of the next generation of conservationists is very important to us. We welcome our student presenters and wish them the best of luck.

Amber Caldwell, Undergraduate Student, Eastern Arizona College, STEM Partnership Intern, Safford BLM

Gregor Hamilton, PhD Student, University of New Mexico

Nicholas Havelock, Student Intern, The Arboretum at Flagstaff

Raven Jackson, Student, Western New Mexico University

Xavier Kherra, Aldo Leopold High School, Silver City, NM

Caleb Loughran, PhD Student, University of New Mexico

Tyler Wallin, Graduate Student, Department of Fish, Wildlife and Conservation Ecology, New Mexico State University

Heather White, Student Intern, The Arboretum at Flagstaff

COMPLETE SCHEDULE

Thursday 22 February

	Theater at Global Resources Center	
1:00 - 1:10PM	Welcome from WNMU	
1:10 - 1:20	Comments from USFS	
1:20 - 2:05	Keynote Address: Garrett VeneKlasen, Global Wildlife Adventures	
	Break	
	Theater at Global Resources Center	Room A-B-C at Global Resources Center
Concurrent Sessions	Resource Management	Botany and Zoology
Moderators	Jony Cockman, Bill Norris	Ted Presler, Wendy Sutton
2:15 - 2:35 pm	Coha, Gaume - 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.	Loughran - The costs of being cool: panting thresholds, thermal limits, and evaporative cooling in a Southwestern lizard.
2:40 - 3:00 pm	Cooper - Describing over a decade of changing habitat at the Iron Bridge.	Hamilton, Benally, Newsome, Turner - Trophic discrimination factors and tissue turnover time in the Red Swamp Crayfish (<i>Procambarus clarkii</i>): a controlled feeding experiment.
3:05 - 3:25 pm	Paroz - Environmental DNA, monitoring tool for aquatic species.	Jennings, Christman, Christman - Conservation Efforts for the Chiricahua Leopard Frog in Southwestern New Mexico.

Thursday 22 February (continued)		
	Theater at Global Resources Center	Room A-B-C at Global Resources Center
3:30 - 3:50 pm	Koehler - Monitoring Seeding Effectiveness as a Post-Fire Emergency Stabilization Treatment in Southwestern New Mexico for the 2014 Signal Fire.	Lerich - Natural History of the Wild Turkey in the Greater Gila Region.
3:55 - 4:15 pm	Caldwell, Cockman - A cameo of two springs in the Gila Box Riparian National Conservation Area.	
Break		
4:30 - 4:50 pm	Cockman - Sands Draw Grassland Restoration Part I: Pecan banches win while exploring tillage and mulch treatments in native grassland seeding for southeastern Arizona.	Felger, Booth, Feldman, Khera, Pineda, Rittchen, Schramski - Gila Region Sustainable Agriculture: The next steps in research and development.
4:55 - 5:15 pm	Cockman - Sands Draw Grassland Restoration Part II: Sediment traps and youth outdoor education.	Gisler - The Southwest Seed Partnership is coming to the Gila.
5:05 - 5:25 pm	Gaume - New Mexico's Gila River basin apportionment made by Arizona v California and water use pursuant to state adjudicated water rights—facts and myths.	White, Havelock, Haskins - Soil type and native soil inoculum level impacts on Chihuahua scurfpea germination success and growth.
Evening Activities		
5:30 - 7:00 PM	Social: Sunset Room on the 2 nd floor of the Thomas B. McDonald memorial Building (WNMU Student Center)	
7:00 - 8:30 PM	Creative Voices: Miller Library Commons Moderator: Heather Steinmann Featuring: Karen Bradberry, Robert Forese, Marty Eberhardt, Ann Hedlund, Leonore Hildebrandt, Silvia Ramos Cruz, Sharman Russell, and Beate Sigriddaughter.	

Friday 23 February

	Theater at Global Resources Center	
8:00 - 9:00	Awards Honoring: Blurton, Coles, Kleinman, Brooks, Jennings and Anon	
9:00 - 9:45	Keynote Address: Esteban H. Muldavin, Natural Heritage New Mexico	
Break		
	Theater at Global Resources Center	Room A-B-C at Global Resources Center
Concurrent Sessions	Policy	Policy & Education
Moderators	Dave Menzie	Roland Shook
10:00 - 10:20 AM	Schultz - An Overview of Forest Plan Revision on the Gila National Forest	James - Native Fish in the Classroom - Using Gila Trout to Engage Youth
10:25 - 10:45 AM	Natharius - Forest Planning in the Face of Change and Uncertainty	Carey - Grazing Permit Retirement in the Greater Gila Bioregion
10:50 - 11:10 AM	Guaderrama - At-risk Species Management and how the Coarse/Fine Filter is Applied in the Gila National Forest Plan	Cole, Cole - Climate Change in Grant County
11:15 - 11:35 AM	Armatas, Borrie, Watson - The relationships between the Gila National Forest and the general public: Results from public meeting input.	Adams - Mimbres Exploitation of Native Copper within the Gila National Forest
11:40-1:20 PM	Lunch on Your Own A list of local patrons and maps are available in the foyer.	

Friday 23 February (continued)	
	Theater at Global Resources Center
Concurrent Sessions	Resource Management
Moderator	Dustin Meyers
1:00 - 1:20 PM	Ferguson - Mimbres River Habitat Restoration
1:25 - 1:45 PM	Wick, Myers, Dean - Gila Trout: Five Years Since the Whitewater-Baldy Fire
1:50 - 2:10 PM	Moeny - Spatial variability in stream temperatures in Black Canyon. Implications for stream restoration and Gila Trout recovery.
2:15 - 2:35 PM	Wiese - Gila Trout for the Future
2:40 - 3:00 PM	Arterburn, Brooks, Canavan, Wallin, Caldwell, Frey - Converging interests in conservation and angling to engage citizen science support for restoration of native Gila Trout
BREAK	
3:20 - 3:40 PM	Stewart - History of the Gila River Basin Native Fish Conservation Program
3:45 - 4:05 PM	Flood - Wilderness Management - Why and How
Poster Session – ABC Room	
ABC Room throughout the day. Authors will be with their posters from 1:00-3:00.	
Archaeology	
Aragon - Not Quite Coalesced: Salado Settlements in the Upper Gila	
Causey, Roth, Creel - Shake A Tail Feather: Investigating Turkey Remains at the Elk Ridge	
Romero, Roth, Creel - Home Is Where The Hearth Is: The Pithouse To Pueblo Transition At The Elk Ridge Site	
Ryan, Shackley, Denoyer - Raw Material Selection and Obsidian Procurement and Use at a Salado Site in the Upper Gila	
Schollmeyer, MacDonald - A Natural and Unnatural History of Faunal Change in Southwestern New Mexico Since AD 500	
Sutton - The Gila Wilderness: Defining, Redefining, and Managing our First Wilderness Area and its Cultural Resources	
Hydrology	
Jackson - Storm Water Runoff in Downtown Silver City, New Mexico	

Saturday 24 February

Field Trips

Geology Field Trip (Morning) 08:30-11:30

Title: General Geology of the Silver City Area

Location: Boston Hill Open Space in Silver City

Date and Time: Saturday February 24, 2018. Meet at steps of Fine Arts Center Theater about 0830 am and carpool to Market St. Trailhead. End by 1130 am.

Trip Description: Hike to top of Boston Hill and review of the local geology (rocks, minerals, fossils, stratigraphy, structure, and plate tectonics). Hike is about 2 miles round-trip, moderate grade, with rough ground disturbed by historic mining activity. Bring water, wear sturdy shoes and hats, and expect cool to cold weather. Limit is 15 participants. Sign up Thursday Morning.

Trip Leaders: Corrie Neighbors and David Menzie

Corrie is Assistant Professor of Geology and GIS at WNMU.

Dave Menzie is a retired professional geologist and surface water specialist.

Hydrology Field Trip (Afternoon) 1:00-3:30

Title: History and Hydrology of the Big Ditch and Urban Storm Water – Then, Now, and the Future

Location: Silver City Historic District

Date and Time: Saturday February 24, 2018. Meet at steps to Fine Arts Center Theater about 1:00 pm and carpool to La Capilla. End by 3:30 pm.

Trip Description: Hike from La Capilla to Bullard and College St. and review the historic Big Ditch flooding. Learn about past and current hydrological research related to urban storm water in Silver City. Hike is about 1.5 miles round-trip with moderate grade on one short section but mostly flat urban setting. Bring water, wear sturdy shoes and hats, and expect cool to cold weather. Limit is 15 participants. Sign up Thursday Morning.

Trip Leaders: Corrie Neighbors, Raven Jackson, and David Menzie
Raven is a student at WNMU.

Corrie is Assistant Professor of Geology, GIS at WNMU.

Dave Menzie is a retired professional geologist and surface water specialist.

Archaeology Field Trip I (all day)

Title: Mimbres Archaeology

Location: Trip will leave from the Forest Service parking lot (3005 East Camino del Bosque, Silver City) at 8:30 AM and will release at the Gila Cliff Dwellings at approximately 3:00 PM. Alternately, some participants can arrange to join the group at the Mimbres Cultural Heritage Site (Mattocks Ruin) at approximately 9:15 AM.

Trip Description: Visit the Mattocks Ruin (Mimbres Cultural Heritage Site), Three Bells Site (Forest Service), and TJ Ruins (Gila Cliff Dwellings National Monument). At each site, individuals familiar with work conducted at the site will lead a tour. A different site may be substituted for Three Bells, depending on road conditions. Short hikes will occur throughout the day. A high clearance vehicle is recommended for one portion of the tour but we should be able to briefly car-pool if necessary. Bring water, lunch, a full tank of gas, and appropriate footwear and gear; expect cool to cold weather.

Trip Leaders: Chris Adams and Wendy Sutton, USFS Archaeologists.

Archaeology Field Trip II - TBD

Adios!

Thank you for attending the 7th Natural History of the Gila Symposium. Your attendance and contributions are greatly appreciated. Look for abstracts, articles and archive resources on our website: gilasyposium.org.

We look forward to seeing you at the next symposium in 2020. If you have suggestions or comments, please drop them in the suggestion box in the foyer or leave a note at the website. Thank you!

ABSTRACTS

Mimbres Exploitation of Native Copper within the Gila National Forest

Christopher D. Adams, East Zone Archaeologist, Gila National Forest, cadams@fs.fed.us

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.

Not Quite Coalesced: Salado Settlements in the Upper Gila

Leslie Aragon, Archaeology Southwest, University of Arizona, leslie@archaeologysouthwest.org

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.

The Relationships between the Gila National Forest and the General Public: Results from Public Meeting Input

Chris Armatas¹, Dr. Bill Borrie², and Dr. Alan Watson³

¹University of Montana, christopher.armatas@umontana.edu

²University of Montana

³Aldo Leopold Wilderness Research Institute, RMRS, USDA Forest Service

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.

Converging Interests in Conservation and Angling to Engage Citizen Science Support for Restoration of Native Gila Trout

Jeff Arterburn¹, James Brooks², Chris Canavan³, Tyler Wallin⁴, Colleen Caldwell⁵, and Jennifer Frey⁶

¹President, Gila/Rio Grande Chapter of Trout Unlimited, and Professor, New Mexico State University, jeffgilatu@aol.com

²Contract Fisheries Biologist

³Hydrologist, New Mexico Environment Department

⁴Graduate Student, Department of Fish, Wildlife and Conservation Ecology, New Mexico State University

⁵Unit Leader, Associate Professor, New Mexico Cooperative Fish and Wildlife Research Unit, Department of Fish, Wildlife and Conservation Ecology, New Mexico State University

⁶College Professor, Department of Fish, Wildlife and Conservation Ecology, New Mexico State University

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.

A Cameo of Two Springs

Amber Caldwell¹ and Joneen Cockman²

¹STEM Partnership Intern, Safford BLM, aac31@monsters.eac.edu

²Lead Natural Resource Scientist, Safford BLM

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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.

Grazing Permit Retirement in the Greater Gila Bioregion

Madeleine Carey, Greater Gila Guardian at WildEarth Guardians,
mcarey@wildearthguardians.org

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.

Shake a Tail Feather: Investigating Turkey Remains at the Elk Ridge

Courtney E. Causey¹, Barbara Roth², and Darrell Creel³

¹University of Nevada–Las Vegas, Causec1@unlv.nevada.edu

²University of Nevada–Las Vegas

³University of Texas–Austin

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.

Sands Draw Grassland Restoratin Part I -Pecan Branches Win: Exploring Tillage and Mulch Treatments in Native Grassland Seeding for Southeastern Arizona

Joneen Cockman, PhD, Arizona BLM, jcockman@blm.gov

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.

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

Joneen Cockman, AZ BLM Safford Field Office, jcockman@blm.gov

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 authors estimate 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.

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

Peter Coha¹ and Norm Gaume²

¹Retired Intel Principal Engineer

² Norm Gaume, P.E. (ret.), MSCE, NM Interstate Stream Commission Director, 1997-2002, normgaume@gmail.com

AECOM, a consulting engineering firm, simulated the water yield of alternative conceptual configurations of the NM Unit of the Central Arizona Project in fulfillment 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.

Climate Change in Grant County

A.T. and Lucinda Cole, Co-owners, Pitchfork Ranch, atandcinda@gmail.com

Following a brief explanation of the 14 years of restoration and carbon-sequestration work we have been doing on the Pitchfork Ranch and a quick overview of the worldwide changes in climate, we'll identify the changes and damages we have observed on the ranch: absence of historic animals and presence of new ones, death of trees, drying of wells, absence of Burro Ciénega flows, and changes in rainfall. If adopted, better stewardship of land, referred to as "natural climate solutions" in a recent paper published in the *Proceedings of the National Association of Science*, can serve as a 37% cost-effective mitigation strategy to achieve the Paris Climate Accord's goal of keeping the Earth below 2°C. Local solutions will be identified to help forestall the human-caused climate crisis we are facing, described by Christian Parenti as "the most colossal set of human events in human history: *the catastrophic convergence* of poverty, violence and climate change."

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Describing Over a Decade of Changing Habitat at the Iron Bridge

Martha S. Cooper, SW NM, The Nature Conservancy, mschumann@tnc.org

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.

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Gila Region Sustainable Agriculture: The Next Steps in Research and Development

Richard Felger¹, Adrienne Booth², Gabriel Feldman³, Xavier Khera⁴, Tsama Pineda⁵, Chelsea Rittchen³, and Sam Schramski⁶

¹Associate Researcher, Herbarium, University of Arizona, and Visiting Scholar, Western New Mexico University, rfelger@e-mail.arizona.edu

²Project and Outreach Coordinator, New Crops for New Mexico, Silver City, NM

³Honeyhawk Farm, Mimbres, NM

⁴Aldo Leopold High School, Silver City, NM

⁵Mimbres Hot Springs Ranch, Mimbres, NM

⁶Co-Executive Director, The Volunteer Center of Grant County, Silver City, NM, and Affiliate Researcher, Indiana University, Bloomington, IN, sam@tvcgrantcounty.org

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.

Mimbres River Habitat Restoration

Bryan Ferguson, New Mexico Department of Game and Fish, Bryan.Ferguson@state.nm.us

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.

Wilderness Management: Why and How

Eric Flood, Outdoor Recreation Planner, Gila National Forest, eflood@fs.fed.us

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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 including the direction from Congress that National Forests evaluate lands for wilderness characteristics and decide which, if any, to recommend to Congress for designation as part of the overall forest plan revision. We evaluate the success of our management actions with a measure we call Wilderness Stewardship Performance, while laying the groundwork for future measures monitoring wilderness character..

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, P.E. (ret.), MSCE, NM Interstate Stream Commission Director, 1997-2002, normgaume@gmail.com

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.

The Southwest Seed Partnership Coming to the Gila

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Growing concern over erodible bare ground in the Southwest 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.

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

Rene Guaderrama, Planning Biologist, Gila National Forest, rguaderrama@fs.fed.us

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.

Trophic Discrimination Factors and Tissue Turnover Time in the Red Swamp Crayfish (*Procambarus clarkii*): A Controlled Feeding Experiment

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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.

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Storm Water Runoff in Downtown Silver City, New Mexico

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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.

Conservation Efforts for the Chiricahua Leopard Frog in Southwestern New Mexico

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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.

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

Nori Koehler, Soil Scientist, USDA Forest Service, nkoehler@fs.fed.us

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.

Natural History of the Wild Turkey in the Greater Gila Region

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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 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.

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

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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 (T_b) 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 (T_a) that ranged from 35°C to 50°C, while simultaneously monitoring T_b . We found SMR and EWL increased steeply following the onset of panting, with the ability to maintain a gradient between T_a and T_b strongly associated with EWL rate. Species inhabiting hot desert environments had higher panting thresholds, were much more efficient at dissipating heat, and tolerated higher T_a 's and T_b '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.

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

John Moeny, Environmental Scientist, Surface Water Quality Bureau, New Mexico Environment Department, john.moeny@state.nm.us

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 aiming 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.

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Forest Planning in the Face of Change and Uncertainty

Jenny M. Natharius, Ecologist, Gila National Forest, jennymnatharius@fs.fed.us

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.

Native Fish in the Classroom: Using Gila Trout to Engage Youth

Angela Palacios James, Fish Biologist, USFWS New Mexico Fish and Wildlife Conservation Office, angela_james@fws.gov

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.

Environmental DNA: Monitoring Tool for Aquatic Species

Yvette Paroz, Regional Fish Program Leader, US Forest Service, ymparoz@fs.fed.us

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.

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Home Is Where the Hearth Is: The Pithouse to Pueblo Transition at the Elk Ridge Site

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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.

Raw Material Selection and Obsidian Procurement and Use at a Salado Site in the Upper Gila

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³Archaeology Southwest

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.

An Overview of Forest Plan Revision on the Gila National Forest

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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.

History of the Gila River Basin Native Fish Conservation Program

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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.

A Natural and Unnatural History of Faunal Change in Southwestern New Mexico since AD 500

Karen Gust Schollmeyer¹ and S.O. MacDonald²

¹Preservation Archaeologist, Archaeology Southwest

²Retired, Museum of Southwestern Biology, University of New Mexico

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.

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

Wendy Sutton, PhD, Gila National Forest, wasutton@fs.fed.us

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.

Soil Type and Native Soil Inoculum Level Impacts on Chihuahua Scurfpea Germination Success and Growth

Heather White¹, Nicholas Havelock¹ and Kristin E. Haskins².

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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 × 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.

Gila Trout: Five Years since the Whitewater-Baldy Fire

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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.

Gila Trout for the Future

Nathan Wiese, Project Leader, Mora National Fish Hatchery, nathan_wiese@fws.gov

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.

