MEET THE AMARGOSA



OCTOBER 25 - 27, 2019 TECOPA, CA

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Celebrating the 25th anniversary of the California Desert Protection Act!

Thank you all for coming out to Meet the Amargosa! The Amargosa Basin as we know it would be a very different place if it was not for the California Desert Protection Act (CDPA), enacted October 8th, 1994. The Act turned Joshua Tree and Death Valley Monuments into National Parks, established Mojave National Preserve, and created millions of protected acres of land by designating them wilderness, natural areas, and/or areas of critical environmental concern. This set a precedent that desert lands are precious lands and worthy of protection. The CDPA ensured open lands essential for wildlife corridors and the open horizons us desert dwellers find solace in. The Act had some unintended consequences, positive for once! It set up the California deserts as

destinations that have become a driver of a thriving ecotourism industry. I'm sure that we are all in agreement that there are some tourists we could live without, but tourism is proving to be the least environmentally damaging industry we've seen in the desert.

The Amargosa has never been a place where the crowds have flocked. It's still a hidden gem, due in no small part to being cushioned on all sides (in California) by wilderness designated 25 years ago in the short and elegant piece of legislation that is the CDPA - only 55 pages, I'd encourage anyone to look it up if they are curious [https://www.govtrack.us/congress/bills/103/s21/text]. In those 55 pages the Amargosa gained 11 Wilderness': Kingston Range Wilderness, Nopah Range and South Nopah Range Wilderness', Pahrump Valley Wilderness, Funeral Mountains Wilderness, Resting Spring Range Wilderness, Ibex Wilderness, Saddle Peak Hills Wilderness, Mesquite and North Mesquite Wilderness', and Hollow Hills Wilderness. Well over half a million acres were set aside, 642,036 acres to be exact. It also established Salt Creek and the Amargosa Canyon as Areas of Critical Environmental Concern. It laid the groundwork for gaining Wild & Scenic River status in 2009 and set aside five Wilderness Study Areas that were subsequently designated as Wilderness in the Dingell Conservation, Management, & Recreation Act in March.

Welcome again to our third annual Meet the Amargosa! It's a big year for celebrations: the Dingell Act that designated an additional seven miles of the Amargosa River as Wild & Scenic and gave us 222,000 new acres of wilderness in the Amargosa, the 10 year anniversary of the Amargosa River's original Wild & Scenic designation, and the 25 year anniversary of the California Desert Protection Act that really started the ball rolling for conservation legislation out here! Glad to have you all here for this confluence of conservation celebrations!



Welcome to the Amargosa!

What I love most out here is the quiet. The early morning sunlight. The ancient stories the land tells us.

That's what led me to join the Amargosa Conservancy. This river basin, that offers so much peace and joy, is worth protecting. The Amargosa Conservancy is about 15 years old now.

Through the years, we've worked on the land to protect habitat for endangered birds, pupfish, and voles. We've helped monitor plants and wells; we've helped to ensure safe drinking water for citizens. We've taught school children and we've supported scientific research.



Enjoy your visit this weekend! I hope you will find moments of beauty and delight as you explore the Amargosa.

> Jane Gillam President of the Board of Directors Amargosa Conservancy

FRIDAY OCTOBER 25

4:00 - 8:00 PM 6:00

7:00 - 8:15AM

8:00 - 8:45

8:45 - 9:00

9:00 - 11:00

11:00 - 12:00 PM

12:00 - 2:00

2:00 - 2:30

2:30 - 3:00

3:00 - 3:45

3:45 - 4:00

4:00 - 5:00

5:00 - 6:00

6:00 - 6:15

6:15 - 7:00

6:30-8:00 AM

8:00 - 12:00 PM

7:00

Opening Remarks *Preview Silent Auction*

SATURDAY OCTOBER 26

Breakfast (Tent) *Silent Auction - Bids Open* **Opening Speakers (Tent)** Welcome from the AC Intro to the Oldest Geology of the Region - Bill Neill Travel Time SESSION 1 FIELD TRIPS (Various Locations) Geology Driving Tour - Bill Neill Amargosa Vole in the Tecopa Marshes - Stephanie Castle The Interplay of Science & Policy at the Amargosa River- Sophie Parker Lunch (Tent or elsewhere) SESSION 2 FIELD TRIPS (Various Locations) [repeated from Session 1] Siesta, Snack, Relax Special Presentations (Tent) Geological History of the Amargosa, Continued - Bill Neill Molecular Ecology as a Window into the Total Amargosa Ecosystem: From Microbes to People - Duane Moser Break Why Big Earthquakes in the Desert - Jim Calzia Hydrogeological State of the Amargosa Basin Update - Andy Zdon Break Dinner **Closing Remarks** *Conclude Silent Auction* Music & Campfire

SUNDAY OCTOBER 27

Breakfast (Tent) Henderson

SCHEDULE

Check-in, Happy Hour, Potluck (Tent)

- SESSION 3 FIELD TRIPS (Various Locations)
 - Nopah Range Botany Exploration Naomi Fraga & Carolyn Mills
 - Salt Hills Geology Tour Bill Neill
 - Willow and Mesquite Planting along the Amargosa River BLM & Tanya





The Nature Conservancy Protecting nature. Preserving life

-AMARGOSA CONSERVANCY —



The Amargosa Conservancy works toward a sustainable future for the Amargosa River and Basin through science, stewardship, and education.

- ABOUT US -

From its headwaters north of Beatty, NV, the Amargosa River flows underground in a southernly direction. Near the Dumont Dunes, it makes a big u-turn and heads north into Death Valley National Park, finally terminating in Badwater Basin, the lowest point in the United States. The river surfaces in a few places, around Beatty and in the Amargosa Canyon south of Tecopa, CA. At times after large rainstorms, the entire course of the river will flow above ground.

The Amargosa River and Basin provide unique desert habitats. The greater ecological setting for the river is the Mojave Desert. In one of the hottest and driest places anywhere, the river and nearby springs provide islands of water that support a variety of plants and animals. Often these animals are unique to the area - or endemic – meaning they can't be found anywhere else on earth.

– WHO WE ARE –

STAFF

Tanya Henderson, Executive Director Julie Vargo, Director of Finance and Operations

BOARD OF DIRECTORS

Jane Gillam, President Chris Roholt, Vice President Naomi Fraga, Treasurer Bill Neill, Secretary John Hiatt Abby Mattson

ADVISORS

Bill Christian David Lamfrom Andy Zdon **Greg James**





The Amargosa River Valley Region

Geology of the Amargosa Region

WITH

BILL NEIL



"...The Great Basin is a recent development in the geologic story of the West.... [During the Eocene] Nevada was a lot higher than it is today. Elevate Nevada into a rugged plateau more than two miles high, much like the Altiplano of the central Andes today, and you have an image of the Nevadaplano — a highland region that dominated Nevada before it collapsed like a punctured soufflé to make the Great Basin.... Visualize snowfields between the rugged peaks. Meltwaters seep across the landscape.... The Sierra Nevada today lies about where the western flank of the Nevadaplano once sloped toward the Pacific Ocean. In effect, the Sierra is what remains of the Nevadaplano's western edge. The rest of the Nevadaplano was destroyed by the stretching and collapse of the crust that made the Great Basin."

- Keith Heyer Meldahl, Rough-Hewn Land: A Geologic Journey from California to the Rocky Mountains

References for further reading:

https://pyrite.utah.edu/fieldtrips/SEGFnevada2009/Readings/Dickenson.pdf *The Broken Land – Adventures in Great Basin Geology* by Frank L. De Courten, published 2003 by The University of Utah Press.

Geology Underfoot in Death Valley and Owens Valley by Sharp and Glazner.



Figure 1. Position of the Great Basin in the western Cordillera (adapted after Dickinson, 2002). Modern triple plate junctions: MTJ-Mendocino; RTJ-Rivera; TTJ-Tofino. Other abbreviations: BM-Blue Mountains; CRP-Columbia River Plateau (check pattern and red color denote extent of Columbia River Basalt lavas); KFMS-Kisenehn-Flathead-Mission-Swan extensional Paleogene basins; KM-Klamath Mountains; LCZ-Lewis and Clark fault zone; PNW-Pacific Northwest; RFZ-Rivera Fracture Zone; SN-Sierra Nevada; SRP—Snake River Plain; TMI-Tres Marias Islands (cross pattern and red color denote extent of bimodal volcanic suite).





OUTLINE OF GEOLOGIC HISTORY

2.5-1.4 B yr	Accretion of Rodinia – Crystalline Basement
850-750 M yr	Intracontinental rifting & Glaciation – Snowball Earth
700-350 M yr	Subsidence of Passive Continental Margin – Marine Fossils
350-225 M yr	Antler & Sonoma Orogenies – Assembling California
190-180 M yr	Erosion & Desert Sand Dunes – Aztec Sandstone
150-80 M <u>yr</u>	Cordilleran Magmatic Arc – Granite Intrusion & Ore Deposits
90-70 M yr	Sevier Orogeny – Back-Arc Contraction – Keystone Thrust
65-30 M <u>yr</u>	Nevadaplano Elevation & Erosion / Flattened Subduction
14-5 M yr	Rapid Basin Extension / Granitic Intrusion & Volcanism

< 5 M yr Slow Basin Extension / Basalt Volcanism & Lake Tecopa



Bill Neill joined the Amargosa Conservancy's Board of Directors in March 2014 and has served as Secretary since April 2018. Although educated as a geologist and petroleum engineer, over the past 40 years his environmental interests have been the

California Desert and control of non-native animals and invasive plants. From 1979 to 1981, Bill produced and directed a Sierra Club educational film on feral burros in the desert, and for 15 years he organized volunteer groups to remove tamarisk or saltcedar, from springs and riparian areas throughout the desert southwest. For the past two decades Bill has been self-employed as a professional herbicide applicator, working to control invasive wildland weeds in coastal watersheds of Los Angeles, Orange and western Riverside Counties.

ABOUT BILL

Conservation and Ecology of the Amargosa Vole

WITH



STEPHANIE CASTLE

Despite receiving less precipitation than almost any other ecosystem in North America, rare spring-fed wetlands along the lower Amargosa River support rich biodiversity and endemic plant and animal life, including the federally and state endangered Amargosa vole (Microtus californicus scirpensis). The vole, now considered one of the most critically endangered mammals in North America, only occurs within 135 hectares of patchy wetland habitat within the Amargosa River Watershed near Tecopa, CA. First described in 1900 in Shoshone, CA, the vole was considered extinct, until it was rediscovered in 1936, then listed as endangered by state and federal agencies in the 1980's.

A subspecies of the California vole, the Amargosa vole is a medium-sized, mouse-like rodent with short, furred ears, a short tail, and a characteristic white goatee. These unique small mammals are considered to be obligately dependent on the presence of standing water and wetland vegetation, specifically three-square bulrush (Schoenoplectus californicus), for food resources, protection from predators, and insulation from the extreme desert temperatures. As somewhat plump and slow-moving animals, the voles them-selves also serve as an important food source for the diverse array of wildlife residing and visiting these important Amargosa wetlands.

Unfortunately, the persistence of these wetlands and the Amargosa vole are threatened by human impacts including climate-related reductions in water availability, groundwater development, spring diversion, invasive species establishment, predation, and wildfire. These impacts represent potential catastrophic threats for this ecosystem, with a high risk of near-term extinction of the Amargosa vole.

Recent efforts to support this ecosystem and the species include data collection on biology and ecology, targeted marsh restoration, vole population and habitat patch modeling, vole population augmentation, and invasive species management. However, the probability of persistence of the Amargosa vole and its wetlands ecosystem could be dramatically improved with a handful of targeted conservation actions. Addressing climate-change, improving water availability and stability, regional groundwater protection, restoring and enhancing wetland habitat, invasive species management, and engaging the local community in conservation and stewardship of the area will be essential for sustaining this species and the unique desert wetlands of the Amargosa River.





ABOUT STEPHANIE

Stephanie Castle is a Post-Doctoral Researcher in the School of Veterinary Medicine at UC Davis studying metapopulation dynamics of the Amargosa vole, and pursuing key habitat conservation and restoration efforts in the Amargosa River Watershed. Stephanie received her Ph.D in Ecology from UC Davis, with a focus in wetland plant ecology and restoration, and a B.S. in Environmental Biology and Management from UC Davis.

Stephanie transitioned into the world of wildlife ecology when joining the Amargosa Vole Team in 2014, and has provided a critical perspective to the team with her experience in wetland restoration. Since then she has gained extensive experience in small mammal ecology and has led the field team in a multitude of studies examining the biology, behavior, and habitat ecology of the Amargosa vole.







Figure 1. Adaptive Management Cycle. During each phase of the cycle, managers draw on and contribute to the evidence base for conservation, building intellectual capital and advancing conservation efforts.



The Interplay of Science and Policy at the Amargosa River

Sophie S. Parker, Ph.D. The Nature Conservancy

- 1. What constitutes "protection" in a conservation context?
 - a. Private lands
 - i. Fee title acquisition
 - ii. Conservation easements
 - iii. Partnerships with land owners
 - iv. Private stewardship
 - b. Public lands
 - i. Designation
 - ii. Management
- 2. How does "protection" occur?
 - a. Awareness is raised
 - i. Scientists make discoveries
 - ii. Public opinion and values are influenced
 - iii. Private individuals take
 - b. Land Trust/Non-profit organizations take action
 - i. The Nature Conservancy
 - ii. Amargosa Conservancy
 - c. Agencies act
 - i. Changes in policies
 - 1. Designations
 - 2. Management actions
- 3. Adaptive Management



Amargosa Watershed Project Chicago Valley Watershed





Example of Current Science-Policy nexus: Mojave Springs Research Project (2018-2020)

Challenges:

- Surface water is scarce in the desert
- Mojave Desert springs are ecologically important due to water scarcity
- Protecting springs is important for conserving the unique biodiversity of the Mojave Desert
- Mojave Desert springs are threatened by human impacts, including groundwater pumping, diversions, livestock grazing, and recreational use
- Mojave Desert springs dependent on regional aquifers can be particularly vulnerable to groundwater pumping, even at significant distance from springs
- There is a lack of information about the hydrogeological and ecological characteristics of • Mojave Desert springs, and a lack of understanding about connections between these characteristics

Goal: Our goal is to use state-of-the art techniques to investigate and describe the physical and ecological characteristics of springs in the Mojave Desert, and to develop a suite of indicators that can be measured to monitor the conservation value of desert springs.

Project Team and Methods to be Used:

- Dr. Sophie Parker from The Nature Conservancy's California Science Team is leading this research project. Collaborating colleagues include Bill Christian and Stephanie Dashiell.
- Geohydrologist Andy Zdon from Partner Engineering and Science, Inc. is collecting water • samples for physical characteristics, including isotopic analysis. This will provide us with information about the origin of the water at each spring.
- Dr. Naomi Fraga from the Rancho Santa Ana Botanic Garden is conducting botanical surveys • around each spring to record the presence of all plant species, with a special focus on wetland obligate species.
- Dr. Maura Palacios Mejia from UCLA is conducting eDNA analyses to detect obligate freshwater species, and describe the biodiversity of the springs.
- Brian Cohen, a spatial data scientist from The Nature Conservancy, is using high resolution, remotely-sensed multispectral imagery to develop a spatial database of groundwater dependent vegetation to create a baseline database of existing vegetation and to aid in the identification of potentially unmapped springs or groundwater sources. Brian is also attempting to discern correlations between vegetation indices derived from the imagery and groundwater pumping records.

Key Deliverables/Products:

- Tabular/graphical output of data from the project, including hydrological, botanical, eDNA, and remote sensing work
- Photographs of spring habitats and species observed •
- Presentations on various aspects of the project
- Reports of outputs of hydrological and botanical analysis: methods, results, and discussion
- Manuscripts for publication—including a synthesis article
- Spatial geodatabase of groundwater dependent vegetation
- Web-based map and website with results from the project •

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ABOUT SOPHIE

Dr. Sophie Parker is a Senior Scientist in The Nature Conservancy's California Chapter. She leads the Energy Program's science team in the Mojave and Sonoran deserts, provides science guidance to the Chapter's engagement on urban stormwater, and leads the Biodiversity Analysis in Los Angeles (BAILA) Program. She is currently leading an interdisciplinary team of scientists in investigating desert springs using isotopic analysis, botany, eDNA, and remote sensing, so that we can develop better,

faster, and less expensive metrics for monitoring of these critical hotspots of desert biodiversity. Dr. Parker has over 20 years of experience in ecology and conservation science. Prior to joining the Conservancy, she was a postdoctoral scholar studying mycorrhizal fungi in the Environmental Studies Program at the University of California, Santa Barbara. She received her Ph.D. from the Department of Ecology, Evolution, and Marine Biology at the University of California, Santa Barbara, where she examined the role of soil nitrogen in preventing the reestablishment of native bunchgrasses in previously invaded California grasslands. One of Dr. Parker's long-term career goals is to better integrate the fields of soil science and ecosystem ecology into conservation practice.



ABOUT DUANE

Dr. Moser is an Associate Professor in the Desert Research Institute's Division of Hydrologic Sciences, where he directs their Environmental Microbiology and Astrobiology Laboratories. His studies on the oceans and on three continents range from deep underground to space. Much of this work involves the Amargosa Basin. Ongoing work includes the use of environmental DNA (eDNA) from archaeological materials to reveal paleohuman occupation patterns going back 1000 years and to track endangered fish (e.g. pupfish) and exotic invaders (e.g. red swamp crayfish) that threaten them. Moser's group has also studied the base of the food web (microorganisms and algae) of the area's aquatic habitats, including Devils Hole, springs, and playa lakes and salt pans. The lab has especially focused on the Death Valley Regional Flow System as a repository for novel microbial diversity and laboratory for the Earth's largest (by volume) and least understood biome - deep fractured rock ecosystems.



ABOUT ANDY



ABOUT

ЛИ

James Calzia is a Geologist Emeritus with the U.S. Geological Survey in Menlo Park, CA. He has studied the geology and mineral resources of southern California, especially the southern Death Valley region, since 1968, received a PhD in Geology from U.C. Davis in 1990 under the tutelage of Bennie Troxel and Lauren Wright, edited the book Fifty Years of Death Valley Research, and published numerous research papers, field guides, maps, and abstracts on that region.

Andrew has 20+ years of experience in the fields of hydrogeology and geology, and is a California Professional Geologist, Certified Hydrogeologist, Certified Engineering Geologist and Registered Environmental Assessor. He has participated in a variety of regional and site-specific hydrogeology, engineering geology, and mining-related projects throughout the southwestern United States, New Zealand and Peru. Among his specialties in numerical groundwater modeling are: finite element and finite difference modeling of groundwater flow and groundwater / surface water interactions, contaminant transport, and dual-phase flow. Mr. Zdon has also provided expert witness testimony regarding hydrogeologic conditions and activities including groundwater modeling. Mr. Zdon has served as a volunteer subject matter expert for the California State Board for Geologists and Geophysicists He is a graduate of Northern Arizona University. Outside of his geologic work, Andy is an avid birder and is a member of the American Birding Association and Western Field Ornithologists. He is also a Member of the Explorer's Club and is President ex-officio of the Friends of the Eastern California Museum. Mr. Zdon is the author of Desert Summits: A Hiking and Climbing Guide to California and Southern Nevada. Desert Summits includes routes up many desert peaks in the Amargosa area.

Nopah Range Botany Exploration

WITH

NAOMI FRAGA & CAROLYN MILLS

Join us for a plant hike in the Nopah Range! We will be parking along the Old Spanish Trail Highway and botanizing along a narrow limestone canyon in the Southern Nopah Range Wilderness. We expect to encounter a diversity of cacti, limestone endemic species, and even a few fall flowers, and will demonstrate how to collect a herbarium specimen, all while enjoying the scenic backdrop of the Nopah Range. The hike will be approximately 3 miles round trip over uneven terrain with a moderate level of difficulty. Please come prepared with closed-toe shoes and plenty of water.





Nopah limestone

Yucca schidigera



Diplactus bigelovii



Sclerocactus johnsonii



western North America, taxonomy of monkeyflowers (Phrymaceae), and pollination biology. She is particularly interested in the flora of the Mojave Desert in southern California. Naomi received her Ph.D. in Botany from Claremont Graduate University and she also holds a M.S. in Botany from Claremont Graduate University and a B.S. in Botany and Biology from California Polytechnic University, Pomona. Naomi also serves is Secretary for the Southern California Botanists, Vice President of the California Botanical Society and is a council member for the American Society of Plant Taxonomists.



Carolyn Mills is a graduate student in botany at Claremont Graduate University and Rancho Santa Ana Botanic Garden in Claremont, CA. For her masters thesis, Carolyn is conducting an inventory of the flora of the Nopah Range in Inyo County, CA to document the vascular plants that occur in the range. Over the past 7 years she's been lucky to conduct botanical work at some of her favorite places on earth, including the Mojave National Preserve, Yosemite National Park, eastern Nevada, and California's Channel Islands. She currently serves on the board of Southern California Botanists.

ABOUT NAOMI

Naomi Fraga is Director of Conservation Programs at Rancho Santa Ana Botanic Garden in Claremont, CA. She has been studying plants of the Mojave Desert for over 15 years. Her research interests include plant geography, conservation biology, rare plants of

ABOUT **CAROLYN**





Thank You

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