

2022

**16th Biennial Conference of
Science & Management
for the Colorado Plateau &
Southwest Region**
Flagstaff • Arizona • USA
September 12–15



Agenda & Program



Ecological Restoration Institute



Restoring Southwest Landscapes



Our Focus

Student development · Collaborative partnerships · Knowledge transfer
Restoration of western forests · Advancing research
Policy analysis · Knowledge exchange with tribal partners

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2022

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**16th Biennial Conference of Science & Management for
the Colorado Plateau & Southwest Region**

Agenda & Program

Featured speakers



Stephen J. Pyne

Monday, September 12, 2022

7:00–8:30 PM

Prochnow Auditorium

Free & open to the public

The Pyrocene Comes to the Plateau



Sasha C. Reed

Tuesday, September 13, 2022

8:00–9:00 AM

Prochnow Auditorium

Free & open to the public

Finding hope in times of change: how science and management can work together to face an uncertain future on the Colorado Plateau



Celebrating NAU's Institute for Tribal Environmental Professionals 30th Anniversary

Nicole Horseherder, Diné

Wednesday, September 14, 2022

7:00–8:30 PM

Prochnow Auditorium

Free & open to the public

Away from coal, returning a borrowed future

THANK YOU!

The 16th Biennial Conference of Science and Management for the Colorado Plateau and Southwest Region is truly a community effort. The conference organizers would like to thank all of the people who organized special sessions, workshops, and field trips! Thank you to the general session moderators, who play an indispensable role. A huge thank you to all of the students and others who volunteered to help with the registration table, driving vans, and so much more.

Special thanks go to the conference sponsors for their generous financial and in-kind support!!



The following Northern Arizona University units generously provided support: Office of the Provost; Office of the Vice President of Research; College of Environment, Forestry, and Natural Sciences; School of Earth and Sustainability; Ecological Restoration Institute; and Center for Adaptable Western Landscapes

THE CHARLES REDD CENTER FOR WESTERN STUDIES

AT BRIGHAM YOUNG UNIVERSITY

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The mission of the Charles Redd Center for Western Studies is to promote the interdisciplinary study of the Intermountain West (including the Colorado Plateau) by sponsoring research, publication, teaching, and public programming.

Events, programming, and various funding and award opportunities are open to researchers, educators, and students in

- environmental sciences
- social sciences
- journalism
- history
- public lands and resource management
- humanities
- public outreach
- and more

Funding and Award application deadline: **March 15**



Since 1972

Conference Planning

Conference Co-chairs

Clare Aslan

School of Earth and Sustainability/
Center for Adaptable Western
Landscapes
Northern Arizona University

Todd Chaudhry

Colorado Plateau Cooperative
Ecosystem Studies Unit
National Park Service

Nikki Cooley, Diné

Institute for Tribal Environmental
Professionals
Northern Arizona University

Catherine Gehring

Biological Sciences/Center for
Adaptable Western Landscapes
Northern Arizona University

Yeon-Su Kim

School of Forestry
Northern Arizona University

Jackson Leonard

Rocky Mountain Research Station
USDA Forest Service

Theodore Melis

Southwest Biological Science Center
U.S. Geological Survey

Anya Nova Metcalfe

Southwest Biological Science Center
U.S. Geological Survey

Erika Nowak

School of Earth and Sustainability/
Department of Biological Sciences
Northern Arizona University

Brenden W. Rensink

Charles Redd Center for Western
Studies
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Center for Adaptable Western
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**Beatrice Bock, Susanne Kovacs,
Gillian Trimmer, and Lara Schmit**

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Our Amazing Volunteers!

**Sarah A Costanzo, Keven Griffen,
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Richard McCormick, Alex Goetz,
Matt McEttrick, Lauren Tango,
Caitlin Walker, Jalyn Gearries,
Lydia Bailey, Kristina Young, Kara
Gibson, and Derek Uhey**

How the SWFSC responds to fire management needs



**Convening scientists,
managers, and the public
to devise science-based
management solutions**



**Making fire science
accessible and relevant
to land managers**



**Increasing public
awareness of wildland
fire science and fire
management challenges**



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At-A-Glance Program

Time	Abinau	Doyle	Fremont	Rees	1899 Ballroom	Ponderosa (Boardroom)	Aspen
Monday, Sept. 12, 2022							
CLIENTS'S DAY & REGISTRATION: High Country Conference Center Lobby (8 AM to 5 PM)							
8 AM to 4 PM	FIELDTRIPS: Ponderosa pine ecology and management tour (Moser and Jackson) & Climate change and management in pinyon-juniper woodlands (McCormick & Cassidy) Both field trips require pre-registration and an extra fee for lunch. Please meet in front of the High Country Conference Center at 7:45 AM to load the vehicles for departure at 8 AM.						
10:00 AM to 3:00 PM			Emory Oak (By invitation)				
11:30 AM to 5:00 PM	USGS/ITEP (By invitation)						
12:00 to 5:00 PM						Colorado Plateau CESU Partners Meeting (By invitation)	
1:00 to 3:00 PM		WORKSHOP: Biocrusts, soils, and restoration tools for a changing environment (Jech, Anenberg, Rakes & Bacovcin)		WORKSHOP: Venomous reptile ecology awareness and safe handling training (Nowak)			Speaker-ready Room
3:00 to 5:00 PM		USGS Terrestrial Drylands Ecosystems (By invitation)					Speaker-ready Room
5:30 to 7:00 PM	RECEPTION: 1899 Bar & Grill Ballroom & Patio - 307 W. Dupont Ave., Flagstaff, AZ - Parking in High Country Conference Center parking garage (Appetizers & no-host bar)						
7:00 to 8:30 PM	EVENING PUBLIC KEYNOTE: Dr. Stephen J. Pyne, Arizona State University, <i>The Pyrocene Comes to the Plateau</i> - Prochnow Auditorium Parking in High Country Conference Center parking garage						

Time	Abinai	Doyle	Fremont	Rees	1899 Ballroom	Ponderosa (Boardroom)	Aspen
Tuesday, Sept. 13, 2022							
7 to 8 AM	REGISTRATION & MORNING REFRESHMENTS: Humphreys Ballroom						Speaker-ready Room
8 to 9 AM	WELCOME & SCIENCE KEYNOTE ADDRESS: Dr. Sasha C. Reed, U.S. Geological Survey, <i>Finding hope in times of change: How science and management can work together to face an uncertain future on the Colorado Plateau</i> - Prochnow Auditorium - Parking in High Country Conference Center parking garage						Speaker-ready Room
9 to 9:30 AM	BREAK: Humphreys Ballroom						Speaker-ready Room
9:30 to 11:30	Contributed: Grazing and grasslands	Managing wildfires for forest restoration on the Colorado Plateau and Southwest Region (Colavito & Huffman)	Vulnerability of SW cultural resources to climate change (Hejl, Meyer, Benjamin & Oskierko-Jeznacki)	Visitor use management in an era of rapid change and dynamic futures (Miller)	Leaves to Landscapes-Part 1-Evapotranspiration: spatial models of ET at the landscape level (Nagler & Johnson)		Speaker-ready Room
11:30 AM to 1 PM	BUFFET LUNCH: Humphreys Ballroom						Speaker-ready Room
11:30 AM to 1 PM	WORKSHOP: Using PhenoCam to monitor dryland ecosystems (Post, Richardson & Zimmerman) (Doyle)						Speaker-ready Room
11:30 AM to 1 PM	WORKSHOP: Co-management of ancestral public lands (Armstrong, Lopez-Whiteskunk, Nickel & others) (Fremont)						Speaker-ready Room
11:30 AM to 1 PM	MEETING: Peer learning to co-develop fire and climate adaptation case studies (LeRoy, Chaudry, Aslan, Leger, & Thode) (Ponderosa)						Speaker-ready Room
11:30 AM to 1 PM	WORKING SESSION: NPS Southern Colorado Plateau Inventory and Monitoring Network Technical Advisory Committee monthly meeting (Rees)						Speaker-ready Room
1 to 3 PM	Carbon and water responses to drought and aridification (Samuels-Crow, Reich & Ogle)	Contributed: Drought and climate change	Integrating Indigenous Traditional Ecological Knowledge (Lyndon, Southern & Cooley)	Bison, the national mammal, in the SouthWest (Terwilliger & Holm)	Leaves to Landscapes-Part 2-Tamarisk and tamarisk beetle impacts: habitat and policy (Nagler & Johnson)		Speaker-ready Room
3:15 to 5:15 PM	Colorado River Basin Actionable & Strategic Integrated Science & Technology (ASIST) (Thomas & Dahm)	After fire; tools to empower our collective response and recovery (Bean & Evans)	Integrating Indigenous Traditional Ecological Knowledge (TEK) (Cont.)	Bison, the national mammal, in the SouthWest (Cont.)	Poster set up		Speaker-ready Room
5:30 to 7:30 PM	POSTER SESSION & RECEPTION: 1899 Bar & Grill Ballroom & Patio - 307 W. Dupont Ave., Flagstaff, AZ - Parking in High Country Conference Center parking garage (Appetizers & no-host bar)						

Time	Abinai	Doyle	Fremont	Rees	1899 Ballroom	Ponderosa (Boardroom)	Aspen
Wednesday, Sept. 14, 2022							
7 to 8 AM	REGISTRATION & MORNING REFRESHMENTS: Humphreys Ballroom						Speaker-ready Room
8 to 10 AM	Contributed: Resilience and restoration	Addressing data gaps related to the effects of mining breccia-pipe uranium deposits in the Grand Canyon Region (Walton-Day)	Advancing solutions: San Francisco Peaks Traditional Cultural Property (Gitlin, Jocks, Mulford)	Threats, research, and conservation of SW succulents (Thomas & Crawford)	Culturally responsive and inclusive teaching in natural resource management (Kim, Antoninka, Fulé)	SWEDR planning meeting (By invitation)	Speaker-ready Room
10:00 to 10:15 AM	BREAK: Humphreys Ballroom						Speaker-ready Room
10:15 AM to 12:15 PM	Climate change adaptation in the NPS (Reynolds)	Interacting effects of fire and warming in pinyon-juniper woodlands of the Southwest (Reed, Lauria, & Phillips)	Advancing solutions: San Francisco Peaks Traditional Cultural Property (Cont.)	Threats, research, and conservation of southwestern succulents (Cont.)	Culturally responsive and inclusive teaching in natural resource management (Cont.)		Speaker-ready Room
12:15 to 1:15 PM	BUFFET LUNCH: Humphreys Ballroom						Speaker-ready Room
1:00 to 1:15 PM	DOCUMENTARY: Re-greening a dryland watershed, U.S. Geological Survey (Norman)	Humphreys Ballroom				USGS Women's Lunch	Speaker-ready Room
1:15 to 3:15 PM	Contributed: Conservation science and management	Demystifying climate adaptation planning: frameworks, partnerships, and case studies from diverse perspectives (McCormick, Munson, Aslan & Thode)	Striving for equity in science communication (Hinck)	A macrosystems approach to managing southwestern riparian ecosystems facing climate change and exotic species invasion (Allan)	Colorado River natural resources in an era of uncertainty: using science to inform river management (Eppheimer, Grams & Palmquist)		Speaker-ready Room
3:15 to 3:30 PM	BREAK: Humphreys Ballroom						Speaker-ready Room

Time	Abinai	Doyle	Fremont	Rees	1899 Ballroom	Ponderosa (Boardroom)	Aspen	
3:30 to 5:30 PM	Contributed: Plant and animal ecology, conservation, and management	Demystifying climate adaptation planning: frameworks, partnerships, and case studies from diverse perspectives (Cont.)	Striving for equity in science communication (Cont.)	Biodiversity counts: does long-term monitoring lead to effective conservation outcomes? (Rowe)	Colorado River natural resources in an era of uncertainty (Cont.)			
5:30 to 7:00 PM	RECEPTION: ITEP 30 th Anniversary Celebration, 1899 Bar & Grill Ballroom & Patio - 307 W. Dupont Ave., Flagstaff, AZ Parking in High Country Conference Center parking garage (Appetizers & no-host bar)							
7:00 to 8:30 PM	KEYNOTE SPEAKER: Nicole Horseherder, Diné, Executive Director, Tó Nizhóní Áni - Prochnow Auditorium Parking in High Country Conference Center parking garage							
Time	Abinai	Doyle	Fremont	Rees	1899 Ballroom	Ponderosa (Boardroom)	Aspen	
Thursday, Sept. 15, 2022								
7 to 8 AM	REGISTRATION & MORNING REFRESHMENTS: Humphreys Ballroom							Speaker-ready Room
8 to 10 AM	Using natural infrastructure as nature-based solutions to heal the planet (Norman)	Remote sensing on the Colorado Plateau and Southwest region (Durning, J. Sankey, T. Sankey, Sensie, and Norris)	Emerging management challenges and research priorities for Southwestern pinyon-juniper woodlands (McCormick, Swan & Gehring)	Considering host-microbial interactions in ecosystem restoration (Bock & Markovchick))			Speaker-ready Room	
10:00 to 10:15 AM	BREAK: Humphreys Ballroom							
10:15 AM to 12:15 PM	Science and restoration of biological soil crusts in a changing environment (Jech, Anenberg, Rakes & Bacovcin)	Remote sensing on the Colorado Plateau and Southwest region (Cont.)	Emerging management challenges and research priorities for Southwestern pinyon-juniper woodlands (Cont.)	Contributed: Fire and fire responses				
12:15 to 1:15 PM	BUFFET LUNCH: Humphreys Ballroom							
ADJOURN: Thank you and safe travels!								



16th Biennial Conference of Science and Management for the Colorado Plateau and Southwest Region

**Theme: Creating hope through action: advancing solutions
to rapid environmental change**

September 12–15, 2022

High Country Conference Center, Northern Arizona University, Flagstaff, Arizona

Monday, September 12, 2022—Clients' Day

Registration and speaker ready room

10:00 AM–5:00 PM **Registration** (High Country Conference Center lobby)
3:00–5:00 PM **Speaker-ready room** (Aspen)

Meetings

Emory Oak Collaborative Tribal Restoration Initiative Advisory Committee meeting (by invitation, 10:00 AM–3:00 PM, **Fremont**)

US Geological Survey & Institute of Tribal Environmental Professionals, Discussion of interdisciplinary science and technology for tribal landscapes (by invitation, 11:30 AM–5:00 PM, **Abinai**)

Colorado Plateau CESU partners meeting (by invitation, 12:00–5:00 PM, **Ponderosa**)

USGS Terrestrial Drylands Ecosystems meeting (by invitation, 3:00–5:00 PM, **Doyle**)

Workshops

Cultivating wonder in the world beneath our feet: biocrusts, soils, and restoration tools for a changing environment—This workshop will provide basic background information about biocrusts. Participants will have an opportunity to observe natural biocrusts and brainstorm additional outdoor educational activities with the instructors. The workshop will include tools for land managers to determine the health of their soils and whether biocrust restoration is an option at their sites. **Organizers:** Sierra Jech, University of Colorado Boulder; Jasmine Anenberg, Northern Arizona University; Julie Bethany Rakes, Arizona State University; and John Bacovcin, Colorado State University). (FREE, 1:00–3:00 PM, **Doyle**)

Venomous reptile ecology awareness and safe handling training—This workshop is intended to help participants learn how to safely handle venomous reptiles in a controlled, carefully supervised environment. The lecture section will be followed by a hands-on demonstration and class participation in supervised handling of non-venomous and venomous snakes, using snake-safe tongs and snake-proof holding containers. Participants will be provided handout materials that reinforce training concepts and additional resources for living safely with venomous reptiles. **Organizer:** Erika Nowak, Northern Arizona University, School of Earth and Sustainability & Center for Adaptable Western Landscapes (Fee: \$35, 1:00–3:00 PM, **Rees**).

Field trips

Ponderosa pine ecology and management tour—This field trip will examine the ecology, dynamics, and management of ponderosa pine ecosystems in the southern edge of the Colorado Plateau. The field trip will begin by driving south to the Beaver Creek watershed to examine lower elevation range of ponderosa pine and its ecotone with pinon-juniper ecosystems. From Beaver Creek, the field trip will move to the forests north of Flagstaff to view a variety of management actions that reflect ponderosa pine dynamics and forest restoration. The field trip will conclude with a drive into the mixed-conifer zone along Snowbowl Road to examine the landscapes surrounding the San Francisco Peaks. **Organizers:** W. Keith Moser and Jackson Leonard, US Forest Service, Rocky Mountain Research Station, and Andrew Sánchez Meador, Ecological Restoration Institute and School of Forestry, Northern Arizona University (Fee: \$35, 8:00 AM~4:00 PM, lunch included). **Meet in front of High Country Conference Center at 7:45 AM.**

Climate change and management in pinyon-juniper woodlands— This field trip will showcase climate change impacts and management efforts in pinyon-juniper (PJ) woodlands. Participants will travel to a Babbitt Ranches site near Slate Mountain, which is 50 miles north of Flagstaff. Babbitt Ranches has been working with Arizona Game and Fish Department on thinning PJ woodlands for the benefit of wildlife. Participants will also visit a nearby area of extensive juniper die-off; a recent and unexpected climate change-induced phenomenon. **Organizers:** Molly McCormick, US Geological Survey, Southwest Biological Science Center, and Steve Cas-sady, Arizona Game and Fish Department (Fee: \$35, 8:00 AM~4:00 PM, lunch included). **Meet in front of High Country Conference Center at 7:45 AM.**

Evening conference events

5:30–7:00 PM **Opening reception**, 1899 Bar and Grill patio, 307 W. Dupont Ave. Parking available in the High Country Conference Center garage. (Appetizers and no-host bar)

7:00–8:30 PM **Public speaker:** Dr. Stephen J. Pyne, *The Pyrocene Comes to the Plateau*

Steve Pyne is a writer, urban farmer, and emeritus professor at Arizona State University. He has written major fire histories for America, Canada, Australia, Europe, and the Earth, and most recently *The Pyrocene. How We Created an Age of Fire, and What Happens Next*. Among books that deal with the Colorado Plateau are *Grove Karl Gilbert: A Great Engine of Research* and *How the Canyon Became Grand*. In a former life he was a member of the North Rim Longshots for 15 seasons at Grand Canyon.

Admission is free and the public is welcome. Prochnow Auditorium, 326 W. Dupont Avenue (next door to the reception). Parking in High Country Conference Center parking garage.

Tuesday, September 13, 2022

7:00–8:00 AM	Morning refreshments (Humphreys Ballroom)
7:00 AM–5:00 PM	Registration (High Country Conference Center lobby)
7:00–5:00 PM	Speaker-ready room (Aspen)
8:00–8:15 AM	Official welcome: Dr. Jason Wilder, Vice President of Research, Northern Arizona University, and Scott VanderKooi, Director, Southwest Biological Science Center, US Geological Survey
8:15–9:00 AM	Science keynote speaker: Dr. Sasha C. Reed , U.S. Geological Survey, Southwest Biological Science Center, <i>Finding hope in times of change: How science and management can work together to face an uncertain future on the Colorado Plateau</i> . (Prochnow Auditorium)
9:00–9:30 AM	Break (Humphreys Ballroom)

Workshops and meetings

11:30 AM–1:00 PM	Workshop: Using Phenocam to monitor dryland ecosystems. Organizers: Alison Post, Andrew Richardson, Northern Arizona University, ECOSS and SICCS, and Oscar Zimmerman, Northern Arizona University, ECOSS and Department of Biological Sciences (FREE, Doyle)
11:30 AM–1:00 PM	Workshop: Co-management of ancestral public lands: sharing outcomes from the 2022 Bears Ears field school. Organizers: Melanie Armstrong, Regina Lopez-Whiteskunk, Tobias Nickel, Lizzy Bauer, Jojo Matson, Addie Mandeville, and Whitney Stewart, Western Colorado University, Center for Public Lands, and Steph Wacha, Grand Canyon Trust (FREE, Fremont)
11:30 AM–1:00 PM	Working session: Peer learning to co-develop fire and climate adaptation case studies. Organizers: Sarah LeRoy and Ariel Leger, University of Arizona; Todd Chaudhry, National Park Service; and Clare Aslan and Andrea Thode, Northern Arizona University (by invitation, Ponderosa)
11:30 AM–1:00 PM	Meeting: NPS Southern Colorado Plateau Inventory and Monitoring Network Technical Advisory Committee monthly meeting (Rees)

Evening conference events

5:30–7:30 PM	Poster session and reception , 1899 Bar and Grill Ballroom and Patio, 307 W. Dupont Ave. Parking available in the High Country Conference Center garage. (Appetizers and no-host bar)
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Invited and contributed talks

Contributed: Grazing and grasslands

Tuesday, 9:30–11:30 AM (**Abinau**)

Moderator: Kristina Young, Colorado State University, Department of Fish, Wildlife, and Conservation Biology

- 9:30–9:45 Climate and soils moderate land cover change following grazing retirement in Capitol Reef National Park. **McNELLIS, B.E.**, Knight, A.K., Nauman, T.W., Chambers, S.N., Brungard, C.W., Fick, S.E., Livensperger, C.G., Borthwick, S., and Duniway, M.C.
- 9:45–10:00 Grazing management may moderate the effects of climate change on big sagebrush plant communities. **HOLDREGE, M.C.**, Palmquist, K.A., England, M., Renne, R.R., Schlaepfer, D.R., Doherty, K.E., Remington, T.E., Lauenroth, W.K., and Bradford, J.B.
- 10:00–10:15 Varied long-term responses to climate change among steady states in a historical grazing gradient in southeast Utah. **FINGER-HIGGINS, R.**, Belnap, J., Geiger, E., Knight, A., Van Scoyoc, M., and Duniway, M.
- 10:15–10:30 Impacts of extreme seasonal drought on Colorado Plateau grassland plant communities. **KNIGHT, A.**, Hoover, D.L., Pfennigwerth, A., and Duniway, M.C.
- 10:30–10:45 Primary production responses to extreme changes in North American Monsoon precipitation vary by elevation and plant functional composition through time. **MUNSON, S.M.**, Bradford, J.B., Butterfield, B.J., and Gremer, J.R.
- 10:45–11:00 Using PhenoCam data to model spring green-up across diverse North American grasslands. **POST, A.**, and Richardson, A.
- 11:00–11:15 Long-term simulated atmospheric nitrogen deposition has minimal impacts on biogeochemical and ecosystem properties in three semiarid grasslands on the Colorado Plateau. **OSBORNE, B.B.**, Roybal, C.M., Reibold, R., Collier, C.D., Geiger, E., Phillips, M.L., Weintraub, M.N., and Reed, S.C.
- 11:15–11:30 RainManSR: an in-situ rainfall manipulation experiment linking above- and below-ground responses to temporal repackaging of precipitation in a semiarid grassland. **BIEDERMAN, J.A.**, Zhang, F., Pierce, N., Roby, M., Blais, J., Reed, S., Potts, D., and Smith, W.K.

Managing wildfires for forest restoration on the Colorado Plateau and Southwest Region

Tuesday, 9:30–11:30 AM (**Doyle**)

Organizers: Melanie Colavito and Dave Huffman, Northern Arizona University, Ecological Restoration Institute

- 9:30–9:45 The current state of managing fires for ecological benefit and resource objectives in the southwestern U.S. **BEAN, R.**, and Z. Evans
- 9:45 – 10:00 Eras of wildfire policy: the history of federal and interagency management of wildfires for restoration. **FRANZ, S.**, C. Edgeley, M. Colavito, and T. Wasserman
- 10:00–10:15 Comparing geography and severity of managed wildfires in California and the southwest USA before and after the implementation of the 2009 Policy Guidance. **INIGUEZ, J.**, A. Evans, S. Dadashi, J. Young, M. Meyer, A. Thode, S. Hedwall, S. McCaffrey, S. Fillmore, and R. Bean
- 10:15–10:30 Preliminary analysis assessing the applicability of the Managed Fire Decision Framework within the post-2009 policy context. **FILLMORE, S.**, and S. McCaffrey
- 10:30–10:45 Rafael Fire case study. **MORFIN, V.**
- 10:45–11:00 Evaluating the US Forest Service Risk Management Assistance program and use during the 2021 wildfire season. Beeton, T., **M. CAGGIANO**, M. Colavito, and C. Huayhuaca
- 11:00–11:15 Ponderosa pine forest patterns following wildfires managed for resource benefit: comparison with reference landscapes. **SÁNCHEZ MEADOR, A.**, J. Donager, and D. Huffman
- 11:15–11:30 Long-term effects of resource objectives wildfires: meeting restoration objectives while balancing the forest carbon cycle. Young, J., A. Ager, and **A. THODE**

The challenges, successes, and future steps in figuring out the vulnerability of southwestern cultural resources to climate change

Tuesday, 9:30–11:30 AM (**Fremont**)

Organizers: Sallie Hejl, National Park Service, University of Arizona; and Lauren Meyer, Pam Benjamin, and Evan Oskierko-Jeznacki, National Park Service

- 9:30–9:45 Interdisciplinary approaches to vulnerability analysis of National Park Service cultural resources to climate change. **OSKIERKO-JEZNACKI, E.**, and L. Meyer
- 9:45–10:00 Vital signs: condition survey and vulnerability assessment for built heritage. **MATERO, F.**, J. Hinchman, and E. Oskierko-Jeznacki
- 10:00–10:15 Collaborative development of CREVAT, a GIS-based tool to assess NPS cultural resources vulnerabilities to climate change in the Intermountain Region. **LEROY, S.R.**, G.M. Garfin, K.A. Hartfield, J.L. Weiss, H. Hartmann, W.J.D. van Leeuwen, B. Jeffery, S. Bierer, E. Oskierko-Jeznacki, L. Meyer, R. Adler, and P. Benjamin
- 10:15–10:30 Rapid risk assessment approach at Fort Union National Monument. **EMERY, V.L.**
- 10:30–10:45 A multipronged approach to assessing impacts of climate change on precontact masonry structures at Tuzigoot National Monument—a case study. **HOEDL, L.M.**
- 10:45–11:00 Adaptation of scenario planning and risk assessment approaches toward development of priorities and approaches to management at Chaco Culture National Historic Park—a case study. **ADAMS, A.**
- 11:15–11:45 Discussion moderated by Lauren Meyer and Pam Benjamin

Visitor use management in an era of rapid change and dynamic futures

Tuesday, 9:30–11:30 (**Rees**)

Organizer: Zach Miller, Visitor Use Management Program Coordinator, National Park Service–Intermountain Regional Office

- 9:30–9:45 What is visitor use management? An overview of the history, science, and framework. **MILLER, Z.D.**
- 9:45–10:00 Considerations for monitoring visitor use into the future. **PETTEBONE, D.**
- 10:00–10:15 Agent-based microsimulation for emergency evacuation in Rocky Mountain National Park. A. Aktildiz, **PAN, B.**, G. Xu, V. Gayah, B.D. Taff, P. Newman, S. Esser, and J. Hannon
- 10:15–10:30 Who started, stopped, and continued participating in outdoor recreation during the COVID-19 pandemic in the United States? Results from a national panel study. Taff, D., W.L. Rice, **B. LAWHON**, and P. Newman
- 10:30–10:45 Climate change and visitation to public lands in the Southwest. **WILKINS, E.**, Y. Chikamoto, A.B. Miller, and J.W. Smith
- 10:45–11:00 On the move: how mobile location data can help public land managers tackle complex problems. **JORGENSEN, J.**, C. Cares, and J. Sage
- 11:00–11:15 Informing visitor use management with statistical and simulation modeling: examples from the field. Lawson, S., and **A. LARKIN**
- 11:15–11:30 Discussion

Leaves to Landscapes: Part 1—Evapotranspiration: spatial models of ET at the landscape level

Tuesday, 9:30 AM–11:30 AM (1899 Ballroom)

Organizers: Pamela Nagler, U.S. Geological Survey, Southwest Biological Science Center, and Matthew Johnson, Northern Arizona University

- 9:30–9:45 Native and non-native riparian tree species of the western US show different seasonal variation in stomatal sensitivity to atmospheric vapor pressure deficit. **BUSH, S.E.**, J.S. Guo, K.R. Hultine
- 9:45–10:00 Mapping and modeling agricultural evapotranspiration and crop water productivity with remote sensing: implications for Water savings applicable to the southwest US in rapid environmental change. **FOLEY, D.J.**, P.S. Thenkabail, A.J. Oliphant, I.P. Aneece, and P.G. Teluguntla
- 10:00–10:15 Machine learning algorithms for land cover classification using Landsat imagery over the Colorado Plateau, performance and training considerations. **JIMÉNEZ HERNÁNDEZ, E.**, K. Didan, A. Barreto Muñoz, and P.L. Nagler
- 10:15–10:30 A cloud based platform for exploring satellite time series data in support of the US southwest riparian corridors vegetation health and ecohydrology. **BARRETO-MUÑOZ, A.**, K. Didan, E. Jiménez Hernández, and P.L. Nagler
- 10:30–10:45 Effects of the 2021 federal flows on riparian plant vegetation index and actual evapotranspiration in the Colorado River Delta, Mexico. **GÓMEZ SAPIENS, M.M.**, P.L. Nagler, K. Didan, A. Barreto-Muñoz, A. Melendez, C. Restrepo
- 10:45–11:00 Cooling capacity of urban trees exposed to thermal stress. **APARECIDO, L.M.T.**, K. Naylor, I. Werner, R. Braithwaite, E. Schmidt, H. Throop, J. Das, and K.R. Hultine
- 11:00–11:15 Convergence of riparian successional trajectories 11 years after a large flood and *Tamarix* bio-control. **GONZÁLEZ-SARGAS, E.**, P.B. Shafroth, and S.R. Lee
- 11:15–11:30 Recovery of a native riparian tree following removal of an invasive competitor. **GOETZ, A.**, I. Moffit, and A. Sher

Leaves to Landscapes: Part 2—Tamarisk and tamarisk beetle impacts: habitat and policy

Tuesday, 1:00–3:00 PM (1899 Ballroom)

Organizers: Pamela Nagler, U.S. Geological Survey, Southwest Biological Science Center, and Matthew Johnson, Northern Arizona University

- 1:00–1:15 The USDA saltcedar biological control program, the saltcedar lawsuit, and the Endangered Species Act section 7(a)1 conservation program. **CARAH, K.**
- 1:15–1:30 Is the endangered Southwestern Willow Flycatcher population growing and expanding its distribution, or declining, and shrinking? (Is it time for a SWFL blitz?) **JOHNSON, M.J.**, J.A. Holmes, and S.L. Durst.
- 1:30–1:45 Southwestern Willow Flycatcher and tamarisk beetle status and habitat restoration efforts—Virgin and Lower Colorado Rivers. **MCLEOD, M.A.** and C. Edwards
- 1:45–2:00 Tamarisk biological control significantly alters bird community composition in the absence of cottonwood and willow vegetation. **MAHONEY, S.M.**, M.J. Johnson, J.A. Holmes, T. Dudley, M. Kuehn, and T.C. Theimer
- 2:00–2:15 Exploring regional patterns in predicted Southwestern willow flycatcher breeding habitat with a Landsat model. **HATTEN, J.R.**
- 2:15–2:30 Southwestern Willow Flycatcher patch occupancy modelling. **YACKULIC, C.B.**, J. Hatten, J. Holmes, M. Johnson, and E. Paxton

- 2:30–2:45 Tools for restoration feasibility planning at the Lower San Pedro Wildlife Area (LSPRWA): Vegetation and soil assessment, LiDAR data, groundwater-surface water model, habitat suitability models. **BANERJEE, M.**, C. McKenna, M. Milczarek, L. Lacher, B. Prucha, C. Miller, S. Lowery, and A. Stingelin
- 2:45–3:00 Managing and restoring resilient river-riparian ecosystems in dryland regions. **ORR, B.**, C. Braudrick, K. Rodriguez, and E. Adelstein

Southwest ecosystems in a new ecohydrological reality: carbon and water responses to drought and aridification

Tuesday, 1:00–3:00 PM (**Abinau**)

Organizers: Kimberly Samuels-Crow, Emma Reich, and Kiona Ogle, Northern Arizona University, School of Informatics, Computing, & Cyber Systems

- 1:00–1:15 Ecological drought metrics to understand dryland ecosystem dynamics. **BRADFORD, J.B.**, D.A. Chenoweth, D.R. Schlaepfer, J.C. Chambers, J.L. Brown, J.L., A.K. Urza, B. Hanberry, D. Board, and M. Crist
- 1:15–1:30 Plant water-use efficiency predictors along an aridity gradient. **REICH, E.**, K. Samuels-Crow, J. Bradford, M. Litvak, D. Schlaepfer, and K. Ogle
- 1:30–1:45 Tradeoffs between leaf cooling and hydraulic risk in hot environments. **HULTINE, K.R.**, L.M.T. Aparecido, D.E. Blasini, D.F. Koepke, and M.E. Moran
- 1:45–2:00 Identification of variables affecting oneseed juniper dieback using structural equation modeling (SEM). **BYERLY, S.B.**, and B.J. Butterfield
- 2:00–2:15 It takes time: carbon starvation in *P. edulis* after a decade of experimental drought. **PELTIER, D.M.P.**, M.S. Carbone, C. McIntire, N. Robertson, R.A. Thompson, S. Malone, M. Friedman, J. LeMoine, A.D. Richardson, N.G. McDowell, H.D. Adams, W. Pockman, and A. Trowbridge
- 2:15–2:30 Future of piñon-juniper woodlands in response to extreme drought in the Southwest. **LITVAK, M.E.**, S. Schwinning, C. Reasner, A. Sengsirirak, T. Duman, and W.T. Pockman
- 2:30–2:45 Soil moisture response to seasonal drought conditions and post-thinning forest structure. **SANKEY, T.**, A. Belmonte, J. Tatum, J. Biederman, J.B. Bradford, and T. Kolb
- 2:45–3:00 How ecosystem water and carbon fluxes across southern Arizona are responding to the drier and more extreme climate of the 21st century. **SCOTT, R.L.**

Contributed: Drought and climate change

Tuesday, 1:00–3:00 PM, (**Doyle**)

Moderator: Adam Noel, US Geological Survey, Southwest Biological Science Center, and Northern Arizona University, Center for Adaptable Western Landscapes

- 1:00–1:15 Increasing mortality and declining recruitment driven by warm, dry conditions leads to decline of western US woodlands. **SHRIVER, R.K.**, Yackulic, C.B., Bell, D.M., and Bradford, J.B.
- 1:15–1:30 Evaluating rock pool hydroperiod fluctuation using climate variables to inform habitat monitoring and protection in the western Sonoran Desert. **LANGE, K.**, Britton, A., An, D., Nixon, C., Geraty, S., and Rao, D.
- 1:30–1:45 Conserving species interactions may be more important than conserving species: the importance of interactions and a community approach. **WHITHAM, T.G.**
- 1:45–2:00 Synergistic land use and climate drivers of wind erosion on the Colorado Plateau: Implications for management. **NAUMAN, T.W.**, and Duniway, M.C.
- 2:00–2:15 Food forests as a strategy for climate mitigation. **ALLEN, J.A.**

- 2:15–2:30 NEON in the Colorado Plateau and Southwest region: expanding the scope of ecological science through long-term, open access ecological data. **MATTHIESEN, K.J.**, Lindauer, J., and Faust, M.
- 2:30–2:45 Using NASA Earth observations to monitor and model juniper woodland mortality in Grand Canyon National Park. Jackson, S., **HITCHNER, M.**, Ritchie, M., and Miotke, J.
- 2:45–3:00 Utilizing aerial imagery and NASA Earth observations to assess pinyon-juniper tree mortality in Flagstaff, AZ. **RAMBERG-PIHL, N.**, Jaenicke, M., Britton, A., Brown, A., and Megraw, L.

Applying Traditional Ecological Knowledge (TEK) and conservation priorities to improve land management outcomes

Tuesday, 1:00–4:15 PM (Fremont)

Organizers: Nanebah Lyndon, USDA Forest Service, Kaibab National Forest; Sara Southern, Northern Arizona University, School of Earth and Sustainability and Center for Adaptable Western Landscapes; and Nikki Cooley, Diné, Northern Arizona University, Institute for Tribal Environmental Professionals

- 1:00–1:15 Traditional Ecological Knowledge (TEK) and land management. **LYNDON, N.**, and S. Southern
- 1:15–1:30 Maintaining Zuni ties to the Grand Canyon. **SEOWTEWA, O.**, and M. Gchachu
- 1:30–1:45 Engaging with federal agencies—best practices from the tribal perspective—case study of a Bureau of Reclamation project, Hopi ethnographic study for the Navajo-Gallup Water Supply Project. **KOYIYUMPTWEA, S.**, and J. Nicholas
- 1:45–2:00 Climate impacts and resilience efforts by Tribal/Indigenous communities in the Southwest. **COOLEY, N.**
- 2:00–2:15 Indigenous woodland management and energy sovereignty on Cedar Mesa, Utah. **MAGARGAL, K.**, and B. Coddling
- 2:15–2:30 A model for Tribal collaboration and information sharing during baseline archaeological and biological survey. **SHINGOITEWA, L.**, and A. Buckles
- 2:30–2:45 Wood for Life program—a best practices model to provide resources and a sustainable source of firewood to local tribes through forest restoration efforts; to reduce forest-wide fuels; and to foster and strengthen partner relationships. **HONANIE, M.**, H. Lomayesva, M. Masayesva, S. Stortz, and E. Sawa
- 2:45–3:00 Emory Oak Collaborative Tribal Restoration Initiative (EOCTRI) —fostering the protection and restoration of culturally sensitive natural resources. **RANDALL, V.**, V. Wesley, N. Lyndon, and S. Southern
- 3:00–3:15 **BREAK**
- 3:15–4:15 **Panel:** Applying Traditional Ecological Knowledge (TEK) and conservation priorities to improve land management outcomes—Tribal perspectives

Facilitators: Nanebah Lyndon & Sara Southern

- *Panelists:*
- **Vincent Randall**, Cultural Director, Yavapai-Apache Nation
- **Stewart Koyiyumptewa**, Hopi Cultural Preservation Office
- **Joel Nicholas**, Archaeologist II, Hopi Cultural Preservation Office
- **Octavius Seowtewa**, Director, Zuni Cultural Resources Advisory Team
- **Victoria Wesley**, Forest Manager, San Carlos Tribal Forest Resources Program

Bison, the national mammal, in the SouthWest

Tuesday, 1:00–5:15 PM (Rees)

Organizers: Miranda Terwilliger and Greg Holm, National Park Service, Grand Canyon National Park

- 1:00–1:15 Introduction—bison history and herds in the SW and CO Plateau. **TERWILLIGER, M.**
- 1:15–1:30 Bison conservation genetics and metapopulation planning in the Department of the Interior. **MOYNAHAN, B.J.**
- 1:30–1:45 Opportunities in co-management of publicly-managed buffalo herds—three years of live transfers of Grand Canyon buffalo, and 30 years of restoring buffalo to tribal nations with InterTribal Buffalo Council. **DAVENPORT, M.**, M. Lyndon, and T. Heinert
- 1:45–2:00 Zuni cultural importance of bison. **SEOTEWA, O.**
- 2:00–2:15 Bison for Tribal, spiritual, and food connections. **IRON CLOUD, A.**, and L. Iron Cloud
- 2:15–2:30 Population dynamics of bison inhabiting the edge of historic range. **SCHOENECKER, K.A.**, K. Searle, and C. Pague
- 2:30–2:45 Management challenges and success of Arizona’s three bison herds. **NELSON, R.**
- 2:45–3:00 Bison hide pictorial history of bison recovery and management in Arizona. **NELSON, R.**
- 3:00–3:15 **BREAK**
- 3:15–3:30 Effects of hunting pressure on resource selection and movement in the Kaibab Plateau bison herd, Arizona. **SALGANEK, S.**, K.A. Schoenecker, M.L.N. Terwilliger, and G. Holm
- 3:30–3:45 Grand Canyon National Park bison herd reduction. **TERWILLIGER, M.L.N.**, and G. Holm
- 3:45–4:00 Managing bison in Utah. **HERSEY, K.R.**, W. Paskett, C. Sampson, and R. Robinson
- 4:00–4:15 Conservation or livestock goals: managing bison for conservation and for income—a case study of The Nature Conservancy’s Medano-Zapata Ranch in southern Colorado. **PAGUE, C.**, K.A. Schoenecker, and C. Kelly
- 4:15–4:30 Bison and elk herbivory in Great Sand National Park: natural patchiness or overgrazing? **SCHOENECKER, K.A.**, L.C. Zeigenfuss, and D.J. Augustine
- 4:30–4:45 Effects of plains bison (*Bison bison bison*) herbivory on grassland structure and function on the North Rim of Grand Canyon National Park, Arizona. **MUSTO, D.T.**, K.A. Schoenecker, and C.L. Aldridge
- 4:45–5:00 Population health assessments for bison conservation. **JUSTICE-ALLEN, A.**
- 5:00–5:15 Questions and discussion

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The Colorado River Basin Actionable and Strategic Integrated Science and Technology (ASIST) project

Tuesday, 3:15–5:15 PM (**Abinau**)

Organizers: Kathryn Thomas, US Geological Survey (USGS), Southwest Biological Science Center; Katharine Dahm, USGS, Rocky Mountain Regional Office

Part 1—From EarthMAP to ASIST, a new framework to advance science through science and technology integration

- 3:15–3:30 A new framework for convergent research: Actionable and Strategic Integrated Science and Technology (ASIST). **DAHM, K.G.**, J. Alexander, E. Anderson, P. Anderson, W. Andrews, J. Erxleben, R. Frus, J. Hevesi, R. Horton, S. House, D. Jones, A. Monroe, S. Qi, A. Tillery, K. Thomas, and A. Torregrosa
- 3:30–3:45 An innovative strategy to assess Colorado River Basin stakeholder science needs related to drought. **FRUS, R.**, P. Anderson, S. Qi, W. Andrews, and K. Dahm
- 3:45–4:00 USGS Colorado River Basin Science and Technology Collaboration Meeting series: insights and next step. **JONES, D.K.**, A. Monroe, M. Dick, R. Frus, A. Tillery, A. Torregrosa, J. Alexander, and P. Anderson
- 4:00–4:15 Advanced information management and technology assessment for science in the Colorado River Basin. **ANDERSON, E.D.**, J.R. Erxleben, D.A. Ignizio, S. Qi, A.P. Monroe, and K. Raja
- 4:15–4:30 **Round table discussion:** Creating action through collaboration to advancing interdisciplinary science solutions in Colorado River Basin. Facilitators: Alicia Torregrosa and Kathryn Thomas

Part 2—Examples of technologies that improve actionable science in a rapidly changing environment

- 4:30–4:45 Modernizing data telemetry efforts for important riparian resources in the Grand Canyon. **GUSH-UE, T.M.**, J.E. Thomas, and C.M. Andrews
- 4:45–5:00 Building a community for FAIR and integrated modeling using catchments in the Lower Colorado River Basin. **NAGLER, P.L.**, A. Barreto-Muñoz, K. Didan, O. Miller, P. Shafroth, E.D. Anderson, S.M. Aulenbach, W.J. Andrews, K.G. Dahm, and K.J. Bagstad
- 5:00–5:15 Mapping semantic networks in risk informed decision-making to improve integrated science. **TORREGROSA, A.**, K. Dahm, S. Bender, E. Anderson, J. Erxleben, K. Thomas, S. Qi, S. House, M. Rocha, and C. Hoover

After fire; tools to empower our collective response and recovery

Tuesday, 3:15–5:15 PM (**Doyle**)

Organizers: Rachel Bean and Zander Evans, Forest Stewards Guild

- 3:15–3:30 Recovering from wildfire in Arizona: insights and opportunities from social science research after six wildfires. **EDGELEY, C.**
- 3:30–3:45 Engaging Tribal perspectives in post-fire restoration and response. **CALABAZA, J.**
- 3:45–4:00 Pre-fire assessment of post-fire debris flow hazards in the Santa Fe Municipal Watershed. **MARGOLIS, E.**, M. Lopez, A. Tillery, and S. Bassett
- 4:00–4:15 Post-fire futures in southwestern forests: trajectories of recovery vs. conversion and management options for an era of rapid change. **COOP, J.D.**
- 4:15–4:30 Opportunities to improve out-planting performance of southwestern ponderosa pine by selection of arid adapted seed sources: insights from field and greenhouse common gardens. **DIXIT, A.H.**, T.E. Kolb, and O.T. Burney
- 4:30–4:45 Accounting for warming climate and future fire: a decision-making framework for complex post-fire landscape-scale management. **HAFFEY, C.**, S. Stortz, and S. Lehnert
- 4:45–5:00 Navigating post-fire response on non-federal, non-Tribal lands. **STUEVER, M.**
- 5:00–5:15 Discussion

Poster Session

Tuesday, September 13, 2022, 5:30–7:00 PM, 1899 Bar and Grill Ballroom & Patio

Poster chair: Sneha Vissa, Northern Arizona University, Department of Biological Sciences

Location and parking: 307 W. Dupont Ave. Validated parking at the High Country Conference Center parking garage.

Presenters: Please hang your posters between 4:00 and 5:30 PM on Tuesday or by special arrangement. Conference staff will be available to assist you.

1. Mapping actual evapotranspiration over croplands using vegetation index methods. **ABBASI, N.**, H. Nouri, S. Siebert, A. Barreto-Muñoz, K. Didan, S. Chavoshi Borujeni, C. Opp, and P.L. Nagler
2. Relationships between management trajectories and ecological patterns in management mosaic landscapes. **ASLAN, C.**, M. Brunson, R. Epanchin-Niell, S. Veloz, and B. Sikes
3. Development and application of an Inductively Coupled Plasma Mass Spectrometer (ICPMS) method to quantify uranium and arsenic in grocery store frozen cow and calf liver. **BLACK, K.**, A.R. Lister, and J.C. Ingram
4. Burn severity impacts on watershed health in warm-dry mixed conifer four years post-fire, southwestern Colorado. **BODNAR G.** and J.E. Korb
5. Resident mitigation for post-fire flooding: lessons learned for collective action from the 2010 Schultz Fire. **BURNETT, J.T.** and C.M. Edgeley
6. Native bees in Buenos Aires National Wildlife Refuge: A first survey in a diverse but vulnerable desert grassland. **BUSBY, M.K.**, A.M. Hoover, and K.A. Thomas
7. The effects of water erosion on archeological sites at Wupatki National Monument. **COVERT, A.**
8. RestoreNet: a restoration field trial network to bridge science and land management. **CROYDON, A.H.**, S.M. Munson, M.L. McCormick, K.M. Laushman, H.L. Farrell, S.A. Costanzo, K.R. Balazs, C.A. Havrilla, E.S. Gornish, A.M. Faist, L. Larios, H. Rowe, M.C. Duniway, S.C. Reed, and B.J. Butterfield
9. A belowground story: a soils perspective on the effects and reclamation options for oil and gas well pads in the western US. **DALY, N.**, R. Reibold, K. Griffen, A. Sengsirak, R. Lupardus, M. Villareal, M. Duniway, J. Bradford, S. Munson, and S. Reed
10. Reducing human-caused wildfire: A survey of recreationists on two southwestern national forests. **DEVENPORT, S.E.**, C.M. Edgeley, and Z.M. Zamudio
11. The influence of underlying factors on treatment effectiveness of piñon-juniper removal in restoring sagebrush habitat in northwest Colorado. **ENNIS, A.S.**, N.N. Barger, C. Domschke, J. Humphries, and L. Waldner
12. Snake snack: eDNA qPCR and DNA metabarcoding assays detect predation on and diet of threatened northern Mexican gartersnakes (*Thamnophis eques megalops*). **FEDERMAN, E.L.**, D.E. Sanchez, M. Wicke, J. Black, R.A. Valencia, E. Nowak, and F.M. Walker
13. The effect of various rates of compost addition on aggregate stability and infiltration rate. **GARCIA, J.**, and E. Stricker
14. Impacts of climate change and Grand Canyon National Park vegetative ecosystems: A case study using phenology and citizen science. **GEARRIES, J.A.**
15. Functional diversity of native seed mixes increases native plant competition with *Bromus tectorum* (cheatgrass). **GILL, A.S.**, E. Enebo, H. Geist-Sanchez, and C.A. Havrilla
16. Convergence of riparian successional trajectories 11 years after a large flood and *Tamarix* biocontrol. **GONZÁLEZ-SARGAS, E.**, P.B. Shafroth, and S.R. Lee
17. Hedging bets in an erratic aquatic environment: how do branchiopod crustaceans in potholes deal with unpredictable timing and volume of precipitation? **GRAHAM, T.B.**, and J. Cook
18. Soil measurements show greater compaction on reclaimed or abandoned oil pads compared to unpaved sites. **GRIFFEN, K.**, **SENDSIRIRAK, A.**, C.J. Williams, J.C. Johnson, R. Lupardus, J. Belnap, J. Bradford, A. Knight, B. Mcnellis, S. Munson, S. Reed, M. Villarreal, and M. Duniway
19. Transgenerational plasticity and genetic variation contribute to varied climate response in black cottonwood. **HERNANDEZ, M.T.**, A.V. Whipple, and L. Holeski

20. Woodland recovery may be related to microclimate more than tree size. **HILL, E.M.**, M.D. Redmond, and T. Ocheltree
21. Tracking snow accumulation and ablation from forest into a 20-year old burn scar in the Sierra Ancha Experimental Forest using snowtopography. **HUTCHINSON, L.**, J. Leonard, and E. Schiefer
22. Assessing native ungulate wildlife habitat four years post-fire in the 416 burn area, southwest Colorado and its implications on wolf management. **JORGENSEN, A.A.** and J.E. Korb
23. Population based differences in cold tolerance affected by drought and temperature acclimation in *Pinus strobiformis*. **KANTORIS, H.R.**, D. Tirado-Barva, and A.V. Whipple, A.V.
24. Abiotic variables associated with conifer regeneration in warm-dry mixed conifer in the 416 Fire, southwestern Colorado. **KORB, J.E.**, E. Post, and M.J. Remke.
25. Is there a hummingbird mediated fitness advantage for a foliar striping phenotype on *Mimulus verbenaceus*? **LAPLANTE, E.R.** and L.M. Holeski
26. Evaluating greenness and water requirement of urban greenery using Sentinel imagery in Google Earth Engine in a dryland city. **LOTFI, W.**, H. Nouri, and N. Abbasi
27. Assessing recent and future climate impacts on *Papilio* spp. and their host plants. **MELKONOFF, N.A.**, E.R. Zylstra, J.C. Oliver, and K.L. Prudic
28. The Arizona Monarch Collaborative: promoting action and collaboration for the western monarchs of Arizona. **MILLER, J.**, C. Boucher, K. Gade, N. Melkonoff, K. Pegram, and K. Thomas
29. New Mexico Highlands University FORT-CREST Project. **MONTOYA, D.**
30. Drought tolerant and drought intolerant pinyons converge in fungal communities during drought but differ in leaf spectra. **MORRIS, K.**, C. Gehring, G. Trimber, A. Whipple, P. Heinrich, S. Chischilly, and C. Doughty
31. Bison hide pictorial history of bison recovery and management in Arizona. **NELSON, R.** and J. Taylor
32. Detection of listed bat species under bridges through the use of fecal DNA. **OWENS, M.D.**, S. Dulc, H. Gates, C.L. Lausen, E. Low, C. Olson, D.E. Sanchez, A. Tobin, C.L. Chambers, and F.M. Walker
33. Evaluating the effects of drought conditioning, container size, and planting season on Ponderosa pine seedlings in post-fire reforestation. **ROE, S.** and O. Burney
34. Assessing combinations of nucleation size and planting density to improve survival and performance of planted ponderosa pine seedlings. **SAFIULLAH, D.**, A. Dixit, O. Burney, and J. Sloan
35. Riparian vegetation trends in health and water use using the two-band Enhanced Vegetation Index and SSEBop methods in restored and unrestored reaches of the Lower Colorado River in the USA. **SALL, I.**, P.L. Nagler, A. Barreto-Muñoz, K. Didan, N. Abbasi, H. Nouri, M. Schauer, and G.B. Senay
36. The 2022 Antelope Fire, fuels management, suppression repair, and lessons learned for cultural resource management at Wupatki National Monument. **SHAW, C.**
37. Understory herbaceous and shrub species richness and abundance variation among burn severities in warm-dry mixed conifer in the 416 Fire, southwestern Colorado. **SISNEROS, S.L.** and J.E. Korb.
38. Identifying barriers to and opportunities for adopting biochar production to reduce fire risk and improve soil health in northern New Mexico. **SORIANO, R.**, T. Falkowski, and E. Stricker
39. Climate Science Alliance Tribal Working Group: A model for advancing tribal and non-tribal collaboration. **TALLAS, N.** and A. Walker
40. Health impacts of wildfire smoke and mitigation efforts in the Hoopa Valley Tribe Reservation. **TELLES, F.T** and B.G. McCaughey.
41. Plant materials development for the Four Forest Restoration Initiative. **WELSH, Z.**, J. Moe, and E. Loefelholz.
42. Spatial and temporal variation in wood density and its impact on tree growth in the Southwest. **WESELY, N.K.**, D. Auty, D.M.P. Peltier, D. Vaughan, and K. Ogle
43. Understanding the impacts of and identifying mitigation strategies for domestic grazing under drought on the Colorado Plateau. **WILSON, S.L.**, T.B.B. Bishop, A.C. Knight, and M.C. Duniway

Wednesday, September 14, 2022

Registration and speaker ready room

7:00–8:00 AM	Morning refreshments (Humphreys Ballroom)
7:00 AM–5:00 PM	Registration (High Country Conference Center lobby)
7:00–5:00 PM	Speaker-ready room (Aspen)

Meetings

8:00–10:00 AM	SWEDR meeting (Ponderosa)
12:15 – 1:15 PM	USGS Women's Lunch (Ponderosa)

Evening conference events

5:30–7:00 PM	NAU's Institute for Tribal Environmental Professionals 30th anniversary celebratory reception , 1899 Bar and Grill patio, 307 W. Dupont Ave. Parking available in the High Country Conference Center garage. (Appetizers and no-host bar)
7:00–8:30 PM	Public speaker: Nicole Horseherder, Diné, Executive Director, Tó Nizhóní Ání. Nicole Horseherder, Diné, is from the Black Mesa region of the Navajo Nation. Nicole is one of the original founding members of Tó Nizhóní Ání and began her work with Tó Nizhóní Ání as an outreach coordinator and interpreting hydrology and legal documents for Diné communities fighting coal-mine impacts. Today Nicole is leading efforts towards transition away from fossil fuel development in the Navajo Nation. Admission is free and the public is welcome. Prochnow Auditorium, 326 W. Dupont Avenue (next door to the reception). Parking in High Country Conference Center parking garage.

Invited and contributed talks

Contributed: Resilience and restoration

Wednesday, 8:00–10:00 AM (**Abinai**)

Moderator: Lydia Bailey, Northern Arizona University, School of Forestry

8:00–8:15	Surprising resilience of old forest in drought: 100 years of data from the Pearson Natural Area, Arizona. EBRIGHT, S.J. , Auty, D., Fulé, P.Z., Sieg, C.H., Moore, M.M., Sánchez Meador, A.J., Iniguez, J.M., and Moser, W.K.
8:15–8:30	A century of vegetation change in sagebrush landscapes of the Rio Grande del Norte National Monument, New Mexico, USA. FOX, K. , Margolis, E., Lopez M., Stevens, J., and Kasten, E.
8:30–8:45	Effects of ecological restoration treatments on understory plant diversity and productivity in Colorado dry conifer forests. DEMAREST, A.B. , Fornwalt P.J., Redmond, M.D., and Wolk, B.
8:45–9:00	Long-term forest structure and tree growth responses following landscape-scale ponderosa pine restoration treatments. ROCCAFORTE, J.P. , Huffman, D.W., Crouse, J.E., Rodman, K.C., Pedersen, R.J., and Normandin, D.P.
9:00–9:15	Developing and using native plant materials for restoration across the Intermountain West. MASSATTI, R.

- 9:15–9:30 Understanding drivers of abiotic and biotic treatment success in dryland soil restoration: a meta-analysis. **KIMMELL, L.B.** and Havrilla, C.A.
- 9:30–9:45 Practitioners’ perceptions and use of emerging techniques for restoration of arid and semiarid ecosystems. **BRUNSON, M.W.**, and Calzado Martinez, C.
- 9:45–10:00 Forest restoration and education through a partnership between Diné College and Northern Arizona University. **WHITEHAIR, L.**, Litson, B., Skaltsas, D., Begay, J., and Fulé, P.Z.

Addressing data gaps related to the effects of mining breccia-pipe uranium deposits in the Grand Canyon Region

Wednesday, 8:00–10:00 AM (**Doyle**)

Organizer: Katherine Walton-Day, U.S. Geological Survey, Colorado Water Science Center

- 8:00–8:15 Geology, geochemistry, and genesis of uranium deposits hosted by solution-collapse breccia pipes in northwestern Arizona. **VAN GOSEN, B.S.**, W.M. Benzel, C.A. Johnson, and I.F. Barton
- 8:15–8:30 Examining the role of faults, folds, and collapse features on groundwater flow in the Coconino Plateau, North-central Arizona. **WILDERMUTH, L.M.**
- 8:30–8:45 Flux and metal concentrations in dust collected across the mine life cycle at breccia-pipe uranium deposits, northern Arizona, USA. **WALTON-DAY, K.**, M. Duniway, and J.E. Hinck
- 8:45–9:00 Variations in hydrology and vertical transport of metals in the unsaturated zone across the mine life cycle at breccia-pipe uranium mines, Arizona, USA. **GREEN, C.T.**, C.H. Conaway, K.S. Perkins, B.J. Andraski, K. Walton-Day, and C.R. Bern
- 9:00–9:15 Reclamation methods matter for long-term site stabilization on a dryland Arizona mine. **MANN, R.**, M.C. Duniway, S. Munson, J.E. Hinck
- 9:15–9:30 Potential use of zero valent iron to reduce toxicity in uranium mine detention pond water. **STEEVENS, J.A.**, G.K. Keith, and C.R. Bern
- 9:30–9:45 The Havasupai perspective of uranium mining in Grand Canyon Watershed: a conceptual risk model. **TILOUSI, C.** and J.E. Hinck
- 9:45–10:00 Discussion

Advancing solutions: San Francisco Peaks Traditional Cultural Property

Wednesday, 8:00 AM–12:15 PM (**Fremont**)

Organizers: Alicyn Gitlin, Sierra Club-Grand Canyon Chapter; Chris Jocks (Kahnawake Mohawk), Northern Arizona University, Applied Indigenous Studies, and Shawn Mulford (Diné)

- 8:00–8:30 Pathogenic boundaries in language and law. **JOCKS, C.**
- 8:30–9:00 Cultural difference vs. the cowardice of privilege: an analysis of the ongoing violence of the double bind residing within “The Master’s House.” **DONGOSKE, K.E.**, E. Wemytewa, and G. H. Curti
- 9:00–9:30 Hopi way of life: having faith and belief in the Creator. **PRESTON, B.**
- 9:30–10:00 Defending the sacred: uniting and living under natural law. **GRASS, L.**
- 10:00–10:15 **BREAK**
- 10:15–10:45 Diné science and sacredness: from time immemorial to today. **DENNY, A.**
- 10:45–11:15 Overview of past litigation related to Arizona Snowbowl Ski Resort. **BERGLAN, L.**
- 11:15–11:45 How far can NEPA requirements bend before they’re broken? The questionable case of Arizona Snowbowl capacity, consultation, and cumulative effects. **GITLIN, A.R.**
- 11:45–12:15 Lessons learned from the Bears Ears Inter-Tribal Coalition. **LOMAHQUAHU, A.**

Threats, research, and conservation of southwestern succulents: Agavaceae, Cactaceae, and Crassulaceae

Wednesday, 8:00 AM–12:15 PM (**Rees**)

Organizers: Kathryn Thomas, U.S. Geological Survey Southwest Biological Science Center; and Julie Crawford, U.S. Fish and Wildlife Service

- 8:00–8:15 Succulents in the Southwest: the overview. **THOMAS, K.A.**, and J.A. Crawford
- 8:15–8:30 A quarter-century perspective on the growth, demography, and decline of Nichol's Turk's head cactus (*Echinocactus horizonthalonius*). **ARNOLD, A.E.**, M.E. McIntosh, L.A. McDade, R.J. Steidl, and A.E. Boyd
- 8:30–8:45 Scaling climate change impacts on the keystone saguaro cactus (*Carnegiea gigantea*). **WINKLER, D.E.**, D.E. Swann, and S.C. Reed
- 8:45–9:00 Sonoran Desert threats and protection mapping for rare, threatened, and endangered plant species. **ROWE, H.I.**, and C. Meredith
- 9:00–9:15 Bartram's stonecrop (*Graptopetalum bartramii*) population status and habitat needs of a tiny succulent of the Sky Islands. **DROST, C.A.**, G.M. Ferguson, and K.A. Thomas
- 9:15–9:30 Agaves, Yuccas, and Hesperoyucca—Oh, My! **HODGSON, W.C.**, A.M. Salywon, and R. Puente-Martinez
- 9:30–9:45 Morphological and genetic analyses of large datasets for taxonomic and conservation considerations of rare cacti from the southwestern deserts of the US. **PORTER, J.M.**, S. Fehlberg, and M. Baker
- 9:45–10:00 Investigating limitations to pollination in rare and endangered cacti: case studies of *Pediocactus* and *Coryphantha*. **ASLAN, C.E.**
- 10:15–10:30 **BREAK**
- 10:30–10:45 Ecological correlates of recruitment and mortality in the acuña cactus (*Echinomastuserectocentrus* var. *acunensis*) Holm, P.A., and **E.D. RIZZO**
- 10:45–11:00 *Sclerocactus mesae-verdae* (Mesa Verde cactus) status update for the Navajo Nation. **TALKINGTON, N.**, and W. McBride
- 11:00–11:15 Clover's cactus (*Sclerocactus cloverae*) conservation and the benefits of ensemble habitat modeling. Jarnevich, C.S.S.K. Carter, **E.M. SAMUEL**, and Z.M. Davidson
- 11:15–11:30 Prioritizing IUCN Threatened Sonoran Desert cactus species for *ex situ* conservation at the Desert Botanical Garden, Phoenix, Arizona. **ESCH, R.L.**, T. Hernández-Hernández, G. Iacona, and B. Goettsch
- 11:30–11:45 Arizona hedgehog cactus (*Echinocereus arizonicus* subsp. *arizonicus*): ongoing restoration efforts in Tonto National Forest. **PUENTE, R.**, L. Butler, and S. Blackwell
- 11:45–12:00 Conservation of Pima pineapple Cactus (*Coryphantha scheeri* var. *robustispina*) in Pima County: an updated model and monitoring with distance sampling. **HAMMER, S.J.**, I.W. Murray, and A.D. Webb
- 12:00–12:15 Potential impacts of climate change on narrowly distributed endemic *Pediocactus* (*Cactaceae*) species in northwestern Arizona. **BRESLIN, P.B.**

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Culturally responsive and inclusive teaching in natural resource management for advancing solutions to rapid environmental change

Wednesday, 8:00 AM–12:15 PM (**1899 Ballroom**)

Organizers: Anita Antoninka, Yeon-Su Kim, and Peter Fulé, Northern Arizona University, School of Forestry

- 8:00–8:15 Incorporating inclusive practices inside and outside the classroom. **MENDOZA, V.**
- 8:15–8:30 Culturally responsive teaching with/in Indigenous contexts: lessons from the Institute for Native-serving Educators. **CASTAGNO, A.E.**, and C.M. Macias

- 8:30–8:45 Knowing your students by working with them: a science faculty perspective of working exclusively with a primarily Hispanic student population. **VILLA, F.A.**
- 8:45–9:00 Providing inclusive and accessible learning experiences to student scientists with disabilities. **METZGER, J.**, and R. Jenson
- 9:00–9:15 Natural resource management professionals Tribal workforce development. **MARTIN, J.C.**
- 9:15–9:30 Promoting diversity, equity, inclusion, and justice in forest resource programs in the U.S: a survey of NAUFRP member institutions. **KIM, Y.S.**, and A. Elko
- 9:30–9:45 Perspectives on gender in wildlife biology. **CHAMBERS, C.L.**
- 9:45–10:00 Place-based research and co-creating science to engage Navajo students. **CHISCHILLY, S.**, P. James, and A.V. Whipple
- 10:00–10:15 **BREAK**
- 10:15–10:30 Creating and increasing STEM capacity and partnerships through cultural sustaining perspectives to environmental changes. **EUTSEY, L.**, and M. Clytus
- 10:30–12:15 **Panel Discussion**

Climate change adaptation in the NPS

Wednesday, 10:15 AM–12:15 PM (**Abinai**)

Organizer: Joel H. Reynolds, U.S. National Park Service, Climate Change Response Program

- 10:15–10:30 Building a park-based climate response using the tools and frameworks developed by the National Park Service and partners. **OLLIFF, T.**, and J. H. Reynolds
- 10:30–10:45 Science to support resource management under uncertainty: lessons learned from a decade of participatory climate change scenario planning. **MILLER, B.W.**, G.W. Schuurman, A.J. Symstad, A.N. Runyon, and B.C. Robb
- 10:45–11:00 Resist-Accept-Direct (RAD): a framework for the 21st century natural resource manager. **GOOLSBY, J.**, G. Schuurman, and A.E. Cravens
- 11:00–11:15 Risk bounding in scenario planning using 'Climate Futures.' **LAWRENCE, D.J.**, A.N. Runyon, J.E. Gross, G.W. Schuurman, and B.W. Miller
- 11:15–11:30 Reproducible climate futures—an R package and other tools. **RUNYON, A.N.** and J.H. Reynolds
- 11:30–12:15 Discussion

Feeling the burn: the interacting effects of fire and warming in pinyon-juniper woodlands of the Southwest

Wednesday, 10:15 AM–12:15 PM (**Doyle**)

Organizers: Sasha Reed, Cara Lauria, Michala Phillips, Brooke Osborne, John Bradford, U.S. Geological Survey, Southwest Biological Science Center; and Catherine Gehring and Gillian Trimmer, Northern Arizona University, Department of Biological Sciences and Center for Adaptable Western Landscapes

- 10:15–10:30 Undisturbed? Effects on shifting climate on pinyon-juniper woodlands in protected places. **SWAN, M.**
- 10:30–10:45 Tribal perspectives on pinyon-juniper woodlands and fire. **LOPEZ-WHITESKUNK, R.**
- 10:45–11:00 Singleleaf pinyon pine trait variation and implications for restoration in a changing climate. **URZA, A.K.**, P.J. Weisberg, G. Vasey, J. Adkins, and H. Reid
- 11:00–11:15 Influence of drought, warming, and fire on the mycorrhizal fungi associated with pinyon-juniper woodlands. **GEHRING, C.A.**

- 11:15–11:30 Effects of fire on biological soil crust in pinyon-juniper woodlands. **LAURIA, C.M.**, M.L. Phillips, T. Spector, R.J. Rondeau, G.M. Trimber, C.A. Gehring, J.B. Bradford, H. Ertl, B.B. Osborne, and S.C. Reed
- 11:30–11:45 What can a rare plant tell us about post-fire recovery in an old-growth piñon-juniper stand? **RONDEAU, R.**, T. Spector, S. Stowell, and D.G. Anderson
- 11:45–12:00 Rethinking indicators of dryland resistance and resilience for the 21st century. **SCHLAEPFER, D.R.**, J.C. Chambers, J.L. Brown, D.I. Board, S.B. Campbell, K.J. Clause, B. Hanberry, A.K. Urza, M. Crist, and J.B. Bradford
- 12:00–12:15 Old growth piñon-juniper: projections for the future and variation among trailing edge woodlands. **FLOYD, L.**, W.H. Romme, and D. Hanna

Contributed: Conservation science and management

Wednesday, 1:15–3:15 PM (**Abinau**)

Moderator: Kara Gibson, School of Forestry, Northern Arizona University

- 1:15–1:30 The utility of GIS for identifying areas of recreation conflict for targeted interpretive messaging. **BRUNSON, M.**, Peterson, B.A, Sharp, R.L., and Fefer, J.P.
- 1:30–1:45 Transforming statewide data on woody biomass resources into utilization through scientific support and funding opportunities in Colorado. **GAETANI, M.S.**, and Mackes, K.H.
- 1:45–2:00 Climate sensitivity and memory of *Populus tremuloides* differ between trees that survive and trees that die during drought. **FORMANACK, A.M.**, Boone, R.D., and Ogle, K.
- 2:00–2:15 Investigating seedling success in assisted population migration of ponderosa pine. **NIGRO, K.M.**, and Redmond, M.D.
- 2:15–2:30 Indigenous knowledge at Grand Staircase-Escalante: an interdisciplinary approach to public lands management. **BEREND, K.**, Clark, L., and Bauman, S.
- 2:30–2:45 Potential insights from southern Africa for co-existence of livestock and wildlife rangelands on the Colorado Plateau. **BIGGS, D.**
- 2:45–3:00 Reduced forest vulnerability due to management on the Hualapai Nation. **STAN, A.B.**, P.Z. Fulé, and M. Hunter, Jr.

A macrosystems approach to managing southwestern riparian ecosystems facing climate change and exotic species invasion

Wednesday, 1:15–3:15 PM (**Rees**)

Organizers: Gerard J. Allan and Hillary Cooper, Northern Arizona University, Department of Biological Sciences and Center for Adaptable Western Landscapes

- 1:15–1:30 A macrosystems approach to managing southwestern riparian ecosystems facing climate change and exotic species invasion. **ALLAN, G.J.**, H.F. Cooper, H.M. Bothwell, E. Sukovich, C.A. Gehring, C. Doughty, G. Asner, T.G. Whitham, and K.R. Hultine
- 1:30–1:45 Genetic variation and ecological consequences of phenotypic plasticity in a widespread riparian species. **COOPER, H.F.**, L.V. Andrews, J.P.M. Corbin, I. Garthwaite, M. Eisenring, R.L. Lindroth, K.C. Grady, C.A. Gehring, K.R. Hultine, T.G. Whitham, G.J. Allan, and R.J. Best
- 1:45–2:00 Tradeoffs between leaf cooling and hydraulic risk taking in the foundation tree species *Populus Fremontii*. **BLASINI, D.**, D. Koepke, S.E. Bush, G.J. Allan, C.A. Gehring, T.G. Whitham, T.A. Day, and K.R. Hultine
- 2:00–2:15 Ephemeral and permanent stream hydrology alter adaptive trait syndromes in a riparian tree species native to the Southwestern US. **CADMUS, A.E.**, K.R. Hultine, K. Ogle, and T.G. Whitham

- 2:15–2:30 Utilizing translocation with symbiotic mycorrhizae to cope with multiple stressors. **MAR-KOVCHICK, L.M.**, A. Belgara-Andrew, D. Richard, T. Deringer, N. Doerry, K. Grady, K.R. Hultine, G.J. Allan, T.G. Whitham, J.I. Querejeta, and C.A. Gehring
- 2:30–2:45 Invasive *Tamarix ramosissima* reduces seedling recruitment in the native foundation tree *Populus fremontii*. **GILLETTE, H.D.**, G. Kirby, P. Rodrigues, R. Pentthany, S. Vollers, T. Vollers, T.G. Whitham, S. Shuster, K. Dlugosch, and G.J. Allan
- 2:45–3:00 Leaf hyperspectral reflectance reveals genetic relationships across an environmental gradient: implications for restoration and ecological monitoring. **CORBIN, J.P.M.**, R.J. Best, H.F. Cooper, C.A. Gehring, G.J. Allan, and T.G. Whitham
- 3:00–3:15 Using aircraft hyperspectral, drone, and leaf spectral data to predict susceptibility of cottonwoods (*Populus fremontii*) to future climate change scenarios. **DOUGHTY, C.**, T. Prys-Jones, J. Parker, A. Abraham, E. Thomson, H.F. Cooper, K.R. Hultine, C.A. Gehring, T.G. Whitham, and G.J. Allan

Demystifying climate adaptation planning: frameworks, partnerships, and case studies from diverse perspectives

Wednesday, 1:15–5:30 PM (Doyle)

Organizers: Molly McCormick and Seth Munson, USGS Southwest Biological Science Center, Restoration Assessment and Monitoring Program for the SW; Clare Aslan, Northern Arizona University, School of Earth and Sustainability and Center for Adaptable Western Landscapes; and Andi Thode, SW Fire Science Consortium (SWFSC) and SW Fire Climate Adaptation Partnership (FireCAP)

- 1:15–1:30 Southwest partnerships for understanding and exchanging knowledge on fire and climate change. **THODE, A.**, M. Sample, and C. Endquist
- 1:30–1:45 Creating opportunities for knowledge exchange to inform fire and climate adaptation planning. **LEROY, S.R.**, and C.E. Enquist
- 1:45–2:00 Adaptation strategies for managing fire in a changing climate. **SAMPLE, M.**, A.E. Thode, C. Peterson, M.R. Gallagher, W. Flatley, M. Friggens, A. Evans, R. Loehman, S. Hedwall, L. Brandt, M. Janowiak, and C. Swanston
- 2:00–2:15 Learning from the past and planning for the future: experience-driven insights into climate adaptation and land management strategies on the Colorado Plateau. **VAUGHN, A.L.**
- 2:15–2:30 Evaluating management options for addressing the cumulative effects of a changing climate and decades of increasingly departed fire regimes. **LATA, M.**
- 2:30–2:45 Land of Enhancement: stories from New Mexico's forest treatments for changing climates. **STUEVER, M.**
- 2:45–3:00 Forest restoration can increase climate resilience in southwestern forests. **MCCAULEY, L.A.**, J.B. Bradford, M.D. Robles, R.K. Shriver, T.J. Woolley, C.A. Andrews
- 3:00–3:15 **BREAK**
- 3:15–3:30 Evaluating ecocultural impacts of climate change in the Southwest. **SOUTHERN, S.**, and N. Lyndon
- 3:30–3:45 CCAST: a community of practice and case study platform to support landscape-scale partnerships for climate change adaptation. **WEINBERG, A.**, **A. LÉGER**, L. Fisher, M. Grabau, G. Johnson, K. Miner, D. Morrell, and M. Dinan
- 3:45–4:00 The Southwest Drought Learning Network. **DINAN, M.**, A. Weinberg, G. Johnson, T. Haigh, E. Elias, and D. Morrell
- 4:00–4:15 Applying the Adaptation Workbook process to the Southwest. **KRAMER, L.R.** and C.L. Peterson
- 4:15–4:30 Vulnerability of arid grasslands to future climate change in the western US. **HAVRILLA, C.A.**, J.B. Bradford, C. Yackulic, and S.M. Munson

- 4:30–4:45 Climate adaptation strategies for semiarid grasslands. **MCCORMICK, M.L.**, M.W. Sample, C. Peterson, T. Fisk, D. Perkins, M. Van Scoyoc, L. Ballenger, D. Thoma, C.E. Aslan, S. Souther, S.M. Munson, C. Havrilla, M. Janowiak, and J.B. Bradford
- 4:45–5:00 RestoreNet strategies for revegetation: lessons learned from a restoration field-trial network spanning the southwestern U.S. **FARRELL, H.L.**, S.M. Munson, M.L. McCormick, K.M. Laushman, C.A. Havrilla, E.S. Gornish, A.M. Faist, L. Larios, H. Rowe, M.C. Duniway, S.C. Reed, and B.J. Butterfield
- 5:00–5:15 Assessing climate change challenges at Grand Canyon National Park—What to do...and not do? **HAAS, S.K.**
- 5:15–5:30 Discussion

Striving for equity in science communication

Wednesday, 1:15–5:30 PM (Fremont)

Organizer: Jo Ellen Hinck, USGS Columbia Environmental Research Center

- 1:15–1:30 No deficits here: strategizing for successful science communication in an age of information overload. **FRIEDERICI, P.**
- 1:30–1:45 The role of conservation organizations in science and information sharing. **GITLIN, A.R.**, and **REIMONDO, A.L.**
- 1:45–2:00 Science-informed decision-making: Coconino County addresses catastrophic wildfire risk and post-wildfire flooding. **HORSTMAN, P.**, L. Andreani, and J. Smith
- 2:00–2:15 Innovation and tradition at Grand Canyon National Park; they can co-exist. **BALSOM, J.**
- 2:15–2:30 Co-producing science to inform land management across the American Southwest—examples from the USGS Restoration Assessment and Monitoring Program for the Southwest (RAMPS). **MCCORMICK, M.L.**, S.M. Munson, and J.B. Bradford
- 2:30–2:45 Strategies for engaging native youth in community environmental issues; inviting native youth to consider environmental protection careers. **NELSON, M.A.**
- 2:45–3:00 Collaborative goal setting and strategy development: building foundations for effective science communication for the USGS Grand Canyon uranium mining project. **MICHALEGKO, L.F.** and E. Welch
- 3:00–3:15 Discussion
- 3:15–3:30 **BREAK**
- 3:30–3:45 Collaborative risk communication: Reducing landslide losses in Puerto Rico. **WEST, J.**, L. Davis, Y. Álvarez Gandía, R. Lugo BendeZú, K.S. Hughes, J. Godt, and L. Peek
- 3:45–4:00 From data to information: exploring uranium concentrations in groundwater in the Grand Canyon region through an online interactive map. **TILLMAN, F.D.**
- 4:00–4:15 Outreach in Puerto Rico: surface water, groundwater, and precipitation gage infographics. **JONES, C.**, J.E. Hinck, G. DeBenedetto, and D. Hernandez
- 4:15–4:30 Science communication: an artist's perspective. **SIEBERS, B.**
- 4:30–4:45 Casting a broader net— using art to communicate environmental effects of mining. **WALTON-DAY, K.**, B.J. Siebers, J.E. Hinck, K.M. Campbell, M.N. Croteau, J.R. Wendel, and D.L. Naftz
- 4:45–5:00 Expanding your audience: collaborating with the arts to communicate science to children. **HANSEN, L.E.**
- 5:00–5:15 Communicating environmental health science to Native communities through Native-themed and Native-created art. **QUETAWKI, M.**
- 5:15–5:30 Discussion

Colorado River natural resources in an era of uncertainty: using science to inform river management

Wednesday, 1:15–5:30 PM (1899 Ballroom)

Organizers: Drew Eppehimer, Emily Palmquist, and Paul Grams, US Geological Survey, Southwest Biological Science Center

- 1:15–1:30 Data integration and coupled modeling to guide water management decisions in the Colorado River Basin. **MIHALEVICH, B.A.**, B.T. Neilson, C.A. Buahin, K. Wheeler, B. Udall, C.B. Yackulic, and J.C. Schmidt
- 1:30–1:45 Links between drought and river nutrition: phosphorus export from Glen Canyon Dam under declining reservoir elevations. **DEEMER, B.R.**, R. Reibold, A. Fatta, J. Corman, C.B. Yackulic, and S. Reed
- 1:45–2:00 Experimental ‘Bug Flows’ increased algae production and insect diversity in the Colorado River, Grand Canyon. **KENNEDY, T.A.**, J.D. Muehlbauer, B.R. Deemer, C.B. Yackulic, M.A. Ford, C. Szydlo, and A.N. Metcalfe
- 2:00–2:15 Bats, bugs, and boaters: insectivorous bat foraging along the Colorado River in Grand Canyon is determined by the availability of aquatic flies. **METCALFE, A.N.**, C.A. Fritzinger, T.A. Kennedy, M.J. Dodrill, J.D. Muehlbauer, B. Holton, L.E. Durning, J.B. Sankey, and T. Weller
- 2:15–2:30 Effects of flow, sediment, and non-native fishes on age-0 population dynamics of humpback chub in the lower Little Colorado River. **DZUL, M.C.**, and C.B. Yackulic
- 2:30–2:45 Forecasting the potential of smallmouth bass invasion in the Grand Canyon and designing responses. **EPPEHIMER, D.E.**, C.B. Yackulic, L.A. Bruckerhoff, J. Wang, K.L. Young, K.R. Bestgen, and J.C. Schmidt
- 2:45–3:00 Common reed (*Phragmites australis americanus*) ecology and responses to flow regulation along the Colorado River in Grand Canyon, Arizona, USA. **STEVENS, L.E.**, E.C. Palmquist, H. Fairley, and J. Sankey
- 3:00–3:15 Assessing 50 years of change in riparian condition along the Colorado River in Grand Canyon. Fairley, H.C., **SCOTT, M.L.**, and A.H. Fairley
- 3:15–3:30 **BREAK**
- 3:30–3:45 Uncultivated riparian plant evapotranspiration and consumptive use for selected areas of the Little Colorado River watershed on the Navajo Nation. **NAGLER, P.L.**, A. Barreto-Muñoz, K. Didan, and I. Sall
- 3:45–4:00 Riparian plant presence and abundance are differentially controlled by hydrology and temperature along a regulated, dryland river. **PALMQUIST, E.C.**, K. Ogle, and B.J. Butterfield
- 4:00–4:15 The hydroclimatic niche: a tool for predicting and managing riparian plant community responses to streamflow seasonality. **BUTTERFIELD, B.J.**, Palmquist, E.C., and C.B. Yackulic
- 4:15–4:30 Riparian seedling establishment following an environmental flow release combined with active revegetation. **GONZÁLEZ-SARGAS, E.**, and P.B. Shafroth
- 4:30–4:45 The Returning Rapids Project: how initial questions led to great collaborations. **DEHOFF, M., BENSON, C.**, M. Flynn, and P. Lefebvre
- 4:45–5:00 Lake Powell as a sentinel for sediment flux in the Upper Colorado River Basin: past, present, and future. **HYNEK, S.A.**, J.C. Root, C.D. Wilkowske, C.L. Johnson, H.B. Hartley, B.B. Bowen, and M. DeHoff
- 5:00–5:15 Delta dynamics: Reestablishment of river channels in the deltas of reservoirs. **GRAMS, P.E.**, R. Tusso, M. DeHoff, and S. Hynek
- 5:15–5:30 Risk of erosion of archaeological sites along the Colorado River in Grand Canyon owing to long-term operations of Glen Canyon Dam. **SANKEY, J.B.**, A. East, H. Fairley, J. Dierker, E. Brennan, J. Caster, and N. Bransky

Contributed: Plant and animal ecology, conservation, and management

Wednesday, 3:30–5:30 PM (Doyle)

Moderator: Sean Mahoney, University of Arizona, School of Natural Resources and the Environment

- 3:30–3:45 Addressing redundancy and representation in rare species recovery frameworks using genetic and distributional data. **MASSATTI, R.**, Winkler, D.E., and Jones, M.R.
- 3:45–4:00 Energy costs energy: a geospatial model of mule deer caloric expenditure in response to oil and gas development on the Colorado Plateau. **CHAMBERS, S.**, Villarreal, M.L., Duane, O., Munson, S.M., Stuber, E., Tyreef, G., Waller, E.K., and Duniway, M.C.
- 4:00–4:15 Oystershell scale: an invasive insect threatening aspen in the Southwest. **CROUCH, C.D.**, Grady, A.M., Wilhelmi, N.P., Hofstetter, R.W., DePinte, D.E., and Waring, K.M.
- 4:15–4:30 Atmospheric radiocarbon for the period 1910 to 2021 recorded by annual plants on the Colorado Plateau: a local record for accurate dating of recent terrestrial organic matter. **CARBONE, M.S.**, Ayers, T.J., Ebert, C.H., Munson, S.M., Schuur, E.A.G., and Richardson, A.D.
- 4:30–4:45 The ecological recovery of plugged and abandoned oil and gas well pads across the Colorado Plateau. **LUPARDUS, R.**, Duniway, M., Belnap, J., Bradford, J., Griffen, K., Huber, C., Knight, A., McNellis, B., Munson, S., Reed, S., Sengsirak, A., and Villarreal, M.
- 4:45–5:00 Comparing full annual cycles of the Cordilleran Flycatcher (*Empidonax occidentalis*) on the Colorado Plateau and Mt Lemmon, AZ. **VAN RIPER, C. III**
- 5:00–5:15 A community of practice to address non-native aquatic species in the West. **MINER, K.**, Grabau, M., Fisher, L., Johnson, G., Weinberg, A., Leger, A., and Morrell, D.
- 5:15–5:30 Data integration to inform bird conservation and habitat management in the Southwest United States. **MILLER-TER KUILE, A.**, J.S. Sanderlin, V.A. Saab, J.G. Dudley, M. Wright, K. Ogle, V. Stein-Foster, and A. Leonard

Biodiversity counts: does long-term monitoring lead to effective conservation outcomes?

Wednesday, 3:30–5:30 PM (Rees)

Organizer: Helen Rowe, School of Earth Sciences and Environmental Sustainability, Northern Arizona University; McDowell Sonoran Conservancy

- 3:15–3:30 Local biodiversity monitoring efforts aggregate into meaningful outcomes. **ROWE, H.I.**
- 3:30–3:45 The Southwest Bat Hub: Implementing the North American Bat Monitoring Program to support conservation in Arizona and New Mexico. **CORBETT, J.**, K. Gerst, C. Long, A. Adams, J. Reichert, B. Reichard, B. Straw, A. McIntire, and W. Frick
- 3:45–4:00 Wildlife monitoring in the Sonoran Desert using regional and global protocols. **DWYER, J.M.**, and H.I. Rowe
- 4:00–4:15 The National Ecological Observatory Network (NEON) Biorepository: a developing resource to facilitate long-term biodiversity monitoring efforts. **YULE, K.M.**
- 4:15–4:30 Integrating multiple data sources for species' distribution models to evaluate management effects on focal bird species. **SANDERLIN, J.S.**, A. Miller-ter Kuile, V. Stein Foster, B.E. Strohmeyer, J. Dudley, K. Ogle, and A. Leonard
- 4:30–4:45 Reevaluating the Southern Colorado Plateau Network's bird monitoring program: accounting for ecological change in the Anthropocene. **JONES, H.H.**, C. Ray, R. Siegel, and J. M. Johnson
- 4:45–5:30 Discussion

Thursday, September 15, 2022

Registration and speaker ready room

7:00–8:00 AM	Morning refreshments (Humphreys Ballroom)
7:00–10:00 AM	Registration (High Country Conference Center lobby)
7:00–10:00 AM	Speaker-ready room (Aspen)
12:15–1:15 PM	Buffet lunch (Humphreys Ballroom)

Meetings

1:15–3:15 PM	PJ management workshop (Ponderosa)
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Invited and contributed talks

Using natural infrastructure as nature-based solutions to heal the planet

Thursday, 8:00–10:00 AM (**Abinau**)

Organizer: Laura M. Norman, US. Geological Survey, Western Geographic Science Center

8:00–8:15	Vegetation response to restoration using rock detention structures in the Madrean Archipelago of the southwestern USA. WILSON, N.R. and L.M. Norman
8:15–8:30	Can rocks solve all of our problems? GORNISH, E.S.
8:30–8:45	Change in ciénegas in the Madrean Archipelago derived from 37 years of Landsat satellite imagery. MIDDLETON, B.R. , R.E. Petrakis, and L.M. Norman
8:45–9:00	Tracking riparian vegetation change on the San Carlos Apache Reservation and Upper Gila River Watershed to inform impacts of climate change and identify restoration priorities. PETRAKIS, R.E. , L.M. Norman, B.R. Middleton, and V. Wesley
9:15–9:30	Using hydrological modeling to validate benefits from green infrastructure at the United States-Mexico border. ANIDES MORALES, A. , L.M. Norman, F. Lara-Valencia, M. Garcia, and E. Castellanos-Rubio
9:30–9:45	Slow down! Surface and subsurface actions to enhance groundwater recharge and storage in arid hydrology. UHLMAN, K. , and C. Eastoe
9:45–10:00	Hydrologic research pre- and post-low impact development in an ephemeral drainage. TOSLINE, D.

Remote sensing on the Colorado Plateau and Southwest region

Thursday, 8:00 AM–12:15 PM (**Doyle**)

Organizers: Laura Durning, Northern Arizona University, School of Earth and Sustainability;

Joel Sankey, US Geological Survey, Southwest Biological Science Center; Temuulen Sankey, Northern Arizona University, School of Informatics, Computing, and Cyber Systems; Steven Sesnie, US Fish and Wildlife Service; and Jodi Norris, National Park Service, Southern Colorado Plateau Network

8:00–8:20	Monitoring <i>Tamarix</i> changes using satellite imagery in Grand Canyon National Park, Arizona. BRANSKY, N.D. , T.T. Sankey, J.B. Sankey, M.J. Johnson, and L. Jamison
8:20–8:40	Ecohydrologic and geomorphic effects on riparian plant species occurrence and encroachment: remote sensing of 360 km of the Colorado River in Grand Canyon. Durning, L., J.B. SANKEY , C.B. Yackulic, P.E. Grams, B.J. Butterfield, and T.T. Sankey

- 8:40–9:00 Deriving fallow cropland maps across sections of the Western United States for 2010–2020 using decision-tree models on Google Earth Engine. **OLIPHANT, A.J.**, P.S. Thenkabail, P. Teluguntla, I. Aneece, and D. Foley
- 9:00–9:20 Forest fire, thinning, and flood in wildland-urban interface: UAV and lidar-based estimate of natural disaster impacts. **SANKEY, T.T.**, L. Tango, J. Tatum, and J.B. Sankey
- 9:20–9:40 LiDAR and PlanetScope metrics for predicting forest inventory parameters in Texas and Oklahoma songbird habitat. **SESNIE, S.E.**, R. Stewart, J. Mueller, and P. Schmidt
- 9:40–10:00 Thinning increases forest resilience during unprecedented drought. T.T. Sankey and **TATUM, J.**
- 10:00–10:15 **BREAK**
- 10:15–10:35 When good indices go bad: why NDVI is unreliable for tracking vegetation dynamics in pinyon-juniper ecosystems. **WALKER, J.**, and J. Norris
- 10:35–10:55 Effects of climate, biological soil crust disturbance, and recovery on lidar-derived soil surface roughness. **CASTER, J.**, T. Sankey, J.B. Sankey, M.A. Bowker, D. Buscombe, M.C. Duniway, N. Barger, A. Faist, and T. Joyal
- 10:55–11:15 High spatiotemporal resolution thermography reveals novel insights into the plant hydraulic strategy of key dryland functional groups. **JAVADIAN, M.**, J.A. Biederman, R.L. Scott, S.C. Reed, M.L. Villarreal, and W.K. Smith
- 11:15–11:35 Recent advances and applications in environmental change detection for resource management decision support. **SANKEY, J.B.**, J. Caster, N. Bransky, and A. Bedford
- 11:35–11:55 Geomorphic change detection on the Upper Verde River using historical transects and terrestrial lidar. **TANGO, L.**, and T.T. Sankey
- 11:55–12:15 Discussion

Emerging management challenges and research priorities for southwestern pinyon-juniper woodlands

Thursday, 8:00 AM–12:15 PM (**Fremont**)

Organizers: Molly McCormick, John Bradford, and Seth Munson US Geological Survey, Southwest Biological Science Center, Restoration Assessment and Monitoring Program for the Southwest; Megan Swan and Jodi Norris, National Park Service, Southern Colorado Plateau Inventory and Monitoring Network; and Catherine Gehring, Northern Arizona University, Department of Biological Sciences and Center for Adaptable Western Landscapes

- 8:00–8:15 “What’s a pinyon-juniper?” Incorporating dynamic landscapes within pinyon-juniper woodland classifications. **WEISBERG, P.J.**
- 8:15–8:30 Classifying pinyon-juniper communities using ecological sites. **GISHI, K.L.**
- 8:30–8:45 Shifting paradigms in ecological restoration of southwestern pinyon-juniper ecosystems: past, present, and future. **HUFFMAN, D.W.**, M.T. Stoddard, J.D. Springer, and J.E. Crouse
- 8:45–9:00 Risk of ecological transformation in pinyon-juniper woodlands across the US West. **NOEL, A.R.**, R.K. Shriver, S.D. Crausbay, and J.B. Bradford
- 9:15–9:30 Field trials to quantify local adaptation, ecotype formation, and associated communities to enhance genetic approaches to maintain p-j woodlands suffering from climate change. **WHITHAM, T.G.**
- 9:30–9:45 What determines the effectiveness of pinyon-juniper clearing treatments? Evidence from the remote sensing archive and counter-factual scenarios. **DUNIWAY, M.C.**, T.W. Nauman, B.W. McNellis, S.E. Fick, and C.W. Brungard
- 9:45–10:00 Feeling the burn: trajectories and tipping points of piñon-juniper woodlands after fire. **PHILLIPS, M.L.**, T. Spector, C. Lauria, J. Bradford, H. Ertl, C. Gehring, B.B. Osborne, R. Rondeau, G. Trimmer, and S.C. Reed

- 10:00–10:15 **BREAK**
- 10:15–10:30 Managing for ecological resilience of pinyon-juniper ecosystems during an era of woodland contraction. **REDMOND, M.D.**, A.K. Urza, and P.J. Weisberg
- 10:30–10:45 The influence of pinyon-juniper fuels reduction treatments on soil erosion rates. **BARGER, N.N.**, and C. Karban
- 10:45–11:00 Influence of fire and cheatgrass legacy on mycorrhizae and pinyon-juniper regeneration: what's going on in the rhizosphere twenty years post-burn? **TRIMBER, G.M.**, M. Marquez Vargas, M.L. Phillips, S.C. Reed, J.B. Bradford, C. Lauria, B.B. Osborne, T. Spector, R.J. Rondeau, H. Ertl, and C.A. Gehring
- 11:00–11:15 Balancing ecosystem resiliency with Pinyon Jay habitat needs on the Kaibab National Forest. **STEIN FOSTER, V.**, E. Juarez, E. Ammon, and C. Wise
- 11:15–11:30 State agency perspective: PJ woodland thinning projects for grassland restoration in northern Arizona. **CASSADY, S.E.**
- 11:30–11:45 Using remote sensing for juniper management on the Kaibab National Forest. **DAHMS, J.**
- 11:45–12:00 An overview of Bureau of Land Management (BLM) pinyon-juniper treatment: a BLM Colorado perspective. **BARRETT, I.P.** and C.T. Domschke
- 12:00–12:15 Panel discussion: Catherine Gehring (NAU), Steve Cassady (AZGFD), Iric Burden (USFS), and others

Considering host-microbial interactions in ecosystem restoration

Thursday, 8:00–10:00 AM (**Rees**)

Organizers: Beatrice Bock, Department of Biological Sciences, Center for Adaptable Western Landscapes, Northern Arizona University (NAU); Lisa Markovchick, Department of Biological Sciences, Center for Adaptable Western Landscapes, NAU

- 8:00–8:15 The gap between mycorrhizal science and application: existence, origins, and relevance during the United Nation's Decade on Ecosystem Restoration. **MARKOVCHICK, L.M.**, V. Carrasco-Denney, J. Sharma, J.I. Querejeta, K.S. Gibson, R. Swaty, D.A. Uhey, A. Belgara-Andrew, Z.I. Kovacs, N.C. Johnson, T.G. Whitham, and C.A. Gehring
- 8:15–8:30 Can whole topsoil inoculation improve seedling establishment on degraded rangelands in the southwestern U.S.? **FARRELL, H.L.**, C.A. Gehring, M.R. Mercure, and S.M. Munson
- 8:30–8:45 Analyzing differences in endophytes in saguaros (*Carnegiea gigantea*) across different precipitation and solar radiation levels. **MARQUEZ VARGAS, M.**, R. Deckert, A. Schuessler, and C.A. Gehring
- 8:45–9:00 Fungal endophyte communities are similar in composition but have different effects on a native and an invasive plant species. **SCHUESSLER, A.R.** Decker, K. Hultine, and C.A. Gehring.
- 9:00–9:15 Qualities of anthropogenically derived habitat types across the Middle Rio Grande Bosque in New Mexico predict soil fungal community structure. **WAGNER, R.R.**
- 9:15–9:30 The relationship between *Coccidioides posadasii* and biological soil crusts in Arizona desert ecosystems. **RAMSEY, M.L.**, B.M. Barker, and A. Antoninka
- 9:30–9:45 Soil biota responses to forest thinning and prescribed fire in Valles Caldera National Preserve, New Mexico: Lessons from three studies. **GIBSON, K.S.**, C.A. Gehring, N.C. Johnson, C. Laturno, D.A. Neher, R.R. Parmenter, and A.J. Antoninka
- 9:45–10:00 Familiar soil biota can help southwestern plant species cope with changing climates. **BOWKER, M.A.**, M.C. Remke, and N.C. Johnson

Science and restoration of biological soil crusts in a changing environment

Thursday, 10:15 AM–12:15 PM (**Abinau**)

Organizers: Sierra Jech, University of Colorado Boulder, Ecology and Evolutionary Biology; Julie Bethany Rakes, Arizona State University, Center for Fundamental and Applied Microbiomics; Jasmine Anenberg, Northern Arizona University, School of Forestry; John Bacovcin, Colorado State University, Department of Forest and Rangeland Stewardship

- 10:15–10:30 Biocrusts are dynamic in both compositional and functional responses to global change drivers. **PHILLIPS, M.L.**, B.E. McNellis, A. Howell, C.M. Lauria, J. Belnap, A.C. Greene, C.M. Currier, P.M. Homyak, and S.C. Reed
- 10:30–10:45 The dark side of the desert: dark biocrusts in the Mexican Chihuahua desert. **NUÑEZ-SOLANO, K.**, M.A. Bowker, L.F. García-Ortega, N. Gómez-Hernández, N.E. López-Lozano, D. Morales-Sánchez, V.M. Reyes-Gómez, L.R. Riego-Ruiz, C.M. Ovando-Vázquez, E. Huber-Sannwald
- 10:45–11:00 Biocrust inoculum survival in restoration depends on source material, cultivation practices and inoculation technique. **JECH, S.D.**, A. Antoninka, N.N. Barger, N. Day, S. Reed, C. Tucker, and J. Belnap
- 11:00–11:15 What makes biocrust happy? Examining abiotic conditions that lead to carbon exchange and increased biocrust cover. **YOUNG, K.E.**, M.A. Bowker, S.C. Reed, A. Antoninka, and A. Darrouzet-Nardi
- 11:15–11:30 Legacy effects of decadal-long drought on biocrust microbes: could microbial legacies slow plant recovery from drought? **FERNANDES, V.M.C.**, M. Patton, S.L. Collins, and J.A. Rudgers
- 11:30–11:45 Seed traits mediate the effects of biocrusts on plant germination. **BACOVGIN, J.**, C. McIntyre, C.A. Havrilla
- 11:45–12:00 Providing context for advancements in *Arctomecon californica* conservation using biocrust: A comprehensive literature review with case studies. **BAILEY, L.N.**, A.J. Antoninka, and M.A. Bowker
- 12:00–12:15 Discussion

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Contributed: Fire and fire responses

Thursday, 10:15 AM–12:15 PM (**Rees**)

Moderator: Martin Holdrege, US Geological Survey, Southwest Biological Science Center

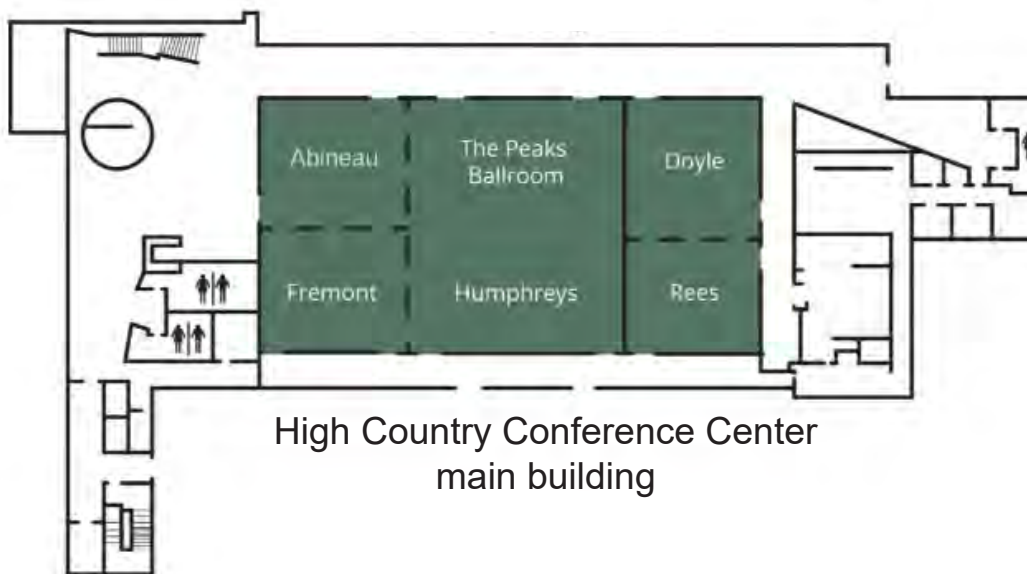
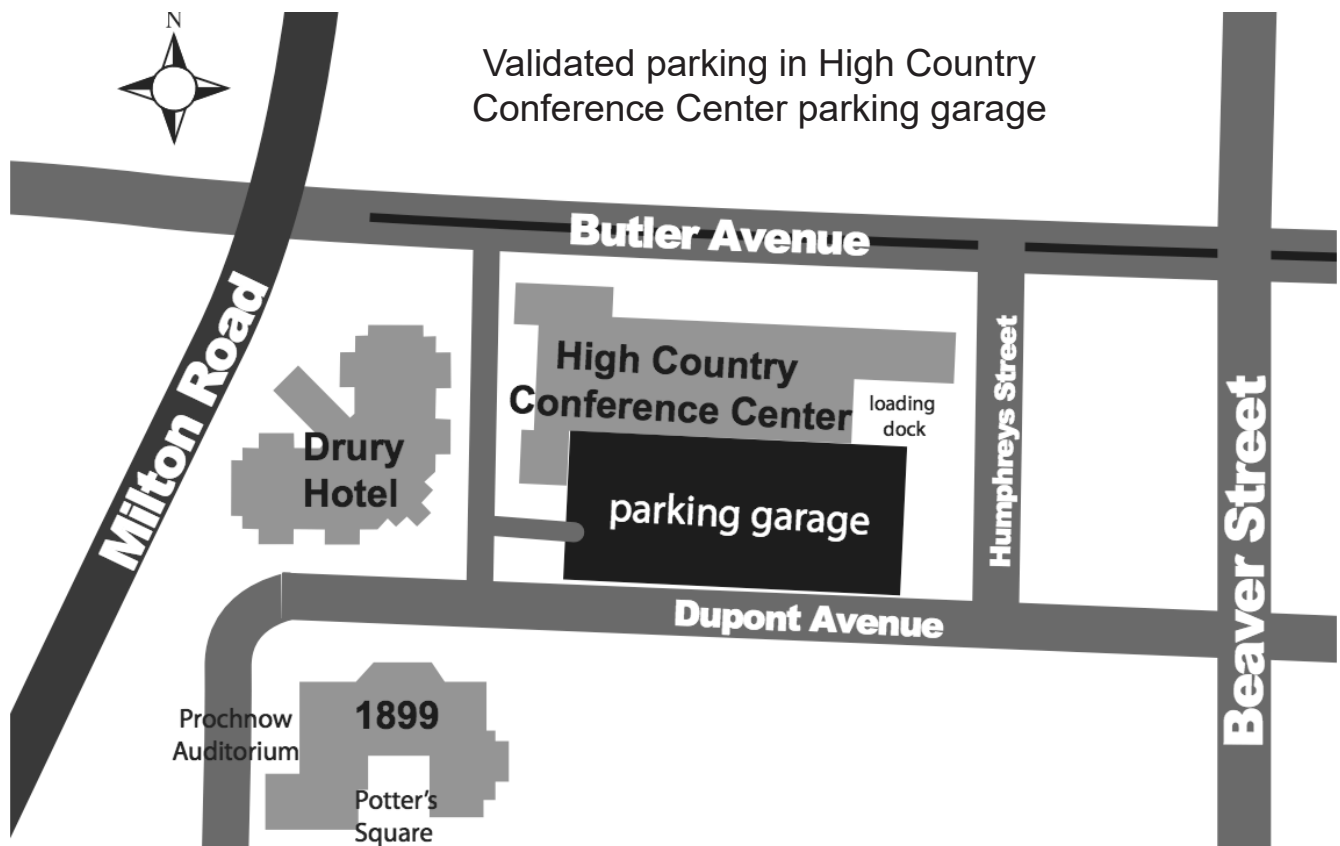
- 10:15–10:30 Building capacity to use Earth observations for wildfire risk reduction and resilience applications: a summary of NASA's DEVELOP 2022 wildfire projects. **ROSS, K.**, Clayton, A., and Childs-Gleason, L.
- 10:30–10:45 Snowtopography: a growing network of flexible, low-cost snow and soil moisture monitoring quantifies hydrologic impacts of forest management and disturbance. **BIEDERMAN, J.A.**, Dwivedi, R., Broxton, P.D., Lee, K., van Leeuwen, W.J.D., Leonard, J.M., Hutchinson, L., Remke, M., Robles, M.D., Pearl, J.K., and Svoma, B.
- 10:45–11:00 Drought and wildfire drive transitions to non-forest cover in two trailing-edge forest landscapes. **RODMAN, K.C.**, Crouse, J.E., Donager, J.J., Huffman, D.W. and Sánchez Meador, A.J.
- 11:00–11:15 Return of the beetles: a Museum Fire story. **MOTT, C.M.**, and Hofstetter, R.W.
- 11:15–11:30 Mixed-severity wildfire shapes habitat use of ungulates and large carnivores. **LEWIS, J.S.**, LeSueur, L., Oakleaf, J., and Rubin, E.S.
- 11:30–11:45 Burn severity in Mexican Spotted Owl PACs and potential habitat across the American Southwest. **DAUGHERTY, M.**, Thode, A., Hedwall, S., Chaudhry, T., and Jones, G.

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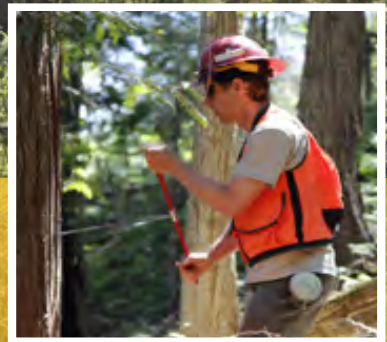
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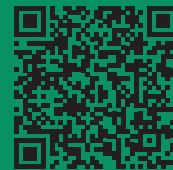
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