

2019

**15th Biennial Conference of
Science & Management
on the Colorado Plateau &
Southwest Region**

Flagstaff • Arizona • USA
September 9–12



Agenda & Program



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2019

High Country Conference Center
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15th Biennial Conference of Science & Management on the Colorado Plateau & Southwest Region

Theme: Science & Solutions for Conserving the Southwest's
Land, Water, Biodiversity & Cultures

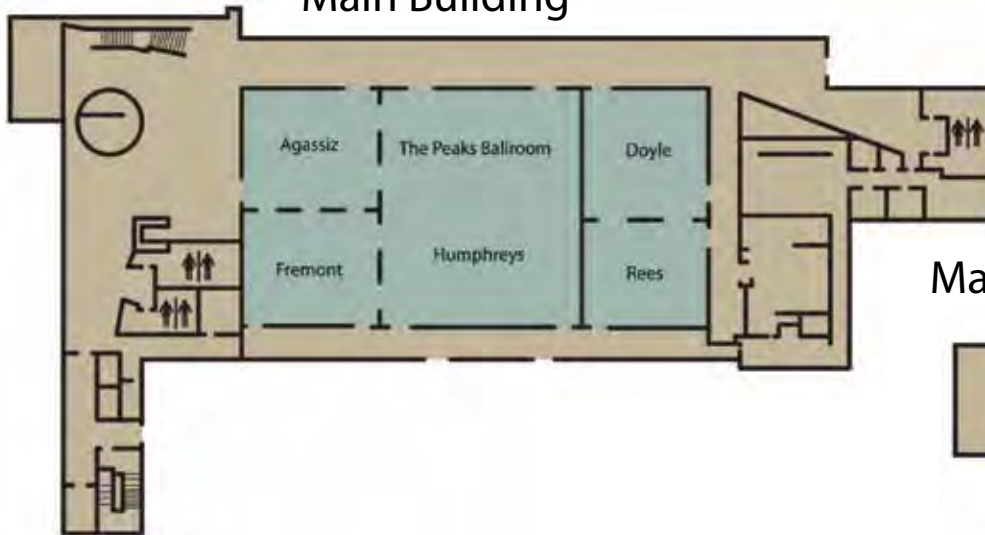
Agenda & Program

High Country Conference Center, Flagstaff

201 W. Butler Ave, Flagstaff, AZ 86001 Phone: (928) 523-9521



Main Building



Main Building 2nd Floor



Special Thanks

The 15th 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! We would like to thank 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!! Finally, would like to extend our whole-hearted thanks to the BYU Charles Redd Center for Western Studies, NAU Office of the President, and NAU College of Arts and Letters Humanities Departments for their support of the public keynote speaker, author Terry Tempest Williams.



The following Northern Arizona University units generously provided support: Landscape Conservation Initiative; Office of the President; School of Forestry; Office of the Vice President of Research, College of Environment, Forestry, and Natural Sciences; College of Arts and Letters Humanities Departments; Ecological Restoration Institute; and Merriam-Powell Center for Environmental Research

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Planning & Organization

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**Maddison Casillas, Emery Cowan,
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At-A-Glance Program

Time	Agassiz	Doyle	Fremont	Rees	Prochnow	1899 Ballroom	Ponderosa (Boardroom)	Aspen
	Monday, Sept. 9, 2019 REGISTRATION: High Country Conference Center Lobby (7:30 AM to 5 PM)							
8:00 AM to 5:00 PM		Introduction to Bayesian and hierarchical Bayesian modeling						
8:00 AM to Noon	Planning biological soil crust restoration projects in a changing climate		Use of mycorrhizal fungi in restoration of southwestern US vegetation	Desert SW CESU Meeting			CPNPP Strategy Meeting	Rocky Mtn CESU Meeting (Walnut) CO Plateau CESU Meeting (Aspen)
1:00 to 5:00 PM	Biological soil crusts (biocrusts) as a model system in science education		SEUG Drought Adaptation Working Group Meeting	Joint CESU Meeting				Speaker-ready Room
5:30 to 7:00 PM	RECEPTION: 1899 Bar & Grill Ballroom & Patio - 307 W. Dupont Ave., Flagstaff, AZ - Free parking in High Country Conference Center parking garage (Appetizers & no-host bar)							
7:00 to 8:30 PM	EVENING PUBLIC EVENT: The Arid Lands and Legacy of John Wesley Powell 150 Years Ago, 150 Years Ahead. History, Science, Culture and Future - Prochnow Auditorium - Free parking in High Country Conference Center parking garage							

Time	Agassiz	Doyle	Fremont	Rees	Prochnow	1899 Ballroom	Ponderosa (Boardroom)	Aspen
Tuesday, Sept. 10, 2019								
7 to 8 AM	REGISTRATION & MORNING REFRESHMENTS: Humphreys Ballroom							Speaker-ready Room
8 to 9 AM	WELCOME & SCIENCE KEYNOTE ADDRESS: Dr. Hugh Possingham, The Nature Conservancy's Chief Scientist, Prochnow (Free and open to the public)							Speaker-ready Room
9 to 9:30 AM	BREAK: Humphreys Ballroom							Speaker-ready Room
9:30 to 11:30	Belowground ecology: the hidden half	Contributed: drought and climate change impacts	Producing science that makes a difference: perspectives from managers and scientists	Celebrating the 20th anniversary of the Cooperative Ecosystem Studies Units	John Wesley Powell & reimagining the Colorado River Basin			Speaker-ready Room
11:30 AM to 1 PM	BUFFET LUNCH: Humphreys Ballroom							Speaker-ready Room
1 to 3 PM	Adapting biological soil crust restoration for a changing climate	Tamarisk in the ecosystem	Producing science that makes a difference (cont.)	Assessing vulnerabilities of cultural heritage to changing environmental conditions	John Wesley Powell & reimagining the Colorado River Basin (cont.)		USGS Women in Science	Speaker-ready Room
3 to 3:15 PM	BREAK: Humphreys Ballroom							Speaker-ready Room
3:15 to 5:15 PM	New insights on addressing rare biota of the Colorado Plateau and Southwest	Tamarisk in the ecosystem (cont.)	Ecological restoration in a changing climate on the Colorado Plateau: use of best available science on our public lands	Addressing cultural resource management needs through partnership, development of cross-disciplinary approaches	River management through integrated assessment of water resource development and conservation			Speaker-ready Room
5:30 to 7:30 PM	POSTER SESSION & RECEPTION: 1899 Bar & Grill Ballroom & Patio - 307 W. Dupont Ave. (Appetizers & no-host bar)							

Time	Agassiz	Doyle	Fremont	Rees	Prochnow	1899 Ballroom	Ponderosa (Boardroom)	Aspen
Wednesday, Sept. 11, 2019								
7 to 8 AM	REGISTRATION & MORNING REFRESHMENTS: Humphreys Ballroom							Speaker-ready Room
8 to 10 AM	The Escalante River Watershed Partnership	Evaluating the effects of flow and connectivity on river ecosystems	Bridging science and management to promote sustainable grazing on the Colorado Plateau	Contributed: human dimensions and cultural resource management		Unmanned Aircraft Systems (UAS) for park and protected area resource management		Speaker-ready Room
10:00 to 10:15 AM	BREAK: Humphreys Ballroom							Speaker-ready Room
10:15 AM to 12:15 PM	Contributed: terrestrial and riparian plant ecology	The Middle Rio Grande in New Mexico	Bridging science and management to promote sustainable grazing (cont.)	Contributed: water and land-use planning		Message box workshop		Speaker-ready Room
12:15 to 1:15 PM	BUFFET LUNCH: Humphreys Ballroom							Speaker-ready Room
1:15 to 3:15 PM	Considering visitor use on the Colorado Plateau	Upper Colorado & San Juan Rivers Recovery Programs	Bridging the gap between science & management	Contributed: animal ecology and nonnative species		Interactions between insects, ecosystems and climate		Speaker-ready Room
3:15 to 3:30 PM	BREAK: Humphreys Ballroom							Speaker-ready Room
3:30 to 5:30 PM	Frontiers of wildfire on the Colorado Plateau	Lower Colorado River Multi-Species Conservation Program	Bridging the gap between science and management (cont.)	The ecological impacts of wildlife- and zoonotic-diseases on the Colorado Plateau		"Thinking story like a journalist" panel & pitch pit		Speaker-ready Room
5:30 to 7:00 PM	RECEPTION: 1899 Bar & Grill Patio - Free parking in High Country Conference Center parking garage (Appetizers & no-host bar)							
7:00 to 8:30 PM	KEYNOTE SPEAKER: Terry Tempest Williams - Prochnow Auditorium - Free parking in High Country Conference Center parking garage							

Time	Agassiz	Doyle	Fremont	Rees	Prochnow	1899 Ballroom	Ponderosa (Boardroom)	Aspen
Thursday, June 27								
7 to 8 AM	REGISTRATION & MORNING REFRESHMENTS: Humphreys Ballroom							Speaker-ready Room
8 to 10 AM	Contributed: conservation management and planning	Glen Canyon Dam Adaptive Management Program & the Amazon Dams Network – International information exchange	Restoration and conservation across Colorado Plateau drylands	Planetary analogs on the Colorado Plateau: past, present, and future				Speaker-ready Room
10:00 to 10:15 AM	BREAK: Humphreys Ballroom							
10:15 AM to 12:15 PM	Climate migration and pressures on natural resources and communities of the Colorado Plateau	Contributed: restoration and conservation	Restoration and conservation across Colorado Plateau drylands (cont.)	Uranium mining in the Grand Canyon: status of USGS research			Glen Canyon Dam Adaptive Management Program & the Amazon Dams Network conversation	
12:15 to 1:15 PM	BUFFET LUNCH: Humphreys Ballroom							Drylands lunch meeting
	ADJOURN: Thank you and safe travels!							



15th Biennial Conference of Science and Management for the Colorado Plateau and Southwest Region

**Theme: “Science & Solutions for Conserving the Southwest’s Land, Water,
Biodiversity and Cultures”**

September 9–12, 2019

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

Monday, September 9, 2019—Clients’ Day

Registration and Speaker Ready Room

7:30 AM–5:00 PM Registration (High Country Conference Center lobby)
1:00–5:00 PM Speaker-ready room (Aspen)

Meetings

Cooperative Ecosystem Study Units Business Meetings (by invitation):

- Rocky Mountain CESU: (8:30 AM–12:00 PM, Walnut)
- Desert SW CESU: (9:00–11:30 AM, Rees)
- Colorado Plateau CESU: (9:00–11:45 AM, Aspen)
- Joint Meeting: (1:00–5:30 PM, Rees)

Colorado Plateau Native Plant Network Meeting (by invitation, 9:00 AM–12:00 PM, Ponderosa Boardroom)

Southeast Utah Group (SEUG) Drought Adaptation Working Group Meeting (by invitation, 1:00–5:00 PM, Fremont)

Monday Workshops

Introduction to Bayesian and hierarchical Bayesian modeling applications in environmental science – This day-long workshop will provide an overview of Bayesian modeling at a relatively introductory level and give participants a toolset to begin exploring creative statistical/modeling solutions within their own research scopes. **Organizers:** Kiona Ogle, Kimberly Samuels-Crow, Drew Peltier, NAU School of Informatics, Computing, and Cyber Systems (Free, 8:00 AM to 5:00 PM, Doyle)

Planning biological soil crust restoration projects in a changing climate – This short course will be an introduction to unmanned aerial vehicles (UAS) and their associated systems. **Organizers:** Colin Tucker and Sasha Reed, U.S. Geological Survey; Anita J. Antoninka, NAU School of Forestry; and Sue Bellagamba and Kristen Redd, The Nature Conservancy (Free, 8 AM to 12 PM, Agassiz)

Use of mycorrhizal fungi in restoration of southwestern US vegetation – This workshop will explore how mycorrhizal fungi and other soil organisms are being used to enhance restoration outcomes in the southwestern United States. **Organizers:** Catherine Gehring, Julia Hull, and Lisa Markovchick, Northern Arizona University; and Dalyna Hannah, Navajo Technical University (Free, 8 AM to 12 PM, Fremont)

Biological soil crusts (biocrusts) as a model system in science education – This workshop will provide the basic background information about biocrusts for science educators. Organizers will share several newly developed active-education modules and a citizen science tool. Organizers: Anita J. Antoninka, Maria Cristina Rengifo Faiffer, and Matthew A. Bowker, Northern Arizona University; Theresa Clark, University of Nevada; and Kristen Fisher, Cal State Los Angeles (1:00 to 5:00 PM, Agassiz)

Monday Fieldtrip

Fossil Creek Restoration Project – Join us for a full-day excursion to Fossil Creek to learn more about the geology, ecology, and policy of this river oasis. The trip will offer options for those who would like to take it easy by the river’s edge and for those feeling up to a 5-mile trek to see the old dam site. **Organizers:** Jane Marks and Denielle Perry, Northern Arizona University (\$30, 7:00 AM to 4:00 PM, followed by stop at Mother Road Brewery; must pre-register, transportation and box lunch provided, meet outside main High Country Conference Center entrance)

Monday Evening Conference Events

- | | |
|--------------|--|
| 5:30–7:00 PM | Opening Reception , 1899 Bar and Grill patio, 307 W. Dupont Ave. Free parking available in the High Country Conference Center garage. (Appetizers and no-host bar) |
| 7:00–8:30 PM | Public Event: The Arid Lands and Legacy of John Wesley Powell 150 Years Ago, 150 Years Ahead. History, Science, Culture and Future —Includes showing rough-cut film of 2019 commemoration trip of John Wesley Powell 1869 Colorado River trip, followed by comments from Daniel McCool, University of Utah, and Paul Hirt, Arizona State University. Sponsored by the Sesquicentennial Colorado River Exploring Expedition project (Powell150.org). Admission is free and the public is welcome. Prochnow Auditorium, 326 W. Dupont Avenue (next door to the reception). |

Tuesday, September 10, 2019

7:00–8:00 AM	Registration, High Country Conference Center lobby
7:00–8:00 AM	Morning Refreshments (Humphrey Ballroom)
8:00–8:15 AM	Official Welcome: David Schultz, Vice President of Research, Northern Arizona University, and Todd Chaudhry, Research Coordinator, National Park Service-Intermountain Region. Prochnow Auditorium
8:15–9:00 AM	Keynote Speaker: Hugh Possingham, Chief Scientist, The Nature Conservancy, Prochnow Auditorium
9:00–9:30 AM	Break (Humphrey Ballroom)

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John Wesley Powell and reimagining the Colorado River Basin: sesquicentennial perspectives

Tuesday, 9:30 AM–3:00 PM – Prochnow Auditorium, 326 W. Dupont Avenue

(Free and the public is welcome)

Organizer: Thomas Minckley, University of Wyoming, Department of Geography

This year marks the sesquicentennial of John Wesley Powell's historic 1869 Colorado River Exploring Expedition. A Sesquicentennial Colorado River Exploring Expedition (SCREE) took place from May to August 2019 to reflect on Powell's legacy while retracing the historical route. An edited volume—*Vision & Place: John Wesley Powell & Reimagining the Colorado River Basin*—similarly has been prepared by a multi-disciplinary group of authors and artists. The focus of these panels will be on John Wesley Powell's historical ideas about water, public lands, and Native Americans ("Powell's vision"), as well as the relative influence of Powell's ideas in shaping the Colorado River Basin up to the present ("Powell's legacy").

Water Panel: Powell's time to present, 9:30–10:10 AM

Moderator: Jason Robison, University of Wyoming, College of Law

- Amorina Lee-Martinez, Ph.D. Candidate, University of Colorado, Boulder, Environmental Studies Program, "Common water commonwealth: the paradox of a shared resource" (co-author)
- Patricia Limerick, Professor of History and Director, Center of the American West, University of Colorado, Boulder, "Common water commonwealth: the paradox of a shared resource" (co-author)
- Daniel McCool, Professor Emeritus, Department of Political Science, University of Utah, "Vision & place" (editor) and "We must either protect him or destroy him" (co-author)
- Rachel St. John, Associate Professor of History, University of California-Davis, "Strange resurrection: the fall & rise of John Wesley Powell"

Public Lands Panel: Powell's time to present, 10:10–10:50 AM

- William deBuys, Author, "Stewart Udall, John Wesley Powell, and the emergence of a national American commons"
- Robert Keiter, Professor of Law and Director, Wallace Stegner Center, University of Utah, "John Wesley Powell and the national park idea: preserving Colorado River Basin public lands"
- Paul Hirt, Professor of History, Arizona State University, "Thinking like a RePublic: public lands in the Colorado River Basin"
- Emilene Ostlind, Editor, Ruckelshaus Institute, University of Wyoming, "Powell as unwitting godfather of outdoor recreation in the great unknown"

Native Americans Panel: Powell's time to present, 10:50–11:30 AM

- Autumn Bernhardt, Instructor, College of Liberal Arts, Colorado State University, "Pastoral and civilized: water, land, and tribes in the Colorado River Basin"
- Daniel Cordalis, Attorney, Lecturer, Humboldt State University, "Civilizing public land management in the Colorado River Basin"
- William Gribb, Professor Emeritus, Department of Geography, University of Wyoming, "John Wesley Powell's land and water policies and southwestern Native American agricultural practices"
- Weston McCool, Ph.D. Candidate, Univ. of California-Santa Barbara, "We must either protect him or destroy Him" (co-author)

11:30–1:00 LUNCH

This session will include a series of three panels by the volume’s authors on subjects that animate these efforts—the future of water, public lands, and Native Americans.

Water Panel: the future, 1:00–1:40 PM

Moderator: Nicholas Crane, University of Wyoming, School of Politics, Public Affairs, and International Studies.

- Amorina Lee-Martinez, Ph.D. Candidate, University of Colorado, Boulder, Environmental Studies Program, “Common water commonwealth: the paradox of a shared resource” (co-author)
- Patricia Limerick, Professor of History and Director, Center of the American West, University of Colorado, Boulder, “Common water commonwealth: the paradox of a shared resource” (co-author)
- Daniel McCool, Professor Emeritus, Department of Political Science, University of Utah, “Vision & place” (editor) and “We must either protect him or destroy him” (co-author)
- Rachel St. John, Associate Professor of History, University of California-Davis, “Strange resurrection: the fall & rise of John Wesley Powell”

Public Lands Panel: the future, 1:40–2:20 PM

- William deBuys, Author, “Stewart Udall, John Wesley Powell, and the emergence of a national American commons”
- Robert Keiter, Professor of Law and Director, Wallace Stegner Center, University of Utah, “John Wesley Powell and the national park idea: preserving Colorado River Basin public lands”
- Paul Hirt, Professor of History, Arizona State University, “Thinking like a RePublic: public lands in the Colorado River Basin”
- Emilene Ostlind, Editor, Ruckelshaus Institute, University of Wyoming, “Powell as unwitting godfather of outdoor recreation in the great unknown”

Native Americans Panel: the future, 2:20–3:00 PM

- Autumn Bernhardt, Instructor, College of Liberal Arts, Colorado State University, “Pastoral and civilized: water, land, and tribes in the Colorado River Basin”
- Daniel Cordalis, Attorney, Lecturer, Humboldt State University, “Civilizing public land management in the Colorado River Basin”
- William Gribb, Professor Emeritus, Department of Geography, University of Wyoming, “John Wesley Powell’s land and water policies and southwestern Native American agricultural practices”
- Weston McCool, Ph.D. Candidate, Univ. of California-Santa Barbara, “We must either protect him or destroy Him” (co-author)

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Belowground ecology: the hidden half

Tuesday, 9:30–11:30 AM – Agassiz

Organizers: Carolyn Sieg, USDA Forest Service, Rocky Mountain Research Station; Catherine Gehring, Northern Arizona University, Department of Biological Sciences and Merriam Powell Center; and Nancy Johnson, Northern Arizona University, School of Earth and Sustainability

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|-------------|---|
| 9:30–9:45 | Decadal influence of a high severity wildfire on microbial communities in Southwest ponderosa pine. OVERBY, S.T. , G.S. Newman, N. Dove, and S.C. Hart |
| 9:45–10:00 | Sagebrush restoration success on the Colorado Plateau depends on soil texture and depth. VEBLEN, K. , K.C. Nehring, S. Fick, and M.C. Duniway |
| 10:00–10:15 | Persistence of <i>Pinus edulis</i> -associated ectomycorrhizal fungi in New Mexico. MONTES, A.M. and D. L. Taylor |
| 10:15–10:30 | Logging machinery impacts to soil fauna and physical properties during forest restoration. GIBSON, K.S. , N.C. Johnson, and A.J. Antoninka |
| 10:30–10:45 | Sympatric pairings of dryland grass populations, mycorrhizal fungi, and associated soil biota enhance mutualism and ameliorate drought stress. REMKE, M. , N.C. Johnson, J. Wright, M. Williamson, M.A. Bowker |

- 10:45–11:00 Mind the myco gap (between research and management potential). **MARKOVCHICK, L.**, V. Denney, K.S. Gibson, N.C. Johnson, J.I. Querejeta, R. Swaty, J. Sharma, T.G. Whitham, C.A. Gehring
- 11:00–11:15 The root race: does stream type affect belowground architecture of a riparian tree species? **PARKER, J.M.**, A. Cadmus, C.A. Gehring, and T.G. Whitham
- 11:15–11:30 Hot and dry versus hot or dry: Consequences for mycorrhizal fungi and their host plants. **GEHRING, C.A.**, S. Sevanto, A. Patterson, D. Marias, and C. Kuske

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Contributed Session – Drought and climate change impacts

Tuesday, 9:30–11:30 AM – Doyle

Moderator: TBD

- 9:30–9:45 Large-scale forest restoration stabilizes carbon under climate change in Southwest U.S. **MCCAULEY, L.**, M.D. Robles, T. Woolley, R.M. Marshall, A. Kretchun, and D.F. Gori
- 9:45–10:00 Legacy effects influencing *Populus fremontii* success at Rio Mesa. **FOLLSTAD SHAH, J.**, S. Boogaard, Z. Lundeen, and K. Grady
- 10:00–10:15 Assessing the durability, stability, and usability of genetic resistance to a non-native fungal pathogen in five-needle pines. **JOHNSON, J.S.**, and R.A. Snieszko
- 10:15–10:30 Physiological responses of dominant grass species to precipitation variation in Southwest grassland ecosystems. **RUEDA, A.**, J. Bradford, S.M. Munson, J. Gremer, and B.J. Butterfield
- 10:30–10:45 Rainfall manipulation quantifies ecosystem sensitivity to hydroclimatic change in Mongolian steppes and Arizona rangelands. **BIEDERMAN, J.A.**, B.K. Smith, N. Pierce, Y. Hao, W. Liu, L. Li, C. Zhou, and R.L. Scott
- 10:45–11:00 Northeastern Arizona Drought Responsive Seeding Strategy. **BURDEN, I.B.**, M.C. Reeves, and H.L. Dial
- 11:00–11:15 Grassland vegetation collapse following long-term drought on relict mesas in Glen Canyon National Recreation Area. **SPENCE, J.R.**, L.H. Pilkington, R. McNeill, and S. Doyle
- 11:00–11:15 Characterizing evapotranspiration dynamics in the riparian zone of the Colorado River Delta to evaluate ecosystem changes in response to the Minute 319 environmental pulse flow to Mexico. **NAGLER, P.L.**, C.J. Jarchow, A. Barreto-Munoz, S. Herrmann, and K. Didan

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Producing science that makes a difference: perspectives from managers and scientists

Tuesday, 9:30 AM–3:00 PM – Fremont

Organizers: Molly McCormick and Rob Massatti, U.S. Geological Survey, Southwest Biological Science Center

- 9:30–9:45 Co-production of science: lessons from social science literature. **COLVATO, M.M.**
- 9:45–10:00 Science and management: never the twain shall meet? Progress in Canyon Country. **FISK, T.T.**
- 10:00–10:15 Connecting science and land management to enhance Southwest ecosystems – examples from the USGS Restoration Assessment and Monitoring Program for the Southwest (RAMPS). **MCCORMICK, M.L.**, S.M. Munson, K.M. Laushman, B.J. Butterfield, K. Balazs, M. Duniway, R. Mann, J.B. Bradford, J. Hartsell, H. Cooper, S. Newell, N. Talkington, and T. Fisk
- 10:15–10:30 Leveraging long-term data sets to address land management issues. **SWAN, M.** and **D.L. WITWICKI**
- 10:30–10:45 Using pilot projects and co-producing science with managers. **DUNIWAY, M.**, R.K. Mann, and S.E. Fick
- 10:45–11:00 Co-production of science to address short- and long-term challenges of accelerated forest restoration in northern Arizona. **ROBLES, M.**, R.M. Marshall, T. Woolley, and L.A. McCauley
- 11:00–11:15 Developing management tools for Great Basin ecosystem restoration. **RICHARDSON, B.**, F. Kilkenny, and B. St. Clair
- 11:15–11:30 Turning research into action: challenges and opportunities for collaboration across the desert Southwest. **GRABAU, M.** and G. Johnson
- 11:30–1:00 LUNCH

- 1:00–1:15 An evolving partnership between Arizona tribes, the Forest Service, and researchers to ensure the availability and sustainability culturally important plant species on federal lands. **SOUTHER, S.**, V. Randall, and N. Lyndon
- 1:15–1:30 Collaborating with tribes: lessons learned from developing the Diné Native Plants Program. **TALKINGTON, N.**, and J. Mike
- 1:30–1:45 Supporting science under shifting sands – reflections from one National Park Service employee. **HAAS, S.**
- 1:45–2:00 REAL co-production of science: examples and recommendations from Cooperative Extension. **GORNISH, E.S.**
- 2:00–2:15 Successes and pitfalls in research and land management partnerships. **WALTZ, A.**, D.W. Huffman, J.E. Crouse, J.P. Roccaforte, J.D. Springer, and M.T. Stoddard
- 2:15–2:30 Developing science with management in mind: stories of participatory analysis and collaborative planning. **STORTZ, S.** and T.D. Sisk
- 2:30–3:00 Discussion

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Celebrating the 20th anniversary of the Cooperative Ecosystem Studies Units: successes in long-term science-management partnerships

Tuesday, 9:30–11:30 AM – Rees

Organizer: Todd Chaudhry, National Park Service, Colorado Plateau Cooperative Ecosystem Studies Unites

- 9:30–9:45 Twenty years of successful federal-nonfederal collaboration: The CESU Network...past, present, and future. **FISH, T.E.**
- 9:45–10:00 Recent developments at three western CESUs: an update from the Colorado Plateau, Desert Southwest and Rocky Mountain CESU Directors. **ALLEN, J.**, J. Koprowski, and T. DeLuca
- 10:00–10:15 A long-term partnership between the Colorado Plateau Research Station and the National Park Service enables scientist-manager collaboration and informs stewardship of natural resources. **VAN RIPER, C.**, M. Johnson, J. Holmes, and E. Nowak
- 10:15–10:30 A praxis-based model for cultural resource learning, preservation, and management. **MATERO, F.G.**
- 10:30–10:45 A collaborative approach to management and conservation of herpetofauna in the desert Southwest: a principal investigator's point of view. **GOODE, M.**
- 10:45–11:00 Public lands and community connections. **BARROW, J.**
- 11:00–11:15 Using citizen engagement to monitor wilderness character in BLM Wilderness Study Areas in Montana. **GERLOFF, L.M.**
- 11:15–11:30 Active scientific integrity: beyond process and products. **MOYNAHAN, B.J.**

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Adapting biological soil crust restoration for a changing climate

Tuesday, 1:00 PM–3:00 PM – Agassiz

Organizers: Colin Tucker, U.S. Geological Survey Southwest Biological Science Center and U.S. Forest Service, Northern Research Station; Sasha Reed, U.S. Geological Survey, Southwest Biological Science Center; Anita Antoninka, Northern Arizona University, School of Forestry; Sue Bellagamba, The Nature Conservancy–Utah; and Kristen Redd, The Nature Conservancy–Utah, Canyonlands Research Center

- 1:00–1:15 Can assisted migration improve biocrust restoration outcomes in the face of accelerating climate change? **TUCKER, C.**, A. Antoninka, M. Bowker, S. Bellagamba, K. Dohrenwend, N. Day, and S. Reed
- 1:15–1:30 Mosses under stress: Morphological changes in dryland moss *Syntrichia* under climate disturbances. **RENGIFO-FAIFFER, M.C.**, A. Antoninka, C. Hensen, and M. Bowker
- 1:30–1:45 When to inoculate?: characterizing temporal and spatial variability in biocrust growth conditions across the Colorado Plateau. **FICK, S.E.**
- 1:45–2:00 Cyanobacterial slime and biocrust restoration: microclimate driven variability in biocrust exopolysaccharides may be important for understanding restoration outcomes. **DAY, N.**, C. Tucker, A. Antoninka, S. Reed, and J. Belnap

- 2:00–2:15 Effects of herbicide treatments on Mojave Desert biological soil crust. **BAILEY, L.**, A. Antoninka, and M. Bowker
- 2:15–2:30 Response of biological soil crust to restoration trials on highly disturbed arid landscapes. **KARBAN, C.**, **MANN, R.K.**, N. Barger, M. Duniway, A. Faist, J.E. Hinck, and D. Hoover
- 2:30–2:45 Citizen science biocrust restoration. **ROWE, H.I.**, A.A. Antoninka, J. Weser, T. Sprague, D. Langenfeld, and J. Brady
- 2:45–3:00 A biocrust inoculum industry: what could/should it look like? **BOWKER, M.A.**

Tamarisk in the Ecosystem

Tuesday, 1:00–5:15 PM – Doyle

Organizers: Pamela Nagler, U.S. Geological Survey, Southwest Biological Science Center; Kevin Hultine, Desert Botanical Garden, Department of Research, Conservation and Collections; and Matthew Johnson, Northern Arizona University, Colorado Plateau Research Station

- 1:00–1:15 USDA, APHIS overview: southwestern willow flycatcher' conservation program. Caraher, K., and **WEEKS, R.**
- 1:15–1:30 Phenology of *Diorhabda carinulata*, a biocontrol agent for *Tamarix* spp., along the lower Colorado River's Cibola and Imperial National Wildlife Refuges. **BEAN, D.**, T. Dudley, F. Grevstad, T. Wepprich, and L. Coop
- 1:30–1:45 An ecohydrological framework for riparian restoration in the American Southwest. **ORR, B.**, G. Leverich, T. Dudley, J. Hatten, M. Johnson, K. Hultine, A.J. Keith
- 1:45–2:00 Tamarisk defoliation and restoration: the influence on birds along the Dolores River in southwestern Colorado. **VAN RIPER III, C.**, A.J. Darrah, H.F. Greeney, and A.J. Boyce
- 2:00–2:15 Native bird responses to tamarisk (*Tamarix* spp.) biological control. **MAHONEY, S.M.**, M.J. Johnson, J.A. Holmes, and T.C. Theimer
- 2:15–2:30 Responses of southwestern willow flycatchers to tamarisk defoliation. **MCLEOD, M.A.**
- 2:30–2:45 A functional approach to endangered bird habitat suitability in an invaded system. **GOETZ, A.R.B.**, A.L. Henry, E. González, and A. Sher
- 2:45–3:00 Forecasting the winners and losers of a riparian herpetofauna in response to habitat invasion and xerification. **RIDDLE, S.**, and H.L. Bateman
- 3:00–3:15 BREAK
- 3:15–3:30 The human ecology of *Tamarix* removal and native recovery in the Southwestern U.S. Clark, L.B., **A.L. HENRY**, E. González, R. Lave, N. Sayre, and A. Sher
- 3:30–3:45 Restoration planning with simulations using southwestern willow flycatcher fine scale (1m) habitat models incorporating riparian woodland species aerial imagery classification. **TRACY, J.L.**, and R.N. Coulson
- 3:45–4:00 Remote sensing of tamarisk beetle (*Diorhabda carinulata*) impacts along 412 km of the Colorado River in the Grand Canyon, Arizona, USA. **BEDFORD, A.**, T.T. Sankey, J.B. Sankey, L. Durning, B.E. Ralston, and N. Bransky
- 4:00–4:15 Vegetation indices trends in restoration and non-restored riparian vegetation sites: exploring the potential to detect changes in foliar cover through Landsat and UAV vegetation indices in the Colorado River Delta, Mexico. **GÓMEZ-SAPIENS, M.M.**, P. Nagler, K. Schlatter, A. Melendez, D. Hernandez-Lopez, A. Barreto-Muñoz, and K. Didan
- 4:15–4:30 Unmanned aerial vehicle based structure from motion for estimating biocontrol impacts on riparian tamarisk. **COMBS, T.P.**, K. Didan, A. Barreto-Muñoz, C.J. Jarchow, M. Gomez-Sapiens, and P.L. Nagler
- 4:30–4:45 Using time-series satellite vegetation indices to assess fractional plant cover changes and ecological recovery for riparian restoration sites on the Colorado Plateau. **BARRETO-MUÑOZ, A.**, P. Nagler, K. Didan, P. Shafroth, and E. González
- 4:45–5:00 Using population models of interacting species to support decisions. **YACKULIC, C.**
- 5:00–5:15 Current distribution and potential impacts of tamarisk beetle (*Diorhabda* spp.) across the Colorado River Basin. **BLOODWORTH, B.R.**

Assessing Vulnerabilities of Cultural Heritage to Changing Environmental Conditions

Tuesday, 1:00–3:00 PM – Rees

Organizers: Lauren Meyer, National Park Service, Vanishing Treasures Program, and Sallie Hejl, National Park Service, Desert Southwest Cooperative Ecosystem Studies Unit

- 1:00–1:15 The future is now: Impacts to our most valued western cultural heritage from changing environmental conditions. **ADLER, R.S.**, and L.M. Meyer
- 1:15–1:30 Erasing lines: working across disciplines to address potential climate change impacts and data gaps. **BENJAMIN, P. K.**, L. Leap, and N. Conti
- 1:30–1:45 Patterns and themes in climate change vulnerability assessments conducted on NPS cultural resources. **YU, P.**, and M. Rockman
- 1:45–2:00 Developing a framework for assessing vulnerability of western cultural heritage. **HARTFIELD, K.**, S.R. LeRoy, J. Weiss, B. Jeffery, W. van Leeuwen, G. Garfin, H. Hartmann, L. Meyer, R. Adler, and P. Benjamin
- 2:00–2:15 Ground-truthing vulnerability: assessing earthen and masonry sites in the arid West. **MATERO, F. G.**, E. Oskierko-Jeznaki, and J. Hinchman
- 2:15–2:30 A proposed interdisciplinary framework for assessing and managing landscapes with significant historical and natural values. **MCGILVRAY, J.**
- 2:30–2:45 Case study: landscape-scale erosion and invasive-woody species impacts to archaeological sites at Canyon De Chelly NM and Navajo NM in northeastern Arizona. **LYONS, K.D.**
- 2:45–3:00 Best practices for conducting vulnerability assessments for cultural resources in the NPS: workshop description and next steps. **YU, P.**, P. Benjamin, S.R. LeRoy, and J. Cuthbertson

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New insights on addressing rare biota of the Colorado Plateau and Southwest

Tuesday, 3:15–5:15 PM – Agassiz

Organizers: Carolyn Sieg, Shaula Hedwall, Joe Ganey, USFS Forest Service, Rocky Mountain Research Station; and Erika Nowak, Northern Arizona University, Department of Biological Sciences and School of Earth and Sustainability

- 3:15–3:30 Partnerships for monarch research in remote southwestern locations. **MORRIS, G.M.**
- 3:30–3:45 Improving the status of roundtail chub in Arizona. **CARTER, J.M.**
- 3:45–4:00 Captive husbandry research informs conservation of federally-threatened narrow-headed gartersnakes. **LAUGER, K.K.**, and E.M. Nowak
- 4:00–4:15 Taxonomy and listing of subspecies under the ESA: the southwestern willow flycatcher. **THEIMER, T.C.**, M.K. Sogge, and E.H. Paxton
- 4:15–4:30 Salad within: a genetic survey of diet of the endangered New Mexico jumping mouse (*Zapus luteus luteus*). **SANCHEZ, D.E.**, Dikeman, A.L., Walker, F.M., Fofanov, V., and Chambers, C.L.
- 4:30–4:45 Collaborative rare species monitoring with environmental DNA sampling. **WILCOX, T.**, R. Lance, M. Young, K. McKelvey, D. Isaak, and M. Schwartz
- 4:45–5:00 What about those rare species? Study design implications for multi-species monitoring programs. **SANDERLIN, J.S.**, C. Yackulic, K. McKelvey, J.L. Ganey, W.M. Block, J. Golding, and M.K. Schwartz
- 5:00–5:15 Butterfly and plant responses to climate change in montane meadows. **DEBINSKI, D.M.**, and Sherwood, J.A.

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Ecological restoration in a changing climate on the Colorado Plateau: use of best available science on our public lands

Tuesday, 3:15–5:15 PM – Fremont

Organizers: Amy Waltz and Wally Covington, Northern Arizona University, Ecological Restoration Institute

- 3:15–3:30 Recent changes in federal legislation supports “cross-boundary” restoration treatments on culturally sensitive tribal lands. **MARTIN, J.**
- 3:30–3:45 An educational partnership for ecological restoration in forests and woodlands on the Navajo Nation. **BENALLY, D.**, P.Z. Fulé, B. Litson, and B. Neztosie

- 3:45–4:00 Ecosystem restoration on the Hopi Reservation, Arizona. **TAYLOR, M.**, and J.A. Duffield
- 4:00–4:15 Updates on the Restoration Assessment and Monitoring Program for the Southwest. **MUNSON, S.M.**, M.L. McCormick, J.B. Bradford, and B.J. Butterfield
- 4:15–4:30 Collaborative climate adaptation: riparian restoration on northern Arizona’s public lands. **HOGLANDER, C.**
- 4:30–4:45 Historical forest conditions in trailing edge ponderosa pine ecosystems of northern Arizona. **HUFFMAN, D.W.**, D.P. Hanna, J.E. Crouse, M.L. Floyd, A.J. Sánchez Meador, J.D. Springer, and P.Z. Fulé
- 4:45–5:00 Development of silvicultural objectives managing high elevation mesic coniferous forests in southwestern Colorado. **TUTEN, M.**
- 5:00–5:15 Discussion

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Building capacity through collaboration: addressing cultural resource management needs through partnership, development of cross-disciplinary approaches and community engagement

Tuesday, 3:15–5:15 PM – Rees

Organizers: Lauren Meyer, Randall Skeirik, and Rachel Adler, National Park Service, Vanishing Treasures Program

- 3:15–3:30 Utilizing cooperative agreements to work with partners in furthering NPS goals. **SKEIRIK, R.D.**
- 3:30–3:45 Partnering with the Vanishing Treasures Program: five case studies. **BARROW, J.**
- 3:45–4:00 Earthen grouts for the adhesion of painted lime plaster at the mission church of San Jose de Tumacácori, Arizona. **MATERO, F.G.**, N. Declet Díaz, and C. Magill
- 4:00–4:15 Cultural landscapes and technology—three case studies to enhance integrated resource protection, education, and interpretation. **MCGILVRAY, J.**
- 4:15–4:30 A case study of the application of an interdisciplinary approach to managing complex landscapes. **ME-DRANO, M.**
- 4:30–4:45 Partnering with the University of Pennsylvania: students, mortars and weather stations at Wupatki National Monument. **HOUGH, I.**
- 4:45–5:00 Photogrammetry of historic resources through CESU partnership: an example from San Antonio Missions National Historical Park. **DUPONT, W.**, A. Lombardi, and S. Snow
- 5:00–5:15 Risk and Vulnerability Assessment of adobe and masonry ruins at Pecos National Historical Park. **STRATTE, S.**, E. Oskierko Jeznaki, J. Hinchman, and F. Matero

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River management through integrated assessment of water resource development and conservation

Tuesday, 3:15–5:15 PM – Prochnow

Organizers: Lucas Bair, U.S. Geological Survey, Southwest Biological Science Center, and Denielle Perry, Northern Arizona University, School of Earth and Sustainability,

- 3:15–3:30 Advancing social equity and ecological sustainability in IWRM: lessons from the Wild and Scenic Rivers Act. **PERRY, D.**
- 3:30–3:45 The role of conservation policy in protecting New Mexico’s Gila River network: assessing public support for a wild and scenic river designation. **SMITH, S.E.**
- 3:45–4:00 Identifying resilient rivers for wild and scenic designation in the Arizona/New Mexico ecoregion using geospatial analysis and statistical modeling. **MAJOR, J.H.**
- 4:00–4:15 Prioritizing dam removal sites for optimal river restoration in the western U.S. **GUETZ, K.**
- 4:15–4:30 Drought and hydropower impacts on electrical system production costs in the Southwest United States. **BAIN, D.**, and T. Acker
- 4:30–4:45 Tribal preferences for Colorado River water management and the Glen Canyon Dam. **HUBER, C.**, L.S. Bair, M. Arviso-Ciocco, C.J. Neher, and J.W. Duffield
- 4:45–5:00 Glen Canyon Dam high flow experiments at powerplant capacity: history, considerations and opportunities for experimentation. **PALMER, C.**, and C. Ellsworth
- 5:00–5:15 Dispatching hydropower to reduce the social cost of electricity sector emissions. **BAIR, L.S.**, and D. Bain

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Poster Session

Tuesday, September 9, 5:30–7:30 PM

1899 Bar and Grill Ballroom & Patio

Location and parking: 307 W. Dupont Ave. Free parking in the High Country Conference Center 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. Assessing the magnitude of compositional change in two arid ecosystems over 80 years. **ANNETTS, T.S.**, R.M. Mitchell, M.M. Moore, D.C. Laughlin, J.M. Leonard, and K.C. Grady
2. Minimal impact of modeled drought on natural dust emission in the Southwest United States. **ARCUSA, S.H.**, N.P. McKay, C.M. Carrillo, and T.R. Ault
3. Multi-stakeholder governance in the Upper Madeira River Basin (Bolivia and Brazil): the case of the “Comité Binacional por la Vida y la Amazonia en la Cuenca del Rio Madera” (Binational Committee for the Amazonia Life in the Madera River Basin). **ARTEAGA GOMEZ-GARCIA, MARLIZ**
4. Leveraging low-cost side scan sonar to map in-stream habitat features in Florida rivers at a landscape scale. **BODINE, C.**
5. Population-level genetics influences *Populus fremontii* success more than antecedent climate regime at Rio Mesa research garden. **BOOGAARD, S.**, J. Follstad Shah, Z. Lundeen, and K. Grady
6. How do plants affect soil microbial communities across drylands? **CASILLAS, M., E. VENHAUS, M.** Patton, C. Cort, K. Young, J. Belnap, J. Rudgers, A. Darrouzet-Nardi, and E. Stricker
7. Comparisons of LiDAR- and field-derived estimates of crown base height and canopy bulk density in ponderosa pine forests in northern Arizona. **CHAMBERLAIN, C.P.**, A.E. Thode, and A.J. Sanchez Meador
8. Acoustical monitoring of overflight noise on the South Rim at Grand Canyon National Park. **CHAMBLESS, H.**, M. Holahan, and D. Johns
9. Southwest Experimental Garden Array: field sites for climate change and genetic research. **COLELLA, E.N.**
10. New hands in U.S. public lands management: the role and influence of non-agency partners in U.S. Forest Service stewardship agreements. **COWAN, E.C.**, and K.E. Grimm
11. Silvicultural treatments to reduce mortality and decline of aspen from oystershell scale. **CROUCH, C.D.**, J.C. Rainey, N. Wilhelmi, A.M. Grady, M.R. Nabel, J.R. Ouzts, E.A. Rokala, M.P. Sedgeman, and K.M. Waring
12. Influences of seed source selection and drought conditioning on seedling physiology and outplanting success of *Pinus ponderosa*. **DIXIT, A.**, O. Burney, and T. Kolb
13. Documenting an adaptive management process to establish records of engagement and decision-making. **DOWNING, E.**
14. Analyzing recreation impacts across the recreation opportunity spectrum. Vanstaveren, J., M. Earl, and **B. EASTEP**
15. Restoring processes: soil health and restoration in a disturbed semi-arid grassland. Farrell, H.L., A. Barberan, and E.S. Gornish
16. NEON: open data to understand our changing ecosystems. **GAETANI, M.S.**
17. Eighty-two years of plant functional type, species richness, and cover changes in an Arizona chaparral community. **GIBSON, W.G.**, M.M. Moore, J.M. Leonard, and K.C. Grady

18. Tamarisk invasion & the ecological and evolutionary consequences for native riparian ecosystems in the southwestern U.S. **GILLETTE, H.D.**, K.M. Dlugosch, S.M. Schuster, T.G. Whitham, and G.J. Allan
19. Testing the adaptive significance of song in willow flycatchers (*Empidonax traillii*). **GONZALEZ, S.I.**, S.M. Mahoney, and T.C. Theimer
20. Drought response and water relations of Southwestern white pine planted in common gardens. **GRAEBNER, M.**, E. Bucholz, T. Kolb, A. Whipple, and K. Waring
21. Climate and tree source effects on *Pinus edulis* mortality, bud performance, and growth in Southwest United States. **HANNAH, D.**, C. Bebo, R. Data, A. Patterson, E. Moler, P. Heinrich, C. Gehring, A. Whipple, and S. Chischilly
22. The Trait and Plant Performance Database: linking plant traits to plant performance to improve restoration outcomes. **HARTSELL, J.**, B. Butterfield, and A. Pilmanis
23. Restoration seeding success across Southwest ecosystems. **HAVRILLA, C.A.**, S.M. Munson, B.J. Butterfield, K.M. Laushman, and M.L. McCormick
24. The Southwest Experimental Garden Array: sites, facilities and capabilities. **HEINRICH, P.L.**, and A.V. Whipple
25. Environmental monitoring of uranium exposure experienced by Navajo Nation community livestock in Cove, Arizona. **HETTLEMAN, G.B.**, D.N. Clashin, M.K. Mares, T.R. Nez, and J.C. Ingram
26. Assessing the utility of gravity data in inferring enhanced permeability zones due to faults. **KAHLER, L.M.**
27. The Amazon Dams Network: advancing integrative research and adaptive management of social-ecological systems transformed by hydroelectric dams. Arteaga Gomez-Garcia, M., S. Athayde, S. Bohlman, B. Colombi, R. de Carvalho, T. Crouch, **D. KAPLAN**, B. Loiselle, T. Melis, and A. Sabo
28. Overcoming barriers to restoration in highly degraded semiarid rangelands on the Colorado Plateau. **KARBAN, C.**, M. Duniway, A. Faist, D. Hoover, R. Mann, and N.N. Barger
29. Do rock lichen represent an important component of the dryland carbon cycle? **LAURIA, C.M.**, A.J. Howell, R.L. Reynolds, and S.C. Reed
30. Spring diets of antelope and black-tailed jackrabbits. **MEACHAM, M.L.**, N. Meneses, K. Baldwin, M.M. Altemus, R.D. Babb, R. Benford, and D.E. Brown
31. Desert fire: assessing vegetation recovery using fire chronosequences from five deserts of the southwestern United States. **MELONE, N.T.**, A.M. Faist, R.K. Hosna, A.J. Howell, C.M. Lauria, E.C. McCann, R.H. Reibold, J.M. Shostrand, M.E. Starbuck, and S.C. Reed
32. Hydropower dams and urbanization in the Brazilian Amazon – a regional analysis. **MENDONÇA DE-CARVALHO, R.**
33. Do biocrusts influence arid-land plant community assembly? **MERKT, R.**, N.N. Barger, and C.A. Havrilla
34. Soil microbial responses to altered precipitation regimes across a southwestern United States elevation gradient. **MONUS, B.**, S. Munson, and H. Throop
35. Plant materials development for effective restoration of native plant communities. **MULLINS, M.**, Z. Davidson, E. Samuel, and M. Parrish
36. Mapping agriculture in the Southwest USA using Landsat imagery, automated cropland mapping algorithms, and cloud computing. **OLIPHANT, A.J.**, P.S. Thenkabail, P. Teluguntla, and D. Foley
37. Seed traits, soil seed bank and above-ground vegetation characteristics in northern Arizona grasslands: implications for restoration. **SIMPSON, A.**, and R. Mitchell
38. A snapshot of pioneer women scientists on the Colorado Plateau. **SMITH, H.**
39. Biocrust optimization of net carbon to varied precipitation pulses. **STARBUCK, M.E.**, K.E. Young, O.E. Sala, A. Darrouzet-Nardi, and S.C. Reed

40. A cost-effective and reliable method to genetically fingerprint horses using degraded scat. **STEPHENS, R.M.**, N. Meneses, and R. Benford
41. Impacts of drought and seed source climate on survival in southwestern white pine seedlings.
- 42. SWENSON, J.K.**, E.B. Bucholz, E.V. Moler, K.M. Waring, and A.V. Whipple
43. Modeling ponderosa pine mechanical properties to aid restoration efforts in northern Arizona. **VAUGHAN, D.R.**, and D. Auty
44. Drought monitoring using quantitative precipitation estimation over northeastern Arizona. **WILLIE, D.**
45. Reproductive biology of giant saguaro cacti (*Carnegiea gigantea*) past, present and future. **WINTERBOTTOM, C.**
46. Cost-effective restoration: evaluating a decade of land treatments across Utah. **YACKULIC, E.**, L. Bair, S. Copeland, K. Gunnell, D. Summers, A. Whittaker, and S. Munson

Wednesday, September 11, 2019

7:00–8:00 AM Registration and Morning refreshments, Humphreys Ballroom

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The Escalante River Watershed Partnership: a decade of success and challenge in the most remote place in the lower forty-eight

Wednesday, 8:00–10:00 AM – Agassiz

Organizers: Jonathan Paklaian and Dave Bastian, Grand Staircase Escalante Partners

- 8:00–8:15 The Escalante River Watershed Partnership: a decade of success and challenge in the most remote place in the lower forty-eight, an overview. **PAKLAIAN, J.R.**
- 8:15–8:30 The Escalante River Watershed Partnership: the Ancestral Lands Navajo program involvement. **BENALLY, M.A.**
- 8:30–8:45 The Escalante River Watershed Partnership: RiversEdge West and assisting watershed partnerships. **BRIGGS, M.**
- 8:45–9:00 The Escalante River Watershed Partnership: partnering with conservation corps to restore riparian ecosystems. **MCKUSICK, A.**
- 9:00–9:15 The Escalante River Watershed Partnership: supporting Grand Staircase-Escalante National Monument in difficult times. **Bastian, D.**
- 9:15–9:30 Discussion

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Evaluating the effects of flow and connectivity on river ecosystems

Wednesday, 8:00–10:00 AM – Doyle

Organizer: Maria Dzul, U.S. Geological Survey, Southwest Biological Science Center

- 8:00–8:15 Environmental drivers of humpback chub population dynamics in the Colorado River and Little Colorado River. **DZUL, M.C.**, C.B. Yackulic, D.R. Van Haverbeke, W. Kendall, and D. Winkelman
- 8:15–8:30 Geomorphic change, biogeomorphic feedbacks, and the downstream transformation of floodwaves in the Little Colorado River, Arizona, USA. **DEAN, D.J.**, and D.J. Topping
- 8:30–8:45 Gene flow among net-spinning caddisfly population in the Colorado River Basin. **METCALF, A.**, T.A. Kennedy, J.C. Marks, and J.D. Muehlbauer
- 8:45–9:00 Colorado River ecosystem responses to the 2018 Bug Flow experiment from Glen Canyon Dam. **KENNEDY, T.A.**, J.D. Muehlbauer, and D.L. Rogowski
- 9:00–9:15 The trophic ecology of a desert river fish assemblage: influence of season and hydrologic variability. **BEHN, K.E.**, and C.V. Baxter
- 9:15–9:30 General indicators of hydro-ecological change for the continental United States. **GEORGE, R.**
- 9:30–9:45 Can a river be restored after a century of disturbance? Lessons from Fossil Creek. **MARKS, J.**
- 9:45–10:00 Designing flows for fish, fisheries and food security. **SABO, J.**

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Bridging science and management to promote sustainable grazing on the Colorado Plateau

Wednesday, 8:00 AM–12:15 PM – Fremont

Organizers: Thomas Sisk and Sara Souther, Northern Arizona University, Landscape Conservation Initiative

- 8:00–8:15 Climate interacts with grazing to alter diversity and composition of a semiarid grassland. **SOUTHER, S.**, M. Loeser, T. Crews, and T. Sisk
- 8:15–8:30 Long-term rangeland monitoring reveals grazing and climate effects vary by ecological site. **MUNSON, S.M.**, M.C. Duniway, and J.K. Johanson

- 8:30–8:45 One hundred years of range research in northern Arizona’s ponderosa pine-bunchgrass ecosystems. **MOORE, M.M.**, D.C. Laughlin, R.T. Strahan, J.D. Bakker, H.E. Dowling, J.D. Springer, and S.D. Olberding
- 8:45–9:00 Why to, and how can, biocrusts be managed in grazed dryland ecosystems. **BELNAP, J.**
- 9:00–9:15 The future of Colorado Plateau rangelands in the context of 21st century climate and drought trajectories. **BRADFORD, J.B.**
- 9:15–9:30 Post-treatment livestock grazing management on mechanical vegetation treatment sites. **JONES, A.L.**
- 9:30–9:45 Encouraging sustainable grazing management innovations for the Colorado Plateau: promise and pitfalls. **BRUNSON, M.W.**
- 9:45–10:00 Discussion
- 10:00–10:15 BREAK
- 10:15–12:15 Moderated panel discussion
Panelists:
- **George Ruyle**, University of Arizona
 - **Billy Cardasco**, Babbitt Ranches
 - **Jose Manual Perez**, Cuenca los Ojos
 - **Mike Hannemann**, USDA Forest Service

Contributed Session – Human dimensions and cultural resource management

Wednesday, 8:00–10:00 AM – Rees

Moderator: TBD

- 8:00–8:15 Monetizing the health impacts and economic value of using wood biomass as a renewable energy source. **HEDGEPEETH, M.**, and C.H. Huang
- 8:15–8:30 Diné kinship as a framework for conserving native tree species in climate change. **YAZZIE, J.O.**, P.Z. Fulé, and Y.-S. Kim,
- 8:30–8:45 Youth engagement in color country: a solution for conserving the Southwest’s land, water, biodiversity & cultures. **EASTEP, B.**, and J. Anderson
- 8:45–9:00 Values Mapping for Planning in Regional Ecosystems (VaMPIRE): a modernized participatory GIS application for assessing social value substitutability on public lands. **SCHUSTER, R.**, S.M. Beck, M. Hannon, and K. Rogers
- 9:00–9:15 Improving adaptive management outcomes through engaged scholarship. **ARMSTRONG, M.**, M. Rehn, E. Downing, and G. Zaldumbide
- 9:15–9:30 From water to land: analysis of prehistoric shell from Wupatki Pueblo. **COVERT, A.**
- 9:30–9:45 A new low in cultural resource management: insights from monitoring archeological resources re-exposed by low levels of Lake Powell in Glen Canyon National Recreation Area. **HARMON, B.C.**, A. Horn
- 9:45–10:00 More than just cliff dwellings: survey at Navajo National Monument, Arizona. **SPURR, K.**

Unmanned Aircraft Systems (UAS) for park and protected area resource management

Wednesday, 8–10 AM – 1899 Ballroom

Organizer: Nell Conti; National Park Service Intermountain Region Geographic Resources

- 8:00–8:15 Unmanned aerial vehicle radio telemetry (UAV-RT) for wildlife localization. **SHAFFER, M.**, G. Vega, K. Rothfus, C. Chambers, and P. Flikkema
- 8:15–8:30 Combining aerial and terrestrial sensors to support archeological research and documentation at Montezuma Castle National Monument. **DEGAYNER, J.**, and L. Hoedl
- 8:30–8:45 Archeological site preservation and management with UAS-collected data at Petrified Forest National Park. Bauer, M., **N. CONTI**, G. Debenedetto, B. Forbes, T. Burton, and M. Burgess
- 8:45–9:00 Drone-based photogrammetry of natural rock arches. **GEIMER, P.R.**, R. Finnegan, and J.R. Moore

- 9:00–9:15 Overview of the Grand Canyon National Park UAS Program. **JAGER, J.**
 9:15–9:30 Comparing Three Platforms for Creating Point Clouds for Forest Inventory. **GARMS, C.**, C. Simpson, C. Parrish, M. Wing, and B. Strimbu
 9:30–9:45 Discussion

Contributed Session—Terrestrial and riparian plant ecology

Wednesday, 10:15 AM–12:15 PM – Agassiz

Moderator: TBD

- 10:15–10:30 1Escaping the sun: characterizing fine-scale structural and temporal shade dynamics buffering moss-dominated biocrusts in the Mojave using Sun Seeker®. **CLARK, T.A.**, A. Russell, M. Hamid, and L.R. Stark
 10:30–10:45 A meta-analysis of context-dependency in plant responses to biocrusts. **HAVRILLA, C.A.**, V.B. Chaudhary, S. Ferrenberg, A.J. Antoninka, J. Belnap, M.A. Bowker, D.J. Eldridge, A.M. Faist, E. Huber-Sannwald, A.D. Leslie, E. Rodriguez-Caballero, Y.M. Zhang, and N.M. Barger
 10:45–11:00 Intra-annual measurement of drought relief in *Pinus ponderosa* radial growth near the northwest edge of the North American monsoon region. **TRUETTNER, C.**, S. Poulson, E. Ziaco, and A. Csank
 11:00–11:15 Differences in seedling drought adaptation between southwestern provenances of ponderosa pine. **DIXIT, A.H.**, T. Kolb, O. Burney, and K. Mock
 11:15–11:30 Genetic structure and gene flow in woody riparian plants: a case study in the Grand Canyon. **PALMQUIST, E.**, G. Allan, T. Whitham, K. Ogle, B. Butterfield, and P. Shafroth
 11:30–11:45 Destruction of a La Sal Mountains alpine community by non-native mountain goats. **COLES-RITCHIE, M.**
 11:45–12:00 Responses of desert plant communities to climate warming since the Last Glacial Maximum - 1: community-climate lags. **BUTTERFIELD, B.**, C.A. Holmgren, R.S. Anderson, and J.L. Betancourt
 12:00–12:15 Responses of desert plant communities to climate warming since the Last Glacial Maximum - 2: life history traits predict colonization and extinction lags. **BUTTERFIELD, B.**, C.A. Holmgren, R.S. Anderson, and J.L. Betancourt

The Middle Rio Grande in New Mexico: the Challenges of drought and increasing demand on water management, endangered species, and habitat restoration

Wednesday, 10:15 AM–12:15 PM – Doyle

Organizers: Richard A. Valdez, SWCA, Environmental Consultants, and David L. Wegner

- 10:15–10:30 The Middle Rio Grande Collaborative Program and New Mexico's role. **HAGGERTY, G.M.**
 10:30–10:45 The Middle Rio Grande – a water user's perspective. **HAMMAN, M.A.**
 10:45–11:00 Floodplain restoration in the Middle Rio Grande. **MCKENNA, C.**, and T. Caplan
 11:00–11:15 Importance of Middle Rio Grande floodplains to the endangered Rio Grande silvery minnow. **VALDEZ, R.A.**
 11:15–11:30 A general model framework for evaluating management choices for freshwater fishes. Hatch, M.D., F. Abadi, W. Boeing, S. Lois, M.D. Porter, and **D.E. COWLEY**
 11:30–11:45 Rio Grande silvery minnow response to management. **YACKULIC, C.B.**
 11:45–12:15 Discussion

Contributed Session—Water and land-use planning

Wednesday, 10:15 AM–12:15 PM – Rees

Moderator: TBD

- 10:15–10:30 Changes in N-aquifer groundwater levels within the Black Mesa area, northeastern Arizona, 1971–present. **MASON, J.P.**

- 10:30–10:45 Employing NASA Earth Observations to monitor alpine lake algal productivity in Rocky Mountain National Park. **SCHMER, N.**, A. Kunz, G. Clow, and S. Wingard
- 10:45–11:00 Winter rain-on-snow buffers streamflow sensitivity to snowpack losses in the Salt River Watershed in semi-arid Southwest US. **ROBLES, M.D.**, J.C. Hammond, S.K. Kampf, J.A. Biederman, and E.M.C. Demaria
- 11:00–11:15 Growing water: can farmers help resolve our water crisis? **RUDELL, B.**, and B. Richter
- 11:15–11:30 Using NASA Earth Observations to quantify tree mortality and burn severity to inform management on ranches and open lands. Leiker, S., K. Davis, **K. DENNIS**, L. McGinnis, and C. Torrens
- 11:30–11:45 Impacts of fire to the herbaceous/shrub layer of the mixed conifer and spruce-fir forests of Grand Canyon National Park. **DECOSTER, J.K.**
- 11:45–12:00 Legacies of fire and woody vegetation on soil seed banks of four North American desert systems. **HOSNA, R.K.**, S.C. Reed, and A.M. Faist
- 12:00–12:15 Analysis of change in woodland canopy cover on the San Carlos Apache Reservation, Arizona (1935 vs. 2017). **MIDDLETON, B.R.**, L.M. Norman, D. Randall, and P.J. Buck

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Message box workshop

Wednesday, 10:15 AM–12:15 PM – 1899 Ballroom
Trainer: Nancy Baron, COMPASS

Biennial Conference participants are invited to a Message Box Workshop to develop their science communication skills. Workshop participants will get hands-on practice and small group feedback from colleagues, Nancy Baron, and local journalists. With peer feedback, this is a terrific way for scientists to learn about each other's work as well as to hone their communication skills and provide greater clarity in their presentations. This workshop will also be useful for those who also hope to prepare for the pitch pit event later in the day.

Sponsored by NAU's Landscape Conservation Initiative.

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Lunch

12:15–1:15 PM – **Humphreys Ballroom**
Lunch will be provided for conference participants

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Considering visitor use on the Colorado Plateau

Wednesday, 1:15–3:15 PM – Agassiz
Organizers: Peter Pettengill, St. Lawrence University, Department of Environmental Studies, and Kelly Goonan, Southern Utah University, Department of Kinesiology & Outdoor Recreation

- 1:15–1:30 Painting a picture of Northern Arizona visitors from multiple visitor studies: Research and management implications. **BUDRUK, M.**, C. Vogt, and K. Andereck
- 1:30–1:45 Decadal-scale patterns in overnight visitor use patterns in Grand Canyon's backcountry. KEARSLEY, M., S. Sullivan, and C. Morris
- 1:45–2:00 Not your father's canyon? Historical, current, and future perspectives of visitor use at Grand Canyon National Park. **BRUNSON, M.A.**, and R.L. Sharp
- 2:00–2:15 Wilderness rock climbing indicators and climbing management implications in the National Park Service. **MCHUGH, K.**, M. Machia, E. Murdock, R. Gimblett, F. Vernon, and M. Manone
- 2:15–2:30 Visitor use and transportation monitoring and management at Bryce Canyon National Park, UT. **GOONAN, K.A.**, J. Pitts, and L. Babcock
- 2:30–2:45 Smart parks: IoT outdoors. **PITTS, J.**
- 2:45–3:00 Informing planning and management through assessment of ecological conditions & visitor experiences in Grand Staircase-Escalante National Monument. **BEAL, J.**, D. Taff, J. Wimpey, J. Marion, J. Arredondo, F. Meadema, and F. Schwartz

Upper Colorado & San Juan Rivers Recovery Programs

Wednesday, 1:15–3:15 PM – Doyle

Organizers: Tom Chart, U.S. Fish and Wildlife Service, Upper Colorado River Endangered Fish Recovery Program, and Melissa Mata, U.S. Fish and Wildlife Service, San Juan River Endangered Fish Recovery Program

- 1:15–1:30 Proposed changes in endangered species classification of two Colorado River fish: part I—U.S. Fish and Wildlife Service proposes downlisting the Humpback Chub (*Gila cypha*). **CHART, T.E.**, and J.W. Stahl
- 1:30–1:45 Proposed changes in endangered species classification of two Colorado River fish: Part II —U.S. Fish and Wildlife Service proposes downlisting the Razorback Sucker (*Xyrauchen texanus*). **STAHLI, J.W.**, and T. E. Chart
- 1:45–2:00 Proposed changes in endangered species classification for two Colorado River fish: part III—question and answer session. **CHART, T.E.**, and J.W. Stahl
- 2:00–2:15 The post 2023 future of two endangered fish recovery programs in the Upper Colorado River Basin. **CHART, T.E.**, J.W. Stahl, and M. Mata
- 2:15–2:30 Recent San Juan River Basin highlights for Colorado pikeminnow and razorback sucker. **MATA, M.**
- 2:30–2:45 Impediments to recovery for Colorado pikeminnow and razorback sucker in the San Juan River Basin. **MATA, M.**
- 2:45–3:15 Panel discussion

Bridging the gap between science & management: integrating to develop better responses to global change

Wednesday, 1:15–5:30 PM – Fremont

Organizers: Catherine Gehring and Thomas Whitham, Northern Arizona University, Merriam-Powell Center for Environmental Research, and Tom Sisk and Clare Aslan, Northern Arizona University, Landscape Conservation Initiative

- 1:15–1:30 Introduction
- 1:30–1:45 Interactions among scientists and managers in a landscape scale collaborative setting: Retrospection from planning, implementation, and monitoring in a changing world. **WOOLLEY, T.**
- 1:45–2:00 Manager-scientist relationships and the Four Forest Restoration Initiative. **MOORE, P.T.**
- 2:00–2:15 Joys and challenges of manager-scientist collaboration in a Tribal Nation context. **FULÉ, P.Z.**, A.C. Becenti, T. Padilla, A. Azpeleta, T. Mockta, J.O. Yazzie, L. Whitehair, A. Sánchez Meador, and Y.-S. Kim
- 2:15–2:45 Greater Grand Canyon Landscape Assessment: ambitions, collaboration, and outcomes at the interface of science and management. **SISK, T.D.**, **J. CALHOUN**, S. Stortz, J. Balsam, R. Newton, C. Aslan, and T. Chaudhry
- 2:45–3:00 Collaborative conservation: updates from the Kane and Two Mile Research and Stewardship Partnership. **HOGLANDER, C.**
- 3:00–3:15 Science at the nexus of diversity and history: Research on the North Rim Ranches. **ASLAN, C.E.**
- 3:15–3:30 BREAK
- 3:30–4:00 Restoration of the US-Mexico Borderlands: Three decades of learning, and the science is finally catching up. **CLARK, V.**, and **H.R. PULLIAM**
- 4:00–4:30 Joining forces to facilitate habitat restoration and climate adaptation along the Little Colorado River. **CORDASCO, B.**, **C.A. GEHRING**, L.M. Schmit, and T.G. Whitham
- 4:30–5:00 Integrating listed species habitat restoration and long-term genetics studies of cottonwoods and willows that can survive climate change at the Cibola National Wildlife Refuge. **WHITHAM, T.G.**, **E.E. JOHNSON**, G.J. Allan, R. Bangert, K.C. Grady, K.R. Hultine, and D.G. Fischer
- 5:00–5:30 Panel discussion

Contributed Session—Animal ecology and nonnative species

Wednesday, 1:15–3:15 PM – Rees

Moderator: TDB

- 1:15–1:30 Monitoring bighorn sheep habitat by assessing vegetation, topography, and soil moisture. **AU, M.**, B. Moneymaker, G. Beltran, and N. Kasraee
- 1:30–1:45 Alpine pollinators of the La Sal Mountains, southeastern Utah: community composition and adult host plant use of Hymenoptera and Lepidoptera (with apologies to Dipterists for now). **GRAHAM, T.B.**, and B. Smith
- 1:45–2:00 Effects of human activity on the behavior, physiology, and demography of the endangered Sonoran pronghorn. **DOERRIES, S.E.**, D.A. Christianson, S.P. Woodruff, and L. Waits
- 2:00–2:15 How the addition of nesting platforms influence nest parasitism by (*Protocalliphora parorum*) on Cordilleran flycatchers (*Empidonax occidentalis*): consequences of a newly introduced parasite. **VAN RIPER III, C.**, H. Greeney, and A. Boyce
- 2:15–2:30 Birds species composition in riparian habitat invaded by Russian olive. Mahoney. S.M., A.N.B. Smith, **P.J. MOTYKA**, E. Lundgren, M.J. Johnson, R.R. Winton, and B. Stevens
- 2:30–2:45 Incorporating tribal youth and elders and other tribal guidance into management of nonnative brown trout and other aquatic species below Glen Canyon Dam. **HYDE, K.**
- 2:45–3:00 Telemetry-based aerial surveys as an efficient method for estimating abundance of sparse populations. **CLEMENT, M.J.**, J.J. Hervet, and J.L. Bright

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Interactions between insects, ecosystems and climate

Wednesday, 1:15–3:15 PM – 1899 Ballroom

Organizer: Richard Hofstetter, Northern Arizona University, School of Forestry

- 1:15–1:30 Climate and vegetation effects on ant communities. **UHEY, D.**, R.W. Hofstetter, K. Haubensak, M. Remke, and S. Vissa
- 1:30–1:45 Interactions between drought stress and induced defenses determine mortality of ponderosa pine to bark beetles. **KOLB, T.**, K. Keefover-Ring, S.J. Burr, R.W. Hofstetter, M. Gaylord, and K. Raffa
- 1:45–2:00 Arthropod communities in the pinyon juniper woodlands. **RISKAS, S.**, and D. Uhey
- 2:00–2:15 Arthropod communities in restoration of slash pile burn scars. **MOTT, C.**, and R.W. Hofstetter
- 2:15–2:30 Climate and bark beetle-caused mortality in the Coconino National Forest over the past 15 years. **NAGLE, G.**, R.W. Hofstetter, M. Gaylord, and J. McMillan
- 2:45–3:00 Effects of temperature on mites and fungi associated with bark beetles. **VISSA, S.**, and R.W. Hofstetter
- 3:00–3:15 Warming temperature effect of Megachilidae bee species along the San Francisco Peak elevation gradient. **MCCABE, L.**, P. Chesshire, and N. Cobb
- 3:15–3:30 Native milkweed species in Arizona and their use by Monarch butterflies. **HOFSTETTER, R.W.**, H. Riskas, and M. Wagner

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Frontiers of wildfire on the Colorado Plateau

Wednesday, 3:30–5:30 PM – Agassiz

Organizers: Peter Fulé and Catrin Edgeley, Northern Arizona University, School of Forestry; Michelle Mack, Northern Arizona University, Center for Ecosystem Science and Society; and Carolyn Seig and Joe Ganey, USDA Forest Service, Rocky Mountain Research Station

- 3:30–3:45 Status of the Mexican spotted owl 15-years after the Rodeo-Chediski fire, Arizona. **LOMMLER, M.L.**, J.L. Ganey, P. Beier, J.S. Sanderlin, S.A. Cushman, and A.J. Sánchez Meador
- 3:45–4:00 Modeling fire trends within the range of the spotted owl. **WAN, H.-Y.**
- 4:00–4:15 Tree and opening spatial patterns vary by tree density in two old-growth remnant ponderosa pine forests in Northern Arizona, USA. **INIGUEZ, J.M.**, J.F. Fowler, W.K. Moser, C.H. Sieg, L.S. Baggett, and P. Shin

- 4:15–4:30 Active and passive rehabilitation of fire mosses in severely burned forests of the southwestern US. **GROVER, H.S.**, M.A. Bowker, P.Z. Fulé, K.D. Doherty, C.H. Sieg, and A.J. Antoninka
- 4:30–4:45 The Southwest Fire Science Consortium: the science-management feedback loop. SATINK WOLFSON, B., A.E. Thode, B. Cespedes, D. Cram, A. Evans, D.A. Falk, P.Z. Fulé, and J.M. Iniguez
- 4:45–5:00 Effects of policy change on wildland fire management strategies: evidence for a paradigm shift in the western US? **YOUNG, J.D.**, A.M. Evans, J.M. Iniguez, A.E. Thode, M.D. Meyer, S.J. Hedwall, S. McCaffrey, P. Shin, and C.H. Huang
- 5:00–5:15 Climate drivers of increasing wildfire in the southwestern US from 1984 to 2015. Mueller, S.E., A.E. Thode, E.Q. Margolis, L.L. Yocom, J.D. Young, and J. Iniguez
- 5:15–5:30 Landscape-scale wildfire has minimal impact on streamflow in the Lower Colorado River Basin. **BIEDERMAN, J.A.**, M.D. Robles, and R.L. Scott

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Lower Colorado River Multi-Species Conservation Program

Wednesday, 3:30–5:00 PM – Doyle

Organizer: John Swett, Bureau of Reclamation, Lower Colorado River Multi-Species Conservation Program

- 3:30–3:45 The Lower Colorado River Multi-Species Conservation Program. **SWETT, J.S.**
- 3:45–4:00 Creating and managing land cover types in a highly managed river system in support of the Lower Colorado River Multi-Species Conservation Program. **MURPHY, T.J.**
- 4:00–4:15 Using adaptive management to address species-specific habitat requirements of the Lower Colorado River Multi-Species Conservation Program. **BLASIUS, B.J.**, and J.M. Knowles
- 4:15–4:30 The Lower Colorado River Multi-Species Conservation Program: Successes and Challenges over Fourteen Years of Implementation. **SWETT, J.S.**
- 4:30–5:00 Panel discussion

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The ecological impacts of wildlife- and zoonotic-diseases on the Colorado Plateau

Wednesday, 3:30–5:30 PM – Rees

Organizers: Joseph Mihaljevic, Northern Arizona University, School of Informatics, Computing, and Cyber Systems; and Bridget Barker, Northern Arizona University, Pathogen and Microbiome Institute and Department of Biological Sciences

- 3:30–3:45 Relationships between ticks, desert tortoises and tick-borne relapsing fever. **BECHTEL, M.J.**, J.E. Lovich, T.E. Esque, K.K. Drake, M.B. Teglas, and N.C. Nieto
- 3:45–4:00 Investigating the role of animal burrows on the ecology and distribution of *Coccidioides* spp. in Arizona soils. **KOLLATH, D.R.**, M.M. Teixeira, A. Funke, K.J. Miller, and B.M. Barker
- 4:00–4:15 The spread of white-nose syndrome in the West. **FOSTER, J.T.**, K.L. Parise, and W.F. Frick
- 4:15–4:30 Urban striped skunk ecology and rabies management in Flagstaff, Arizona. **THEIMER, T.C.**, and L. Hastings
- 4:30–4:45 Coyotes as a reservoir for the emerging zoonotic parasite, *Onchocerca lupi*, in the southwestern United States. **ROE, C.C.**, H. Yaglom, A. Howard, J. Urbanz, G.G. Verocai, L. Andrews, V. Harrison, R. Barnes, T. Lyons, J.R. Bowers, and D.M. Engelthaler
- 4:45–5:00 Mechanisms of *Ranavirus* transmission and its impacts on amphibian and reptile conservation. **MIHALJEVIC, J.R.**, A. Greer, and J. Brunner
- 5:00–5:15 Modeling the infection dynamics of tick-borne relapsing fever in a community of wild hosts. **MOTYKA, P.J.**, J.R. Mihaljevic, M.B. Teglas, and N.C. Nieto
- 5:15–5:30 Discussion

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Thinking story like a journalist panel and pitch pit

Wednesday, 3:30–5:30 PM – 1899 Ballroom

Trainer: Nancy Baron, COMPASS

How are current events influencing (science) journalism and societies’ conversations? What are the challenges and opportunities today and how are they changing? Following a short, moderated discussion to provide insights and context, researchers will be invited to pitch a story idea to the panel of journalists in two minutes or less. The journalists will provide feedback and reactions: What did they like? What would they want to know more about? This fun event is designed as an informal and entertaining opportunity for scientists to interact with journalists and to practice their research communication skills in a supportive environment among peers. It will enhance the evening reception where the conversations and mixing and mingling will continue.

Journalist Panelists:

- **Terri Cook**—Freelance Journalist, Science Writer, and Author
- **Felicia Fonseca**—Associated Press Regional Writer, Northern Arizona
- **Rose Houk**—Freelance Journalist, Science Writer, Editor, and Author
- **Melissa L. Sevigny**—Science & Technology Field Reporter, KNAU Arizona Public Radio / Arizona Science Desk

Sponsored by NAU’s Landscape Conservation Initiative.

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

7:00–8:30 PM **Biennial Conference Keynote Speaker: Terry Tempest Williams**
Welcome: Rita H. Cheng, President, Northern Arizona University
Speaker Introduction: Brenden W. Rensink, Associate Director, Charles Redd Center for Western Studies, Brigham Young University



An evening with author Terry Tempest Williams
7:00–8:30 PM
Prochnow Auditorium, 326 W. Dupont Avenue
Admission is free and the public is welcome.

Terry Tempest Williams has been called “a citizen writer,” a writer who speaks and speaks out eloquently on behalf of an ethical stance toward life. A naturalist and fierce advocate for freedom of speech, she has consistently shown us how environmental issues are social issues that ultimately become matters of justice. “So here is my question,” she asks, “what might a different kind of power look like, feel like, and can power be redistributed equitably even beyond our own species?”

Known for her impassioned and lyrical prose, Terry Tempest Williams is the author of the environmental literature. Williams, like her writing, cannot be categorized. She has testified before Congress on women’s health issues, been a guest at the White House, has camped in the remote regions of Utah and Alaska wildernesses and worked as “a barefoot artist” in Rwanda.

The event is sponsored by BYU’s Charles Redd Center for Western Studies, NAU Office of the President, and NAU College of Arts and Letters Humanities Departments.

COMPASS

“Thinking story like a journalist” panel & pitch pit

Biennial Conference of Science & Management

1899 Ballroom

Wednesday, September 11 — 3:15 to 5:00 PM



Landscape Conservation Initiative

Made possible with support from NAU's
Landscape Conservation Initiative

Moderator



Nancy Baron

Director of Science Outreach, COMPASS

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Nancy Baron is the Director of Science Outreach for COMPASS. Nancy holds workshops around the world for academic, government, and NGO scientists helping them develop core competencies as scientist communicators who want to make their work relevant to journalists, policy makers, and the public. Nancy began her career as a biologist in

Banff National Park, spent 6 years as Director of Education at the Vancouver Aquarium, then morphed into journalism. She has won numerous writing awards including the Canadian Science Writers Science in Society and National Magazine awards. An ardent naturalist, she published a popular field guide, *The Birds of Coastal British Columbia* (Lone Pine Publishing) and a “how to” communications guide book for scientists titled *Escape from the Ivory Tower* (Island Press). Nancy received the 2013 Peter Benchley Ocean Award for Excellence in the Media for her work at the intersection of science and journalism.

Journalist Panelists



Terri Cook

Freelance Journalist, Science Writer, and Author

down2earthwriting@gmail.com

@GeoTravelTerri

Growing up in a home whose cornerstone was a meteorite inspired Terri to become a travel and science writer. A geologist by training and a member of both the Society of American Travel Writers and the National Association of Science Writers, Terri weaves accurate, engaging stories for a wide variety of clients and outlets including the U.S. Geological Survey,

Eos, Scientific American, and Lonely Planet. She is the author or co-author of five books, including *Hiking the Grand Canyon's Geology*, and the recipient of numerous awards, including a 2019 AHJ Fellowship and a 2016 EGU Science Journalism Fellowship. Terri is GSA's 2019-2020 Science Communication Fellow.



Felicia Fonseca

Associated Press Regional Writer, Northern Arizona

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Felicia Fonseca is the northern Arizona correspondent for The Associated Press and a member of the AP's Race and Ethnicity beat team. She covers Native American tribes, the Grand Canyon, mining, tourism and major crimes, among other things. She was a 2017 Nieman Foundation for Journalism fellow at Harvard University. In 2010, she received The

Associated Press-Robert Eunson Distinguished Lecturer Award from Northern Arizona University for her work in the region. Before joining the AP in 2005, she worked as an intern for The Albuquerque Tribune, the Santa Fe New Mexican and for the Spanish-language newspaper La Voz del Norte.



Rose Houk

Freelance Journalist, Science Writer, Editor, and Author

mpcreh@msn.com

Rose Houk is a freelance writer and editor specializing in interpretive natural history, history, archaeology, and travel. National parks and monuments have been her special focus, especially in the Southwest and Great Smoky Mountains. She has written for *Arizona Highways* magazine, and wrote the text for *The Mountains Know Arizona: Images of the Land and Stories of Its People*, with photographer Michael Collier. For KNAU Arizona

Public Radio, she has written and narrated series including "Land Lines" and "America's Best Idea," and is a frequent contributor to Earth Notes. Rose first came to Arizona to work as a ranger-naturalist at Grand Canyon National Park, where she also served as publications assistant for the Grand Canyon Association. She has worked as an editor at the University of Arizona Press and National Wildlife Federation, and as a daily newspaper reporter.



Melissa L. Sevigny

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Melissa L. Sevigny is the science & technology reporter at KNAU (Arizona Public Radio) in Flagstaff, Arizona. She has a degree in environmental science from the University of Arizona and an M.F.A. in creative writing from Iowa State University. She's the author of two science books: *Under*

Desert Skies: How Tucson Mapped the Way to the Moon and Planets, and *Mythical River: Chasing the Mirage of New Water in the American West*.

Thursday, September 12, 2019

7:00–8:00 AM Registration and Morning refreshments, Humphreys Ballroom

Contributed Session—Conservation management and planning

Thursday, 8:00 AM–12:15 PM – Agassiz

Moderator: TBD

- 8:00–8:15 Thirty years of connectivity conservation plans: an assessment of factors influencing implementation of plans. **BEIER, P.**, A.T.H. Keeley, T. Creech, K. Jones, R. Jongman, G. Stonecipher, and G. Tabor
- 8:15–8:30 Preserving the connection: habitat connectivity in Scottsdale’s McDowell Sonoran Preserve. **SPRAGUE, T.A.**, H.I. Rowe, R. Lipfert, K.C.B. Weiss, and J. Schipper
- 8:30–8:45 An index for measuring community resilience to energy development boom & bust cycles on Colorado Plateau. **BECK, S.M.**, and R.M. Schuster
- 8:45–9:00 Field scale soil and ecological maps for adaptive land management. **NAUMAN, T.W.**, and M.C. Duniway
- 9:00–9:15 Harnessing landscape genomics to guide seed collection and increase habitat restoration success in a changing climate. **SHRYOCK, D.F.**, L.A. DeFalco, T.C. Esque, and L.K. Washburn
- 9:15–9:30 A geospatial meta-analysis of global crop water productivity of leading world crops over three decades: Implications for feeding the planet and saving water in a changing climate. **FOLEY, D.J.**, P.S. Thenkabail, I.P. Aneece, P.G. Teluguntla, and A.J. Oliphant
- 9:30–9:45 A new multifunctionality index: improving information to support rangeland management for multiple purposes. **LOPEZ ZIEHER, X.M.**, S. Reed, L. Vivanco, and L. Yahdjian
- 9:45–10:00 Which environmental variables should one use to select sites for species representation? **MILLER, S.N.**, and P. Beier

Glen Canyon Dam Adaptive Management Program meets the Amazon Dams Network – International information exchange

Thursday, 8:00 AM–12:15 PM – Doyle

Organizers: Theodore Melis, U.S. Geological Survey, Southwest Biological Science Center, and Michael Moran, U.S. Geological Survey, Southwest Biological Science Center, Grand Canyon Monitoring and Research Center

- 8:00–8:15 High-Flow Experiments on the Colorado River Downstream from Glen Canyon Dam: two decades of adaptive-management for sediment resources in Grand Canyon National Park. **GRAMS, P.D.**, and Topping, D.J.
- 8:15–8:30 A review of a decade of conservation actions for imperiled desert fishes in Grand Canyon tributaries: implications for conservation of large-river fishes. **HAAS, S.K.**, B.D. Healy, R.C. Schelly, R.C. Koller, and E.O. Smith
- 8:30–8:45 Glen Canyon Dam Adaptive Management Program. **KARTHA, V.**, and S. Shanahan
- 8:45–9:00 Glen Canyon Dam Adaptive Management Program—the next 20 years. **OMANA SMITH, E.**
- 9:00–9:15 Structuring science and assessment to inform policy and management within regulated and complex ecosystems. **WEGNER, D.L.**
- 9:15–9:30 Quantifying and reducing uncertainty of sediment transport through two ‘run-of-the-river’ mega-dams on the Madeira River (Brazil). **CROUCH, T.**, D. Kaplan, E. Latrubesse, and L. Santos
- 9:30–9:45 River resource governance in dam impacted areas—lessons learned from the Brazilian Amazon’s Madeira River. **SABO, A.**
- 9:45–10:00 Engaging southwestern tribes in sustainable water resources topics. **CHIEF, K.**
- 10:15–11:30 Roundtable discussion with river managers & researchers – Ponderosa Boardroom (2nd floor)

Restoration and conservation across Colorado Plateau drylands: concerted activities of the Colorado Plateau Native Plant Program and partners

Thursday, 8:00 AM–12:15 PM – Fremont

Organizers: Rob Massatti, U.S. Geological Survey, Adrienne Pilmanis, Bureau of Land Management, Jackie Grant, Southern Utah University, Daniel Winkler, U.S. Geological Survey, and John Bradford, U.S Geological Survey

- 8:00–8:15 10 years of the Colorado Plateau Native Plant Program—successes and future directions. **PILMANIS, A.P.**
- 8:15–8:30 University of the Parks meets the Colorado Plateau Native Plant Program: an undergraduate perspective on regional plant conservation activities. **GRANT, J.B.**, L. Correa, J. Dyer, K. Holsten, J. Whitlock, K.J. Jarvis, R.M. Ogburn, and A. Patiño
- 8:30–8:45 Sparser but larger: phenological shifts compensate for reduced performance after 13 years of warming. **WINKLER, D.E.**, C. Grossiord, J. Belnap, A. Howell, S. Ferrenberg, H. Smith, and S.C. Reed
- 8:45–9:00 Vegetation response in reclamation studies on highly disturbed lands across the Colorado Plateau. **MANN, R.K.**, N. Barger, D. Baird, J.E. Hinck, C. Karban, M. McCormick, S. Munson, R. Reisor, H. Whitcomb, and M. Duniway
- 9:00–9:15 Can shrub seedlings be a viable restoration tool in arid systems? **GRANT-HOFFMAN, M.N.**, and H. Plank
- 9:15–9:30 Sand dropseed and drought: an outdoor experiment to test plant plasticity and the role of seed source in seeding success under varying precipitation regimes. **REED, S.C.**, D. Winkler, R. Massatti, M. Duniway, J. Shostrand, and J. Bradford
- 9:30–9:45 Effect of soil and soil biota on successful deployment of native plant materials: what are we missing? **BOWKER, M.A.**, M. Remke, A. Voříšková, M. Janoušková, and N.C. Johnson
- 9:45–10:00 Environmental filtering acts on plant traits to influence survival and community composition across RestoreNet plantings. **BALAZS, K.B.**, S. Munson, K. Laushman, and B.J. Butterfield
- 10:00–10:15 BREAK
- 10:15–10:30 Intraspecific trait variation of restoration species at early developmental stages. **GARBOWSKI, M.**, C.S. Brown, and D.B. Johnston
- 10:30–10:45 Cultivation of the Southwest Seed Partnership—the stage of interesting seed quandaries. **GISLER, M.M.**
- 10:45–11:00 Exploring local adaptation and climate resiliency of priority restoration species in northern New Mexico. **SAMUEL, E.M.**, R.M. Mitchell, D.E. Winkler, and R. Massatti
- 11:00–11:15 Developing pollinator-dependent plant materials for use in a growing restoration economy. **BAUER, T., H. LEE**, K. Haubensak, C. Aslan, and K. Grady
- 11:15–11:30 Genetic investigation of *Bouteloua gracilis* on the Colorado Plateau: implications for restoration using wild and cultivated varieties. **ALLAN, G.J.**, and K. Tso
- 11:30–11:45 Using patterns of genetic differentiation as the foundation for seed transfer guidelines. **MASSATTI, R.**, D. Winkler, and F.F. Kilkenny
- 11:45–12:15 Discussion
- 12:15–1:00 LUNCH (Conversation will continue over lunch in the Ponderosa Boardroom (2nd floor))

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Planetary analogs on the Colorado Plateau: past, present, and future

Thursday, 8:00–10:00 AM – Rees

Co-chairs: Greg Vaughan and Annette Sunda, U.S. Geological Survey, Astrogeology Science Center

- 8:00–8:30 Northern Arizona analog sites used for Apollo astronaut training. **SCHINDLER, K.**, and G. Vaughan
- 8:30–8:45 Grand Falls dune field, a Mars analog on the Colorado Plateau. **SUNDA, A.**
- 8:45–9:00 Southwestern pits and caves as planetary science analogs. **CUSHING, G.**
- 9:00–9:15 Using Meteor Crater, Arizona, to understand impact craters throughout the solar system. **BARLOW, N.**
- 9:15–9:30 Constraining martian knickpoint retreat and erosion rates at Grand Falls, Arizona. **SALVATORE, M.**
- 9:30–10:00 Panel discussion: What other possible planetary analogs are there on the Colorado Plateau?

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Climate migration and pressures on natural resources and communities of the Colorado Plateau

Thursday, 10:15 AM–12:15 PM – Agassiz

Organizers: Sasha Stortz and Clare Aslan, Northern Arizona University, Landscape Conservation Initiative

- 10:15–10:30 Patterns and ecological impacts of human migration in response to climate change on the Colorado Plateau. **ASLAN, C.E.**
- 10:30–10:45 Managing National Forest System lands in a changing climate: the Kaibab National Forest plan approach. **LEONARD, A.**
- 10:45–11:00 Increasing heat and growing visitor pressures on a public recreation treasure: a case study of Fossil Creek. **ROYBAL, M.A.**
- 11:00–11:15 Social-ecological systems and climate migration across the western US. **STORTZ, S.D.**, and C.E. Aslan
- 11:15–11:30 Sustainability planning for an uncertain future. **ANTONPOULOS, N.**
- 11:30–11:45 Climate migrants, climate refugees and the future of the Colorado Plateau. **SOMMER, S.**
- 11:45–12:15 Moderated panel discussion

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Contributed Session—Restoration and conservation

Thursday, 10:15 AM–12:15 PM – Doyle

Moderator: TBD

- 10:15–10:30 Skyglow Estimation Toolbox: utilizing NASA Earth Observations to detect changes in nighttime sky brightness using hemispherical visualizations. **PARKER, S.**, R. Luo, C. Rivard, E. Turrietta, and K. Ross
- 10:30–10:45 Survey and monitoring of the endangered Arizona hedgehog cactus: Can we do it better? **THOMAS, K.A.**, D.F. Shryock, and T.C. Esque
- 10:45–11:00 Launching a regional effort for regional native plant conservation: IUCN Sonoran Desert Plant Species Specialist Group. **ROWE, H.I.**, B.A. Polidoro, and L.L. Howard
- 11:00–11:15 Buffelgrass and fountain grass removal experiments. **SPRAGUE, T.A.**, H.I. Rowe, and P. Staker
- 11:15–11:30 Monroe Mountain wants to grow aspen, so how are we doing? Eight years of complementary and collaborative research. **O'BRIEN, M.H.**
- 11:30–11:45 Cultivating moss fabrics for biocrust restoration. **DOHERTY, K.**, M. Bowker, R. Durham, A. Antoninka, and H. Grover
- 11:45–12:00 Determining prescribed fire and fuel treatment compatibility with semi-desert grassland habitat rehabilitation for the critically endangered masked bobwhite quail (*Colinus virginianus ridgwayi*). **SESNIE, S.E.**, E. Yurcich, L. Johnson, and T.D. Sisk
- 12:00–12:15 Restoration, mitigation & vegetative recovery...a matter of scale. **BURDEN, I.B.**, and H.H. Dial

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Uranium mining in the Grand Canyon: status of USGS research

Thursday, 10:15 AM–12:15 PM – Rees

Organizers: Jo Ellen Hinck, U.S. Geological Survey, Columbia Environmental Research Center, and Katie Walton-Day, U.S. Geological Survey, Colorado Water Science Center

- 10:15–10:30 Investigating the potential for effects from breccia-pipe uranium mining on regional water resources in the Grand Canyon region. **TILLMAN, F.D.**, K.R. Beisner, J.E. Knight, J.A. Unema, and J.R. Anderson
- 10:30–10:45 Summary of effects of breccia-pipe uranium mining in northern Arizona to soil trace-element content, dust flux, and flux of elements into the unsaturated zone across the mine life cycle. **WALTON-DAY, K.**, D.L. Naftz, C.R. Bern, M. Duniway, B.J. Andraski, and C.T. Green
- 10:45–11:00 Results and remaining data gaps from biological studies at breccia-pipe uranium mines in the Grand Canyon watershed. **HINCK, J.E.**
- 11:00–11:15 Are Native Americans exposed to uranium mining-related elements in smoke particulates during traditional uses of sagebrush? **CLEVELAND, D.**, and J.E. Hinck

- 11:15–11:30 Conceptual models of groundwater flow in the Grand Canyon region, Arizona. **KNIGHT, J.E.**, and P.W. Huntoon
- 11:30–11:45 Geochemical Characterization of Groundwater South of Grand Canyon, Arizona. **BEISNER, K.R.**, J. Solder, F.D. Tillman, J.R. Anderson, and R.C. Antweiler
- 11:45–12:00 Monitoring uranium and trace elements associated with breccia pipe uranium deposits in the Colorado River and main tributaries of Grand Canyon, northern Arizona. **ANDERSON, J.R., J.A. UNEMA**, F.D Tillman, and Chapin, T.
- 12:00–12:15 Uranium bioaccumulation in aquatic invertebrates: a comparative study in spring outflows in Grand Canyon National Park. **CROTEAU, M.N.**, D.J. Cain, K.M. Campbell, and C.C. Fuller

Lunch

12:15–1:00 PM – **Humphreys Ballroom**

Lunch will be provided for conference participants

THANK YOU AND SAFE TRAVELS!

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