SRM 2020 Denver: Symposium/Workshops/Ignite Sessions

Monday AM (10:00 am to Noon)

Session 1	Governors 14	**Transforming ranching through precision livestock management in extensive rangelands (Symposium)**
Session 2	Silver	**Creating Success in Rangeland Management, Tapping into our Emotional Intelligence (Workshop)**
Session 3	Plaza A-C	**Strategies for sustainability transformations in western rangelands (Symposium)**
Session 4	Windows	**Social-Ecological Resilience in The Northern Great Plains: Connections and Feedbacks of The Dominant Drivers (Ignite)**
Session 5	Plaza F	**Conservation Economics: Lessons from Western Rangelands (Ignite)**
Session 6	Governors 15	**Managing Rangelands for Pollinators: Best Management Practices, Current Research, and Research Needs (Ignite)**

Management of livestock in extensive rangelands has long been a labor-intensive endeavor for ranchers and pastoralists worldwide, often made even more challenging in rangelands characterized by dramatic temporal and spatial variability in forage resources. Recent technological advances have begun to empower livestock managers by providing more rapid, near-real-time monitoring of livestock locations and condition, by providing means to track and predict changes in forage resources across broad landscapes, and by enhancing the means to manipulate livestock distribution remotely. In this session, we bring together speakers to discuss the current state and future direction of precision livestock management in rangelands, and how these technologies can transform the way rangelands are managed.

Talk #1: Dr. Mark Trotter from CQ University in Rockhampton, Queensland: "Transformation of livestock management in Australia through sensor technologies, and implications for grazing management in spatially extensive rangelands worldwide."

Talk #2: Dr. Derek Bailey, New Mexico State University, New Mexico, USA: "Development of real-time livestock management strategies using GPS tracking and sensor technologies"

Talk #3: Dr. Tony Waterhouse, Emeritus Professor, Scotland Rural College and Head of Hill and Mount and Beef Research Centres: "Real-time monitoring technologies for free-ranging sheep and cattle management"

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As rangeland managers, we are asked to manage increasingly complex ecological and social situations and account for the needs of a diverse cross-section of people, plants, and animals. It can be overwhelming and applying the science in a way that creates workable solutions can be challenging. However, humans are incredible creatures and are equipped with everything necessary to succeed. Making our work more effective is often not about more science, but the human application, i.e. stronger leadership. Great leadership is grounded in mastering our own inner resources, increasing our emotional intelligence, and communicating effectively. It requires challenging our beliefs and transforming our perspectives in order to engage a broader view and move from polarizing positions to collaboration.

Transformation and translation. Transforming our engagement in the world is a self-lead endeavour. It begins with recognizing that we translate every interaction and conversation by filtering data through our experiences, insights, cultures, and beliefs. To transform we must gain greater personal awareness, identify our motivations, and learn where we get caught in the emotions. People look outside of themselves for the source of their challenges and miss opportunities that are available when we look within first. To shift our interactions it is critical to examine biases and the ways we unconsciously judge. Equally important are the ways we choose behaviours to increase leadership effectiveness. When we recognize we have the power to choose our response, we increase meaningful conversations and arrive at productive outcomes.

The workshop is broken into three components, with an additional post-conference follow-up offered to participants.

Component One - Self Discovery and Self-Management:
Participants learn the foundations of emotional intelligence and are provided exercises for individual reflection and small group discussions. They will examine their inner operating systems, explore their own emotional states, reactions, behaviours, and awareness. Participants will be asked to self-evaluate and identify scenarios in which they recognize the interplay of emotions, biases, and choice. The foundation of this component is based on the Bar-On Psychometric Emotional Intelligence Model developed by Reuven Bar-On.

The outcomes of this component are:
- To become familiar with emotional intelligence and its applications,

- To ignite curiosity about the components of emotional intelligence you rely on frequently and areas that you use less frequently (based on the EQi-2.0 inventory model),
- To build group trust and create an equal playing field for component two,
- To learn and engage.

Component Two - Bringing Emotional Intelligence into Practice:
In the second portion of the workshop, participants will have a series of topics, rooted in the values and management of rangelands, to explore in groups. They will reflect on their approach and behaviours in challenging conversations and practice key elements of emotional intelligence to brainstorm ideas and solutions. This model is foundational upon mutual respect, equality, and listening, and is designed to engage all views.

The outcomes of this component are:
- To examine our own behaviour, reactions and responses in challenging conversations,
- To practice using coaching tools within the conversation model
- To approach difficult rangeland management topics in a new way
- To gain an understanding of how these tools can be applied and developed,
- To play and have fun!

Component Three – Choosing a Path Forward:
The final aspect of the workshop will debrief the experience and help participants identify key actions to employ in their life and work. They will receive resources related to the emotional intelligence learning, coaching and conversation tools, and leadership development.

The outcomes of this component are:
- To identify key actions to apply the learnings
- To identify specific interests in personal and leadership development
- To get curious and creative.

Beyond the Workshop:
The final component of the workshop will include a follow-up group conversation online, post meeting. This will allow participants to reengage and share their experience with the materials since the workshop. This will require participants supply email addresses during the workshop.

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Ranching and rangelands are undergoing rapid and intertwined changes. Changes include 1) ecological transitions due to climate and invasive species; 2) land use transitions associated with urbanization and shifting priorities for public lands; 3) demographic transitions reflected in the increasing average age and decreasing number of ranchers; 3) market transitions associated with changing consumer attitudes and globalized markets, and 4) technological transitions with advances in wireless and sensor technologies and access to "big data". In this symposium, we ask: how can we direct inevitable change in desirable ways? Through these changes, how can we sustain the flow of rangeland products to consumers and improve environmental conditions in order to maintain or increase the well-being of those who live, work, and recreate on rangelands? The symposium will feature three invited speakers, each of whom will synthesize existing and emerging strategies for enhancing ranching and rangeland resilience, including:

1. Strategic connections between rural producers and urban consumers: the future of marketing for rangeland products—Dr. Sara Place, National Cattleman's Beef Association.

2. Precision technology and other adaptation strategies in ranching systems—Dr. Andres Cibils, New Mexico State University.

3. Collaborative planning for diverse land uses in changing rangelands—Dr. Lynn Huntsinger, University of California, Berkeley.

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Complex interactions among climate and disturbance regimes, economic restructuring, and shifting land-use priorities are changing the social-ecological landscape of rangelands of the American West. In addition, many working rangelands are transitioning from traditional agricultural-based systems to multifunctional landscapes with a diverse mix of land uses. This session features participants in an ongoing multidisciplinary and participatory resilience adaptation and transformation assessment (RATA) in Montana. Our goal is to collectively seek a better understanding of the drivers of the area in order to provide a scientific basis that can be used to understand the trajectory of the area and strengthen the social-ecological system. The initial work on the resilience assessment has identified the relationship between changing climate and disturbance regimes, land-management practices and biodiversity, and economic policy and land use as dominant drivers of the system. Currently, climate, land-use, and market forces are changing, and often experiencing increased variability, leading to shifts in the region. Projected intensification of climate trends, coupled with ongoing and legacy effects of altered disturbance regimes (e.g. fire and grazing), are expected to have profound implications for future vegetation dynamics, structure, and function. Furthermore, emphasis and focus on biodiversity conservation has led to a diverse and evolving body of knowledge for individual species and communities. However, the tradeoffs from management across diverse targets is complex, and in conjunction with broader landscape factors, require cross-boundary coordination to implement. Finally, diverse and interacting market and policy forces are driving new, and sometimes conflicting, land use outcomes, with direct and indirect feedbacks to vegetation productivity, and biodiversity. This session aims to present highlights of the ongoing research in these three areas to foster discussion on the interaction and feedbacks between drivers acting, and studied, at different geographic and temporal scales. Furthermore, attendees are encouraged to relate strategies for identifying and studying social and ecological drivers in combination, as well as conveying the complex interactions in social-ecological systems.

Session Organization and Intro – David Wood (Moderator)

Rangeland Conservation Science & Practice in the NGP I: Competing Trajectories, Katie Epstein and Julia Haggerty, kathleenepstein@montana.edu, julia.haggerty@montana.edu, Montana State University

The changing climate of the Northern Great Plains, Paul Stoy, pcstoy@wisc.edu, University of Wisconsin-Madison

Vegetative change in Northern Great Plains rangelands: vegetative greening and woody plant encroachment, Bryce Currey, brycecurrey93@gmail.com, Montana State University

The long view: Paleo-perspectives on rangeland disturbance in the Northern Great Plains, John Wendt, johnafwendt@gmail.com, Montana State University

Prescribed fire and the biogeochemical dynamics of ecosystem development in the Musselshell-Missouri River Breaks of Central Montana, Justin Gay, justin.gay802@gmail.com, Montana State University

Microbes of the Grasslands, Hannah Goemann, hannah.goemann@montana.edu, Montana State University

Biodiversity responses to management in Montana rangelands, Lance McNew, lance.mcnew@montana.edu, Montana State University

Grassbanking as a novel approach to engage ranching and reach large-scale conservation outcomes, Brian Martin, bmartin@tnc.org, The Nature Conservancy

Systems thinking for social-ecological issues in the Great Plains, Ted Toombs, ttoombs@edf.org, Colorado State University, Environmental Defense Fund

Rangeland Conservation Science & Practice in the NGP II: Towards an Integrative Praxis, Julia Haggerty and Katie Epstein, julia.haggerty@montana.edu, kathleenepstein@montana.edu, Montana State University

Discussion Session –David Wood and John Wendt with all speakers

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Overview

"In the Sonoran and Chihuahuan bioregions and most of the arid West, ranching is now the only livelihood that is based on human adaptation to wild biotic communities … Much more is at stake here than the future of a few ranch families. Wildlands teach those for whom they are home an outlook and insights to which others are blind."

-Jim Corbett, *The Malpai Agenda for Grazing in the Sonoran and Chihuahuan Bioregions*

The irony for many such livelihoods is that they are under more pressure than ever from public perception as economic margins continue to narrow. Neither condition is inevitable, but turning the trend requires that public dialogue and policy be better informed by rangeland livelihoods.

Session Speakers

- Session organization and introduction - Cole Mannix (Moderator), WLA Staff
- History of rangeland science- Dr. Nathan Sayre, Professor of Environmental Geography, University of Cal Berkeley
- BLM rangelands allotment monitoring pilot in NV - James Rogers, Winecup Gamble Ranch and WLA Board Member
- Agricultural policy - Jen Livsey, Flying Diamond Ranch and WLA Board Member
- Wildlife and conservation policy – Jessica Crowder, WLA staff
- Sustainable agriculture is the foundation of conservation - Nils Christoffersen, Wallowa Resources Executive Director

Moderated Discussion with Speakers (moderator: Cole Mannix)

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Our Ignite-style Session will cover pollinator research and conservation, a subject area of rapidly increasing interest on America's rangelands. One special feature of our session will be broad geographic coverage, with best management practices for both western range and Great Plains range. We will have multiple talks by early career professionals on grazing and fire regimes and how they impact pollinators and the plants they depend on. And our final talk, by someone on the downslope of his career, will include a list of crucial research needs to help guide the research paths of the younger generation. Following a traditional question and answer session, Dr. Ray Moranz and Dr. Torre Hovick will run an audience participation event in which audience members are randomly selected and asked about range management regimes near their home region. We will then ask other audience members to make predictions about effects of management practices on pollinator habitat (in terms of wildflower diversity and abundance) in that home region, and for our panel of presenters to also discuss their predictions. By doing this, we hope to extend the knowledge of all involved beyond the scope of the information presented during the 5-minute talks (and to further highlight gaps in our understanding).

- "Best Management Practices for Pollinators on Western Rangelands", by Stephanie McKnight, Emma Pelton, Candace Fallon and Ray Moranz (presenter). All authors are from the Xerces Society for Invertebrate Conservation. Ray Moranz also Partner Biologist with USDA NRCS.
- "Native Bees in Pacific Northwest Rangelands: Challenges in Management and Conservation", by Sandra DeBano (Oregon State University).
- "USDA-NRCS Rangeland Resource Inventory: Extent and Distribution of Milkweed Species on Non-Federal Rangelands", by Ken Spaeth (NRCS Central National Technology Support Center).
- "Native Bees are an Important but Overlooked Rangeland Resource in the Great Plains", by Chyna Pei, Torre Hovick, Ryan Limb, Jason Harmon, Ben Geaumont and Adrienne Antonsen (all authors are from North Dakota State University).
- "Sheep are Baahhhddd for Bees", by Jasmine Cutter, Torre Hovick, Benjamin Geaumont, Devan McGranahan, Jason Harmon and Ryan Limb. All authors are from North Dakota State University.
- "Effects of Fire and Grazing on Butterflies in Tame Grasslands", by Jasmine Cutter, Torre Hovick, Benjamin Geaumont, Devan McGranahan, Jason Harmon, and Ryan Limb. All authors are from North Dakota State University.
- "Quantifying Butterfly Responses to Natural Disturbances", by Brooke Karasch, Torre Hovick, Jason Harmon, Ryan Limb and Kevin Sedivec. All authors are from North Dakota State University.

- "Patch-burn Grazing Extends Flowering Plant Phenology", by Cameron Duquette, Torre Hovick, Jason Harmon, Devan McGranahan, Ryan Limb, and Benjamin Geaumont. All authors are from North Dakota State University.
- "The Evolution of Rangelands and Rangeland Management: Implications for Great Plains Pollinators", by Shelly Wiggam (Kansas State University).
- "Best Management Practices for Pollinators on Great Plains Rangelands," by Ray Moranz, Rae Powers, Sarah Hamilton Buxton, and Jennifer Hopwood. All authors are from the Xerces Society for Invertebrate Conservation. The first three are also Partner Biologists with USDA NRCS.

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Session 8	Plaza A-C	**What are animals eating? New methods for estimating diet composition on rangelands** **(Ignite)**
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Session 11	Governors 14	**The future is here: applications of technological advances for precision livestock management in extensive rangelands** **(Symposium)**
Session 12	Windows	**Social Science Advancements to Rangeland Management: Perspectives from the Long-Term Agroecosystem Research (LTAR) Network** **(Ignite)**

In the US, public rangelands support livelihoods and provide local people with a sense of place. At the same time, these landscapes are recognized as homes to wildlife and areas that protect open space. These benefits are valued not only by the people who derive their livelihoods from the land, but also a broader society. Despite the value of rangelands to multiple groups, divisions exist about how rangelands should be managed. Some of this division stems from differences in organizational culture, occupational jargon, and the unique constraints faced by stakeholders as varied as ranchers, agency managers, and research scientists. Additional tension is derived from past management strategies, which at times compromised livelihoods or ecosystem health. Such division blocks development of effective rangeland management by preventing stakeholders from advancing common objectives and implementing innovative management derived from sharing knowledge and resources. In this session we will explore how multi-stakeholder partnerships are creating invested stewardship networks that can overcome division and lead to novel and durable rangeland management.

This symposium brings together members of collaborative partnerships in the Intermountain West who provide insights on the challenges and opportunities of developing multi-stakeholder partnerships. In doing so, they will share how they engaged stakeholders across organizational and cultural silos to lay the foundation of their partnership. They will also highlight management innovations stemming from the hard work of both developing trust among partners and creating a shared vision of management objectives. Symposium topics span current management foci from outcomes-based grazing to time-controlled grazing. We will start the session by introducing principles and practices that are the foundation of multi-stakeholder collaboration, followed by team-presented talks that capture the differing perspectives of partnership members. Speakers represent a diversity of viewpoints from rancher to nonprofit to state and federal agency. Their roles in the partnerships range from manager to facilitator to regulatory agent to scientist. The symposium will conclude with an interactive discussion designed to help attendees navigate the complexities of developing partnerships with a range of constituencies. We expect the discussion to provide the seeds for future collaborations that allow partnership groups to communicate, share information, ask the hard questions, struggle through disagreements, and learn in order to develop solutions to rangeland management problems at hand.

- Laura Van Riper, BLM: Social Scientist/ROGER facilitator –Transforming Conflict and Fostering Collaborative Action: The Results Oriented Grazing for Ecological Resilience (ROGER) Collaborative
- James Rogers, Winecup-Gamble Ranch: Ranch Manager & Liz Munn, The Nature Conservancy Sagebrush Ecosystem Program Manager – Collaborative development of outcome-based management alternatives: From value-scoping to policy creation
- Taylor Payne, Utah Grazing Improvement Program: Regional Coordinator & Kris Hulvey, Working Lands Conservation: Lead scientist – The Three Creeks Grazing Project: Reimagining partnerships on public-lands from legal structures to adaptive management

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Plant selectivity is a driver of how livestock and wildlife utilize and influence rangeland plant communities through space and time. Both research scientists and rangeland managers need accurate and user-friendly tools to quantify diet composition in order to monitor how different grazing animal species select plants in diverse rangeland areas. Researchers have used a number of techniques (i.e., visual observation, microhistology, etc.) in the past to assess diet composition of grazing animals. Newer technologies (i.e., near infrared reflectance spectroscopy [NIRS], fecal DNA barcoding [fDNA]) have received more recent research attention as potential tools to more quickly and accurately assess diet composition and diet quality of grazing animals. The objective of this ignite-style session will be to invite presentations from six to nine researchers who have either evaluated the efficacy of these new technologies and/or utilized these technologies in their research to determine diet composition of grazing animals. The presentations will focus on the science of these emerging technologies, comparisons of new technologies to other diet composition procedures, and current research that has utilized these technologies to address rangeland management questions and challenges. A panel discussion will follow to discuss applications of these technologies for both researchers and managers. The session will provide innovative information on the most appropriate use and interpretation of data derived from these new techniques and stimulate discussion on how both researchers and managers can utilize these techniques to gather valuable information on diet composition. Expected outcomes for participants of this session will be 1) a greater understanding of diet selectivity and composition analysis techniques in different management scenarios, 2) knowledge of how to conduct, and analyze research for diet composition, and 3) understanding of potential challenges associated with analyzing diet composition in grazing animals on rangelands.

1. Joseph Craine (Ecologist, Jonah Ventures): *Methodological advances in fDNA to correctly distinguish among related plant species*
2. John Walker (Professor and Resident Director of Research, Texas A&M AgriLife Research and Extension Center): *Comparison of techniques to analyze diet composition of livestock*
3. Derek Scasta (Rangeland Extension Specialist, University of Wyoming): *fDNA validation trial using confined cattle*
4. Tamara Jorns (Former graduate student, USDA-ARS): *fDNA and diet quality analyses of cattle grazing mixed grass prairie*

5. Darren James (Range Management Research Statistician, USDA-ARS): *fDNA-based diet selection by Raramuri Criollo and Angus crossbreds in the Chihuahuan Desert*
6. Sarah King (Research Scientist, Colorado State University): *fDNA and microhistology to evaluate feral horse diets*
7. Mitch Stephenson (Range Management Specialist, University of Nebraska - Lincoln): *Using fDNA to evaluate targeted cattle grazing on cheatgrass invaded areas*
8. Laura Goodman (Range Extension Specialist, Oklahoma State University): *The use of fDNA to identify plant families in the diets of cattle, bison, and greater prairie chicken in Oklahoma*

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Ecological Sites and State-and-Transition Models as a basis for management and decision-support have been common practice on rangelands for more than 25 years. This revolutionary approach has improved communication across the management/research boundary and has become widely taught in range management programs. The principles that have been developed have been adopted in a variety of other land use and management situations. For example, cropland, forestland, urban and subaqueous ecological site descriptions are being developed, extending and broadening the concepts. In this session, presenters will demonstrate the use of state-and-transition models to describe ecosystem behavior and help support management decisions.

1. Skye Wills: Agro-ecological applications of STMs
2. Michael Kucera: Developing STMs for multiple land uses in the eastern Great Plains
3. Jamin Johanson: STMs for Dynamic Ecosystem Services: Wildlife Habitat
4. Michael Margo: Applying STMs to Urban Land Management Decision-making
5. Nick Webb: Defining thresholds for wind erosion in desert rangeland STMs
6. Curtis Talbot: Applying STM format to riparian ecosystems
7. Ken Spaeth: Development of STMs on a barrier island ecosystem, the Chincoteague Reserve
8. Phil Barber: Incorporating reindeer grazing interpretations into Alaska rangeland STMs
9. Blaine Spellman: STMs for drying lakes of the Yukon Flats Lowlands
10. Shane Green: Integrating Rapid Assessment Tools into STMS
11. Budbaatar Ulambayar: Ecological Sites and STMs for land management and policy decisions in Mongolia
12. Alexandra Heller: Detecting and describing ecological states on the Taos Plateau

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Invasive annual grasses are one of the most pressing challenges facing rangelands in the western United States, and each year the size of the infestation and the challenges managers face grow larger. Meaningful control and mitigation of annual grass threats is critical to halting the continuing conversion of native rangelands to annual grass-dominated landscapes and maintaining the provision of ecosystem services that these landscapes provide. In response to this challenge, new tools are emerging to give managers options in the face of the threats posed by these invaders. Indaziflam (Esplanade© 200 SC herbicide, Bayer CropScience LP) is an emerging herbicide that has demonstrated particular promise as a tool to selectively control annual grasses without harming established perennial plants. Indaziflam has sparked a proliferation of research and the science is moving rapidly. Maximizing the effectiveness of these new tools and proactively avoiding unintended outcomes will require consistent interactive engagement between involved stakeholders (managers, researchers, industry). Our symposium will feature speakers from each of these stakeholder groups to show how collaborative work between researchers, industry representatives, and land managers can translate into meaningful annual grass control. Our target audience will be the diverse array of stakeholders involved in annual grass management (public land managers, private landowners, researchers, industry professionals), and our objectives will be to present results from projects involving annual grass management with indaziflam and demonstrate how these results can be translated into meaningful conservation gains in areas where these infestations have thus far thwarted the efforts of managers. This to ultimately slow the transformation of natural areas in the western US into impaired landscapes dominated by these invaders. During the discussion portion of the symposium, we will engage the audience and identify key similarities and differences between management objectives and how indaziflam fits into plans to achieve them.

Included Speakers:

Speaker	Presentation Title
Harry Quicke (Bayer Vegetation Management)	*Depleting the Seed Bank: Key to restoring land devastated by annual grass invasion*
Jake Courkamp (CSU)	*Sagebrush-grassland plant community responses to long-term cheatgrass control in Sublette County, WY*
Noe Marymor (NRCS)	*Maybe we won't fly the coop: Effects of cheatgrass control using indaziflam herbicide on habitat quality of grassland birds*

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New technologies are being rapidly developed to monitor livestock and forage resources in rangelands, but can these be implemented in ways that effectively enhance livestock production? In this session, we bring together scientists and managers who are actively engaged in the use of sensor technologies on working ranches, to share their experiences with how they are changing ranching operations.

Each talk to be 20 min, including questions:
1) Melissa Brandao (Founder and CEO of Herddogg): A "fit bit for cows": applications of accelerometer ear tags for real-time monitoring of cattle.
2) Kevin Heaton (Extension Professor, Utah State University): Using remote sensing technology to monitor stock tanks.
3) Melissa Johnston (Central Plains Experimental Range Manager, USDA-ARS, Nunn, Colorado). Walk-Over-Weighing scales for real-time monitoring of livestock weight gains: implications of knowing seasonal and individual variation in cattle performance.
4) Corey Moffet (Rangeland Management Specialist, USDA-ARS, Woodward, Oklahoma): Enhancing grazing management with animal activity and location measurements.
5) Sarah Adams (Rancher and Global Business Development Manager for eShepherd, Gallagher Animal Management). Pushing new boundaries in livestock farming with virtual fencing.

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Session 12	Windows	**Social Science Advancements to Rangeland Management: Perspectives from the Long-Term Agroecosystem Research (LTAR) Network (Ignite)**

The rangeland community has become increasingly aware of the connectedness of human and ecological systems. It is now widely accepted that we cannot view environmental problems in isolation from the social and economic settings in which they occur, but we still struggle to understand how to integrate science and human decision making to address complex socio-ecological issues facing rangelands.

The Long-Term-Agroecosystem Research network (LTAR) is well poised to address the challenge of integrating science and management of rangelands with human decision making as it takes a network approach to compare agricultural productivity, social, economic and ecological outcomes of predominant agricultural practices to further human well-being.

The LTAR network provides context-specific knowledge related to on-the-ground management issues from scientists and practitioners that inform local decision making and provides scientific knowledge related to human decision making at a broader scale. This local to national scale ultimately leads to actionable science that can be used by various stakeholders, including landowners, scientist and law makers.

The Ignite-style session will feature six invited speakers, who will provide examples of interdisciplinary approaches that include novel science-practitioner collaborations, synthesize information from the natural and social sciences to address complex natural resource issues, and discuss tradeoffs associated with managing for both intensified agricultural production and human well-being.

1. Social change processes and their influence on human well-being: illuminating the impacts of community interactions for public lands management in southwestern Idaho, USA. Amanda Bentley Brymer, University of Idaho and USDA-ARS LTAR.
2. Can Collaborative Adaptive Rangeland Management (CARM) help conservationists move beyond individual-based conservation? Ted Toombs, Environmental Defense Fund.
3. Landowner attitudes and management of Kentucky bluegrass in invaded northern Great Plains grasslands. Kiandra Rajala and Mike Sorice, Virginia Tech.
4. Ecosystem service tradeoffs associated with agricultural intensification of grazinglands. Sheri Spiegal, USDA-ARS Jornada Experimental Range, Las Cruces, NM.
5. Multiple stakeholder perceptions of brush control efforts in the Southwest region. Maude Dinan, USDA-ARS Jornada Experimental Range, Las Cruces, NM.
6. Evaluating rangeland management innovations: adoption constraints and capacity for change. Gwendŵr Meredith, University of Idaho and USDA-ARS LTAR.

SRM 2020 Denver: Symposium/Workshops/Ignite Sessions

Tuesday AM (10:00 am to Noon)

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Session 14	Plaza A-C	**Adaptive management of burned rangelands: challenges and opportunities for its co-production by land-agency staff and scientists (Symposium)**
Session 15	Governors 15	**Unheard: Amplifying Atypical Voices in Rangeland Management (Ignite)**
Session 16	Windows	**Healthy Ecosystems for Rangeland Development (HERD): sustainable rangeland management strategies and practices (Symposium)**
Session 17	Plaza F	**Greenhorn to Trailboss: Cultivating the Next Generation of Stewards (Workshop)**
Session 18	Silver	**Refocusing Rangeland Songbird Research: Connecting Songbirds, Land Management, and Critical Habitat Characteristics (Ignite)**

What will prompt diverse land managers, landowners, livestock producers, and government decisionmakers to take effective, proactive, and sustained actions to address current and emergent threats from invasive plants? This is a central unanswered question in rangeland management. Across the western US and in many other rangeland systems around the world, invasive exotic grasses are displacing native plants, reducing biodiversity, and fueling wildfires. These invasive grasses can have potentially devastating impacts on the economic and ecological health of rangeland communities – both human and natural. The scientific community has responded to this threat by producing detailed data and decision support tools to mitigate the impacts and aid in the management of invasive species. However, similar scientific study on how to structure and implement effective and efficient governance and management systems to successfully constrain the impacts of invasive species is lacking. This symposium focuses on this gap in knowledge. We begin by reviewing the current state of knowledge on invasive plant governance and identify key questions and gaps. We then propose a shift in thinking about the type of management challenge presented by invasive plants from a place-based program involving individual landowners or public land managers to a common pool resource challenge requiring individual and coordinated actions. A final presentation will then show how these barriers to effective governance and management are evident in efforts to mitigate the impacts of buffelgrass (*Cenchrus ciliaris*) in southern Arizona and suggest how shifting thinking about invasive species from a place-based problem to a coordination problem can lead to more effective governance. The three presentations provide a foundation for an interactive discussion with meeting participants about their experiences with management and governance of invasive plants on rangelands, barriers they have identified, and solutions to working across interests and jurisdictions to more effectively share scientific knowledge, apply mitigation techniques, and expand available resources.

Speakers/discussion facilitators:

Aaron M Lien, Assistant Research Scientist, School of Natural Resources and the Environment, University of Arizona, Tucson, AZ amlien@cals.arizona.edu

Elise Gornish, Cooperative Extension Specialist, School of Natural Resources and the Environment, University of Arizona egornish@email.arizona.edu

Mitchel McClaran, Professor, School of Natural Resources and the Environment and Associate Director, Arizona Experiment Station, University of Arizona mcclaran@email.arizona.edu

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Like many other rangelands worldwide, the sagebrush-steppe of the western US has been greatly impacted by wildfire and invasive plants. Efforts to restore desirable native species and ecosystem function are challenging and frequently unsuccessful. Increasingly, land managers recognize the need to practice adaptive management of post-wildfire burned areas at both the project and regional scales. Acting on this recognition will require managers and scientists to develop a shared understanding of their roles, and the challenges and opportunities they experience at each step in the adaptive management process.

Presentations in this symposium will focus on how science for informing adaptive management of public lands is being co-produced by scientists and managers regarding the objectives of reducing exotic annual grasses, increasing desirable perennial plant communities, and stemming the increase of wildfire in sagebrush steppe.

Karen Prentice, Bureau of Land Management's (BLM) National Science Advisor, will describe land agency perspectives on the challenges and opportunities for co-producing science in sagebrush steppe landscapes. Next, Matt Germino, Research Ecologist with the US Geological Survey (USGS) will present lessons learned by a diverse team of public resource managers, land owners, and Federal and University researchers who carefully coordinated post-fire management to maximize opportunities for research and learning on the 2015 Soda Wildfire. With five years of monitoring, 2500 plots distributed across nearly 300,000 acres of varied terrain, ecological condition, and management treatments already provide an unparalleled learning laboratory from which key lessons on adaptive management can be learned. These 2500 plots provide a strong foundation for future monitoring, learning, and adaptive management. Then, USGS Research Ecologist David Pilliod will describe the co-production process of the Land Treatment Exploration Tool and the Land Treatment Digital Library that supplies its data. The Land Treatment Digital Library is a catalog of information about past treatments on public lands administered by the BLM in the western United States, especially burned areas. The Land Treatment Exploration Tool is designed for resource managers to use when planning land treatments. It provides useful summaries of environmental characteristics of planned treatment areas and facilitates adaptive management practices by comparing those characteristics to other similar treatments within a specified distance or area of interest. Paul Steblein, Wildland Fire Science Coordinator for the USGS, will then moderate a discussion session that we anticipate will explore needs, barriers, and opportunities for

improving information flow between scientists and managers for rehabilitation and restoration of post-fire rangelands.

Introduction: Paul Steblein (USGS)

A land manager's perspective:
Co-production of science that supports adaptive management: scaling considerations from the field to the national level
Karen Prentice (BLM), Sarah Carter (USGS)

Project-specific case study:
The seminal trial of post-fire adaptive management on the 2015 Soda Fire
Matt Germino (USGS), Rob Bennett (BLM), Alex Webb (USFWS), Amy Stillman (BLM), Cara Applestein (Boise State Univ), Matt Fisk (USGS)

National-scale learning system:
The Land Treatment Digital Library and Exploration Tool: Science co-production and adaptive management on public rangelands
David Pilliod (USGS), Gordon Toevs (BLM), Justin Welty (USGS)

Discussion moderated by Paul Steblein (USGS)

SRM 2020 Denver: Symposium/Workshops/Ignite Sessions

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While rangelands are the most extensive terrestrial land-cover, the voices and stories of rangelands are rarely widely heard by urban residents and when they are, the perspectives shared with the general public are limited. External pressures such as energy development, ex-urban development, and invasives threaten to lead to unintended transformations on rangelands that are uninformed by the stories of people who depend on these landscapes. At the same point, scientists struggle to use storytelling effectively to translate challenges to a broader audience.

During this ignite-style session we will explore with attendees the narratives and narrators of stories that are less frequently heard in rangeland management. We will begin with an overview of the importance of rangelands and a meta-analysis of news stories about rangelands to lay a foundational understanding of the stories widely circulated about rangelands. We will frame the importance of narrative and power in management decision-making, and a conceptual diagram of how we see stories influencing rangeland management. We will then lead a discussion and audience polling about the dominant narratives and narrators heard on rangelands. We will transition to case studies with a brief introduction to rangeland challenges that we will address in case studies.

We have three stories to share. 1) Cheatgrass: An invasive species problem that is overtaking the West--how do we communicate data that impacts our communities? 2) Wild Horses and Burros: how do we listen to multifaceted perspectives on a disputed topic? 3) Women's voices in ranching: how can we make sure diverse voices are included in management conversations? These stories will be used to illustrate how storytelling and narratives can and do function in rangeland management and how they could be harnessed for better land management. We will ask the audience to propose synergistic questions after they listen to these three short talks. After each short talk, we will facilitate a brief audience polling activity to generate conversation and explore these topics in more depth. We will end with a discussion on which voices do we need in our current and future rangeland management decisions--who can we actively bring to this discussion?

Our goals for the session are to address and explore the following questions: 1) How can storytelling on rangelands include diverse voices and influence land management practices? 2) Whose voices are included at the table and whose voices are not here? 3) How can we redefine our collective consciousness of the West? In addition to understanding the three case studies we will share, we hope attendees will leave with a better understanding of the role of storytelling and diverse perspectives in rangeland management.

Amanda Botsford, MEM Student, Western Colorado University
Anna Coburn, MEM Student, Western Colorado University
Sam Liebl, MEM Student, Western Colorado University
Corrine Knapp, Assistant Professor, University of Wyoming

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The Healthy Ecosystems for Rangeland Development (HERD) approach aims to improve Rangeland governance at the local level of rangeland users (local communities) and the intermediate level of decentralized rangeland managers and service providers in districts and governorates level, at the national level and at the regional level. The project approach designed to support dialogue-based processes in which all rangeland users and stakeholders are involved in a shared search for negotiated solutions. Rangeland governance is, on this basis, 'improved' or 'good' if the process that leads to it is transparent, democratic, equitable, pro-poor, and gendered, and that these approaches are reflected in the outcomes.

One of the important aspects of Sustainable Rangeland Management (SRM) is the active participation of local communities and collaboration with relevant stakeholders during the different phases of the strategic planning process. The project methodology targeted the three levels in set of activities that in total aims to improve knowledge and information sharing, multi-stakeholders dialogue for better resources management, and build the local and national institutional in the process.

HERD approach brings together many components adapted from well-proven methodologies in the fields of project management, business management, Rangeland Management and Planning and rural development. The approach also builds on existing sets of guidelines such the EU project EMPOWERS Guidelines for Water Governance (2004-2007), the IUCN Increasing Climate Change Resilience Guiding Toolkit (2014) and the Participatory Rangeland Management Planning (PRMP) guideline.

HERD project will adopt the Participatory Rangeland Management and Planning (PRMP) Methodology as the base approach with some customization in the project management cycle to reflect the strategic planning at the three management levels of the project and merge some of other methodologies and tools to enrich the processes. PRMP initially is intended to help practitioners adapt participatory approaches to the unique situation of the rangelands. PRMP is an iterative/cyclic process laid down in the essential steps. The aim of PRMP is to facilitate participatory rangeland management planning in a simplified and practical way.

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The younger generation has been further removed from agriculture today with the transition of the cultural norm to urban lifestyles, but we are still having students enroll in natural resource degrees. One of the challenges our younger generations faces is learning how to build those professional relationships through face-to-face conversations with those in the private sector. Forest production, mining, and ranching are the oldest private sector users of forestry and rangelands. It is essential for students' professional development to make personal connections with these credible resource users to open productive conversations about the knowledge and skill base necessary to reach the goals and objectives of private operations. For this to happen, it will take the technology focused generation that is graduating to see how important the ability to communicate effectively across a broad range of resource users is in the early stages of career development.

Our outcome for the training is for young professionals to learn how scientific and educational communication approaches will impact application of their work outcomes and the pitfalls or struggles they might encounter starting out in their career. Since ranches are the resource that most range managers will encounter early in their career, YPC will focus on the livestock production industry.

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Rangeland songbirds are experiencing widespread population declines across the US. From the tallgrass prairie to the sagebrush ecosystem, loss of habitat is considered the primary cause of decline for many species of conservation concern. The majority of research and conservation efforts focus primarily on population metrics, tracking the downward trajectory of bird numbers. However, there is strong evidence that declining songbird populations are linked to the loss, degradation or fragmentation of habitat. As bird populations continue their downward trend, it is imperative to focus on wildlife habitat characteristics and management of remaining tracts of land. In rangeland ecosystems, the need for effective multi-use management strategies that support wildlife and traditional rangeland uses continues to increase. In this symposium, sponsored by the SRM wildlife habitat committee, we will highlight current songbird habitat research conducted by rangeland professionals. This ignite session will emphasize the connection between declining populations and loss or degradation of habitat, by featuring research on land management, songbirds and critical habitat characteristics such as forbs and plant community structure.

Tracey Johnson- Livestock grazing as a tool for managing songbird habitat: evidence from a broad-scale grazing experiment

Cameron Duquette-Grassland Bird Nesting Success and Community Composition in a Landscape Managed with Patch-burn Grazing

Jennifer Lutze: Increasing structural heterogeneity for bird habitat and private lands management

Vanessa Schroeder- Short Term Effects of Contemporary Grazing Practices on Sagebrush-obligate Songbird Habitat and Reproductive Success

Courtney Duchardt: What mountain plovers and cattle (may) agree on: moderate-sized prairie dog colonies in the Thunder Basin National Grassland

Sam Wolfe- Songbird Abundance on Rangelands in Eastern Oregon Prior to Juniper Removal

Jason Tack-Conifer Management Tools for Woodland and Sagebrush Obligate Songbirds

Kristin Davis-Tradeoffs and challenges in applying adaptive rangeland management for a shortgrass-obligate bird

Jennifer Timmer- Multiple Ecosystem Services in a State-And-Transition Model for Sagebrush Rangelands

Alan Harrington: A Unique Look into Landscape-level Threats and Sagebrush-obligate Songbird Dynamics

Anna Chalfoun: Multi-scale Habitat Associations of the Three Sagebrush-obligate Songbirds: Mechanistic Insights from 18 Years of Study

SRM 2020 Denver: Symposium/Workshops/Ignite Sessions

Tuesday PM (1:30 pm to 3:30 pm)

Session 19	Governors 15	**Open(source) Range (Ignite)**
Session 20	Silver	**Managing invasive species using geospatial technologies (Symposium)**
Session 21	Plaza F	**Partnerships are the New Conservation Paradigm (Symposium)**
Session 22	Governors 14	**Kenyan IRC 2020 (Symposium)**
Session 23	Windows	**The Art & Science of Stockmanship in Rangeland Management: Asking better questions and engaging more people (Symposium)**
Session 24	Plaza A-C	**Stakeholder Engagement to Improve Federal Rangeland Wildfire Mitigation and Response (Symposium)**

Science has entered a transformative phase catalyzed by burgeoning data streams, powerful and accessible analytical software, and the democratization of prototyping and manufacturing technologies. This is observable in rangelands in many ways including the deployment of connected sensor networks (e.g., the National Wind Erosion Research Network), the rapid adoption of unmanned aerial vehicles (i.e., drones) for rangeland research and monitoring, the proliferation of powerful and free data analysis tools (e.g., firebehavioR or lidR packages for R), and development of cloud-based, crowd-sourced monitoring apps (e.g., LandPKS). Many of these efforts are developed using open-source software, hardware, and data, and many likewise offer the outputs of their work as open-source products. An open-source product is one where the author or creator makes the original source materials (e.g., code, designs, documentation, concepts) freely available for others to use or modify. While generally associated with free software, open source means more than just free: it is a philosophy that embraces a willingness to share ideas to spur collaboration and advancement in science. We propose an Ignite Session at the 2020 SRM Annual Meeting to showcase open-source efforts in rangeland science and management and to explore the opportunities and implications of open-source research and development. This Ignite session will feature presentations from rangeland researchers who are using or developing open-source hardware, software, or data. The goals of this session are fourfold: 1) highlight exciting open-source projects in rangeland environments, 2) promote an open-source ethos for advancing research and management in rangelands, 3) increase the audience's understanding of the range of possibilities for open-source development; and 4) increase awareness of how to create open-source hardware, software, and data.

Tentative list of presenters:
1. Jason Karl – Livestock GPS collars for $40 – Development of an open-hardware location tracker
2. Devan McGranahan – thermocouples and fire weather
3. Craig Tweedie – A Raspberry Pi based camera system for phenology monitoring
4. Jeff Herrick – LandPKS – a cloud-based, crowd-sourcing app for rangeland monitoring
5. Matt Dickinson/Bob Kremen – IR fire behavior sensors
6. Justin Ziegler - fire behavior R package
7. Slot to be filled
8. Slot to be filled
9. Jason Karl – Open hardware development and prototyping – from 3D printing to custom circuit boards
10. Devan McGranahan – Data and code sharing = open science!

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Invasive species are continuing to spread throughout native rangelands. Mitigating the degrading effects of these species is contingent upon our ability to monitor their spread. Moreover, many areas that have the greatest risk to invasive species degradation are difficult to access or inaccessible. The use of remote sensing combined with geospatial (GIS) technology provides users a reliable tool for monitoring the degrading effects of invasive plant species, when accessibility or time are limited. Throughout this seminar, presenters will discuss new tools, the benefits, and the drawbacks of using geospatial technologies for monitoring invasive species across rangelands and identify the best management strategies for these regions. A key benefit of this proposed symposium is that it applies to many North American rangeland ecosystems in three short presentations; e.g. The southern Great Plains, desert southwest, and the Great Basin. We also aim to engage audience members during a discussion session that will follow the presentations where we will discuss the possibilities of using these technologies across multiple rangeland regions.

Steve Petersen: "The application of geospatial technology to assess pinyon/juniper invasion in western rangelands"

Temuulen Sankey: "Unmanned Aerial Vehicle – Based Rangeland Monitoring: Examining a Century of Vegetation Changes"

Humberto Perotto: "Geospatial perspectives and approaches to monitoring invasive species in South Texas"

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Reversing the decline of grassland bird populations in North America requires creative solutions that transcend fence lines, funding sources, and individual agency goals. Conservation practices that stop at lines of jurisdiction or fences fail to address broader goals of landscape connectivity, rangeland health, and biodiversity. We assert collaborative partnerships are the new model of grassland conservation to achieve landscape-scale results across publicly- and privately-owned land. We introduce a new conservation model that spans non-profit conservation organizations, landowners and managers, and federal and academic researchers to deliver creative solutions to challenges of grassland management and conservation. Six strategically paired speakers will deliver 15-minute talks on collaborative approaches to solving conservation challenges, programmatic approaches through federal collaborations, and adaptive management led by unlikely partnerships in local landscapes.

We begin our symposium with a paired talk to address how partnerships are achieving conservation by addressing challenges and solutions through collaboration. Bird Conservancy of the Rockies' Executive Director, Tammy VerCauteren will begin by delivering a "state of the birds" and creative approaches to conserving grassland birds and their habitats through stewardship, research, and education. The Nature Conservancy's Senior Conservation Ecologist, Terri Schulz will share novel approaches to conservation in the grasslands of Colorado across publicly and privately-owned landscapes.

In the next section, we will explore working models of partner positions with Colorado USDA-NRCS State Conservationist, Clint Evans, who leverages partnerships with non-profit organizations to access specialized skillsets and staffing opportunities to deliver USDA Farm Bill conservation practices on private lands.

Next, Bird Conservancy of the Rockies' Biometrician, David Pavlacky will present peer-reviewed research evaluating the efficacy of two Farm Bill programs, Lesser Prairie Chicken Initiative and Conservation Reserve Program, as mechanisms to slow the decline of grassland birds.

In our final section, two innovative collaborative projects will synthesize these concepts through working models of adaptive management in Colorado and Wyoming. Landscape Ecologist David Augustine with the USDA Agricultural Research Service will introduce the Collaborative Adaptive Rangeland Management Experiment in northeast Colorado. This project engages ranchers, land managers, non-profits, and federal and state employees to collectively and adaptively manage shortgrass prairie for multiple uses, including grassland bird habitat and cattle production. Finally, Thunder Basin Grassland Prairie Ecosystem Association Executive Director, Dave Pellatz, will present a second collaborative effort in eastern Wyoming, the Thunder Basin Research Initiative. Here, a checkerboard of privately-owned land and public land managed by the USDA Forest Service makes landscape-level management especially challenging. Dave will share challenges and accomplishments of

the collaborative, multi-stakeholder effort to answer locally identified management questions concerning a suite of bird guilds.

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	Presenter	Position	Role in the National Organizing Committee (NOC)
1.	Mr. Harry Kimtai	Principal Secretary (PS), State Department of Livestock	Chairman of the NOC
2.	Dr. Eliud Kireger	Director General (DG), Kenya Agricultural and Livestock Research Organization (KALRO)	Chairman of the NOC Secretariat
3.	Mr. Ernest Mbogo	Deputy Director, State Department of Livestock	Member, NOC
4.	Dr. Cecelia Onyango	Lecturer, University of Nairobi	Vice Chair, Local and Arrangements Sub-Committee of NOC
5.	Dr. Foustine Peter Wandera	Director Livestock Systems, KALRO	Secretary, Program Sub-committee of NOC
6.	Ms. Primrose Nabwire	ICT expert	Manager, Kenya IGC-IRC Secretariat office and managing software running the Congress website

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Since 2015 there have been three Stockmanship Symposia at SRM Annual Meetings (2015, 2016, & 2018). The value of Stockmanship to range management has been demonstrated in bison and wild horse management, livestock/range management in the presence of predators, utilization of range, managing wilderness grasslands with pack stock, and placing livestock. This proposed symposium for the 2020 SRM AM is not about answers, but what are the new questions for translating Stockmanship into practice to facilitate the transformation of range science. Some questions that we have to start the discussion include: Improving diversity among Stockmanship practitioners; Do new technologies facilitate or antagonize stockmanship?; Do stockmanship skills, experience and techniques impact cattle placement?; Can reductions in livestock stress when applying stockmanship in rangeland conditions be measured?; How do people, livestock and predators interact when stockmanship is applied?; Are we meeting the needs of students, managers, scientists and ranchers in how we inform them about Stockmanship?; and most importantly what are your questions?

Derek W. Bailey, Ph.D. – Professor & Director Chihuahuan Desert Rangeland Research Center; New Mexico State University – Las Cruces, New Mexico

Matt Barnes – Rangeland Scientist, Conservationist, Consultant, and Writer; Shining Horizons Land Management, LLC – Montezuma, Colorado

Retta Bruegger – Western Regional Specialist Range Management; Colorado State University Extension

Jesse Bussard – Storyteller, Community Builder, and Writer; Cowpunch Creative – Bozeman, Montana

Whit Hibbard, Ph.D. – Publisher of Stockmanship Journal (Former National Park Service Law Enforcement & Natural Resources Ranger), Rancher; Sieben Livestock Company – Helena, Montana

Kent Reeves – Range/Wildlife Scientist, and Western Photographer; The Whole Picture and Rancher to Rancher Network – Mariposa, California

David M. Voth – Rangeland Health Coordinator; Nevada Department of Agriculture – Elko, Nevada

Mike Williams – Rancher; Co-owner Diamond W Cattle Company, Ventura, California

Engaging More People to Transform Stockmanship into Practice

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Session 23	Windows	**The Art & Science of Stockmanship in Rangeland Management: Asking better questions and engaging more people (Symposium)**
Session 24	Plaza A-C	**Stakeholder Engagement to Improve Federal Rangeland Wildfire Mitigation and Response (Symposium)**

Rangeland wildfires have grown in size, frequency, and length of season due to factors that include increasing human use of rangelands, vegetation state change (e.g., cheatgrass invasion), drought, and climate change. For example, the largest wildfires ever recorded in all four Great Basin states have been rangeland fires that have occurred in 2007 or later. In response, land managers and researchers have proposed solutions such as novel grazing systems, pre-emptive restoration, fuel break provision, and more. Because western U.S. rangelands are largely managed by the federal government for multiple uses, and because wildfires frequently cross jurisdictional boundaries, implementing successful strategies to reduce wildfire risk and impact or to improve post-wildfire recovery is likely to require involvement by multiple actors beyond the federal rangeland management agencies.

This symposium presents results of new research exploring options for engagement between land management agencies and multiple stakeholders to improve federal wildfire mitigation and response. First, Katherine Wollstein will present results from three BLM field offices showing how formal and informal arrangements and processes affect learning, interpretation, and subsequent implementation of management designed to reduce wildfire risk in Idaho. Emily Jane Davis will describe her findings in studies of evolving partnerships for rangeland wildfire mitigation and suppression in Oregon and Idaho. Finally, Gwendwr Meredith will present her analysis of how collaborative management efforts in southwestern Idaho and southeastern Oregon shaped, and were shaped by, rehabilitation needs after the 280,000-acre Soda Fire that occurred in 2015.

In their talks, each presenter will not only explain her findings, but also propose ways that local rangeland and fire/fuels managers can use those findings to shape their own external engagement strategies to improve wildfire risk reduction and post-fire response. Subsequent discussion will invite symposium attendees to share their own unique institutional, stakeholder, and fire risk contexts in order to think through together how research findings can be rapidly translated to action.

• Katherine Wollstein, University of Idaho: "Context matters: Institutional Conditions for Outcome-Based Approaches to Address Wildfire Risk on Idaho's Rangelands"
• Emily Jane Davis, Oregon State University: "Fire on the Range: 'Co-Managing' Risk Among Agencies and Landowners in the Great Basin"
• Gwendŵr Meredith, University of Idaho: "Effects of Wildfire on Collaborative Governance of Rangelands - a case study of the Soda Fire"

SRM 2020 Denver: Symposium/Workshops/Ignite Sessions

Wednesday AM (10:00 am to Noon)

Session 25	Plaza A-C	**Has Scientific Communication Failed the Art of Range Management? (Symposium)**
Session 26	Windows	**Vulnerability of Beef Cattle Production to Ecological and Socio-Economic Challenges of Future Climates (Symposium)**
Session 27	Plaza F	**Researchers and Practitioners Integrating Knowledge to Restore and Reclaim Rangelands and Riparian Areas (Symposium)**
Session 28	Silver	**Stakeholder Engagement: Who, When, Why, and How (Workshop)**
Session 29	Governors 14	**Shared Monitoring, Shared Stewardship (Ignite)**
Session 30	Governors 15	**Targeted Livestock Grazing to Reduce Fine Fuels in the Great Basin (Symposium)**

''Not everything that counts can be counted, and not everything that can be counted, counts''
-Albert Einstein

When does science become art? We often refer to the "Art and Science of Range Management' but how often do we acknowledge the "art" or the "artist?" In today's world of ever-expanding technology and engineering, many aspects of the "art" of natural resource and land management are being overshadowed by a desire for predictability driven decision processes. The desire to be "right," or better yet, to not be "wrong," weighs heavily on the decision-maker and ultimately can lead to inaction for fear of getting the science wrong. Science and management theory have become a driver for many decision-makers in their efforts to minimize potential negative impacts of decisions made, and in the realm of natural resources, command and control are sought over managed ecosystems. Management decisions must be made every day in the world of land management and are nearly always made with less than perfect and far less than complete knowledge. Those tasked with the responsibility of stewarding the lands they manage are confronted with challenges that require a decision in the present that may have long-term implications, both to the operation as well as across a broad array of society. Added to the basic operational challenges of land management, the impacts of social, political, ecological and economic drivers confront the land manager with a complexity of scenarios that cannot be addressed through traditional scientific methodologies. In addressing these facts, the Society for Range Management recognized that rangeland management is the "art and science" of deploying management decisions on the landscapes. Whereas, academic endeavors rightfully focus on the "science," the practitioner remains the ultimate decision-maker in the rangeland management system, the "artist" if you will, integrating both "art" and "science" into the decision-making process. In many ways, land management is truly a creative endeavor with the managers creativity producing the art of the management process. Science favors one "right" answer, while the artist may create many scenarios on the landscape, utilizing the science but considering all the other drivers mentioned above. The Sub-Plenary and accompanying Symposium will focus on inputs from the ranching community as to needs for communicating science to action and will address/challenge the need for new means of communication that brings the science closer to action. To paraphrase a belief of Dr. John "Chip" Merrill "*…as land managers, if the focus is on dealing with problems then we will continue dealing with problems. If the focus is on our desired objectives and we visualize what it takes to achieve that objective, then we can get it done.*" "Communicating" science into action in the 21st century is a challenge that will require changes in "WHY" we communicate.

Jenny Pluhar and Frank Price, involving a "Conversation with H.L. Bentley, Special Agent in Charge of Grass, Abilene, Texas Field Station, 1898." This session will be "Facebook Live" and interactive.

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Cattle producers have historically had to contend with climate variability, but an increase in the variability of future climates may exceed the existing adaptive capacity. Drought reduces forage availability, increases operating costs, and reduces profits as a result of supplemental feeding, loss of animal condition, and destocking-restocking cycles. Wet years challenge the ability of beef producers to convert high forage production into profits without the purchase of additional livestock. Consequently, increasing climate variability presents a serious challenge to the economic viability of beef cattle production and it defines a major knowledge gap for the region.

This symposium will explore the vulnerability of beef cattle production to future climates in the Northern, Central and Southern Great Plains. We will emphasize (1) the response of beef cattle production to recent droughts (1980s and 2010s), (2) trends in forage production throughout the 21st century, (3) the impact of future climate variability and change on economic viability of beef cattle production, and (4) the ability of beef producers to adapt to future climates to maintain economically viable operations.

The maintenance of economically sustainable beef cattle production may require the collaboration of agricultural research institutions, the beef cattle industry, and local, state, and national governments. Effective contingency planning to sustain beef cattle production has major implications beyond the nation's beef supply by maintaining intact grazing lands and the diverse ecosystem services that are derived from them.

Speakers:
(1) David Briske, Texas A&M University – Retrospective Assessment of Beef Cattle Dynamics to Climate Variability the Past 40 Years
(2) Toni Klemm, Texas A&M University – Future Climate and Forage Projections: Implications for Beef Cattle Numbers and Distribution
(3) John Ritten, University of Wyoming – An Economics Assessment of Beef Cattle Vulnerability to Future Climates
(4) Amber Campbell, Kansas State University – Assessment of the Adaptive Capacity of Beef Cattle Producers to Future Climates

SRM 2020 Denver: Symposium/Workshops/Ignite Sessions

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Reclamation and restoration efforts on rangelands are often fueled by collaborations between researchers and practitioners, but the integrated knowledge created by these interdisciplinary teams is poorly represented in the scientific literature and in the SRM community. The SRM Reclamation and Restoration (R&R) Committee proposes to build on SRM's capacity by exploring partnerships between science and management in reclamation and restoration on rangelands, including riparian areas.

We propose to continue the stimulating discussion begun at the 2019 Annual Meeting, at the symposium "The Proof is in the Pudding: Showcasing Diverse Perspectives on Success and Failure in Rangeland Reclamation and Restoration." R&R Committee members in attendance in 2019 expressed the need to continue the discussion and learn more about best practices in science-management partnerships in reclamation and restoration. Accordingly, we have secured three pairs of speakers to present on such partnerships, with each pair containing a researcher and a "practitioner" -- with the latter being widely defined. Each pair of speakers will have 25 minutes to illuminate what has worked and what has not in their collaborative project, similarities and differences between research and management perspectives, and the opportunities and challenges experienced in two-way transfers of knowledge between researchers and practitioners. Remaining time will be dedicated to group discussion among speakers and audience participants, including members of the R&R and Watershed/Riparian committees.

Nancy Shackelford, University of Victoria, British Columbia; *Dr. Katharine Suding, University of Colorado Boulder; Dr. Rebecca Hufft, Denver Botanic Gardens; *Larry Vickerman, Denver Botanic Gardens Chatfield Farms. *Rangeland restoration for multiple audiences, from local results to global implications*.

Justin Hossfeld, Sunlight Ranch Company; Shannon Clark, Colorado State University. *Lessons from research and application in restoring native rangelands from annual grass invasion using Indaziflam herbicide*.

Sam Lossing, Smith Creek Ranch; Tamzen K. Stringham, Ph.D., University of Nevada. *Dalton Meadow Restoration: Intersection of Science, Management and Education*.

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This two-hour workshop will introduce SRM 2020 attendees to purposes and processes of stakeholder engagement *outside the NEPA process.* Engagement with stakeholders can be useful for rangeland managers in a number of contexts, e.g.,

- identifying opportunities for collaboration,
- prioritizing efforts to address management challenges,
- understanding citizen perceptions of those challenges,
- gauging public perspectives on alternative management strategies that will be the subject of subsequent NEPA efforts.

Likewise, for range researchers, stakeholder engagement is a cornerstone of translational science, useful for identification of researchable problems or soliciting assistance with study design, implementation (i.e., citizen science), interpretation of results, and dissemination of findings. Yet principles of stakeholder engagement are not typically taught in university courses. This workshop will help attendees identify when stakeholder engagement can be useful, gain practice at stakeholder identification, and collaboratively identify best practices for effective engagement.

The workshop will combine presentations with hands-on activities and discussion. After an introductory presentation on the potential purposes of stakeholder engagement in rangeland management and situations where it must be most effective ("when" and "why"), attendees will work in small groups to identify which stakeholders and subject matter experts could best inform a real-world situation ("who"). Following report-out from that exercise, the second half of the workshop will focus on the "how," combining discussion with a real-time quiz game to identify effective stakeholder engagement practices that foster efficient use of time as well as beneficial social learning processes and outcomes.

Organizers/Presenters**:** Amanda Bentley Brymer and Mark Brunson

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Standardized monitoring information is transforming land stewardship by creating a common language for translating diverse ideas about land conditions and changes. Core monitoring indicators and methodologies adopted by BLM, NRCS, and other groups provide comparable information that can be readily understood by stakeholders. When collection and analysis of this information occurs in partnership, outcomes are often improved for both the lands and communities involved. This session will showcase partnerships that are using core indicator information to achieve shared land management goals. Examples will span the variety of land uses in the Western US, including livestock grazing, land treatment effectiveness, wildlife habitat management, and energy development and reclamation. Together, these examples will demonstrate the hallmarks of successful monitoring partnerships which can be extended into new communities and resource management applications.

Brandon Bestelmeyer (ARS), Leticia Lister (BLM), Zoe Davidson (BLM)	Big Data, Local Science: Not an Oxymoron
Tom Grant (Gunnison Conservation District), Renee Rondeau (Colorado Natural Heritage Program)	Working Together to Get Work Done: Meadow and Riparian Restoration in the Gunnison Basin and Beyond
Andrew Johnson (BLM)	AIM after Fire: Long-Term Monitoring of Vegetation Treatments within the 2012 Rush Fire
Steven Hale (Utah Gas Corps), Sean diStefano (ARS)	Bridging the Gaps: Optimizing Monitoring Data from Oil and Gas Reclamation Reporting
Jeff Wahlert (Rancher), David Augustine (ARS)	Collaborative Adaptive Rangeland Management (CARM) in Northeast Colorado
Kathryn Dyer (BLM)	Addressing Flexibility through Outcome Based Grazing Authorizations
Mike Pellant (ret. BLM), Pat Clark (ARS)	The Use of Targeted Livestock Grazing to Reduce Fine Fuels: Monitoring a Multi-State Demonstration Program
Terri Schulz (TNC)	Landowner monitoring and adaptive management using the phone app, LandPKS
Casey Addy (BLM), Daniel Olsen (Utah DWR)	Mule Deer Migration and Habitat Selection in Utah using GPS Collar Data and Terrestrial AIM Monitoring Data
Travis Nauman (USGS), Mike Duniway (USGS)	Development of Ecological Site Group Descriptions and Maps for Adaptive Land Management

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Wildfires continue to increase in the Great Basin threatening flora, fauna, ecological integrity, economic well-being, and rural heritage. Fuels management projects are an important proactive approach to reduce wildfire threats that impact federal, state, tribal and private lands. There is a renewed interest in using livestock to reduce fine fuels as another tool in the fuels management toolbox. Several approaches are being implemented and evaluated by collaborative partnerships using livestock to reduce fine fuels—composed of cheatgrass, medusahead, and ventenata. The Bureau of Land Management is supporting three demonstration projects in Nevada, Idaho, and Oregon to strategically reduce fine fuels at a landscape scale using targeted grazing. Livestock permittees are using water and nutrient supplements, herding, and in some cases fencing to meeting fuels reduction objectives (generally two-inch stubble heights) by the beginning of the fire season). An intensive research project has been implemented by the Agricultural Research Service's Northwest Watershed Research Center to evaluate the effects of the grazing on fuel loads, vegetation and soils. Results have been variable in terms of meeting objectives to date given the variability of the spring growth of cheatgrass for the past two years. However, a 2018 wildfire started by lightning burned into an approximately one-mile segment of the T Lazy S targeted grazing fuel break in the Elko District and stopped along the water haul road. The other approach being investigated is using livestock to remove the invasive annual grasses thatch layer and emerging fall growth when desirable perennial plants are dormant (e.g., dormant season grazing) and less susceptible to disturbance. The goal of this livestock management strategy is to increase residual desirable plants, reduce annual grass germination and carryover fine fuel residue. Dormant season grazing studies are being conducted by the University of Nevada Reno, Oregon State University and the Agricultural Research Services Eastern Oregon Agricultural Research Center in Burns, Oregon. Initial results are promising in terms of reducing residual fine fuels and promoting recovery of desirable perennial vegetation. Both strategies will be addressed in this symposium with an emphasis on collaboration, results, lessons learned, challenges and future directions.

Sergio Arispe, Kirk Davies, Karen Launchbaugh, Pat Clark, Kathryn Dyer, Barry Perryman (tentative), April Hulet, and Mike Pellant

SRM 2020 Denver: Symposium/Workshops/Ignite Sessions

Wednesday PM (1:30 pm to 3:30 pm)

Session 31	Governors 15	**Engaging Rangeland Managers in Grass-Cast to Improve Translation & Transfer** (Symposium)
Session 32	Plaza F	**Translation of key insights from long-term stocking rate studies to range managers** (Symposium)
Session 33	Governors 14	**Addressing Flexibility through Outcome Based Grazing Authorization** (Symposium)
Session 34	Plaza A-C	**Science to Action: Communication Needs of the 21st Century Rangeland Manager** (Symposium)
Session 35	Silver	**Ignite Your Rangeland Collaboration: Lessons Learned and Keys to Success** (Ignite)
Session 36	Windows	**Improving Communication and Collaboration Among Diverse Experts** (Workshop)

The Grassland Productivity Forecast or "Grass-Cast" uses over 30 years of historical data on weather and vegetation growth—combined with satellite NDVI data and seasonal precipitation forecasts—to predict if rangelands in individual ~6 mile x 6 mile areas are likely to produce above-normal, near-normal, or below-normal amounts of vegetation. Grass-Cast can help rangeland managers throughout the Great Plains and Southwest adaptively manage lands to better match animal demand to available forage by providing early warning for drought-induced forage shortages. It was first released to the public in 2018 for the Northern Great Plains, and to the Southern Great Plains in 2019. Work is now underway to develop Grass-Cast for the Southwest region of the United States. This symposium will provide an overview of Grass-Cast, followed by a demonstration of its interactive online maps. Finally, we will use scenarios from 2018 and 2019 to engage participants in small-group discussions centered on how Grass-Cast might fit within existing conservation planning and outreach activities of rangeland specialists with University Extension, private industry, and land management agencies such as NRCS, Forest Service, and BLM.

The symposium will open with a 30-minute introduction to Grass-Cast by a duo of senior and junior team members. Participants will learn how the Grass-Cast maps are made, how to find them online, and how to interpret them. The next 20 minutes will be dedicated to Q&A with the audience to address technical questions. During the second half of the symposium, the USDA Northern Plains Climate Hub will kick off an interactive portion by introducing Grass-Cast maps from the 2018 and 2019 seasons (10 minutes), which exhibited very different characteristics and management implications. Participants will then use the maps in small groups to hone their understanding of Grass-Cast and discuss how they might act upon the early-season information for a location of interest to them (30 minutes). The symposium will conclude with a report-out from all groups to capture their insights about the opportunities and challenges of using Grass-Cast to help inform rangeland management decisions. We are seeking input from rangeland managers to help make Grass-Cast more usable and envision how it might be incorporated into existing conservation planning and outreach programming efforts.

Speakers: Dannele Peck, Justin Derner, Kristin Dickinson, Matt Reeves, Windy Kelley.

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Session 36	Windows	**Improving Communication and Collaboration Among Diverse Experts (Workshop)**

Sustainable livestock production is centered on matching animal demand with forage availability, which presents a challenge to managers faced with changing climatic conditions. Long-term stocking rate studies have provided fundamental knowledge to the range management profession. Key insights from these studies have not been translated well to range managers or to agencies (state, federal, tribal) for land management recommendations.

In this symposium, translation of the key insights from several multidecadal stocking rate studies could provide the focus and vision (i.e., 20/20) for reshaping the sustainable management of rangelands in a changing climate. Our goal is to highlight ways that science-based information on livestock production can benefit sustainable ecosystem management. Objectives of resulting discussion with attendees will be: 1) advance questions centered on how long-term data can inform our understanding of climatic drivers and rangeland conditions which mediate livestock production, 2) introduce novel uses of such long-term data for management/practice applications, and 3) engage attendees and speakers in a discussion of livestock production using operation examples from different regions. Expected outcomes for attendees include a better understanding of regional variation in livestock production under different stocking rates, and implications for rangeland ecosystem management and decision-making under changing climatic conditions.

Alexander "Sandy" Smart, South Dakota State University, Dept. of Natural Resource Management, "Balancing ecosystem goods and services: why do ranchers do what they do?"

Keith Harmoney, Kansas State University, Dept. of Agronomy, "'Old' Stocking Study Still Yields New Information for Current Management".

Peter O'Reagain, Queensland Australia Department of Agriculture and Fisheries, "'Testing, developing and communicating guidelines for sustainable and profitable management in the rangelands of northern Australia"

Edward J. Raynor, USDA-ARS, Rangeland Resources & Systems Research Unit, "Large-scale and local climatic controls on large herbivore productivity: Implications for adaptive rangeland management"

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The Bureau of Land Management initiated the Outcome Based Grazing Authorization (OBGA) demonstration project in September 2017. The OBGA project is intended to support enhanced collaboration and partnerships for managing livestock based on conservation performance and ecological outcomes rather than process and prescription. This is expected to result in cooperative improvement, management and/or protection of public lands within the project areas as well as creating or continuing achievement or attainment of positive economic and social outcomes. Flexibility in yearly operational management is key to the OBGA, and clearly stated objectives and an associated monitoring plan is key to implementing legally sound flexibility.

Speakers will be comprised of the OBGA lead and speakers from 2 of the OBGA projects. The symposium will begin with the OBGA lead giving an overview of the effort and the variety of projects involved. The overview will include information regarding the expected outcome of the initiative, which is new national policy and direction on how to renew BLM grazing permits in order to enhance collaboration and maximize flexibility. Two of the 11 National OBGA projects will then present, specifically focusing on innovative monitoring, and successful approaches to collaboration. The projects will also include a discussion of the importance of monitoring to the effort, and how some innovative new techniques are being used to compliment other 'agency' monitoring techniques and support management decision making. Discussions will include information on flexibility that has already been implemented, and how that information is being captured and shared.

Public lands grazing is an important contributor to the agricultural industry in the west, and there is expected to be much conversation initiated through this presentation.   There are many opportunities to improve the flexibility afforded a public lands grazing permit, and this project explores those opportunities. Benefits of OBGA are expected to include improved relationships, healthier ecosystems, and enhanced economic viability.

We have from Oregon: Autumn Toelle-Jackson (BLM) and Stacy Davies (or a ranch representative) of Roaring Springs Ranch.
From Nevada we have Jeff Morre (BLM) and James Rogers of the Winecup-Gamble Ranch, and
From Wyoming we have Cheryl Newberry (BLM) and Niels Hansen of PH Livestock Co.
Kathryn Dyer of BLM, will also be a presenter/contributor as well as being the facilitator/moderator.

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When "Rangeland Scientists" question why those who manage ecosystems do not implement the information developed into action, the managers concern is not centrally about the quality of *data* or *information,* but rather, the processes of *knowledge* production and implementation*. Knowledge* is a consequence of human reflection and experience, and it is most often found within an individual, collective, routine or process that results in an increased capacity for decision-making and action to achieve some purpose. This definition stands in meaningful contrast to *data*, which refers to unedited descriptions or results of observations about states of past, present or future domains, or *information,* which refers to patterns that observers find or instill onto the data that has been generated through experimentation. The adoption and spread of innovation through a society/organization was formally described by Everett M. Rogers in the book *Diffusions of Innovations* and expanded upon by Geoffrey Moore to not only address the concepts of innovation, but also the spread if *ideas*. These concepts apply particularly well in natural resource management with a bell-curved continuum from those who readily develop and adopt (Innovators – 2.5%, Early Adopters – 13.5%) through those who are waiting to see (Early Majority – 34%, Late Majority – 34%) and ending with those who lag behind (Laggards – 16%). David Scarnecchia described rangeland "Management Science" as a distinct scientific entity that provides the basis for synthesizing many of the basic sciences into a discipline focused on the effective management of rangeland/grazing land ecosystems. He pointed out one distinct issue…" To accomplish synthesis, **organization** is essential, as is **communication**". What has lacked in most components of the profession is the realization that no matter the complexity of the subject (stocking rate, ecohydrology, landscape dynamics, etc.); to apply rangeland management science is most importantly a science of **communication**. Fred Provenza stated that the role of today's rangeland scientist is to provide understanding of the structures, processes and functions that are critical to the "wise" management of rangeland/grazing land ecosystems. To answer the call for communication and knowledge generation in the 21st century, those who study, assess, create policy, assist and manage natural resource ecosystems must coalesce around a common vision of "Why?" the systems are important, "How?" we can most efficiently and effectively manage them, and "What?" will become the actions and decisions that influence the future of this vital natural resource. The proposed symposium builds upon the questions of the days sub-plenary session and provides insight from rangeland managers and ideas for communication that traverses science to management.

Moderated by Bill Fox with special guest: Special Agent H. L. Bentley. Speakers will include Neal Wilkins (East Foundation), Meredith Ellis (rancher) and Martin Carcasson (CSU).

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Ignite Your Rangeland Collaboration: Lessons Learned and Keys to Success

Organizers: Terri Schulz, Mark Brunson, and Michael Duniway

Collaborations occur in many different contexts from landowner led groups sharing best practices to co-management of a property. Some are formed to share information and others to resolve conflicting priorities. Are there characteristics of collaboration that ensure success or predict failure? Four – six speakers from a diversity of collaboratives will tell the story of their group and why they have been successful. These ignite presentations will focus on lessons learned and themes which are transferable across a variety of collaborations. After the presentations, a discussion with the audience will determine how universal the themes are.

Speakers:
- John Sanderson - Collaborations in Conservation: What do they look like, how do they work, and when do they succeed
- Terri Schulz – Collaborative Adaptive Rangeland Management project in Colorado
- Lynn Huntsinger – Ranchers, Agencies, Scientists, and Consultants work together as the California Rangeland Conservation Coalition
- Mike Duniway – Well Pad Reclamation Research & Collaboration in the Uinta Basin
- Maria Fernandez-Gimenez – Co-creating Knowledge for Action with Women Pastoralists in Spain
- Brian Martin - Ranch Community Collaboratives and Conservation in Central Montana
- Nathan Sayer - Species of Capital in Collaborative Conservation: the Malpai Borderlands Group
- Jay Angerer – Developing national livestock and rangeland information systems: Lessons learned and adaptations
- Mark Brunson – Can boundary-spanning collaborations help us cross the desire/outcome barrier?

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Session 35	Silver	**Ignite Your Rangeland Collaboration: Lessons Learned and Keys to Success (Ignite)**
Session 36	Windows	**Improving Communication and Collaboration Among Diverse Experts (Workshop)**

Collaboration between experts from different fields and backgrounds is essential in producing actionable science that is applicable as well as accepted and trusted. Diverse expertise, languages, cultures, and priorities can challenge a team's progress, and ineffective collaboration can lead to misunderstanding, inefficiency, and frustration, impacting progress and reducing the acceptance and perceived trustworthiness of results. Improving communication helps to incorporate perspectives of diverse stakeholders, including those who are frequently under-represented or overlooked, and improve public understanding of the benefits of scientific work and its results.

The goal of this workshop is to help bridge the gap between the scientific, managerial, and administrative communities; to improve actionable, collaborative research; and to increase the presence and relevance of research findings in the decision- and policy-making process. Participants will learn and practice ways to transform complex scientific studies into concise descriptions of problems, goals, methods, and relevance using less jargon-heavy and technical language.

The workshop consists of four parts and is built around the Message Box, a widely used concept to communicate complex problems, and guided conversations among three people from different fields (e.g., scientist, management officer, agency employee). Participants first learn the basics of science communication to a broader audience, before being introduced to the Message Box concept, including goals and examples. Then, participants team up in groups of three to apply the concept using their own work and evaluate each other. Finally, all participants will share their experience with each other.

Organizers/hosts:
Toni Klemm, Ph.D., Texas A&M University, College Station, Texas
Cait Rottler, Ph.D., USDA Southern Plains Climate Hub, El Reno, Oklahoma

Toni Klemm and Cait Rottler are postdoctoral researchers. They have extensive experience working in interdisciplinary groups and have been teaching and practicing science communication for several years.