



Finding common ground: Collaborative adaptive management for conservation and livestock-based livelihoods in the Greater Yellowstone Ecosystem

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Abstract

Rangeland social-ecological ecosystems experience conflicting social goals for land use that can stall progress towards effective governance and land management. This can be detrimental to social and ecological wellbeing. In the western United States, disparate land use goals for wildlife conservation and ranching within sustainable rural communities have led to polarized management contexts and legal challenges. At the US Sheep Experiment Station (USSES), a federal research ranch located in the Greater Yellowstone Ecosystem (GYE), researchers, diverse community partners and organizations, and ranchers are asking: what would happen if conflicting groups agreed to manage the land together in a participatory, co-production manner within a scientific research project framework? Could we learn to work with, rather than control, the rangeland social-ecological system and one another to achieve common objectives and outcomes? In this study, we report on the initial phases of the USSES Collaboratory, a multi-year collaborative adaptive rangeland management project focused on rangeland domestic sheep systems, rural livelihoods, biodiversity conservation, and climate adaptation. Initial social and ecological assessments have been used to inform the development of management goals and experimental treatments for a participatory grazing experiment. We report early key lessons from the baseline social assessment and initial objectives-setting workshops, which will inform how we work to bring divergent viewpoints together to build common ground based on increased trust and a new, shared understanding of complex systems dynamics.

Introduction

Rangeland social-ecological systems include multiple ecological processes and societal goals including livestock production, biodiversity conservation, and recreation, and management for numerous ecosystem services (Reid et al., 2014). The potential for conflict over uses of these systems is particularly high for privately-owned working lands where ranchers or pastoralists operate within a patchwork of public-private land ownership near protected areas (Bindi, 2022). Local-scale conflicts over management and policy can become regional, national, or even international discourses (Epstein et al., 2021; West, 1994). Diverse and competing demands of rangelands' social-ecological systems highlight larger social issues related to incongruent values and goals for local food systems and conservation (Barry & Huntsinger, 2021; Loconto et al., 2020). If left unaddressed, disagreements over land use values lead to continued frustrations and actions that drive negative social and ecological outcomes (Webel & Galtung, 2007).

These conflicts are evident in the Greater Yellowstone Ecosystem (GYE), the broader ecological region that surrounds Yellowstone and Grand Teton National Parks, federally-protected areas in the US Intermountain West. Here, rangeland-based livestock production shares a diverse and complex landscape with numerous protected species across a patchwork of public and private land ownership patterns. Various actors, including state and federal public agencies, conservation organizations, ranching organizations, and others have experienced substantial conflicts over priorities for land use in this region (Epstein et al., 2021). However, in the ever-changing western US, exurban development and increasing climate variability have induced shifts in ecological dynamics which are threatening the goals of multiple actors at once, including those who have long been foes. As conservation organizations, public land management agencies, ranchers and the ranching industry, and researchers increasingly recognize the value of working together, new opportunities are emerging to transform long-standing environmental conflicts. Transdisciplinary research, which actively engages the knowledge of diverse societal partners and scholars to address society's most challenging problems, offers a methodology by which researchers can initiate new conversations to bridge the social divisions (Reid et al., 2021).

Methods

This paper reports early results from “The Rangeland Collaboratory”, a transdisciplinary rangeland research project designed to address adaptive capacity and conflict in rangeland domestic sheep systems in the US Intermountain West. Initial results include: 1) an overview of a baseline social context assessment, and 2) management objectives and hypothesized synergies/trade-offs developed from participant workshops in 2024. The project is based at the US Sheep Experiment Station (USSES), a commercial scale (19,400 ha) research sheep ranch operated by the United States Department of Agriculture - Agricultural Research Service, Range Sheep Production Efficiency Unit (USDA-ARS-RSPER). The USSES is on the eastern edge of the GYE and is comprised of sagebrush steppe and montane/sub-alpine rangeland systems in Clark County, Idaho and Beaverhead County, Montana, USA.

Collaborative adaptive management (CAM). CAM is a form of adaptive management that uses the action-oriented methodologies of participatory research to braid the knowledges of multiple land management and scientific communities with experimentation resulting in the promotion of learning over time (Wilmer et al., 2018). Researchers and partners identify goals, objectives, experimental treatments, indicators for success, and triggers for action. As a management plan unfolds, the science-stakeholder team monitors and evaluates results and options for adaptation and modifies the management plan based on their own learning. Additional levels of learning may be achieved as the team



recognizes limitations of their earlier assumptions and modifies actions, objectives, or even the project goal in a co-produced iterative process.

Structure of the Collaboratory. The project is modelled after the Collaborative Adaptive Rangeland Management experiment implemented at ARS's Rangeland Systems and Resources Research Unit in Colorado, USA, but includes several modifications for the USSES context (Augustine et al., 2024). Throughout 2023-2024, social scientists at USSES conducted a baseline assessment of stakeholders involved in ranching, conservation, public administration, recreation, or research in the surrounding region. This assessment involved semi-structured interviews, participant observation, literature review, and initial meetings with various individuals or groups to elucidate key perspectives of public actors (Wilmer et al., 2018). At the same time, the research team conducted plant community and animal science assessments at USSES. Then, we developed an experimental design outlining key parameters (e.g. management of a band of white-face range sheep, no additional fencing), the requirement for certain areas of focus (livestock, social, wildlife, and vegetation outcomes), and identification of which management decisions stakeholders could use in adaptive management (livestock and vegetation management, social activities, etc.). We held a group tour and subsequent meetings throughout 2024 to identify core objectives for a forthcoming adaptive management plan.

Results

Social baseline data reveal context of conflict and collaboration. The GYE has fostered complex forms of conflict among environmental and agricultural interests over priorities for land use, livestock grazing, and wildlife habitat, particularly on public lands viewed as having particularly high conservation value. For example, wildlife advocates and agencies have long worked where livestock and wildlife goals overlap to maintain habitat for some of the continent's most iconic species, such as grey wolf (*Canis lupus*), grizzly bear (*Ursus arctos horribilis*), Greater sage grouse (*Centrocercus urophasianus*) and big horn sheep (*Ovis canadensis*) whose populations have been substantially reduced due to agricultural expansion and settlement of the region. Conservation advocates we interviewed describe themselves as working to protect and help wildlife, ecosystems, and public access to natural resources. They advocate for increased legal protections and programs to enhance wildlife populations and mobilized litigation efforts to this end. They also take on public education roles and organized support for land management changes, such as reductions in public grazing permits. The ranching industry has sought to maintain the financial and ecological viability of individual ranching operations, and the vitality of rural communities dependent on ranching. Ranchers we interviewed described themselves as stewards of the land. They seek to maintain their ranching lifestyles, cultures, and businesses, and their access to transhumant grazing practices on federal lands. Pressures from a globalized market, increased environmental regulation, and the interactive effects of social and climatic change have prompted them to adapt genetics, range management, and marketing to new realities, and to engage in more collaborative and advocacy activities.

Despite these dynamics, many forms of collaboration have supported solutions for wildlife and land management issues. By the early 2000s, some conservation and ranching advocates across the western US grew tired of persistent conflict and came together to conceptualize "The Radical Center" (White, 2008). This idea recognizes the common need to steward healthy ecological and social systems, and to prevent exurban development (Brunson & Huntsinger, 2008). It motivated a conversation about how enhanced financial and social viability of ranching operations and communities could help limit exurban development and therefore help conserve wildlife habitat.

Table 1: Stakeholder-developed rangeland management objectives (blue cells), and the hypothesized relationships among them, including potential synergies (green cells) and trade-offs (grey cells) for a ranch-scale grazing study in the Greater Yellowstone Ecosystem case study.

	Social systems	Livestock systems	Wildlife biodiversity	Vegetation biodiversity
Social systems	Multiple uses multiple perspectives; reduce conflict; promote healthy local food systems; increase community adaptive capacity; intergenerational learning	Increased adaptive capacity, fair wages and profit; reduced conflict; connectivity to local food systems	Increased awareness and connectivity to ecological systems and wildlife; reduced conflict; increased multi-party buy in for science-based management	Increased awareness and capacity to manage for vegetation biodiversity
Livestock systems	Reduced access for livestock to seasonal grazing ranges; increased competition for land use from recreation or development; loss of social license to operate	Improve animal performance and ranch profitability	Decreased disease, depredation, or habitat competition; improved trust, reduced conflict in management of livestock-wildlife interactions	Livestock grazing and/or prescribed fire management used to enhance heterogeneity, which bolsters livestock system flexibility
Wildlife biodiversity	Increased negative interactions among public users and wildlife; increased conflict over conservation efforts	Increase disease, depredation, or habitat competition among livestock and wildlife	Maintain and improve connectivity, biodiversity; reduce conflict with humans	Increase biodiversity, connectivity, and heterogeneity to enhance wildlife and plant community outcomes
Vegetation biodiversity	Negative effects of multiple land uses, including recreation, urban development or other uses on plant communities.	Negative livestock grazing impacts on riparian or upland biodiversity; loss of biodiversity due to invasion in turn reduces livestock performance	Habitat modification via development, invasive plants, or fragmentation reduce processes that support landscape and regional-scale conservation outcomes	Maintain or increase habitat heterogeneity and connectivity, and core native rangeland plant communities; reduce invasion

Identifying objectives for the USSES Collaboratory. In addition to the social baseline assessment, we also engaged participants in the initial USSES Collaboratory meetings to identify which social and ecological objectives they want to prioritize for the participatory grazing experiment. The scientist team provided guidance that objectives needed to include social and livestock systems, as well as wildlife and plant biodiversity realms. Participants outlined key desired future conditions and discussed potential trade-offs and synergies among objectives, which the science team expanded (see Table 1). During objectives workshops, participants discussed the challenge of successfully balancing multiple objectives. They also identified common themes in supporting healthy ecological and social communities, learning, reducing conflict, and coming together on the land.

Conclusions/Implications

We have outlined methodology for the USSES Rangeland Collaboratory, a co-produced research project seeking to find common ground on rangeland systems in the GYE. The baseline social context assessment provides a grounded view of cultural and political dynamics within the GYE, and it will inform more meaningful engagement and learning for participants in the future. Next steps include the development of culturally-oriented activities within the larger project to foster outcomes towards social objectives. We will also co-develop key indicators, treatments, and monitoring plans to advance adaptive management for project objectives over the next two growing seasons via a participatory ranch-scale grazing study. Collaboration with wildlife experts and engagement with agricultural economists will be key to identifying systems level outcomes and synergies/trade-offs among objectives.

Some twenty years after ‘The Radical Center’ was conceptualized, the GYE face new challenges as climate, land use, and community change dynamics continue reshaping the conversation (Martin, 2019). The USSES Collaboratory follows a CAM model which lends the power of research to help rangeland stakeholders bridge social worlds. Our initial experiences suggest that the complexity of the project creates the need for investment in problem exploration. It is not reasonable to expect research data to sufficiently bridge divergent goals among rangeland actors. The challenge of finding common ground now requires a concerted effort to transform conflict via depolarization, systems-thinking, and science-based solutions that together create a shared, creative search for a new, peaceful reality (Webel and Galtung, 2007; Zecher, 2024). Across the GYE, CAM may require intentional infusion of social sciences and the humanities, including peace studies, which have been valuable in other rangeland systems for challenging assumptions about human-nature relationships and pointing toward productive conflict transformation (Butler & Gates, 2012). Our early workshops indicate the potential of Collaboratory participants to engage in respectful dialogue and problem exploration, but the challenge ahead will be to co-develop creative strategies that actually move the community beyond the livestock-wildlife divide at the USSES and across the GYE.

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