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Bridging academia and outreach: mentorship programs for future rangeland scientists

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Abstract

Integrating graduate students into mentorship programs that encompass teaching, research, and Extension/outreach is essential for developing a skilled workforce capable of addressing the multifaceted challenges of rangeland management. Although many graduate programs focus on developing academic skills necessary to conduct rangeland research, students often enter the workforce unprepared to engage with diverse stakeholder groups that comprise the rangeland community. We explore how outreach specialists can collaborate with academic researchers to create deliberate, comprehensive mentorship frameworks that enhance graduate education and professional development. This paper directly responds to Theme 2 of the 2025 International Rangeland Congress as we present a model that involves a synergistic approach to incorporating stakeholder engagement with student training. Specifically, this model integrates the expertise of outreach specialists, who provide practical, field-based insights, with academic researchers, who contribute theoretical and methodical rigor. The resulting collective collaboration ensures that graduate students gain a holistic understanding of rangeland science, encompassing both traditional and innovative practices. Critical components of the mentorship program are 1) co-designing research projects that address real-world, producer-driven problems, 2) engaging students in community-based outreach activities, and 3) fostering partnerships with local stakeholders. The hands-on approach both enhances students' technical skillsets and builds capacity for effective communication and collaboration - essential for future leadership roles in rangeland management. By embedding graduate students in multidisciplinary teams and providing opportunities for participatory research, this mentorship model aims to strengthen the academic-research-outreach paradigm and further embed graduate students in the rangeland community. A holistic mentorship approach ultimately contributes to more resilient and sustainable rangeland outcomes and prepares the next generation of rangeland scientists to tackle the complexities of global rangeland ecosystems.

Introduction

Rangeland science can address some of the most pressing global challenges, including food security, climate change adaptation, biodiversity conservation, and sustainable land use. Rangelands cover 54% of the global terrestrial surface, amounting to approximately 79.5 km^2 (Rangelands Atlas 2021). Consequently, they support key ecosystem services (Macfadyen et al. 2012) such as carbon storage, wildlife habitat, and water filtration, while simultaneously providing a foundation for livelihoods based in agriculture. Effective management of rangelands is critical, then, and requires science and practice to be integrated to address complex challenges and "wicked" problems, from climate change to biodiversity loss.

Although rangelands have a significant role in global sustainability, a gap exists between academic research and practical application. The results from research generated by universities and research institutes can sometimes stay in the "ivory tower" and fail to reach practitioners, policy makers, and local stakeholders who depend upon and manage rangelands across the globe. Contributing factors include limited communication among groups, different priorities between academics and managers, and limited training opportunities that integrate outreach and applied applications. Consequently, it is important to bridge this divide to ensure that rangeland science effectively addresses real-world challenges.

Mentorship programs create the potential to serve as the crucial bridge between academia and outreach, helping to prepare the next generation of rangeland professionals to apply their knowledge in practical settings. Mentorship – the guidance of a less experienced individual (mentee) by an experienced professional (mentor), creates a collaborative framework for knowledge transfer, skill development, and professional growth (Allen et al. 2004). Within the context of rangeland science, mentorship can connect students and early-career professionals with experienced researchers, outreach specialists, and land managers, fostering a well-rounded understanding of both scientific principles and their application in diverse landscapes.

This paper explores the role of mentorship programs in bridging the gap between academia and outreach in rangeland science graduate education. We first examine the challenges that contribute to the academic-outreach divide, and then discuss gaps in rangeland graduate curriculum. Finally, we offer recommendations for designing and implementing mentorship programs that are tailored to the unique needs of rangeland science. By integrating cross-disciplinary mentorship into the broader framework of professional development, the field can cultivate a workforce that is not only scientifically literate, but also skilled in outreach, communication, and collaborative problem-solving.

Challenges Between Academia and Outreach

Several challenges are inherent when discussing the disconnect between academia and outreach in rangeland science. Among them are divergent priorities and goals, communication barriers, a perceived disconnect between theory and practice, time and resource constraints, the complexity of rangeland systems, and a decline in integrating traditional ecological knowledge (TEK). Academics tend to prioritize research advancements, publishing peer-reviewed articles, and securing grant funding. This can result in not fully understanding the needs of stakeholders, such as helping them adapt to climate change (Briske et al. 2015). Further, the pressing needs of stakeholders may not align with those outlined in funding requests for applications (RFAs). Communication between academia and outreach can be fraught, with research findings often published with technical jargon. Reed et al. (2014) examine principles for effective knowledge exchange in environmental management and suggest that knowledge exchange needs to be designed into research questions; the needs of both academics and stakeholders should be systematically represented in research; and finally, that long-term relationships must exist and be built on trust to construct a dialog between academics and stakeholders to ensure co-generation of new knowledge. Drawing parallels to rangeland science, if both academics and outreach professionals incorporate these principles, together they can increase the cross-pollination needed between theory and practice.

This cross-pollination can be hindered by time and resource constraints, as well as the complexity of rangeland systems, and lack of TEK. For example, faculty members are tasked with balancing research, teaching, advising, and service, leaving little time for outreach. Outreach is often underfunded and understaffed, leading to reduced capacity to facilitate knowledge transfer between academia and stakeholders. Further, granting agencies usually do not require outreach, reducing the impetus to include it in proposals. Thurow et al. (2007) explain that in the United States, a shift has occurred in funding from a baseline support formula to one that relies on competitive research grants that don't support management-oriented research. Engle and Wailer (1993) express frustration that the increase in competitive grant funding moves rangeland professionals away from long-term research priorities and instead has them focus on grantor priorities. In addition, rangeland systems are complex and face many "wicked problems," such as invasive species and climate change (Briske et al. 2015); this can result in disciplinary silos instead of cross-pollination between research groups. Lastly,

modern research can overlook TEK, despite it being developed throughout time with rangeland systems (Berkes et al. 200). This can result in stakeholder groups feeling that academics are untrustworthy and further reduces collaboration between academia and local communities.

Gaps in Rangeland Science Curriculum

Research to date of rangeland science curriculum is not exhaustive; however, the research and commentaries that do exist underscore the need for a more comprehensive education that includes formal mentorship and collaboration between academia and outreach. Buckhouse and Powell (1985) express that undergraduate students in rangeland resources at Oregon State University (United States) are increasingly coming from more urban/suburban backgrounds; the same has been shared anecdotally among rangeland professionals recently and holds true for both undergraduate and graduate students. The authors further conclude that a student can have strong academic skills, but "if he/she cannot open the pasture gate, the knowledge may never be shared with the landowner" (Buckhouse and Powell 1985). It is not only practical skills that may be lacking in today's students, but lack of stakeholder involvement in rangeland curriculum development. For example, Taylor and Andrews (2012) describe a complete restructuring of rangeland graduate curriculum in Australia, which entailed a strategic approach that combined focus groups with stakeholders, course scoping workshops, and research on learning. The focus groups identified current and future issues and challenges; through the course scoping workshops, the authors detail that a significant outcome was "the learning and insights the scientists and academics gained about real-world contexts, local knowledge, and the emerging issues perceived by a wide range of stakeholders" (Taylor and Andrews 2012). This has led to increased awareness and ownership of the program by stakeholders, ultimately helping the program be recognized as "best practice" (Taylor and Andrews 2012).

Rangeland curriculum has a direct impact on the abilities of graduates entering the workforce. Thurow et al. (2007) surveyed Society of Range Management (SRM) members and undergraduate students at the University of Wyoming (United States) to investigate what aspects of rangeland curriculum were perceived as important. Within the top ten skills needed by professionals, an average score of 4.3 ± 0.8 (1 = grasp of general concepts to 5 = highly detailed proficiency) was given by survey respondents on public interaction (listening/collaboration/mediation skills), 4.0 ± 0.9 was given for technical writing, and 3.9 ± 0.9 was given for public speaking. Further, resource management (scientific application and techniques) and communication skills were listed as the top two things that respondents indicated a rangeland science program should provide to students. The authors conclude that employers that enact management objectives (e.g., state and federal land management agencies) are likely to be frustrated by the lack of focus on management and low proficiency in communication and quantitative skills (Thurow et al. 2007). Although this study addressed undergraduate students, collectively, we as range professionals who train students have not purposefully addressed these issues that arise in undergraduate rangeland curriculum and focus our research efforts – and therefore, the graduate education of our students – on fundamental (e.g., 'basic') research instead of emphasizing rangeland management and the proficiency of our students to communicate about it.

A Comprehensive Mentoring Framework For Rangeland Graduate Students

Using the knowledge gained from the existing research outlined above, we provide a comprehensive mentoring framework for rangeland graduate students that strives to address both the challenges between academia and outreach and the gaps in rangeland science curriculum. There are three mentorship components (MC) to the framework: MC1) addressing producer-driven problems, MC2) community-based outreach activities, and MC3) partnerships with local stakeholders (Fig. 1). The framework further outlines both *who* and *how* these components can be accomplished. Across all MC are graduate students, cross-pollinated researchers, and outreach specialists. Cross-pollinated researchers are those that cultivate a rich, inter-disciplinary "intellectual ecosystem." These researchers actively integrate ideas from other specialities to foster innovation and holistic approaches to rangeland management. An example would be a rangeland scientist who collaborates with an economist to evaluate the financial implications of sustainable grazing practices or with sociologists to understand the decision-making processes of producers during drought. Outreach specialists are trained and have the technical expertise in rangeland management, but also have a breadth of interpersonal skills such as

relationship and capacity building, as well as the adaptability to tailor their educational approaches to different audiences. It is critical throughout the three steps of the framework that graduate students are trained by both cross-pollinated researchers and outreach specialists.

The focus of MC1 is constructing a strong foundation with producers. Researchers and outreach specialists can work collaboratively with graduate students to engage producers through several different avenues. One avenue would be to conduct focus groups and listening sessions with producers, with the purpose of understanding their perspectives on rangeland management and what challenges they face. Another avenue would be to conduct a formal needs-assessment to identify gaps between current states and desired outcomes, as well as to prioritize identified needs. Both methods will help promote knowledge exchange and the co-development of potential solutions, such as alternative grazing methods, that can then be researched. This not only helps facilitate trust, ownership, and collaboration with producers, but it demonstrates that their input is valued. A facilitator is likely to benefit these methods and can help remove the emotion that often surrounds critical rangeland management threats. Finally, integrated grants – grants that require outreach, in addition to research – are grants that provide several benefits. One, they are competitive and often have higher funding caps (e.g., $750,000 to several million USD) that will be viewed favourably by university administration. Two, because they require research *and* outreach to occur on the same project, there is ample opportunity to provide graduate students with training and experience in both aspects. Three, integrated grants typically allow for an interdisciplinary approach between researchers and outreach specialists, helping to underscore the importance of both to graduate students.

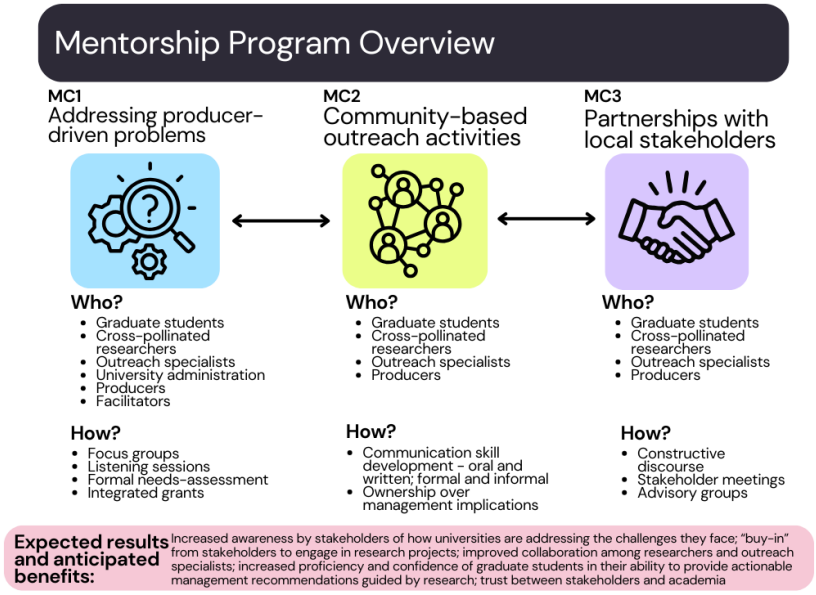

Figure 1. A mentorship program overview with three mentorship components (MC): MC1, addressing producer-driven problems; MC2, community-based outreach activities; and MC3, partnerships with local stakeholders. For each MC, a description of *who* and *how* is provided, along with overall expected results and anticipated benefits.

MC2, community-based outreach activities, provides mentorship for graduate students that is often disregarded. Outreach activities provide several informal opportunities for graduate students to develop their skills, particularly in both oral and written communication. This can be in addition to any formal (e.g., classroom-based) communication training that the university may offer. Graduate students can contribute to outreach activities and learn how to translate complex scientific concepts into accessible language for diverse audiences, through presentations and outreach articles for producers and the public. Another benefit of mentoring graduate students through outreach activities is that they will see the real-world application of their scientific knowledge, by helping to solve practical, producer-driven problems. Further, graduate students will

feel empowered through participation and take ownership over the potential management recommendations suggested by their research. Finally, producers can also provide mentorship through these activities, by fostering relationships between academia and outreach, helping to expose students to diverse viewpoints and experiences.

The last piece of the mentorship program is MC3, partnerships with local stakeholders. This emphasizes and expands the groundwork that is laid in MC1 with producers. Specifically, MC3 helps graduate students enhance the success, relevance, and sustainability of their research. Partnerships further help graduate students learn the real-world application, as well as the social, cultural, and economic contexts of their research. These contexts often result in discourse that can be applied constructively and either developed into future research questions or used to create outreach programs that address stakeholder concerns. Some research projects – particularly those supported by integrated grants – benefit from an advisory group of stakeholders. By attending stakeholder meetings or leveraging an advisory group, graduate students can further develop their communication skills and help foster trust between academia and producers. Additionally, these interactions with stakeholders help graduate students increase career preparedness. By understanding the multi-faceted nature of rangeland management, students will be better prepared for interdisciplinary careers. Lastly, the involvement and familiarity with stakeholder groups explicitly demonstrates experience in applied research, outreach, and collaboration, thereby helping make students more competitive on the job market.

Implications

As outlined above, challenges exist between academia and outreach; these challenges can be overcome by mentoring the next generation of rangeland scientists to be 1) cognizant of the challenges, and 2) have the capacity to address them. We recommend that this is best achieved through mentorship of rangeland graduate students, via a three-component mentorship program that overcomes a common concern that the ivory tower of academia is "producing too much of the wrong kind of information" (McNie 2006). In addition to the benefits to graduate student training, the mentorship program we outline has several benefits for research/academia and stakeholders. Specifically, research quality may increase, as the increased collaboration with stakeholders ensures that research is aligned, and it may also improve access to local resources. Further, collaboration among researchers and outreach specialists will broaden perspectives on rangeland management, ultimately encouraging innovative and interdisciplinary approaches to problems. Stakeholders will gain access to emerging knowledge, ideally benefiting their operations. They will also benefit from the mutual learning that will co-occur with the academic insights the graduate students provide and the practical, hands-on knowledge they use daily. Overall, the mentorship program we outline has the potential to move the needle in rangeland graduate curriculum, bridging the gap between academia and outreach, while simultaneously fostering a new generation of leaders that are adept at collaborate, interdisciplinary, and impactful work.

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