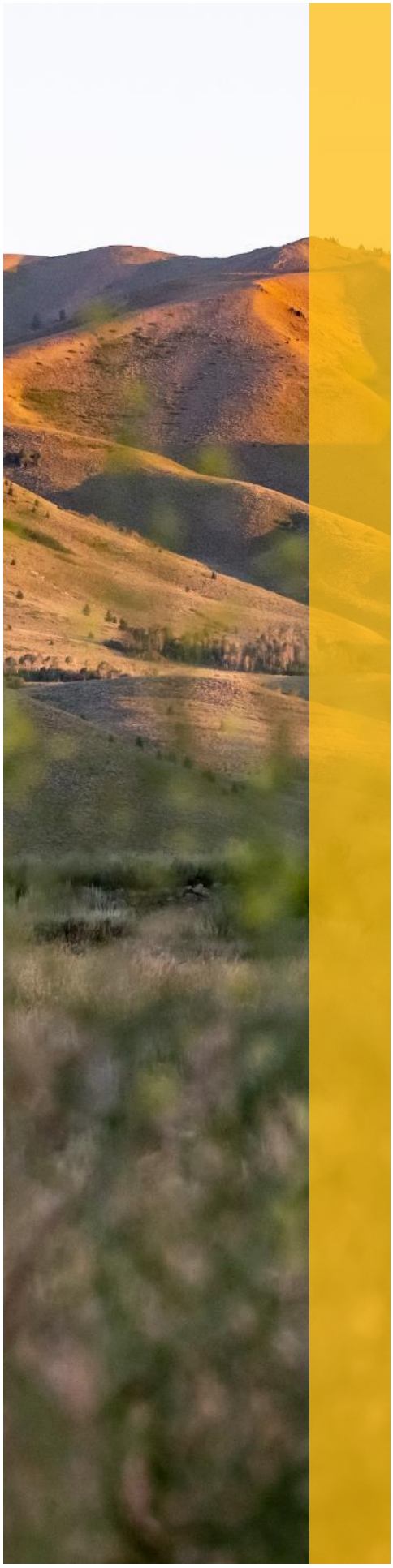
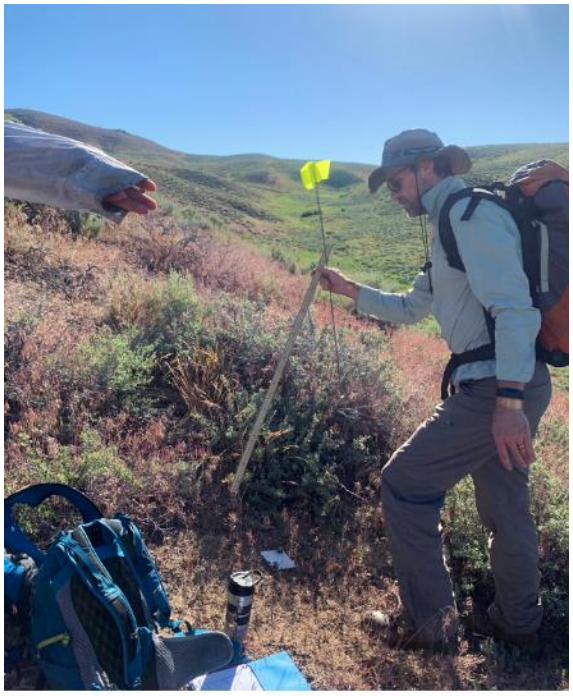
ANNUAL REPORT

2022



University of Idaho
Rangeland Center
College of Natural Resources, College of Agricultural and Life Sciences and UI Extension

University of Idaho Rangeland Center 2022 Annual Report



The University of Idaho (U of I) Rangeland Center (RC) Annual Report summarizes activities conducted to address the focus areas outlined in our Strategic Plan (2017-2021). These focus areas provide a framework for the projects we pursue:

- Fire/fuels/invasive plants and restoration
- Rangeland uses (including grazing, recreation, energy, etc.)
- Rangeland wildlife
- Watershed function
- Climate variability

The Center has three operational goals which guide ongoing staff activities and expenses to accomplish work related to the Center's focus areas:

- Engage partners and stakeholders to jointly provide leadership for discovery of new knowledge and create science-based solutions for rangelands.
- Provide objective and relevant rangeland information for individuals, organizations, land managers, communities, policy makers and others interested in rangelands.
- Offer learning opportunities for rangeland stewardship.

Individual projects come from conversations with members of the Rangeland Center, including our Partner Advisory Council (PAC), faculty, and U of I leadership. The project list is turned into an annual operating plan that describes how Center resources are used to support Center members to empower research, outreach, and education to produce solutions for contemporary rangeland issues.

2022 Center Activities

The Rangeland Center focuses research and outreach around the five topic areas outlined in our strategic plan, emerging topics identified at our spring retreat, and subjects suggested by our Partners Advisory Council (PAC). This annual report highlights activities supported by Rangeland Center financial or staff resources in 2022 and includes other rangeland activities occurring at the U of I.

Fire/Fuels/Invasive Plants and Restoration – There is an important need for research and outreach on topics related to wildland fire/fuels, invasive plant species, and rangeland restoration. Our work recognizes the importance of increasing the use and frequency of fire to manage woody plants, such as juniper, in some settings while reducing the frequency and extent of wildfire in other settings, such as cheatgrass-invaded sagebrush steppe. We also study approaches for restoration of systems altered by fire and invasive plants.

Specific challenges identified in our strategic plan include post-fire policies that limit restoration opportunities and the need for ecologically and economically effective approaches to minimize rangeland fire risk/severity and address restoration. In 2022, several ongoing projects continued research on these topics. A four-year project funded to investigate dormant season grazing to reduce annual grasses is in its second year of data collection. Another project assessing the economic and ecological effectiveness of different types of fuel breaks wrapped up field work and participants are working on data analysis. In another project, Center members Tim Prather and Eva Strand are examining how cheatgrass increases flame height in different vegetation communities. Dr. Prather and his graduate students are also looking at how effective the herbicide indaziflam is at reducing annual grass cover.

Project Title and Status of 2022 Projects	**Participants** * Indicates Rangeland Center Member G Indicates Graduate Student
Dormant season grazing to reduce cheatgrass and promote perennial grasses. In 2022, the team monitored vegetation before and after summer and fall grazing. A local rancher grazes cows in the spring and fall to assess the influence of dormant-season grazing. The project will last 2 more years. Funding from US Forest Service ($425k) and from the US Fish & Wildlife Service ($19k). *RC Role-Staff assisted in securing funding, participated in research and promoted project at Fall Forum field tour*	A. Hulet, J. Sprinkle*, K. Lee*, K. Launchbaugh*, E. Winford*, D. LauritzenG, JB PlayfairG
Assessment of fuel break performance – fire risk, ecology, and economy. In 2022, field work wrapped up, preliminary analysis and results were presented at the Association for Fire Ecology conference and data were delivered to the Bureau of Land Management (BLM). In 2023, data analysis will continue, manuscripts will be drafted for publication. Funding from the Joint Fire Science Program ($420k) and the US Fish & Wildlife Service ($81k). *RC Role-Staff assisted in securing additional funding and in stakeholder engagement.*	E. Strand*, K. Lee*, T. Prather*, E. Winford*, K. JohnstonG

Rangeland Uses – Rangelands provide many uses and values, including livestock grazing, recreation, and sustainable energy production. Rangeland Center faculty are conducting significant work on the ecological impacts and benefits of livestock grazing to inform management decisions. Each year, RC members present science-based options for livestock management to livestock producers and land managers in several outreach events including the Idaho Range Livestock Symposium. We also work closely with the team at U of I's Rinker Rock Creek Ranch to better understand how working ranches provide multiple benefits to society and find ways to concurrently consider the ecologic, economic and social implications of management and conservation actions.

Challenges identified in our strategic plan included policies that limit management flexibility to account for annual variations in forage, water, drought, pests, disturbance, and market conditions; a need for greater understanding of how land uses affect rural community stability; and increased public understanding of the complexity of livestock grazing encompassing both unfavorable and beneficial effects. As livestock grazing remains a dominant use of Idaho's rangelands, several projects focus on livestock use and health. Center member Jim Sprinkle is leading a project to investigate how cows can become better adapted to rangeland conditions. Center member Carmen Wilmore is leading another project comparing forage intake and foraging efficiency of two different groups of cattle.

As increasing recreation use on rangelands has increased the need for information and management options, and we have responded by developing interdisciplinary project teams. One team, led by Jason Karl, is comparing various methods of counting recreation user numbers. Another project seeks to understand the impacts of recreation use on different communities.

Title and Status of 2022 Projects	**Participants**
Virtual Fence. Project initiated in 2021 with $1 million in funding from USDA. An interdisciplinary team of faculty and graduate students across Idaho and Washington are develop a rugged low-cost virtual fence prototype. *RC Role-Staff led the development of the grant and are leading the project team.*	K. Launchbaugh*, J. Karl*, K. Lee*, Hope de Avila[G], and many others.
National Grazingland Information System. Project initiated in 2019 with funding from NRCS Conservation Initiative Grant with additional funding secured in 2021 from USDA RREA. An online searchable database of range-related science and technical documents is now available, and curated collections are in development. *RC Role-Staff worked significantly in proposal development and are active participants in the ongoing project. Range Center interns participated in document annotation.*	J. Karl*, J. Kenyon*, K. Launchbaugh*, E. Winford*, and many others with the Rangeland Partnership.
Idaho Range Livestock Symposium 2022 – Managing Livestock During Drought. U of I Extension hosted a virtual symposium focused on how to manage livestock operations during the state's ongoing drought. *RC Role-Staff assisted with outreach, virtual meeting support, and event funding.*	S. Jensen*, B. Glaze*, J. Hall*, J. Sprinkle*, E. Winford*, and many others
Contribution of the range-livestock industry to the Idaho economy. The U of I Policy Analysis Group is leading this economic analysis. The project initiated in 2020 and continues to gather data. *RC Role-Staff provided stakeholder coordination and data procurement.*	G. Alward, P. Watson, R.G. Taylor, D. Becker, G. Latta, E. Winford*

Title and Status of 2022 Projects (Continued)	Participants
Measuring Recreation Use on Rinker Rock Creek Ranch. A new project in 2022 compared trail and vehicle counters and individual activity reports to assess the number and type of recreation users. GPS collars on cattle will examine the level of disturbance recreation caused livestock. Data analysis will continue through the winter, with outreach expected in Spring 2023. *RC Role-Provided start-up funding, helped write grant proposals, and assisted with implementation.*	J. Karl*, C. Weskamp*, E. Winford*, J. Sprinkle*
Managing Rangeland Recreation as a Land Use. Initially developed as a priority topic at the Center's Spring Retreat, this project seeks to compare the intensity, type, and timing of recreational use across different communities. This project is seeking funding. *Role-Staff worked significantly in proposal development and are active participants in the ongoing project.*	J. Karl*, E. Winford*, K. Lee*, K. Wallen, J. Sprinkle*, and S. Jensen*
Improving monitoring and assessment of oil and gas reclamation on BLM land. This project looked at soil and land factors that affected the success of oil and gas reclamation. The project concluded in 2022 and outreach efforts are ongoing. *RC Role-Rangeland Center interns tested soil samples and staff will help with outreach.*	S. Di StefanoG, J. Karl*,
Maternal influences on calf adaptability to rangelands. Project initiated in 2021, data collection finished in 2022. Preliminary results are expected by mid-2023. *RC Role-Little Endowment research funding.*	J. Sprinkle*, J.B. Hall*, L. SullivanG, S. Jensen*, Benton Glaze*

Rangeland Wildlife – An unquestioned and consistently affirmed value of Idaho's rangeland is wildlife habitat conservation.

Specific challenges identified in our strategic plan include inadequate understanding of how land management practices and uses in sage-steppe ecosystems affect sage-grouse and other sagebrush-obligate species, limited understanding and information about wildlife habitat values that are provided by well-managed rangelands, and a need to identify strategies to reduce conflict and competition between livestock and wildlife.

Significant research being conducted by Rangeland Center faculty focuses on sage-grouse and sagebrush habitat. The Idaho Grouse and Grazing project finished its ninth year of data collection in 2022. Rangeland Center member Tracey Johnson and her graduate students are looking at how juniper expansion and removal effects sage-grouse and their predators as well as other non-target wildlife species. Drs. Johnson and Tim Prather are also evaluating how herbicides targeted for annual grasses may influence sage-grouse habitat at the UI's Rinker Rock Creek Ranch.

Title and Status of 2022 Projects	Participants
Wildlife and humans in shared landscapes. A new website for this one-year old project is live: https://whisl.org. Data collection will continue through 2023. Funding came from the National Science Foundation ($1.6 M) and incorporates researchers from Idaho and Oregon. *RC Role-Staff will assist with stakeholder engagement and outreach.*	C. Wardropper*, L. Sheneman, N. Carter, J. Bruskotter, N. Bergmann
Effect of cattle grazing on sage-grouse habitat and demographic traits. This project completed the 9th year of a proposed 10-year study. Field work was conducted at 4 sites across Idaho on BLM allotment with permittee collaborators. Over $200k was secured for research in 2022. Researchers followed 200 radio-collared and monitored 176 sage-grouse nests and 42 sage-grouse broods. *RC Role-Travel funds, Little Endowment research funding, staff time to conduct research, and research assistance by RC interns.*	C. Conway*, K. Launchbaugh*, J. Karl*, Sanford Eigenbrode, Nolan HelmstetterG, Taylor FletcherG, Grace OverlieG, J.B. PlayfairG , many other collaborators.
Relationship between cattle grazing and diets of greater sage-grouse. The team extracted DNA from over 1200 samples of hen and brood fecal collections. Analysis will continue in 2023, and results will be published and shared. *RC Role-Staff managed the Little Endowment which provided funding.*	T. StyhlG, L. Waits, C. Conway*
Short-duration vs season-long grazing and sage-grouse brood rearing habitat in wet meadows at Rock Creek. The team published two articles in 2022, officially completing the project. *RC Role-Staff assisted in supporting outreach and the Little Endowment provided funding.*	K. RandallG, M. Ellison*, T. Johnson*
Grazing management on Andrus Wildlife Management Area. These researchers will work with the Idaho Department of Fish and Game to draft a plan for livestock grazing to enhance wildlife habitat. *RC Role-Staff assisted in supporting research and stakeholder engagement..*	K. Launchbaugh*, · Strand* T, Johnson*, Z. HulingG

Watershed Function – Sufficient, high-quality water is a rangeland resource important to an array of land users. A challenge raised in our strategic plan was the lack of awareness and understanding of the link between rangeland watersheds and ground and surface water abundance and availability for other purposes, including farming, commercial and domestic use. The need for a greater understanding of how management and conservation activities effect riparian health and ground water resources was also recognized.

Center staff have continued to be involved in a three-year old project looking at the effects of restoration techniques like beaver-dam analogues (BDAs) on stream and meadow characteristics. Located on the Rinker Rock Creek Ranch, this project has one more year of data collection but is already hosting field visits and tours to interested land managers. Continuing to develop projects in this topic, Center member Laurel Lynch is seeking funding to better understand the combined effects of BDAs and livestock grazing affect water quality and quantity.

Title and Status of 2022 Projects	Participants
Assessing the effectiveness of low-tech process-based restoration techniques. One year after 60 structures were installed into a tributary to Rock Creek, the team is evaluating changes to groundwater levels, water quantity, and vegetation. This project will continue to gather data in 2023. Funding from NRCS Conservation Innovation Grant. *RC Role- Staff helped secure funding and are participating in research.*	C. Goebel*, E. Winford*, M. Ellison*, J. Karl*
Evaluate the social, economic, and ecological impacts of riparian management practices. In 2022, the team searched for and hired a graduate student. Funding ($495k) for project came from the USDA–AFRI. *RC Role- Staff helps with project coordination.*	M. Ellison*, T. Johnson*, T. Thomas[G], K. Lee*, J.D. Wulfhurst*, J. Aycrigg*, E. Winford*,
Effects of beaver dam analogs on mesic meadow function and carbon cycling. This project is seeking funding. Data gathered in 2021 and 2022 will help determine the effects of BDAs on carbon sequestration, forage production, and water quality. *RC Role- Staff helps with project coordination and research.*	L. Lynch*, E. Winford*, H. Neace[G], E. Incelli[G]

Climate Change – Annual climate variation and long-term climate trends are clearly affecting rangeland plant and animal communities. Research and outreach efforts are needed to understand the ecologic and economic implications of climate change on rangelands

Specific challenges identified in our strategic plan include: the need to understand how changes in seasonal temperature and precipitation patterns will affect plant and animal communities on rangelands; and insufficient awareness among land managers and users regarding consequences of climate change and opportunities for adaptive management on rangelands.

Center staff are working with partners to address these challenges. One project, led by the McClure Center, is sharing an assessment of how climate change will impact Idaho's economy. Another fact sheet, published with UI Extension, answers basic questions on greenhouse gas emissions.

Title and Status of 2022 Projects	Participants
Idaho climate-economy impacts assessment. A state-wide assessment identifies climate impacts to various sectors of Idaho's economy, including rangelands, led by McClure Center with several partners. Published in 2021, this project is actively being shared with partners across the state. ***RC Role-Staff actively participated in the project and coordinated sections on rangelands, fish, and ungulates.***	K. Himes, K. Lee*, E. Winford*, G. Latta, C. Wardropper*, and others.
Fact sheet on climate change emissions. A team of researchers published an article to answer questions with Idaho-specific information to disentangle competing narratives about the sources and amounts of greenhouse gases. *RC Role-Staff coordinated the group, contributed to document writing, and led stakeholder engagement.*	M. de Haro Marti, L. Chen, E. Winford*

Crosscutting Activities

Many activities and projects of Rangeland Center faculty, staff, and PAC cut across focus areas, topics, and needs for outreach and research. These crosscutting activities are important to accomplish our mission to create knowledge and foster understanding for the stewardship and management of rangelands. Crosscutting activities, the Rangeland Center engaged in during 2022 are listed below.

Fall Forum – The 2022 forum, "Conservation that works for rangelands" focused on themes of valuing conservation, funding conservation, and making conservation work. The forum returned to an in-person gathering at the Stephens Performing Arts Center in Pocatello. Over 80 individuals came for the full day of speakers and a half-day field trip. The Rangeland Center partnered with the U of I McClure Center for Public Policy Research, the Sagebrush Steppe Land Trust, the Bureau of Land Management, and Idaho Fish and Game.

Rinker Rock Creek Ranch – Rangeland Center faculty are central to the research and outreach mission at Rinker Rock Creek Ranch. In 2022, Rangeland Center staff and financial resources provided project support and coordination in several ways:

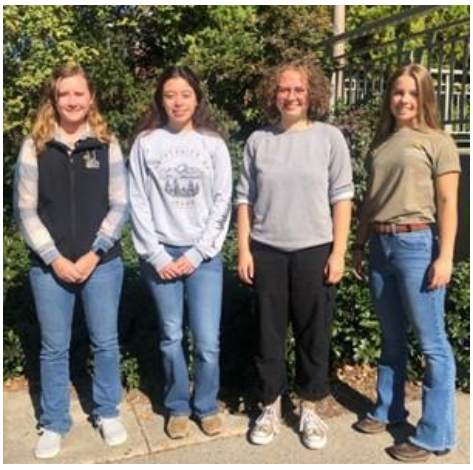
- Participated in working groups. Drs. Tim Prather and Tracey Johnson chair the Research and Monitoring working group and Eric Winford chairs the Fish and Wildlife Habitat working group.
- Director Launchbaugh secured a grant for one summer interns and Eric Winford supervised interns and assisted in setting up and maintaining facilities.
- Research and outreach by Rangeland Center members included projects on wildlife conservation, range livestock production, rangeland monitoring, riparian restoration, and recreation.
- The Rock Creek Monitoring Blitz, held in June, brought in 38 individuals from a wide range of agencies and backgrounds to learn and share range monitoring techniques. Members Karen Launchbaugh, Tim Prather, Tracey Johnson, Jason Karl, Ren Lawson, and Eric Winford helped plan and implement this annual event.

Developing Rangeland Technologies – Advancing technologies for rangeland management is also a Rangeland Center focus with staff time and resources used to facilitate several projects. An interdisciplinary team of faculty, graduate students and interns in rangeland ecology and biological engineering are designing a virtual fencing prototype. This project is in the first year of a three-year $1 million grant funded by the UDSA National Institute of Food and Agriculture. Dr. Karl also continued research and training on monitoring with drones and image analysis to support research.

Providing Rangeland Information – The Rangeland Center partnered with the McClure Center for Public Policy Research to produce a new publication, *Idaho at a Glance: Idaho Rangelands*. This two-page resource is designed for individuals who are unfamiliar with rangelands provides a broad overview of rangeland management and the many social, economic, and ecological issues in which rangelands play a fundamental role. Since the publication was completed in early October, over 400 copies have been shared with partners and agencies. The publication is available online through the Rangeland Center's and McClure Center's webpages.

The Rangeland Center continued to promote the Field Guide to Idaho Grasses and Grass-like Plants and the Backpack Guide to Idaho Rangeland Plants through Extension Publishing. Online promotion, social media posts, and flyers taken to events resulted in 121 printed copies (and 11 digital copies) of the grass book and 60 copies of the backpack guide sold during fiscal year 2022. Other resources published by Rangeland Center faculty such as our FAQ documents continued to be available through the Rangeland Center website. Jason Karl, several Center members, and the Rangeland Center Interns played essential roles in the development of RangeDocs which is a searchable database of rangeland management published articles and technical references. This project continues to be updated through the support of a USDA RREA National Focus Fund grant.

The Rangeland Partnership – Several rangeland members work actively with the Rangeland Partnership which is a unique organization of rangeland extension specialists and librarians who provide public and private land managers, researchers, Extension professionals, educators, and the public with information and tools needed for rangeland management. In 2022, Rangeland Center faculty, staff and interns work with the Rangeland Partnership to build the RangeDocs searchable database, adding documents and curating collections.



Supporting the Next Generation of Rangeland Managers – Students seeking degrees in agriculture and natural resources are a major workforce for rangeland projects conducted by our faculty. In 2022, the Rangeland Center supported and supervised seven undergraduate interns (pictured left) on campus during the academic year and two summer interns at Rinker Rock Creek Ranch. Funding for these interns came from endowments and competitive grants. These interns helped eight different rangeland faculty with several different projects performing tasks such as monitoring, data correction and entry. The interns also delivered a weekly e-mail update on rangeland events and jobs for rangeland students and recent graduates.

The Rangeland Center continue to support Rangeland Career Development Events for high school FFA students. The Idaho Event was held in Shoshone in October and the Western National event was held in Richfield, Utah in November.

The National Resource Inventory (NRI) is a USDA-NRCS led project to assess the status, condition, and trend of non-federal rangelands across the US. The Idaho NRI has been a UI-led activity for the last several years. The survey employs several undergraduate students for the summer and teaches them valuable rangeland monitoring skills. In 2022, Center Director Karen Launchbaugh directed this effort with the assistance of Daniel Lauritzen, a CNR PhD student. The project brought in $224k of funding and employed eight students.

Center Communications

In 2022, Ren Lawson joined the Rangeland Center staff as the Communication Manager.

Websites/Web pages – In 2022, we drove visitors to our website via social media posts and through emails by linking to partners' websites and resources available on our webpage to make use of our website as a landing page.

Social Media – The Rangeland Center relied on Facebook and interacted with 1,070 page-followers throughout the year. We worked closely with colleagues in CALS and the McClure Center to cross-post relevant stories. Our "reach" increased by 316% this year, and our Facebook page visits increased by 89%, meaning that our followers and individuals beyond our subscribed audience are seeing our social media content at a higher rate. The Center also set up an Instagram account this year, with 125 followers so far.

Internal Updates– Beginning in April, the Rangeland Center resumed sending monthly email updates to Center members, keeping them informed of opportunities such as research partnerships, available funding and grant deadlines, and events. Additional emails were sent for events and important announcements, such as the Fall Forum and Spring Retreat.

External Updates– The Rangeland Center resumed sending quarterly newsletters to our external audience this year. As of November 2022, the external email list had 783 subscribers, a 25% increase from 2021. As of the third and fourth quarter, external email updates from the Center maintained an open rate around 35%; well above the industry-standard benchmark open-rate of 20%. Newsletters include overviews of relevant range research, events, new resources produced by the center, and more. Additionally, emails were sent to our external audience for important upcoming Rangeland Center events, such as the Fall Forum.

Articles & News – The Center produced a press release on a Center-member led virtual fence project, which was featured in multiple regional publications and generated additional articles in Beef Magazine and other large publications. A press release on the Fall Forum was also produced by the Center that was featured in multiple regional news outlets, such as the Intermountain Farm & Ranch and Rexburg Standard Journal.

Rangeland Center Funding

The primary budget for the Rangeland Center is provided through the College of Natural Resources' FUR Budget. For the 2022 calendar year, the Center sent $144,118 in salary and fringe, $22,512 in travel, and $10,883 in other expenses, for a total of $177,513.

Endowments and gifts managed by the Center included the David Little Livestock Range Management Endowment, which provided $27,000 to support four research and outreach projects in 2022. Endowments established by the Soulen, Little, and Brackett families provided funding for Rangeland Center interns, which included 4 students each semester working about 10 hours per week to assist faculty and conduct projects that helped maintain the Center. These internships were highlighted in video presented the Gala for the U of I development campaign kick-off in October. Gift funds that support the Rangeland Center include the Launchbaugh Family Fund and the Rangeland Center gifts accounts which spent $1,676 to support students in 2022. Three generous ranchers also donated $4,000 to support student in the interdisciplinary virtual fence project.

Most of the research and outreach conducted by Rangeland Center Faculty is supported through competitive grants and cooperative agreements. The Rangeland Center assists faculty to secure funding by providing staff time, and in some cases small grants for travel or preliminary research. In 2022, Center faculty secured $224,000 in new, external funding. In addition, there is $4.1 million in continuing project funding.

Center Staff and Faculty

The Rangeland Center included 33 faculty members and 3 staff in 2022 from the Colleges of Natural Resources (CNR) and Agricultural and Life Sciences (CALS), with many faculty holding U of I Extension appointments. Faculty and staff worked in locations across Idaho with 19 housed on campus and 13 in other locations. A full list of faculty and staff can be viewed on our website.

Faculty – Rangeland Center members included 19 faculty and staff from CALS in the Departments of Animal & Veterinary Science, Agricultural Economics & Rural Sociology, Entomology, Plant Pathology & Nematology, and Plant Sciences. Twelve faculty and staff were from CNR in the Departments of Forest, Rangeland & Fire Sciences, Fish & Wildlife Sciences, and Natural Resources & Society. Two faculty members in the Center were from the UI Library.

Extension – Fifteen Rangeland Center faculty hold appointments with UI Extension. These Extension faculty hold specialist positions or are county faculty from Adams, Bannock, Custer, Jefferson/Clark, Idaho, Lemhi, Lincoln, Oneida and Owyhee counties.

Staff – Center staff include Director Karen Launchbaugh, Senior Associate Director Tim Prather, and Associate Director Eric Winford. Communications manager Ren Lawson was hired in January 2022.

Annual Reporting Metrics

Metric	Impact
The number of interdisciplinary research teams the Rangeland Center helped develop.	In 2022, Center members J. Karl, E. Winford, K. Lee, J. Sprinkle, and S. Jensen developed a proposal to assess recreational use and intensity on rangelands. Their proposal to the Public Lands Commission was not funded, however the group is working on additional funding proposals. Center faculty L. Lynch, along with E. Winford and others submitted a proposal to study the effects of riparian restoration techniques.
The number of interdisciplinary projects that have funding and are ongoing.	Center Director K. Launchbaugh is leading an interdisciplinary project looking at virtual fencing technology. There are an addition four ongoing interdisciplinary research projects that Center staff participate in totaling over $4 million in grant funding (Virtual fence; Dormant season grazing; Assessment of fuel break performance; Integrated human-wildlife interactions; Evaluating the Social Economic and Ecologic impacts of riparian management).
The number of outreach and education project teams the Center leads or assists, the number of events held, and audience participation.	The Center was involved in 6 outreach efforts in 2022. 1) Idaho Range Livestock Symposium; 2) Idaho Range Conservation Partnership meeting; 3) Fall Forum which was held in Pocatello with over 80 in attendance; 4) several events focusing on the Idaho Climate-Economy Impacts Assessment; 5) FFA Rangeland Career Development; 6) Sagebrush Saturday at the UI Rinker Rock Creek Ranch.
The number of articles and publications produced with Center support.	The Center published 8 internal-focused newsletters, and 3 external-focused newsletters. The total estimated audience reached by these products is 800+. The Center produced two press releases, one on a Center-led virtual fence project, and another on the Rangeland Fall Forum. Both press releases were picked up by multiple publications, and various articles were written on the virtual fence project. In addition, Center Associate Director E. Winford co-authored 1 Extension bulletin in 2022. A partial list of publications is listed in the appendix.
The number of students involved in Center activities, the mentors, and the funding.	In 2022, the Center enlisted 9 undergraduate students to accomplish the work of the Center: 7 during the school year and 2 for summer at Rinker Rock Creek Ranch.

Additional Center Member Activity

Rangeland Center members participate in a vast array of research and outreach projects beyond the support of Center funding or staff assistance. These range-related projects not directly supported by Center resources include the following.

Project Name	**Persons Involved** *Indicates Center Member
Sources of non-sampling error in BLM's AIM program	J. Karl*, L. Dreesman[G]
Evaluating non-target effects of herbicides on sage-grouse habitat	K. Lau, T. Johnson*, T. Prather*
Using virtual fence to manage riparian systems and optimize grazing during early and late season grazing	M. Ellison*, M. Ratterman
Characterizing willow utilization by cattle and large ungulate wildlife	M. Ellison*, J. Yelich
Does protein supplementation in fall increase digestibility and amount of invasive annual grasses grazed by?	G. Chibisa, S. Jensen*
Budget management for cow-calf ranchers.	H. Tejeda*, J. Hall*
The economics of grazing production systems on public v. private lands.	J. Hall*, H. Tejeda*
Utilization monitoring from field to satellite	J. Karl*, A. Traynor, T. Fletcher
Identifying sheep with bitter-taste sensitivity and their relative feeding/foraging behavior	M. Ellison*, C. Southerland
Winter grazing medusahead	S. Arispe, A. Hulet, S. Jensen*, W. Price
Sheep and goat monthly webinar and Facebook group	M. Ellison*, C. Wilmore*, W. Stewart, C. Page
Effects of broadscale juniper removal on sage-grouse and non-target species, including sage-grouse nest predators	T. Johnson*, S. McIntire

Rangeland Center Members 2022

College of Agricultural and Life Sciences

Cooperative Extension – County

- Sarah Baker – Range and Livestock Extension, Custer County (Challis)
- Jim Church – Land and Livestock Extension, Idaho County (Grangeville)
- Nikki Dalton – 4-H Youth and Extension, Bannock County (Pocatello)
- Scott Jensen – Range and Livestock Extension, Owyhee County (Marsing)
- Tyanne Roland – Land Management and Extension, Adams County (Council)
- Joseph Sagers – Land Management and Extension, Jefferson/Clark County (Rigby)
- Shannon Williams – Land Management and Extension, Lemhi County (Salmon)
- Carmen Willmore – Land Management and Extension, Lincoln County (Shoshone)

Agricultural Economics and Rural Sociology Department

- Katherine Lee – Natural Resource and Environmental Economics (Moscow)
- Paul Lewin – Agricultural Economics and Rural Community Development (Extension Specialist - Boise)
- Hernan Tejeda – Applied and Production Economics (Twin Falls)

Animal and Veterinary Sciences Department

- Melinda Ellison – Range Livestock Production and Wildlife Interactions (Salmon)
- Benton Glaze – Livestock Production and Genetics (Extension Specialist – Twin Falls)
- John Hall – Ruminant Nutrition and Reproduction (Extension Specialist – Salmon)
- James Sprinkle – Rangeland Monitoring and Beef Production (Extension Specialist – Salmon)

Entomology, Plant Pathology, and Nematology Department

- Steve Cook – Entomology, Insect Ecology and Management (Moscow)

Plant Sciences Department

- Tim Prather – Invasive Plant Ecology/Mgmt. and Rangeland Restoration (Extension Specialist – Moscow)
- Lisa Jones – Research Specialist (Moscow)

Soil and Water Systems

- Laurel Lynch – Ecosystem Ecology and Biogeochemistry (Moscow)

College of Natural Resources

Forest, Rangeland, and Fire Sciences Department

- Charles Goebel – Rangeland and Forest Restoration Ecology (Moscow)
- Vincent Jansen – Landscape Ecology and Geospatial Technologies (Moscow)
- Jason Karl – Landscape-scale Monitoring, Management and Data Science (Moscow)
- Karen Launchbaugh – Range Animal Behavior and Nutrition (Moscow)
- Tim Link – Wildland Hydrology and Watershed Management (Moscow)
- Eva Strand – Landscape, Fire and Rangeland Ecology (Moscow)

Fish and Wildlife Resources Department

- Jocelyn Aycrigg – Conservation biology, Spatial ecology, Large landscape conservation (Moscow)
- Courtney Conway – Wildlife management, Conservation biology, and Behavioral ecology (Moscow)
- Tracey Johnson – Livestock-Wildlife Interactions, Wildlife Habitat Ecology (Boise)
- Janet Rachlow – Wildlife and Habitat Ecology (Moscow)

Natural Resources and Society Department

- Travis Paveglio – Naturel Resource Collaboration and Communication (Moscow)
- Lee Vierling – Biogeochemistry, Landscape Ecology and Remote Sensing (Moscow)
- J.D. Wulfhorst – Rural Sociology, Social Assessments and Community Resilience (Moscow)

Library

- Jeremy Kenyon – Natural Resource Information (Moscow)
- Bruce Godfrey – Geospatial Resources Information (Moscow)

Emeriti

- Neil Rimbey – Range Economics and Natural Resource Policy
- Paul McDaniel – Soil Science and Land Resources
- Ed Krumpe – Recreation and Wilderness
- Steve Bunting – Rangeland and Fire Ecology
- Penny Morgan – Wildland Fire Ecology & Management
- Glenn Shewmaker - Forage Management and Utilization

Partners Advisory Council 2022

Chair

Jason Pyron	US Fish and Wildlife Service, Branch Chief - Conservation & Consultation

Vice-Chair

Tim Murphy	Idaho Fish and Game Commission,

Council Members

Daniel Bertram	Idaho Governor's Office of Species Conservation, Upper Salmon Basin Watershed
Mike Courtney	Twin Falls District Manager for the Bureau of Land Management
Mark Davidson	Blaine County Recreation Department
Darcy Helmick	Land Manager for Simplot Land & Livestock
Laurie Lickley	Idaho Cattle Company Rancher, Idaho legislature, Past-president Idaho Cattle Assoc.
Matt Lucia	Sagebrush Steppe Land Trust, Executive Director
Rob Mickelsen	Ecosystem Branch Chief Targee National Forest (USFS)
Tim Murphy	Retired Idaho BLM State Director, Idaho Fish and Game Commission
Caroline Nash	Hydrologist and geomorphologist with CK Blueshift, LLC
Anna Owsiak	Regional Habitat Manager, ID Department of Fish and Game
Tom Page	Big Creek Ranch, Western Landowners Alliance, Central ID Rangeland Network
Jerald Raymond	Rancher/Cattle Breeder and Consultant, Idaho Rangeland Resource Commission
Royce Swehnkfelder	Rancher SS Cattle Company, member Washington County Weed Control Assoc.

Appendix - Center Member Publications

Rangeland Center researchers engage in a wide variety of topics that span social science, rangeland ecology, livestock production, wildlife biology, technology development, and climate change. The many articles published by Center members include the following subset of articles most relevant to understanding rangelands and rangeland management.

Arispe, S. A., Johnson, D. D., Wollstein, K. L., Hulet, A., Jensen, K. S., Schultz, B. W., Sprinkle, J. E., McDaniel, M. F., Ryan, T., Mackenzie, M., & Cunningham, S. (2022). Strategic partnerships to leverage small wins for fine fuels management. *Rangeland Ecology & Management*, *85*, 66–75. https://doi.org/10.1016/j.rama.2022.09.004

Brymer, A. L. B., Wulfhorst, J. D., Clark, P., & Pierson, F. (2022). Communal processes of health and well-being for rangelands research and practice. *Rangelands*, *44*(5), 327–333. https://doi.org/10.1016/j.rala.2022.03.007

Debasitis, C., Goddard, S., Ellison, M., Chibisa, G., Yelich, J., & Hall, J. (2022). PSII-8 Impact of grazing high nitrate forages on serum nitrate concentration and production performance in beef heifers. *Journal Of Animal Science*, *100*(SUPP 4). https://doi.org/10.1093/jas/skac313.042

Ellison, M., Cockrum, R., Means, W., Meyer, A., Ritten, J., Austin, K., & Cammack, K. (2022). Effects of feed efficiency and diet on performance and carcass characteristics in growing wether lambs. *Small Ruminant Research*, *207*. https://doi.org/10.1016/j.smallrumres.2021.106611

Ellsworth, L. M., Newingham, B. A., Shaff, S. E., Williams, C. L., Strand, E. K., Reeves, M., Pyke, D. A., Schupp, E. W., & Chambers, J. C. (2022). Fuel reduction treatments reduce modeled fire intensity in the sagebrush steppe. *Ecosphere*, *13*(5), e4064. https://doi.org/10.1002/ecs2.4064

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Friedrichsen, C. N., Mizuta, K., & Wulfhorst, J. D. (2022). Advancing the intersection of soil and well-being systems science. *Soil Security*, *6*, 100036. https://doi.org/10.1016/j.soisec.2022.100036

Godfrey, B. (2021). Image files, web services, web applications, and partnerships: Two decades of managing digital georeferenced aerial imagery collections of Idaho. *Journal of Map & Geography Libraries*, *17*(1), 39–57. https://doi.org/10.1080/15420353.2022.2041529

Hall, J., Bloomsburg, M., & Goddard, S. (2022). Effect of a *Lactobacillus* fermentation product on postweaning heifer performance. *Translational Animal Science*, *6*(1). https://doi.org/10.1093/tas/txac015

Jansen, V., Traynor, A. C. E., Karl, J. W., Lepak, Nika, & Sprinkle, J. (2022). Monitoring grazing use: Strategies for leveraging technology and adapting to variability. *Rangelands*, *44*(1), 64–77. https://doi.org/10.1016/j.rala.2021.07.005

Jones, L., Wallace, J., Painter, K., Pavek, P., & Prather, T. (2022). Perceptions and management of ventenata by producers in the Inland Pacific Northwest. *The Journal of Extension*, *60*(2). https://doi.org/10.34068/joe.60.02.10

McCord, S. E., Welty, J. L., Courtwright, J., Dillon, C., Traynor, A., Burnett, S. H., Courtright, E. M., Fults, G., Karl, J. W., Van Zee, J. W., Webb, N. P., & Tweedie, C. (2022). Ten practical questions to improve data quality. *Rangelands*, *44*(1), 17–28. https://doi.org/10.1016/j.rala.2021.07.006

Olsoy, P., Milling, C., Nobler, J., Camp, M., Shipley, L., Forbey, J., Rachlow, J., & Thornton, D. (2022). Food quality, security, and thermal refuge influence the use of microsites and patches by pygmy rabbits (*Brachylagus idahoensis*) across landscapes and seasons. *Ecology And Evolution*, *12*(5). https://doi.org/10.1002/ece3.8892

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Pilliod, D. S., Beck, J. L., Duchardt, C. J., Rachlow, Janet L., & Veblen, K. E. (2022). Leveraging rangeland monitoring data for wildlife: From concept to practice. *Rangelands*, *44*(1), 87–98. https://doi.org/10.1016/j.rala.2021.09.005

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Stauffer, N. G., Duniway, M. C., Karl, J. W., & Nauman, T. W. (2022). Sampling design workflows and tools to support adaptive monitoring and management. *Rangelands*, *44*(1), 8–16. https://doi.org/10.1016/j.rala.2021.08.005

Tilley, D., Hulet, A., Bushman, S., Goebel, C., Karl, J., Love, S., & Wolf, M. (2022). When a weed is not a weed: Succession management using early seral natives for Intermountain rangeland restoration. *Rangelands*, *44*(4), 270–280. https://doi.org/10.1016/j.rala.2022.05.001

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