

ANNUAL REPORT 2017



**UCROSS
HIGH PLAINS
STEWARDSHIP
INITIATIVE**



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INTRODUCTION

The Ucross High Plains Stewardship Initiative (UHPSI) is a science-based research program focused on land stewardship in the American West. UHPSI seeks to provide quantitative, science-based solutions to issues of rangeland management, and to share our findings, locally, regionally, and nationally. Our team includes professionals and graduate students with extensive experience in landscape ecology, wildlife biology, botany, hydrology, statistics, remote sensing and geospatial analysis. Students and staff bring experience garnered by research operations around the world, from Alaska to Kansas to New England to Chile to Turkey to Nepal.

EXPERIENTIAL LEARNING

We believe boots-on-the-ground experiences provide some of the best opportunities for students to learn about and apply lessons in Western land management. Currently, we offer summer and academic-year internships with Western partners, a two-week applied course in rangeland assessment, and support for students pursuing their own creations across the West.

MAPPING

Western landscapes are vast, which makes land management expensive and time consuming. New mapping technologies allow us to create tools and maps that can make land management more efficient and timely. Using satellite imagery, we develop mapping tools that detect changes in vegetation characteristics over time, monitor the spread of invasive species, and prioritize habitats of key concern for wildlife species. These mapping tools are designed to be easy to use and up-to-date in order to meet the changing needs of land managers.

APPLIED RESEARCH

Our team of students, researchers, staff, and faculty study questions spanning environmental and social issues pertinent to land management in the Rockies. Recent research ranges from valuing ecosystem services provided by beavers and beaver mimicry devices, to mapping the social values relating to the Red Desert to Hoback, WY mule deer migration, to quantifying the potential flush of nitrogen in our fragile alpine systems during snow melt, and developing a feasibility analysis of the grassfed beef market.

COLLABORATION

From the halls of Yale University to the mountains and plains of the Rockies, we strive to broaden and strengthen Western land management through collaborative research, pairing the knowledge of local practitioners with cutting-edge applied science. Our network of collaborators spans ranchers, researchers, non-profit organizations, academics, and public agencies. We are always eager to explore opportunities and look forward to connecting with new partners.



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WESTERN RESEARCH FELLOWS

Awarded to students devoted to furthering land stewardship in the American west, student projects spanned 11 western states and provinces in the summer of 2017

34

RESEARCH ASSISTANTS

These students worked on a huge variety of projects with partners all across the west, from Colorado, New Mexico, Montana, Wyoming, Kansas, California, Oklahoma, and Texas.

14

GRASSX PARTICIPANTS

Students competed against other teams to manage plots of grassland to maximize a number of ecological indicators, including pollinator habitat and invasive species control.

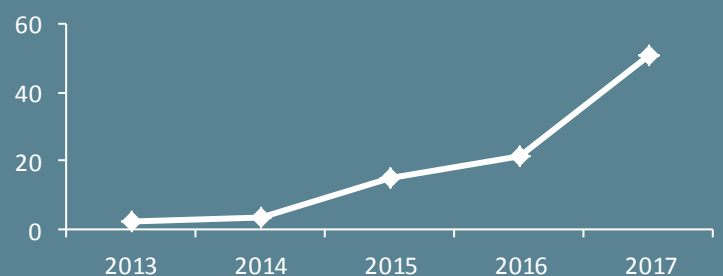
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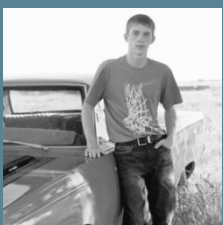
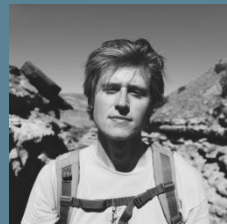
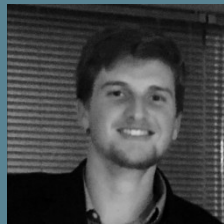
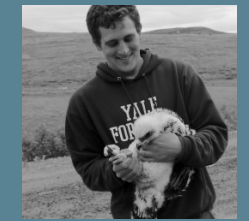
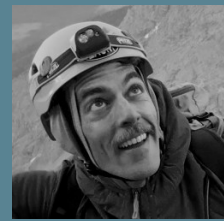
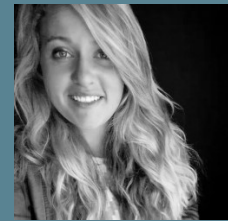
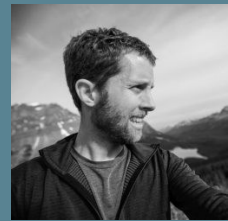
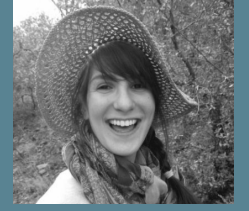
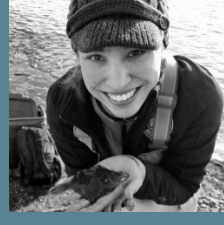
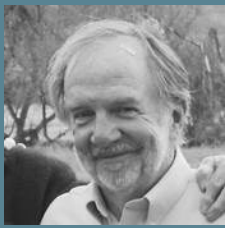
RANCH CREW STUDENTS

This program provides students from Yale University, University of Wyoming, and Sheridan College with an opportunity to evaluate a real-world land management issue

Program Growth over Five Years

Over the past five calendar years, UHPSI has grown from two staff and two students to four staff and 51 students







PROJECT HIGHLIGHT: SUDDEN ASPEN DECLINE

Quaking aspen trees are important providers of ecosystem services in the west. They establish valuable wildlife habitat, support biodiversity, create opportunities for ecotourism, serve as a firebreak for wildfires, and retain soil moisture across forests. Despite their importance to and prevalence upon the western landscape, aspen trees are widely experiencing rapid die-off at the individual, stand, and landscape level—incidents dubbed “sudden aspen decline” or “SAD” by researchers. SAD is ascribed to a combination of stressors, primarily water shortage. Other contributing factors include mature aspen mortality, lack of regeneration, understory conifer encroachment, disease and beetle infestation, ungulate herbivory, and a handful of other possibilities. Climate change is expected to further exacerbate the effects of these stressors, and land managers are rapidly searching for strategies to deal with what could be the widespread death of a dominant forest-type across much of the intermountain west.

Four students at Yale F&ES – Charlie Faires, Mark Foster, Jack Singer, and Rob Turnbull – are currently working with the Two Shoes Ranch, a private property in Carbondale, Colorado, on this issue. The ranch professionals—Ian Carney, the Two Shoes ranch manager, and Jason Jones, co-founder and co-owner of local-arborist-firm Aspen Tree Services—have directed much of their past efforts toward an area on the Ranch dubbed “Prince Creek.” This area contains an aspen stand deemed critical due to its water retention services and aesthetic value. Jack Singer recently traveled to the ranch and was able to view Prince Creek and speak with Ian and Jason about their assessment of aspen management and discuss the next steps to preserve the remaining trees. The students’ on-the-ground research at the ranch will consider SAD’s effects on aspen trees in various stands at the ranch, and the students will recommend management practices to mitigate further aspen loss.



PROJECT HIGHLIGHT: NATIVE TROUT RESTORATION

A team of graduate and undergraduate students came together to work with the Nature Conservancy on a feasibility study on native trout restoration on a stream in northern Wyoming. Brendan Boepple, Laurel Low, and Frank Eccher, have delved into academic literature and case studies while also interviewing experts in the field.

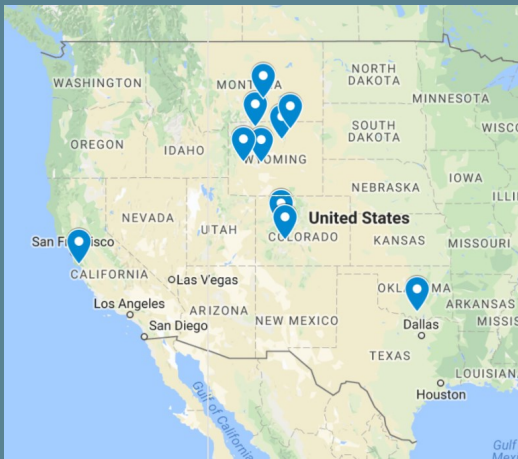
This project seeks to outline the options for nonnative trout removal in Mountain West streams for the purpose of native trout conservation. The decision to pursue trout reintroduction requires a thorough decision making process from scoping of a project's location within a larger watershed to the considerations for re-establishing a new native trout population, either through introduction or growth of established stocks currently competing with nonnative trout. This project provides resources to allow a manager consider the complex system of a surrounding watershed, the stream characteristics on a project site and a suite of other concerns that will ensure viability of native trout for the future.

The focus of this project arose specifically from the interest of the Nature Conservancy's Tensleep Preserve in northeastern Wyoming to explore reintroduction of native trout in Canyon Creek. Thus, this project and its specifics bound much of the paper's research and have guided some of the considerations related to management suggestions. However, we do hope that the content presented here will find wide applicability to other relevant projects across the Mountain West and beyond.

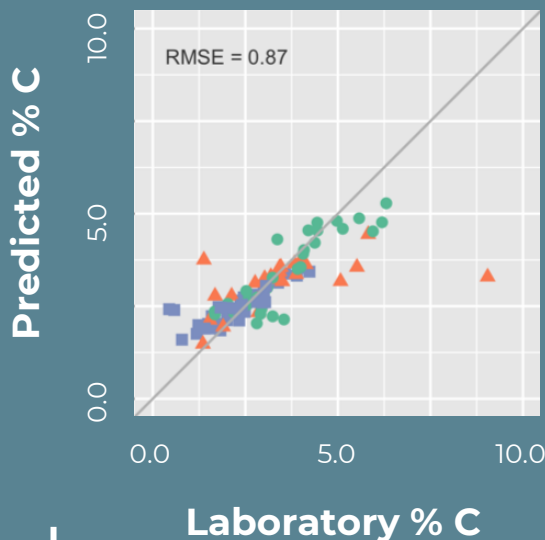
PROJECT HIGHLIGHT: RAPID SOIL CARBON INVENTORY



Spectrometer in use — Carbondale, CO



Project locations across the country—mostly Northern Great Plains



Over the last two years, we have developed a rapid soil carbon measurement protocol that makes use of low-cost field spectrometers. These affordable, pocket-sized devices measure soil carbon (C) using the reflectance of soils in the visible and infrared spectra. As carbon content increases, a soil's color darkens, giving it a slightly different spectral signature than soil with lower carbon content (Fig. 1). Standard benchtop spectrophotometers used in similar work cost tens of thousands of dollars and are not portable, whereas this device can be produced for less than \$500 and can fit in a pocket.

This reduced sampling time and cost allows managers and researchers alike to take more samples over a larger area, providing real time monitoring of changes to soil carbon stocks and high-resolution maps of soil carbon at the scale of farms or ranches. This is especially important in dryland systems where management induced change to carbon stocks may be slow/small, yet significant at large scales if measurable. This level of monitoring capability will allow us to understand what management practices are effective and where, providing the foundation for soil carbon offset markets and effective extension programming.

KEY FEATURES

- In-field measurement
- No lab time or cost
- <2 minutes to collect sample
- Integrated collection/sampling kit
- Bluetooth connection to smartphone records C level and GPS location
- Inexpensive, open-source hardware and software (<\$500)

KEY FINDINGS

- Accuracy on par with benchtop spectrometers
- Proven ease of measurement across 11 use cases
- Strong correlation between traditional lab measurement of soil C and in-field measurement



PROJECT HIGHLIGHT: RANCH CREW 2017

Summer 2017 marked the inaugural Ranch Crew course and, despite the course's nascency, it felt like anything but Ranch Crew's first rodeo (although in its future form, hopefully its actual first rodeo event will be incorporated). Ranch Crew is a two-week rangeland practicum in August held across the state of Wyoming. Divided into two primary sections, Ranch Crew begins with an intensive didactic and field curriculum in rangeland ecology and ranch management before sending crewmembers out to complete a rapid assessment on a working ranch.

The 2017 crew was comprised of four Yale School of Forestry students and four University of Wyoming students. The Ranch Crew completed a rapid assessment of Currant Creek Ranch, a 90,000+ acre cattle ranch in Sweetwater County, Wyoming near the Flaming Gorge Dam.

The rapid assessment was done in coordination with the Currant Creek Ranch owners, Wyoming Trout Unlimited, and Wyoming Game and Fish. Currant Creek Ranch specifically was chosen because of the landowners' multi-use management objectives and their desire to maintain a working cattle ranch while utilizing best management practices. The nuances of Currant Creek Ranch's multi-stakeholder dynamic made it an ideal, real-world learning laboratory for such a practicum. Additionally, the Currant Creek Ranch is rich in historical, social and ecological value and provided a wonderful opportunity for the crewmembers to better appreciate the benefits and challenges of conservation-minded western land management. (In fact, Currant Creek Ranch is rumored to have been one of Butch Cassidy and the Sundance Kid's hideouts and the spot where they stashed their feloniously-acquired fortune...)

While the 2017 crew learned an immense amount and had an invaluable experience, we are confident that subsequent years will only improve, given the rich subject matter and the supporting staff and institutions behind the initiative. We would like to thank everyone involved for making it such a rewarding, enriching experience!



PROJECT HIGHLIGHT: WESTERN RESEARCH FELLOWSHIP

During the second year of the Western Research Fellowship (WRF), UHPSI awarded summer fellowships to a selection of applicants interested in issues pertinent to land management in the High Plains. Ideal projects targeted high-impact biophysical or social questions with management implications for private land management in the West. In addition to a financial award, fellows were given access to a broad network of partner organizations and properties across the Mountain West, as well as technical, logistical, and publication support.

We awarded the WRF to eleven students -- nine master's, one doctoral, and one undergraduate. Their research spanned a broad array of management issues from water to soil to policy to finance. The WRF projects were, in fact, a wonderful reflection of the myriad issues facing land managers in the West today. Topics span topics from sustainable grazing with Bison, to predator-prey interactions, to invasive species, to grazing issues on public lands, and spanned Wyoming, Montana, Utah, Colorado, Nevada, Alberta, and Alaska! With UHPSI's emphasis on publication and dissemination of research, we're confident that the impact of the 2017 WRF projects will extend across and beyond the high plains. A number of projects are nearing publication in academic journals, popular press, or as technical white-papers.

Anthony Bell – Bridging the gap between commercial and conservation bison ranching (Wyoming, South Dakota, and Montana)

Paul Burrow – social and political life of pine nuts, Pinyon-Juniper species management, grazing, and native resource use in the Great Basin.

Ross Donihue – Cooperative conservation on working lands in the Northern Rockies (Alberta, Montana, and Wyoming)

Adam Eichenwald – Predator prey interactions between raptors and ground-birds, potential carbon implications (Nome, Alaska)

Cayley Geffen – National monument designations – diverse voices from Utah (Bears Ears, Utah)

Carli Kierstead – Decision-making for irrigation and conservation (Lander, Wyoming)

Jeremy Menkhaus – Impact investment in rangelands, a case for Bison (Pinedale, Wyoming)

Austin Rempel – Incentivizing efficient water use through financial incentives for landowners (Lander, Wyoming)

Rachel Renne – Understanding sagebrush mortality and building tools for long-term monitoring (Wyoming)

Jessica Swindon – Understanding climate change impacts on roots systems of shrub-steppe species

Samuel Wall – Hydro power in Montana, ecosystem services and water quality (Flathead Indian Reservation, Montana)