SER GREAT BASIN SOCIETY FOR ECOLOGICAL RESTORATION

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SERGB NEWSLETTER

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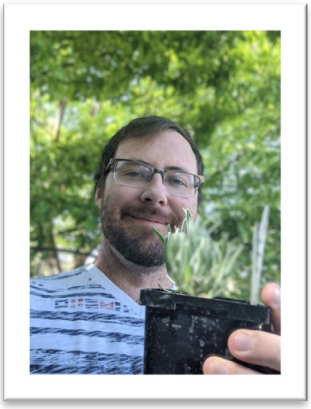
INSIDE THIS ISSUE:

Stories From The Sage	2-5
Name That Seed	6
Student Chapter Updates	7-8
Upcoming Events	9

Out-going President's Message



Serving our Great Basin Chapter for the past several years has been an honor and a privilege. Our recent accomplishments as an organization include hosting the 2021 virtual symposium, "Emerging Voices in the Sagebrush Steppe." This symposium provided a forum for early career researchers from around the Great Basin to present their work. It was amazing to see the breadth of innovative research around the region, from Alison Agneray's work on neighborhood models in diverse plantings to Travis Soward's research on warehouse seed viability. I personally enjoyed awarding the practitioner of the year to Martha Brabec and establishing a new award for Diversity, Equity, and Inclusion efforts with Elizabeth Leger as the first recipient. If giving awards and hearing about cutting-edge research sounds interesting to you, I encourage you to consider running for SER GB president in the future.

We are lucky to have a terrific incoming president, Mark Brunson, who has a distinguished record as a researcher as well as a long history of service for the Great Basin Fire Science Exchange as well as the Ecological Society of America's Restoration Section. I also want to acknowledge Anne Halford (newsletter), Owen Baughman (Treasurer), and Sarah Barga (website editor) for their invaluable service to SER GB. I look forward to being involved in our upcoming events, including our long-awaited in person conference.

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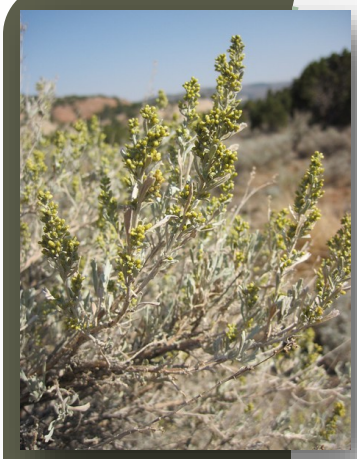
Trevor

*Achnatherum hymenoides (*Indian rice grass) BLM ID931 Seeds of Success Smug Mug Photo.

Stories From the Sage



Fire Effects on Soil Properties: Amending Post-fire Soils with Native Microbial Communities and Biochar to Improve Sagebrush Performance

Sabrina Schuler, Graduate Student & Marie-Anne de Graaff, Professor,

Boise State University, Boise, ID

Drastic changes in fire regime and plant species invasions have impaired restoration efforts in the sagebrush steppe. Scars left behind on the landscape after a fire, such as the ones shown in this picture, are easy to recognize, but these scars may just be the tip of the iceberg. What about the scars left behind that are invisible to the eye? How do fire and shifting plant communities affect the foundation that supports native plant communities – the soil? How do management practices aimed at restoring the sagebrush steppe, such as herbicide broadcasting affect the cryptic belowground habitat of soil organisms that are essential to sagebrush establishment and survival?

We developed a study that sought to evaluate how fire, post-burn vegetation succession, and post-burn herbicide application affect soil structural and functional properties foundational to plants. The study was conducted with soils that vary in time since exposure to fire, post-fire plant communities, and post-fire site management. All the sites from which we collected soils are located in the Orchard Training Combat Center, approximately 17 miles south of Boise, ID.

This study confirmed that fire instantaneously and persistently – through its effect on plant communities – depleted soil organic matter and carbon in soil aggregates, and that herbicide application exacerbated these effects. Fire also elevated plant-available soil nitrogen, which has the capacity to further catalyze plant species invasion. Finally, we observed changes in the soil microbial community composition, and found that herbicide application in particular decreased richness of arbuscular mycorrhizal fungi. These are symbiotic soil-plant mutualists that are essential to sagebrush establishment.

We expanded on this study by initiating a greenhouse experiment that aimed to evaluate how inoculations with native soil microbial communities and biochar amendments affected soil properties and sagebrush establishment. Inoculation of degraded soil with live soil inocula has been shown to

enhance restoration efforts, and biochar is a pyrolysis product with known beneficial impacts on soil structure and functioning. For this study, we germinated and grew sagebrush in the post-fire soils described above and amended them with live inocula and biochar in a full-factorial design.

The inocula affected soil microbial community structure and enhanced mycorrhizal presence, but these changes did not feedback to promote sagebrush establishment. Biochar, however, increased sagebrush germination and growth, which we contribute to its positive effects on soil moisture retention, mycorrhizal colonization, and pH buffering. Even though these amendments enhanced soil properties and sagebrush establishment across treatments, the presence of herbicide still inhibited sagebrush growth. Given that the herbicide was applied over a year earlier, this suggests that herbicide may have longer residence times in soil than previously thought.

Taken together, these findings demonstrate that fire, post-fire plant community composition and post-fire site management have significant impacts on biogeochemical soil properties, and reveal that soil amendments including biochar may aid in sagebrush restoration.

"Fire also elevated plant -available soil nitrogen, which has the capacity to further catalyze plant species invasion".

Landscape after a recent burn in sagebrush habitat (left), and surrounding native big sagebrush without fire disturbance (right) at the Orchard Combat Training Center near the Birds of Prey National Conservation Area south of Boise, Idaho Photo credit Sabrina Schuler, Boise State University

Badger– Snake River Plain—Seeds of Success ID930 Smug Mug photo.

Walker Basin Conservancy's Stewardship Program

Walker Basin Conservancy's stewardship program complements our water program by revegetating old fields associated with purchasing water rights from willing sellers. We revegetate formerly irrigated fields with plant communities that will be able to persist in our harsh, dry, hot, and saline conditions. This work is done in cooperation with private partners with whom we've made water acquisition deals, state partners like the Mason Valley Wildlife Management Area and the Walker River State Recreation Area to whom we've reconveyed land, and on properties that WBC owns and will manage into the future. To date, the Conservancy has worked or is currently working on over 18,000 acres, with roughly 7,000 of that being formerly irrigated fields, much of which was fallow at the outset of WBC's management.

WBC is legislatively required to achieve soil stabilization, fugitive dust abatement, and noxious weed abatement on all the land we steward in order to be a good neighbor within the community. This standard, while it doesn't meet the criteria of true restoration, is still not easy to accomplish in one of the driest parts of the Great Basin (Yerington receives an average of 5 inches of precipitation annually). Fortunately, on the vast majority of the land we work on, the MVWMA, WRSRA, and our own properties, we can go beyond legislative requirements and work toward establishing appropriate native plant communities that do not require supplemental irrigation to sustain themselves.

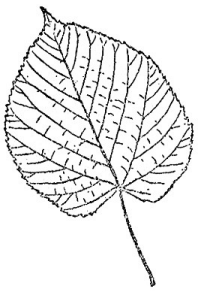
The lands that WBC stewardship works on come to us in varying states. Some have never had the soil disturbed, while others have been tilled repeatedly for up to a century. Some have been fallow for a decade or more, while others have until recently been in production. Some fields are directly adjacent to the Walker River and plants rooted there can tap into the groundwater table easily, while others are on the lower slopes of alluvial fans outside the direct influence of the riparian area. The land use history and location determine what kind of restoration techniques we must use. The scale at which we work, usually hundreds of acres of old fields at a time, allows WBC to use some labor-intensive techniques such as irrigated outplanting and seeding while still effecting positive ecological change at a meaningful scale. WBC aims to put the fields on a restoration trajectory, establishing appropriate diversity of shrubs, grasses,

and wildflowers at densities lower than those of an intact reference site. It is not feasible to install reference site densities at this scale, but by planting and seeding at a high enough density, the plants we establish can serve as seed sources to fill in the rest of a field over time through natural processes. It will still likely take decades for the fields we are working on to approach anything like relatively undisturbed salt desert shrublands.

Restoration in the salt desert is challenging, and there are fewer established restoration resources than for higher elevation sagebrush steppe systems. The heavily disturbed nature of old fields adds further complications. WBC and the Walker Basin Restoration Program have only been doing terrestrial restoration for about a decade, and we've learned a great deal and refined our strategies accordingly. Not surprisingly, our biggest struggles are often with the massive seedbank of agricultural weeds associated with the soil disturbance and increased soil nutrients, especially nitrogen, in the old fields we work on. Consequently, our restoration efforts aim to find a balance of giving our plants enough water to establish successfully and not so much that weeds can overwhelm our native plants. Fortunately our water program provides us with the water necessary for irrigation to establish native plant communities.

We have found that we cannot expect the seed that is currently widely available on the market to successfully establish without irrigation, but irrigation promotes broadleaf agricultural weeds that are difficult to control effectively among seeded forbs and shrubs. Thus we have decided to focus on outplanting container stock of forbs and shrubs and irrigating them on driplines, which is much more targeted and efficient use of water and allows for manageable weed control. Using stock grown in our nursery also allows us to overcome many of the early life hurdles to establishment, such as finding a suitable location, breaking dormancy, germinating, and emerging from the soil, in a much more controlled environment. We've planted over 50,000 plants over the last four years, and we've seen up to 70 percent survival with these methods. We can and do still establish grasses from seed, as irrigation and broadleaf selective herbicides allow for effective weed control in an area usually too dry for largescale cheatgrass invasion. Where we want to establish both shrub and forb as well as grass components, we spatially separate the grasses from the shrubs and forbs to effectively control weeds on both, with the hope that the components will begin to mix once irrigation is removed. Long-term success is still a long way off, but the short-term results are encouraging. Some of our planted shrubs are producing seed within a year of planting. Young greasewood, fourwing saltbush, and quailbush are starting to establish between larger planted shrubs on some of our older fields, and we hope to see this trend continue in our ongoing monitoring.

"The scale at which we work, usually hundreds of acres of old fields at a time, allows WBC to use some labor-intensive techniques such as irrigated outplanting and seeding while still effecting positive ecological change at a meaningful scale".



This is the last article in this 3 part series from the Walker Basin Conservancy—check out the prior 2021 SERGB Newsletters to read previous stories.

Walker Lake—Walker Lake Conservancy Photo

Name The Seed

Figure 1. Seed and chaff from the mystery species. Photo: Department of the Interior, Bureau of Land Management ID230, Seeds of Success
Hint: This species fixes nitrogen.

Additional hints (to be presented at the end). The species is broadly adaptable. Seed collected from several different ecoregions representing a broad range of elevations, temperature gradients, and precipitation regimes grew well in common gardens in northern Utah. It is a long-lived, fire-tolerant perennial that begins growth in early spring, flowers in late May or June, and produces seed by early July. Seed production can be prolific. Assuming each flower in the crowded spike inflorescence produced a single seed, a single plant could produce 18,000 seeds.

The species is important to pollinators. In a survey conducted of plants growing in Elmore County, Idaho, Malheur County, Oregon, and Benton County, Washington, researchers collected 114 bees representing 22 species. At maturity, seeds of this are easily stripped from the inflorescence. Because flowering and seed production begin at the base of the inflorescence and progress upward, the tip of the inflorescence may be flowering while the lower portion is producing mature seed. In the common garden study, flowering date was positively correlated with the temperature and negatively correlated with the elevation of the seed origin collection site.

Trials for growing this species for seed production were conducted at Oregon State University's Malheur Experimental Station (OSU MES). Plants flowered and produced harvestable seed in their second year. Seed was harvested for 6 years at OSU MES but may be harvestable for longer. Seed yields were maximized by 4 to 8 inches of irrigation in warm, dry years and without irrigation in cool, wet years. Seed yield over the 6-year OSU MES study averaged 201 lbs/acre without supplemental irrigation, 326 lbs/acre with 4 inches of irrigation, and 332 lbs/acre with 8 inches of irrigation. In a guide to conservation plantings in the Intermountain West, the species was described as having a moderate growth rate, providing excellent wildlife forage, and providing pollen and nectar to bees. It is beneficial to both native and managed agricultural pollinators and produces attractive flowers, making it useful for planting along roadsides, in rest areas, parks, campgrounds, and other low maintenance landscapes.

Answer. Blue Mountain or western prairie clover (*Dalea ornata*). Learn more about this species and other native forbs useful for Great Basin restoration in the online book, Western Forbs: Biology, Ecology, and Use in Restoration.

Photo: Kevin Connors, USDA, Agricultural Research Service.

Student Chapter Updates

Brigham Young University SER Student Chapter – Fall 2021 Update
Otto De Groff
President, BYU SER Student Club

Introduction

This fall at BYU, we have had two successful student SER activities. They have taken **place** in the canyons just east of Provo, Utah. In September, we met with Dr. Phil Allen, a professor in the Plant and Wildlife Sciences department at BYU. Dr. Allen gave our club a tour around the mouth of Rock Canyon, and gave us ideas of how we can participate in future restoration projects there. In October, we planted a variety of native shrubs, forbs, and grasses at the popular Y trailhead, just east of BYU. This project was done with the help of Dr. Matt Madsen, who serves as the faculty advisor for our club.

Rock Canyon – September 2021

Background

Rock Canyon is located northeast of BYU campus, in between Y Mountain (to the south) and Squaw Peak (to the north). The area is popular with rock climbers and hikers, as well as many other groups. Over the past decades, human traffic in Rock Canyon has increased substantially, leading to overcrowding in the canyon's mouth, with social trails crisscrossing the area. Other negative impacts to the area include erosion of the steep, lower canyon walls, and invasion of non-native plants [especially cheat grass, (*Bromus tectorum*)]. In response to this, the Rock Canyon Preservation Alliance (RCPA), led by Dr. Phil Allen, has partnered with Provo City to close unofficial trails, stabilize hillslopes, revegetate bare ground, and remove weeds in the canyon mouth.

SER Involvement

For our activity, Dr. Allen gave us suggestions of how we can be active participants in the ongoing restoration projects around Rock Canyon. In the Spring of 2022, we plan to coordinate with the RCPA to remove cheat grass from the canyon. Additionally, we will work to plant native forbs and grasses in the area.

Y Trailhead – October 2021

Background

Over the past year, BYU has been involved in restoration of the Y Trailhead. This is a popular area, used heavily by college students and residents of Utah Valley. Many of the lower mountain slopes around the trailhead are dominated by invasive grasses and forbs, including cheat grass and redstem filaree (*Erodium cicutarium*), and goathead (*Tribulus terrestris*), among others. In response to this, Dr. Matt Madsen has led several projects aimed at revegetating the area with native species.

"For our activity, Dr. Allen gave us suggestions of how we can be active participants in the ongoing restoration projects around Rock Canyon".

Rock Canyon, UT. Wikipedia Photo.

Planting near the Y Trailhead.

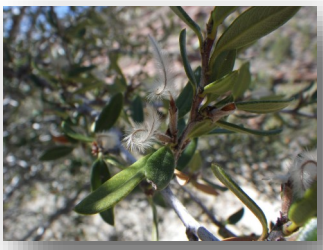
SER Involvement

We met in mid-October, just after a period of fall rain storms that created moist soil conditions ideal for planting. Prior to our activity, we measured a 300 square foot plot adjacent to the trailhead, in a high visibility area. Before planting, we removed the top inch of soil, which harbors a weed seedbank, from the site. Following removal of the seed bank, we tilled the soil, digging furrows perpendicular to the hillslope that will serve to catch runoff from rain at the site.

With the site prepared, we proceeded to plant a variety of shrubs, forbs, and grasses. Species planted included: mountain mahogany (*Cercocarpus ledifolius*), yarrow (Achillea *millefolium*), penstemon (*Penstemon* spp.), bluebunch wheatgrass (*Pseudoroegneria spicata*) and others. After planting, we covered the plot in a thin layer of mulch, to reduce the chance of weed establishment.

Future Projects

Over the coming winter months, we will have a couple activities focused on planting seeds for future projects. We will keep the seedlings in our greenhouse space at BYU until planting this coming year. We also plan to invite a guest speaker to talk with us about potential restoration projects we can be part of over the coming year. Overall, we have been excited to see the interest in our club this fall, and plan to keep moving forward next semester!



Cercocarpus ledifolious (mt. mahogany) and seed - BLM Seeds of Success UT080 Smug Mug photo.

Upcoming Events

PJ woodlands in a changing climate webinar series; **December 7 @ 11:00 am PST** https://greatbasinfirescience.org/event/pj-woodlands-in-a-changing-climate-webinar-series/

Native Plant Materials Virtual Conference – Institute for Applied Ecology, The Willamette Valley Native Plant Partnership and the Southwest Seed Partnership

Bridging the Gap: Connecting Native Plant Materials Development with Successful Habitat Restoration

This conference will bring together native plant producers, restoration ecologists and practitioners, and seed researchers to discuss progress and challenges related to increasing the supply of ecologically appropriate native seed. Seed partnerships and collaboratives are innovative and key groups that engage multiple perspectives, pool demand, and leverage efforts across regions. Author Doug Tallamy will present his work on the nature of oaks and Olivia Messinger Carril will present her work on pollinator networks. The conference will also include expert speakers and seed producer panels from the Pacific Northwest and Southwest.

The Willamette Valley Native Plant Partnership and the Southwest Seed Partnership, two regional plant materials partnerships coordinated by the Institute for Applied Ecology (IAE), have come together to host the 2022 Native Plant Materials Virtual Conference. Registration includes links to live conference webinars on **January 12 & 13 (Zoom via Whova platform**), speaker bios, detailed agenda, and networking opportunities.

Register here: https://whova.com/portal/registration/vwvnp_202107/
Draft Agenda here: https://whova.com/embedded/event/vwvnp_202107/?utc_source=ems
Questions? Email alexislarsen@appliedeco.org

SER's Certified Restoration Practitioner Applicant Window is open now—**Applications are accepted on a rolling basis year-round. Applications received by April 30 will be reviewed by June 30; applications received by October 31 will be reviewed by December 31.** Check out the applicant portal here: https://www.ser.org/page/Certification

SER's Certified Ecological Restoration Practitioner (CERP) program encourages a high professional standard for those who are designing, implementing, overseeing, and monitoring restoration projects throughout the world. The only certification program for restoration practitioners, the program guarantees that practitioners meet a set of minimum requirements for restoration and ecological knowledge, on-the-ground practical experience, and an understanding of international restoration principles and standards.