Great Basin Consortium Conference

The Great Basin: A Landscape Under Fire

Conference Program

December 9-10, 2013

University of Nevada, Reno
Joe Crowley Student Union
Reno, Nevada, USA

Participating Organizations:

Great Basin Cooperative Ecosystem Studies Unit (GB-CESU)
Great Basin Environmental Program (GB-EP)
Great Basin Fire Science Delivery Project (GB-FSD)
Great Basin Landscape Conservation Cooperative (GB-LCC)
Great Basin Research and Management Partnership (GB-RMP)
Great Basin Restoration Initiative (GB-RI)

Great Basin Cooperative Ecosystem Studies Unit

GREAT BASIN ENVIRONMENTAL PROGRAM

Great Basin LCC
LANDSCAPE CONSERVATION COOPERATIVE

GREAT BASIN Restoration Initiative

Great Basin Research and Management Partnership

Great Basin Fire Science Delivery

http://environment.unr.edu/consortium/

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CONFERENCE SCHEDULE

MONDAY, DECEMBER 9

Joe Crowley Student Union - Ballroom A Entrance (4th floor)

8:00 a.m. – 2:00 p.m. **Registration**

Joe Crowley Student Union - Room 423 (4th floor)

7:00 a.m. – 9:00 a.m. **Great Basin-FSD business meeting**
Convener: Eugénie MontBlanc, Great Basin-FSD Coordinator

Joe Crowley Student Union - Rita Laden Senate Chambers (3rd floor)

9:00 a.m. – 12:00 p.m. **Great Basin-LCC business meeting**
Convener: Linda Kelly, Great Basin-LCC Coordinator, BLM

Joe Crowley Student Union – Room 402 (4th floor)

10:00 a.m. – 12:00 p.m. **Great Basin-CESU business meeting** (lunch provided for GB-CESU partners following meeting in the adjacent Great Room)
Convener: Michael Collopy, Director, Great Basin-CESU

Joe Crowley Student Union - Ballroom A (4th floor)

1:00 – 1:15 p.m. **Welcome and Introduction**
Michael Collopy, Director, Great Basin-CESU, University of Nevada Reno
Marc Johnson, President, University of Nevada Reno

1:15 – 2:00 p.m. **Keynote Speaker and Discussion**
Amy Lueders, Nevada State Director, Bureau of Land Management

SESSION ONE: SAGE-GROUSE VISIONING AND PANEL DISCUSSION

Moderator: Mike Pellant, BLM
Joe Crowley Student Union - Ballroom A

2:00 – 3:00 p.m. AGENCY PANEL FOR VISIONING ON THE SAGE-GROUSE ISSUE FROM DIFFERENT PERSPECTIVES
Lauren Mermejo, BLM Great Basin Greater Sage-Grouse Project Manager
Tim Rubald, State of Nevada Sagebrush Ecosystem Program
Michael Cameron, Nevada TNC Associate State Director
Ted Koch, Nevada State Supervisor, U.S. Fish and Wildlife Service

Joe Crowley Student Union - Ballroom C

3:00 – 3:30 p.m. **Refreshment Break**

SESSION TWO: DISCUSSION OF HIGH PRIORITY ISSUES FROM VARIOUS AGENCY AND ORGANIZATIONAL PERSPECTIVES

Moderator: Todd Hopkins, Great Basin-LCC
Joe Crowley Student Union - Ballroom A

3:30 – 4:30 p.m.

William Campbell, Inter-Tribal Council of Nevada
Bill Dunkleberger, Forest Supervisor, USFWS Humboldt-Toiyabe National Forest
Mark Boggess, USDA-ARS National Program Leader, Pasture, Forage and Rangeland Systems
Ted Koch, Nevada State Supervisor, U.S. Fish and Wildlife Service
Michael Cameron, Nevada TNC Associate State Director
Eric Eldredge, USDA-NRCS Great Basin Plant Materials Center, Fallon NV
Susan Phillips, USGS Research Manager, Forest and Rangeland Ecosystem Science Center, Corvallis OR

Joe Crowley Student Union - Ballroom C

5:00 – 7:00 p.m. **Poster Session and Reception**
No-host bar. Refreshments and hors d'oeuvres provided

Joe Crowley Student Union - Conference Room 420

8:00 a.m. – 5:00 p.m. Conference room (capacity 12) available for ad hoc meetings, see registration desk for availability

TUESDAY, DECEMBER 10

Joe Crowley Student Union - Room 423

7:30 – 9:00 a.m. **Great Basin-RMP business meeting**
Convener: Jeanne Chambers, Great Basin-RMP, US Forest Service, RMRS

SESSION THREE: JOINT FIRE SCIENCE PROGRAM - PROGRAM OVERVIEW, FUTURE DIRECTIONS AND CHALLENGES AND 3 PROGRAM SPEAKERS ON SPECIFIC PROJECT HIGHLIGHTS

Moderator: Eugénie MontBlanc, Great Basin-FSD
Joe Crowley Student Union - Ballroom A

9:00 – 9:20 a.m. THE JOINT FIRE SCIENCE PROGRAM AND THE GREAT BASIN – OVERVIEW AND FUTURE DIRECTION, **Tim Swedberg**, Communications Director, Joint Fire Science Program, Boise ID

9:20 – 9:30 a.m. THE GREAT BASIN FIRE SCIENCE DELIVERY 2013 UPDATE, **Eugénie MontBlanc**, Great Basin-FSD Coordinator, University of Nevada, Reno NV

9:30 – 9:45 a.m. SAGEBRUSH STEPPE TREATMENT EVALUATION PROJECT (SAGESTEP): SUMMARY OF SHORT-TERM RESULTS, **James McIver**, Oregon State University, Corvallis OR

9:45 – 10:00 a.m. EFFECTIVENESS OF SAGEBRUSH STEPPE POST-FIRE REHABILITATION PROJECTS: SHORT AND LONG-TERM RESPONSES, **David Pyke,** US Geological Survey, Forest and Rangeland Ecosystem Science Center, Corvallis OR

Joe Crowley Student Union - Ballroom B

10:00 – 10:30 a.m. **Refreshment Break**

SESSION FOUR: CLIMATE CHANGE – ADAPTATION STRATEGIES AND PANEL DISCUSSION

Moderator: Linda Kelly, BLM
Joe Crowley Student Union - Ballroom A

10:30 – 10:50 a.m. MOVING BEYOND VULNERABILITY ASSESSMENTS: ARE WE READY TO SCIENTIFICALLY EVALUATE CLIMATE ADAPTATION ACTIONS?
Nicole DeCrappeo, Department of the Interior Northwest Climate Science Center, Corvallis OR

10:50 – 11:10 a.m. WILDFIRE AND INVASIVE SPECIES IN THE WEST: AN APPROACH TO ADDRESSING THE PRIMARY THREAT TO GREATER SAGE-GROUSE IN THE GREAT BASIN, **Kenneth Mayer**, WAFWA Wildfire and Invasive Initiative Coordinator

11:10 a.m. – 11:30 p.m. CLIMATE CHANGE VULNERABILITY OF NATIVE AMERICANS IN THE SOUTHWEST: PYRAMID LAKE PAIUTE TRIBE RESILIENCE AND ADAPTIVE MANAGEMENT STRATEGIES, **David Busch**, U.S. Geological Survey, Pacific Region, Sacramento CA

11:30 a.m. – 12:00 p.m. **Panel Discussion**

12:00 – 1:15 p.m. **Lunch Break** (on your own in the student union)

SESSION FIVE: CHALLENGES AND OPPORTUNITIES ON A CHANGING LANDSCAPE UNDER FIRE WORKSHOP, DISCUSSION, RECOMMENDATIONS AND ACTION ITEMS

Joe Crowley Student Union - Ballrooms

1:15 – 2:15 p.m. **World Café / Table discussions** – refer to your name tag for table assignments
Convener: Todd Hopkins, Great Basin-LCC Science Coordinator

2:15 – 3:00 p.m. **Report out on groups. Discuss next steps for the consortium to implement suggestions.**

3:00 p.m. **Closing remarks and adjourn**

Joe Crowley Student Union - Conference Room 420

8:30 a.m. – 4:00 p.m. Conference room (capacity 14) available for ad hoc meetings, see registration desk for availability

GENERAL INFORMATION

REGISTRATION

Registration will be available at the Joe Crowley Student Union, Ballroom A Entrance on:

Monday, December 9, 2013 8:00 a.m. – 2:00 p.m.

MEETING LOCATION

The conference venue is the Joe Crowley Student Union on the campus of the University of Nevada, Reno.

FACILITY AMENITIES AND INFORMATION

The Joe Crowley Student Union offers a number of retail and food options including: Bookstore with a mini mart, Starbucks, Keva Juice, Einstein Bros Bagels, Villa Italian Kitchen, Panda Express, Tahoe Creamery, Port of Subs, Spudistro and Cantina del Lobo.

MEALS AND BREAKS

Refreshment breaks are provided on Monday, December 9 and Tuesday, December 10. Lunch is on your own. There are several eating establishments at the Joe Crowley Student Union and near the University campus. The reception on Monday evening will offer appetizers, refreshments and a no-host bar.

GETTING TO THE CONFERENCE

CAMPUS PARKING

Complimentary event parking is available at the Brian Whalen Parking Garage on the east side of Virginia Street, just south of the Lawlor Events Center. Park on the top level and enter the provided event parking code (#1291210) at the kiosk by the elevators for a day use pass each day. It will dispense a parking pass to display on your dash. A campus map is provided on page 17.

LOCAL PUBLIC TRANSPORTATION

The Sierra Spirit is a bus that travels from downtown Reno to the University every 15 minutes from 7:00 a.m. to 7:00 p.m. every day of the week for $0.25 each way. Conference attendees can catch the northbound bus across Virginia Street on the east side of the Silver Legacy hotel. It is a yellow bus that is easily identified. Sierra Spirit is wheelchair accessible and offers free WiFi. A route map is included on page 23 of this program. RTC Ride is the local public transportation system. The main bus terminal is one block east of the Silver Legacy at 40 East 4th Street. To get to the University, take Route 7, which runs every 30 minutes, and get off at Lawlor Events Center. The Joe Crowley Student Union is near the Lawlor Events Center. The cost is $2 per ride. Exact change is required. RTC Ride is wheelchair accessible.

GREAT BASIN CONSORTIUM - PARTICIPATING ORGANIZATIONS

GREAT BASIN COOPERATIVE ECOSYSTEM STUDIES UNIT (GB-CESU)

Mission Statement: The GB-CESU is a partnership for research, technical assistance and education to enhance understanding and management of natural and cultural resources of the Great Basin.
Unique Role: Part of a national program that provides a funding mechanism for transferring funds from federal partners to universities to conduct projects
Partners/Collaborators: Universities, federal agencies and NGOs
Initiating Organization: Department of the Interior
Funding/Support: Projects funded with federal agency funds through a cooperative agreement

GREAT BASIN ENVIRONMENTAL PROGRAM (GB-EP)

Mission Statement: To develop funding for on-the-ground projects and related research and outreach education to improve the Great Basin environment
Unique Role: Develop funding from public and private sources to facilitate landscape-scale, on-the-ground projects by engaging NGOs, state agencies and their coalitions, and the private sector in collaboration with universities and federal agency partners
Partners/Collaborators: Universities, federal agencies, state agencies and coalitions, and NGOs
Initiating Organization: Land grant universities in the Great Basin
Funding/Support: Federal, state and private

GREAT BASIN LANDSCAPE CONSERVATION COOPERATIVE (GB-LCC)

Mission Statement: The Great Basin Landscape Conservation Cooperative enhances understanding of the effects of changing climate and other natural and human impacts across the region and promotes the coordination of science-based actions to enable human and natural communities to respond and/or adapt to those conditions.
Unique Role: DOI initiative working with stakeholders to develop landscape-scale tools and monitoring to address climate change and other regional stressors
Partners/Collaborators: Inclusive. All agencies (federal, state and local), Tribes, NGO's, public, etc. No restrictions on participation via the LCC Forum
Initiating Organization: Initiated by Department of Interior in 2009 by Secretary Executive Order.
Funding/Support: Funding is committed to three positions (BLM, US F&WS, and USGS) with associated support funding for each position.

GREAT BASIN RESEARCH AND MANAGEMENT PARTNERSHIP (GB-RMP)

Mission Statement: The GB-RMP promotes comprehensive and complementary research and management collaborations to sustain ecosystems, resources and communities across the Great Basin.
Unique Role: Grassroots organization that provides a web-based clearinghouse of information for the Great Basin and mobilizes teams of researchers and managers to fund and implement projects that address priority science needs.

Partners/Collaborators: All Great Basin organizations—federal and state research labs and management agencies, universities, local agencies, tribal governments, NGOs, and collaboration developed to address regional and local needs
Initiating Organization: Research agencies and universities
Funding/Support: Member agencies and grants

GREAT BASIN RESTORATION INITIATIVE (GB-RI)

Mission Statement: To maintain and/or restore public lands in the Great Basin using science-based strategies supported by stakeholders
Unique Role: Maintain or improve the health of public lands by reducing the impacts of wildfires and invasive species
Partners: USGS, Forest Service, ARS, and other research agencies, State management agencies, and larger NGO's (for example TNC)
Initiating Organization: Initiated by BLM (Nevada State Office and the National Interagency Fire Center) in 1999 to address the large wildfires in the Great Basin
Funding/Support: A permanent full-time Coordinator is funded for GBRI. The other main funding source is the BLM's Native Plant Initiative that provides $800,000 per year for native plant development and application research.

GREAT BASIN FIRE SCIENCE DELIVERY (GB-FSD)

Mission Statement: The Great Basin Fire Science Delivery Project serves to: 1) provide a forum where Great Basin land managers can identify their technical needs with respect to fire, fuels, and post-fire vegetation management; 2) develop/synthesize the necessary information and technical tools to meet these needs; and 3) provide the necessary information and tools through venues most preferred by field staff, field office managers and higher administrative levels, respectively.
Unique Role: The Great Basin Fire Science Delivery Project is the Joint Fire Science Program's Regional Knowledge Exchange Consortium for the Great Basin. Our unique role is to provide Great Basin land managers with faster access to applicable fire and fuels science information and to develop direct knowledge exchange between managers and scientists in the Great Basin.
Partners: Federal, State, Tribal, NGO, and Private fire and fuels land managers.
Initiating Organization: The Joint Fire Science Program implemented this project in 2010. The Joint Fire Science Program is funded by the Departments of Interior and Agriculture and was initiated in 1998.
Funding/Support: This project is funded by the Joint Fire Science Program through a Great Basin Cooperative Ecosystem Studies Unit agreement with the Nevada State Bureau of Land Management.

KEYNOTE SPEAKER

BLM'S LANDSCAPE APPROACH TAKING THE NEXT STEP BEYOND THE BOUNDARIES

Amy Lueders, Nevada State Director, Bureau of Land Management, Reno NV

The BLM recognizes that the public lands are facing increasingly complex and widespread environmental challenges that transcend traditional management boundaries. These challenges include managing wildfire, controlling weeds and insect outbreaks, providing for energy development and urban growth, and addressing pervasive impacts from the effects of climate change. The BLM is developing a landscape-scale management approach to better understand these challenges and support balanced stewardship of the diverse natural resources of the public lands. A landscape approach examines such larger areas to more fully recognize natural resource conditions and trends, natural and human influences, and opportunities for resource conservation, restoration, and development. The approach seeks to identify important ecological values and patterns of environmental change that may not be evident when managing smaller, local land areas. The BLM's landscape approach builds on land management concepts and experiences that have been evolving for nearly three decades. BLM managers recognized in the early 1980's that western forests and rangelands were beset by widespread wildfires and weed and insect infestations that could no longer be managed effectively by local offices alone, or through traditional management practices. Scientists, land managers, and stakeholders have been working since then to understand these wide-ranging impacts, develop shared strategies, and implement collaborative management efforts. These collective experiences and partnerships underpin the BLM's landscape approach. Now we have the tools and ability to understand these complexities and working through partnerships we can overcome them.

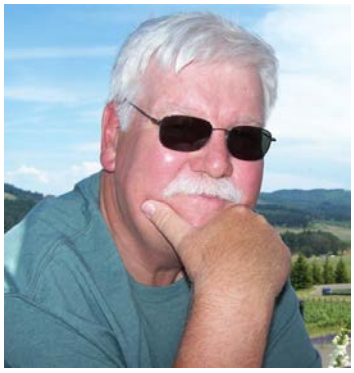
ABSTRACT | SESSION ONE: SAGE-GROUSE VISIONING AND PANEL DISCUSSION

AGENCY PANEL FOR VISIONING ON THE SAGE-GROUSE ISSUE FROM DIFFERENT PERSPECTIVES

Lauren Mermejo, BLM Great Basin Greater Sage-Grouse Project Manager,
Tim Rubald, State of Nevada Sagebrush Ecosystem Program,
Michael Cameron, Nevada TNC Associate State Director,
Ted Koch, Nevada State Supervisor, U.S. Fish and Wildlife Service

The sage-grouse issue is having an enormous impact on land management throughout the Great Basin and involves a very large number of agencies, organizations, working groups and individuals at the federal, state and local level. The Bureau of Land Management has responsibility for managing millions of acres of sage-grouse habitat on federal lands, the Natural Resources Conservation Service provides cost-share funding for sage-grouse management; the US Fish and Wildlife Service is responsible for critical determinations of legal status; various state agencies are often responsible for direct management of the wildlife; and there are extremely active working groups developing management strategies and cooperative programs at the national, state and county level. This panel will focus on several specific issues: the current status of the sage-grouse EIS process in the Great Basin; federal and state perspectives on sage-grouse management alternatives; the current listing status of sage-grouse, and high priority science and management issues that have yet to be resolved. After brief presentations by our panel members, the session will be opened to discussion among the panel and the audience.

THE JOINT FIRE SCIENCE PROGRAM AND THE GREAT BASIN – OVERVIEW AND FUTURE DIRECTION



Tim Swedberg, Communications Director, Joint Fire Science Program

The Joint Fire Science Program (JFSP) has been involved in Great Basin research since 1998 when the first million dollar project was awarded to Jeanne Chambers, USFS Rocky Mountain Research Station, Reno, NV, for "A Demonstration Area on Ecosystem Response to Watershed-Scale Burns in Great Basin Piñon-Juniper Woodlands." The Sagebrush Steppe Treatment Evaluation Project began with five years of JFSP funding and is one of the largest fire research efforts ever. The JFSP continues to make investments in restoration and rehabilitation of Great Basin ecosystems, and the development of biocontrols for cheatgrass. More importantly, the field trips and field guides produced by JFSP funded projects for Great Basin managers will lead to putting the science into practice.

Nora Devoe, formerly with the Nevada State BLM, was a champion for building the bridge between managers and scientists in the Great Basin. Through her enthusiasm and organization, the Great Basin Fire Science Delivery Project was created as part of the Joint Fire Science Program's Regional Knowledge Exchange Consortia. Today, Mike Pellant, Idaho State BLM; Génie MontBlanc, University of Nevada; and the project Steering and Advisory Committees continue to build relationships that help managers guide, understand, and implement new science information.

What lies around the bend and how can the Joint Fire Science Program and the Great Basin Fire Science Delivery Project help you manage the land?

GREAT BASIN FIRE SCIENCE DELIVERY 2013 UPDATE

Eugénie MontBlanc, University of Nevada, Reno NV; Mike Pellant, Bureau of Land Management, Boise ID; Jeanne Chambers, US Forest Service, Rocky Mountain Research Station, Reno NV; Brad Schultz, University of Nevada Cooperative Extension, Winnemucca NV; Elizabeth Leger, University of Nevada, Reno NV; Steve Bunting, University of Idaho, Moscow ID; Cheri Howell, USDA Forest Service, Wells NV; Mark Brunson, Utah State University, Logan UT
www.gbfiresci.org

This year, the Great Basin Fire Science Delivery Project coordinated a variety of activities. Our primary focus was on synthesis development and website improvement. Both approaches addressed our participants' stated needs for relevant research and improved access to regional information and events. Five scientific literature syntheses are in the works that will be published as US Forest Service Rocky Mountain Research Station General Technical Reports or other peer-reviewed literature: (1) Fire effects on vegetation and soils in the Great Basin and the role of site characteristics, (2) Livestock grazing effects on fuel loads for wildland fire in sagebrush dominated ecosystems, (3) Ecohydrologic impacts of rangeland fire on runoff and erosion, (4) Field guide to site recovery potential in sagebrush ecosystems, (5) Field guide to wind erosion as it relates to landscape assessment of post-fire stabilization. Our new website design was released in August, with improved navigation and multiple ways to search for information. We updated the home page to reflect the fire- and fuels-focused topics of our regional research bibliography which was completed this spring,

and we added an, “Ask an expert,” button on the home page. Our webinar series continued with five webinar presentations and over 200 attendees. Three field workshops were conducted this season with 42 participants: the ecology of fuel treatments (White Pine Mountain Range, Ely area, NV), the effectiveness of rehabilitation techniques and seeding rates (southwestern ID), and 30 years of western juniper management in the Owyhee Mountains (ID). We enhanced our outreach through increased social media participation and activity: (1) Mail Chimp list serve and Twitter followers both grew by over 100 members; (2) continued Twitter and Facebook activity with 41 new tweets and 28 posts, respectively, for a potential audience of 2228 people; and (3) five new videos posted on our YouTube channel with 176 video views and 12 channel subscribers. Next year we plan to continue supporting information syntheses for the Great Basin, conduct a series of field workshops based on the Field Guide to Site Recovery Potential in Sagebrush Ecosystems, continue our seasonal webinar series, conduct an informal social network analysis of fire and fuels professionals in the Great Basin, and continue to assist with finding the scientific information and/or connections needed to answer priority questions from our Great Basin land managers.

SAGEBRUSH STEPPE TREATMENT EVALUATION PROJECT (SAGESTEP): SUMMARY OF SHORT-TERM RESULTS

James McIver, Oregon State University, Corvallis OR; Mark Brunson; Steve Bunting; Jeanne Chambers; Paul Doescher; James Grace; Dale Johnson; Steve Knick; Richard Miller; Mike Pellant; Fred Pierson; David Pyke; Ben Rau; Kim Rollins; Bruce Roundy; Eugene Schupp; Robin Tausch; David Turner

SageSTEP is a regional experiment that evaluates alternative methods of sagebrush steppe restoration in the Interior West. In 2006, SageSTEP scientists and their manager partners began implementing alternative fuel treatments to reduce woody vegetation -- prescribed fire, clearcutting, mastication, mowing, herbicides -- at 18 study sites, and have studied treatment response in the herbaceous vegetation, the fuel bed, soils, water resources, erosion, wildlife, and invertebrates. After tree removal, prescribed fire and shredding lowered potential wildfire *intensity* should a fire occur, and plots could serve as defensible space during suppression. Potential wildfire *severity* would likely be lower only in areas previously treated by prescribed fire, due to the removal of surface fuel. Cheatgrass and native perennial grass cover declined immediately after burning, but increased in post-treatment years 2 and 3; native perennial forbs increased after both burning and mechanical treatments. Biological soil crusts declined after fire and had not recovered by post-treatment year 3. The amount of available soil water was key to vegetation recovery after treatment, as herbaceous species responded to tree removal. Yet the post-treatment balance between cheatgrass and native perennial grasses shifted markedly from perennials in the mountain big sage systems toward cheatgrass in Wyoming big sage. When pre-treatment cover of perennial tall grasses exceeded 10%, tree removal initiated herbaceous recovery even under phase III conditions. Encroached sagebrush steppe woodlands pose a risk of soil loss in the event of a severe wildfire, especially if followed by convective storms. Tree removal by prescribed fire decreases runoff from tree interspaces but increases runoff from tree coppices, with effects expected to decline after a few years. Mastication decreased runoff across the hillslope by leaving shredded debris that increased water infiltration rates. Carbon management goals parallel those of fuel and vegetation management -- maintaining low density woodlands with healthy herbaceous vegetation pays off in the long run, by incorporating relatively more carbon into the soil. Bird communities shifted slightly after prescribed burning, from those dominated by woodland birds to those more dominated by shrubland species. Tree removal at most woodland sites increased cover of the annual forb component of sage grouse food, and generally improved structural habitat conditions that grouse prefer. Butterflies tended to respond positively to restoration treatments, due to increases in herbaceous

vegetation. Links between butterflies and native vegetation suggest that unintended consequences are not likely to arise for butterflies after prescribed fire or its mechanical surrogates.

At lower elevation treeless sites, mowing reduced shrub cover in a spatially homogenous way, and is expected to decrease fire *intensity*, making these sites more defensible in the event of wildfire. Prescribed fire however, was the only treatment that was effective in decreasing potential fire *severity*, due to surface fuel reduction. Prescribed fire and mechanical treatments increased both cheatgrass and native perennial grass cover with time. The annual herbicide imazapic reduced cheatgrass cover for three years after treatment, but also decreased native forbs and perennial short grasses.

URL: http://sagestep.org

EFFECTIVENESS OF SAGEBRUSH STEPPE POST-FIRE REHABILITATION PROJECTS: SHORT AND LONG-TERM RESPONSES

David A. Pyke[1], Troy A. Wirth[1], Kevin C. Knutson[1], Jan L. Beyers[2], David S. Pilliod[1], Robert S. Arkle[1], Jeanne C. Chambers[3], Matthew L. Brooks[4]

[1]U.S. Geological Survey, Forest and Rangeland Ecosystem Science Center, Corvallis OR; [2]USDA Forest Service, Pacific Southwest Research Station, Riverside CA; [3]USDA Forest Service, Rocky Mountain Research Station, Reno NV; [4]U.S. Geological Survey, Western Ecological Research Station, El Portal CA

Wildfires continue to threaten the foundational shrub of the sagebrush steppe ecosystem, Artemisia tridentata, as well as the perennial herbaceous community. Post-fire seedings have been used as tools for rehabilitating sagebrush throughout the west, but a thorough evaluation of their effectiveness has never been done. We took two approaches to examine success of these seedings. First, we conducted a synthesis of the literature including a meta-analysis of rehabilitation project effectiveness determined at the end of the third year after the project was implemented. The synthesis provided insights into the importance of elevation and precipitation in these projects. Secondly, we conducted a field evaluation of rehabilitation projects that were implemented between 5 and 15 years earlier. This study examined nearly 100 projects across the northern Great Basin. It compared locations that were burned and seeded, burned and unseeded, and unburned and unseeded. In addition, the field study compared both aerial and drill seedings. We provide preliminary analyses of these studies. We determined that elevation and precipitation are important variables in projecting success of post-fire seedings in the Great Basin.

ABSTRACTS | SESSION FOUR: CLIMATE CHANGE – ADAPTATION STRATEGIES

MOVING BEYOND VULNERABILITY ASSESSMENTS: ARE WE READY TO SCIENTIFICALLY EVALUATE CLIMATE ADAPTATION ACTIONS?

Nicole DeCrappeo and Gustavo Bisbal, Department of the Interior Northwest Climate Science Center, Corvallis, OR

As we gain greater confidence in downscaled climate models and understanding about how natural and cultural resources will respond to climate change, our desire to implement climate adaptation actions grows. Many agencies and organizations have developed climate adaptation strategies, but these can lack specificity about on-the-ground actions. Further, even when specific management

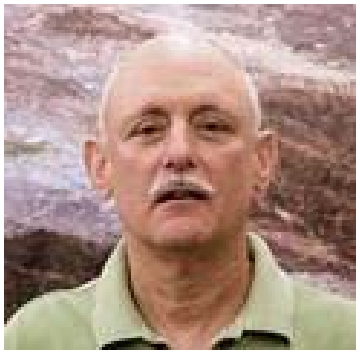
actions are suggested, there are few comprehensive syntheses of the science surrounding those actions. The Northwest Climate Science Center is exploring ways of compiling and categorizing climate adaptation actions in order to conduct meaningful synthetic reviews of the science behind those actions. Our goal is to provide guidance on the suite and suitability of options available to resource managers who must manage for climate change impacts.

WILDFIRE AND INVASIVE SPECIES IN THE WEST: AN APPROACH TO ADDRESSING THE PRIMARY THREAT TO GREATER SAGE-GROUSE IN THE GREAT BASIN

Kenneth E. Mayer, Coordinator, WAFWA Wildfire and Invasive Initiative Coordinator

The USFWS has contracted with the Western Association of Fish and Wildlife Agencies (WAFWA) to summarize the management, policy and scientific work focused on the wildfire and threat in the Great Basin (GB). Moreover, this review will include the identification of "gaps" that need to be addresses and suggestions as to how to improve existing programs and ideas for mew work. To conduct this review, a Working Group (WG) was formed. This WG consists of 16 nationally recognized experts in fire ecology and suppression, sage-grouse ecology and management, range management, restoration ecology, plant ecology, invasive species management and federal land management agency planning. This presentation will report on the accomplishments to date of this WG.

CLIMATE CHANGE VULNERABILITY OF NATIVE AMERICANS IN THE SOUTHWEST: PYRAMID LAKE PAIUTE TRIBE RESILIENCE AND ADAPTIVE MANAGEMENT STRATEGIES



David E. Busch, U.S. Geological Survey, Pacific Region, Sacramento CA; Karletta Chief and Edward Schuyler Chew, Department of Soil, Water, and Environmental Sciences, University of Arizona, Tucson AZ; Aleix Serrat-Capdevila, Department of Hydrology and Water Resources, University of Arizona, Tucson AZ; William J. Smith Jr., Harry Reid Center for Environmental Studies, University of Nevada - Las Vegas, Las Vegas NV

Native Americans in the Southwest are particularly vulnerable to climate change because of the close relationship with the environment upon which their culture, tradition, and livelihood depend. Climate change may overwhelm tribes already stressed by economic, social and environmental challenges. Nevada's largest tribe, the Pyramid Lake Paiute, has a history of active environmental stewardship, including consideration of potential climate change response alternatives. Our project, supported by the Department of the Interior's Southwest Climate Science Center, involves research to: 1) determine the potential of the Pyramid Lake Paiute Tribe for adaption to climate change by understanding vulnerabilities, thresholds, and resiliencies of the systems, 2) explore potential adaptive water management strategies; 3) produce a framework for a decision support system model of a coupled climate-biophysical-social system; and 4) evaluate tribal partnerships and collaboration possibilities. Unique and complex links between Pyramid Lake Paiute cultural values and the natural environment are strong but difficult to portray in conventional modeling approaches. We plan to cover our hydrological, climatological, socio-economic and institutional analyses, as well as climate change adaptation potential based on questionnaire responses and focus groups to investigate physical and social limits of adaption and resiliency.

GREAT BASIN COOPERATIVE ECOSYSTEM STUDIES UNIT

Michael W. Collopy and Christina Clack, Great Basin Cooperative Ecosystem Studies Unit, Office of Undergraduate and Interdisciplinary Research, University of Nevada, Reno
http://environment.unr.edu/contact/collopy.html
http://environment.unr.edu/gbcesu/

The Cooperative Ecosystem Studies Units (CESU) Network is a national consortium of federal agencies, tribes, academic institutions, state and local governments, nongovernmental conservation organizations, and other partners working together to support informed public trust resource stewardship. The CESU Network includes 331 partners, including 14 federal agencies, in 17 CESUs representing biogeographic regions encompassing all 50 states and U.S. territories. The CESU Network is well positioned as a platform to support research, technical assistance, education and capacity building that is responsive to long-standing and contemporary science and resource management priorities. The 17 CESUs bring together scientists, resource managers, students, and other conservation professionals, drawing upon expertise from across the biological, physical, social, cultural, and engineering disciplines (from Anthropology to Zoology) to conduct collaborative and interdisciplinary applied projects that address natural and cultural heritage resource issues at multiple scales and in an ecosystem context. Each CESU is structured as a working collaborative with participation from numerous federal and nonfederal institutional partners. CESUs are based at host universities and focused on a particular biogeographic region of the country. The Great Basin Cooperative Ecosystem Studies Unit (GB-CESU) is a regional partnership among 15 non-federal (i.e., universities and a non-governmental organization) and 9 federal agencies. Created in 2001, the mission of the GB-CESU is to create a partnership for research, technical assistance and education that enhances understanding and management of natural and cultural resources within the Great Basin. Specifically, the objectives of the GB-CESU are to: (1) provide research, technical assistance and education to federal land management agencies, environmental and research organizations and their potential partners; (2) develop a program of research, technical assistance and education that involves the biological, physical, social, and cultural sciences needed to address resource issues and interdisciplinary problem-solving at multiple scales and in an ecosystem context at the local, regional, and national level; and (3) place special emphasis on the working collaboration among federal agencies and universities and their related partner institutions.

GREAT BASIN FIRE SCIENCE DELIVERY 2013 UPDATE

Eugénie MontBlanc, University of Nevada, Reno NV; Mike Pellant, Bureau of Land Management, Boise ID; Jeanne Chambers, US Forest Service, Rocky Mountain Research Station, Reno NV; Brad Schultz, University of Nevada Cooperative Extension, Winnemucca NV; Elizabeth Leger, University of Nevada, Reno NV; Steve Bunting, University of Idaho, Moscow ID; Cheri Howell, USDA Forest Service, Wells NV; Mark Brunson, Utah State University, Logan UT
www.gbfiresci.org

This year, the Great Basin Fire Science Delivery Project coordinated a variety of activities. Our primary focus was on synthesis development and website improvement. Both approaches addressed our participants' stated needs for relevant research and improved access to regional information and events. Five scientific literature syntheses are in the works that will be published as US Forest Service Rocky Mountain Research Station General Technical Reports or other peer-reviewed literature: (1) Fire effects on vegetation and soils in the Great Basin and the role of site characteristics, (2) Livestock grazing effects on fuel loads for wildland fire in sagebrush dominated ecosystems, (3) Ecohydrologic impacts of rangeland fire on runoff and erosion, (4) Field guide to site

recovery potential in sagebrush ecosystems, (5) Field guide to wind erosion as it relates to landscape assessment of post-fire stabilization. Our new website design was released in August, with improved navigation and multiple ways to search for information. We updated the home page to reflect the fire- and fuels-focused topics of our regional research bibliography which was completed this spring, and we added an, "Ask an expert," button on the home page. Our webinar series continued with five webinar presentations and over 200 attendees. Three field workshops were conducted this season with 42 participants: the ecology of fuel treatments (White Pine Mountain Range, Ely area, NV), the effectiveness of rehabilitation techniques and seeding rates (southwestern ID), and 30 years of western juniper management in the Owyhee Mountains (ID). We enhanced our outreach through increased social media participation and activity: (1) Mail Chimp list serve and Twitter followers both grew by over 100 members; (2) continued Twitter and Facebook activity with 41 new tweets and 28 posts, respectively, for a potential audience of 2228 people; and (3) five new videos posted on our YouTube channel with 176 video views and 12 channel subscribers. Next year we plan to continue supporting information syntheses for the Great Basin, conduct a series of field workshops based on the Field Guide to Site Recovery Potential in Sagebrush Ecosystems, continue our seasonal webinar series, conduct an informal social network analysis of fire and fuels professionals in the Great Basin, and continue to assist with finding the scientific information and/or connections needed to answer priority questions from our Great Basin land managers.

GREAT BASIN LANDSCAPE CONSERVATION COOPERATIVE: 2013 HIGHLIGHTS

Linda Kelly, Coordinator, Todd Hopkins, Science Coordinator, and Matt Germino, Research Ecologist

The Great Basin Landscape Conservation Cooperative (LCC) is part of a seamless national network of 22 LCCs working with over 300 partners on 400+ projects. The LCCs were established by the Department of the Interior to better integrate science and management to address climate change and related issues. The Great Basin LCC is a self-directed partnership which seeks to enhance understanding of the effects of changing climate and other natural and human impacts across the region and promote the coordination of science-based actions to enable human and natural communities to respond and adapt. Our highlights for 2013 include engaging over 130 of our partners and community in several Great Basin Weather and Climate Forums and helping to create the Great Basin Weather and Climate Dashboard. Our landscape ecologist has published several recent studies on blackbrush and climate change, native shrub restoration, and wind erosion on burned sagebrush-steppe. The Great Basin LCC science program funded six projects and was able to leverage $4 for every $1 we spent.

GREAT BASIN RESTORATION INITIATIVE

Mike Pellant, Bureau of Land Management, Boise ID

Background: GBRI was initiated in 1999 as a result of wildfires that burned 1.7 million acres of public land in the Great Basin. Land managers realized that the solution to increasing wildfires and accelerating spread of invasive species was a **proactive** restoration program that "fixed" resource problems in advance of the disturbance. The **reactive** approach of wildfire suppression, fire rehabilitation, and post-invasion weed control is not working on the 75 million acres of public land in the Great Basin. Of even greater concern to managers is the accelerating downward ecological spiral that is occurring on the estimated 25 million acres of public land dominated by cheatgrass that is now being replaced by even more problematic biannual and perennial weeds (knapweeds, rush skeletonweed, yellowstar thistle, leafy spurge, etc.). Native pinyon pine and/or juniper trees are also expanding into sagebrush steppe, reducing native plant diversity and soil stability, significantly reducing habitat for sagebrush obligate species such as the sage grouse, and reducing forage for livestock.

GBRI Vision: Healthy Great Basin landscapes and sustainable resources that meet the needs of the public that use and enjoy these lands.

GBRI Goals

1. Maintain landscapes (especially native plant communities) and dependent species where healthy land exists now or can be obtained by using or modifying standard management practices.
2. Strategically restore degraded landscapes to improve land health and reduce invasive species, especially those responsible for altered wildfire regimes.
3. Sustain long-term multiple use and enjoyment of public land in the Great Basin and provide potential economic opportunities to local communities in the restoration process.

Current Major Activities

- Providing technical expertise and input into BLM's Sage-grouse Strategy (http://www.blm.gov/wo/st/en/prog/more/sagegrouse.html)

- Program lead for the BLM's Great Basin Native Plant Selection and Increase Project, a regional program to improve access to and success in strategically restoring native plants (http://www.fs.fed.us/rm/boise/research/shrub/greatbasin.shtml).

- Steering Committee member for the Great Basin Fire Science Delivery Project (www.gbfiresci.org) to "Link Managers and Scientists to Improve Pre- and Post-fire Management Decisions"

- Active Great Basin Consortium member and supporter

THE GREAT BASIN RESEARCH AND MANAGEMENT PARTNERSHIP

Stuart Hardegree, USDA Agricultural Research Service, Northwest Watershed Research Center, Boise ID; Jeanne Chambers, USDA Forest Service, Rocky Mountain Research Station, Reno NV

The Great Basin Research and Management Partnership (GBRMP) supports development of multidisciplinary, multi-organizational teams to address critical management issues related to wildland fire, invasive weeds, drought, climate change, urbanization and land use in the Intermountain West. In 2013, GBRMP enhanced its web clearinghouse (http://greatbasin.wr.usgs.gov/gbrmp/index.html) to improve basic functionality and to catalog regional webinar information on research and science applications relevant to Great Basin management and initiated a webinar series that has been administered through the GBRMP affiliated Great Basin Fire Science Delivery Project. GBRMP was asked and agreed to review the BLM Central Basin and Range Rapid Ecological Assessment and provide feedback on challenges and opportunities for using REA information as a resource for management. The GBRMP Bromus REEnet working group is currently developing a 12-chapter book "Exotic Brome Grasses in Rangeland Ecosystems of the Western US: Assessing Current and Future Invasions, Impacts, and Management Alternatives" which it expects to publish in 2014. GBRMP has also submitted a collaborative proposal with the Great Basin Joint Fire Sciences - Fire Science Delivery Project to sponsor a symposium for the Association for Fire Ecology national meeting in Missoula, 2014, on the subject of large rangeland fires. GBRMP recently initiated a renewal of the Memorandum of Understanding among its member organizations and updated its Charter to streamline its organizational structure.

"HIDDEN CAVE" DOCUMENTARY FILM

Mark Gandolfo, Director, University of Nevada, Reno; Winter Carrera, Producer, University of Nevada, Reno

Affiliations:
Mathewson-IGT Knowledge Center at the University of Nevada, Reno
Bureau of Land Management Carson City District
Churchill County Museum & Archives
Nevada Department of Transportation

"Hidden Cave" is a high-definition documentary film focusing on premier archaeological site, Hidden Cave. The film emphasizes the cave's importance as a unique and valuable link to Nevada's deep historical past and a site used to better understand American Indian life going back thousands of years in Nevada's Carson Sink. Both the cave and the Nevada landscape come to life as world-renowned researchers and Fallon Paiute-Shoshone Tribe members share their stories. The intended audiences are k-12 school children, the elderly and special needs individuals or anyone not able to physically visit the site in person. Today visitors can view a screening of "Hidden Cave" prior to cave tours held twice a month managed by the Churchill County Museum and Archives.

This short film will be available for viewing in Ballroom A during the Reception. Showtimes: 5:00, 5:20, 5:40, 6:00, 6:20, and 6:40 p.m.

IDENTIFYING NEW CONSERVATION PRIORITY AREAS AND OPPORTUNITIES ON UNPROTECTED ROADLESS LANDS IN THE WESTERN U.S.: A CASE STUDY IN THE GREAT BASIN

Christine Albano, John Muir Institute of the Environment, UC Davis; Brett G. Dickson, Conservation Science Partners; Luke Zachmann, Conservation Science Partners; Leslie Duncan, Pew Environment Group

How to identify land conservation targets that are politically viable and scientifically valid is a topic of ongoing discussion in the conservation community. In the US, vast areas of public land, including those administered by the Bureau of Land Management (BLM), present a conservation opportunity, but also a challenge due, in part, to the diverse interests of many stakeholders. For the 11 contiguous western states in which the BLM chiefly operates, we used a systematic approach and novel multiple-criteria analysis to model and map contiguous areas of roadless BLM land that possessed important ecological indicators of high biodiversity, resilience to climate change, and landscape connectivity. Specifically, we leveraged available spatial datasets and a systematic process of variable selection to implement a statistically robust analysis of seven key indicators at three different spatial scales, and to identify the locations of potential conservation priority areas (CPAs) across 294,274 km^2 of roadless BLM land. Within this extent we identified approximately 48,300 km^2 of land with relatively high conservation value in the Great Basin, 12,300 km^2 of which met criteria for CPAs. These CPAs represent a diverse set of places that can be used alone or in conjunction with other datasets representing specific conservation values (e.g., sage grouse) in ongoing landscape conservation and special designation efforts in BLM and adjacent ownerships. Our methodological framework and novel weighting approach can

accommodate a wide range of input variables and is readily applicable to other jurisdictions and regions within the US and beyond. Our highly collaborative approach links rigorous science with grassroots efforts at regional and national scales and seeks to inform ongoing discussions about protected land designations across the West.

EVALUATING SPECIES MANAGEMENT GUIDANCE AND MONITORING PROGRAMS FOR THE GREAT BASIN IN NEVADA

Elisabeth M. Ammon and John D. Boone, Great Basin Bird Observatory, Reno NV

Agency-specific and regionally-based resource management plans typically feature a list of conservation priority species, and these species are usually ranked or categorized according to their known or perceived vulnerability and the urgency of management action. For many of these priority species, however, existing management guidance is based on poor or incomplete knowledge about the species' current status, distribution, trends, habitat requirements, and response to potential threats. Consequently, management guidance for these species may be insufficient or conjectural. This project was funded by the Great Basin LCC to help identify and address inadequacies in the currently-available management guidance for conservation priority species in the Great Basin region of Nevada. This process will involve selecting a consensus set of vertebrate priority species that are identified in multiple management plans. We will collect existing guidance for these species in Nevada's Great Basin from a variety of sources, including BLM, USFS, USFWS, NPS, USBOR, NDOW, TNC, and NNHP. The existing guidance will be cross-referenced and compared, and will evaluated for consistency with existing data monitoring programs (including the Nevada Bird Count, a program of the Great Basin Bird Observatory), reports, and published sources. We will then generate species-specific assessments about the adequacy of current knowledge, and the adequacy of the guidance that is based upon this knowledge. The outputs from this project will include specific recommendations for high-priority research and monitoring, and will further recommend modifications or enhancements to existing guidance that can be justified based on our present knowledge of species biology, habitat needs, and threats. We will also incorporate into these recommendations results from ongoing projects funded by BLM and NDOW to improve our understanding of disturbance impacts on birds in shrub-dominated landscapes, along with data from the Nevada Bird Count and other sources (including ww.EBird.org) that help to define periods of seasonal sensitivity for breeding birds. This project is scheduled for completion in spring, 2014, and the findings it generates will be provided to all agency partners.

SEEDLING ROOT ARCHITECTURE STRONGLY INFLUENCES FIELD PERFORMANCE OF GENOTYPES OF A COMMON BUNCHGRASS

Daniel Z. Atwater[1], Jeremy J. James[2], Elizabeth A. Leger[1]
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[2] Sierra Foothill Research and Extension Center, University of California

We investigated how variation in root traits affected the field performance of different genotypes of *Elymus elymoides* (squirreltail), a common bunchgrass native to the Western United States. This research contributes to the growing awareness that high within-population variation in functional traits strongly affects the performance of individual plants in nature. Seeds from 50 *E. elymoides* individuals were collected from a drier and a wetter site in Northern Nevada. We planted a subset of these wild-collected seeds in the greenhouse, along with seeds of a commercially-available accession, and analyzed 10-day root architecture of each half-sib family. Root traits of greenhouse-reared plants were correlated with the performance of siblings grown in field plots close to the seed collection sites. Root architecture was inherited, with root diameter and a PCA score for root proliferation showing significant differences among families and broad-sense heritabilities between 0.120 and 0.270. Root architecture also had strong effects on performance of plants at both sites. At the drier site, within-population variation in root diameter and proliferation combined to cause a three-fold increase in

seedling survival probability and a 1.5-fold increase in seedling size. At the wetter site, survival probabilities were highest for intermediate phenotypes. At both sites, wild-collected genotypes consistently outperformed a commercially available accession. These results present evidence of a link between root architecture and field performance, and suggest that heritable variation in root architecture has strong effects on seedling development and on the first-year survival and performance of plant genotypes growing in a natural environment.

AN EXTENSION OF THE MUTCH HYPOTHESIS: DOES AGE INFLUENCE RELATIVE FLAMMABILITY IN FIRE ADAPTED AND NON-FIRE ADAPTED PINES?

Kevin J. Badik[1, 2], Elizabeth A. Leger[1, 2], and Lora A. Richards[3]
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Flammability varies among plant species. Several hypotheses have been put forward about the benefits of plants developing increased flammability, including: elimination of competitors, creation of optimal conditions for germination, and promotion of quicker burning fires to preserve saplings and underground organs. If true, these hypotheses suggest enhanced flammability would only be an advantage when individuals reach maturity; thus one would expect to see enhance flammability in fire-adapted adults compared to juvenile individuals of fire adapted species. We investigated the relationship between reproductive status and flammability in pine species, asking the questions: 1) can differences in flammability be detected in needles from pre- and post-reproductive pines? and 2) do age differences in flammability differ between fire adapted and non-fire adapted pines? Downed needles from pre-reproductive and post-reproductive individuals were collected from two fire adapted pine species (*Pinus palustris* and *P. jeffreyi*) and two non-fire adapted species (*P. monophylla* and *P. albicaulis*). Additionally, a subset of needles from fire adapted pines was cut to mimic the length of the non-fire adapted species. Ten 25 gram sample of each treatment were dried and burned. Maximum temperature and smoldering time were recorded.

As expected fire adapted and non-fire adapted pines differed in both smoldering time ($p < 0.001$) and maximum temperature ($p < 0.001$), with non-fire adapted pines burning longer and hotter. However, effects of age were greater on fire adapted pines than non-fire adapted ones for both smoldering time and especially maximum temperature. Lastly, when needles from fire adapted were cut to match the length of needles in non-fire adapted pines, significant differences were observed in both smoldering time ($p < 0.001$) and maximum temperature ($p = 0.005$) relative to unmanipulated needles. In both smoldering time and maximum temperatures, cut needles performed intermediately to intact fire adapted and non-fire adapted pines. These results indicate that age of the individual does affect flammability of these fire adapted pines, with needles from mature individuals burning quicker and hotter than immature sources. Difference between the shorter needles (non-fire adapted and cut treatments) and intact fire adapted needles reinforce the importance of needle length on burning characteristics. In the field, quicker burning could help spread fire to eliminate neighbors as well as reduce residence time of flames, which impacts survival of individuals, lending support for hypotheses about the benefits of enhanced flammability. Understanding variation in flammability across a species' life history not only reveals the evolutionary history of that species but also the ecological role that species plays in a fire-prone environment. Evolutionary and ecological knowledge of species with enhanced flammability may be especially important give the recent shifts in fire regimes for many landscapes.

WILL LOCAL OR COMMERCIAL NATIVES SUCCEED WHERE EXOTIC INVADERS FAIL? CHEATGRASS DIE-OFFS AS AN OPPORTUNITY FOR RESTORATION IN THE GREAT BASIN, USA

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The exotic annual cheatgrass (*Bromus tectorum*) commonly occurs in dense near-monocultures in the Great Basin, U.S.A. after diverse native plant communities have been mostly extirpated. Efforts to reestablish native species via direct seeding are often unsuccessful. In addition to climatic factors that influence establishment, strong cheatgrass dominance impedes native establishment in highly invaded communities, and commercially produced, non-local seeds may lack important adaptive traits. The phenomenon of complete cheatgrass stand failure, or 'die-off', can leave areas within cheatgrass near-monocultures devoid of growth for one or more years. Such areas may represent restoration opportunities if native seeds can establish within them. This ongoing study addresses two questions within one cheatgrass die-off in northern Nevada: (1) Will native grasses establish from seed within cheatgrass die-offs, with or without modest ameliorations? and (2) Do adaptations to local conditions result in greater establishment of local genotypes relative to commercial cultivars? In October 2012, local and commercial sources of Sandberg bluegrass (*Poa secunda*) and bottlebrush squirreltail (*Elymus elymoides*) were precision-planted in recent die-offs and adjacent near-monocultures (controls) under six treatments: litter removal, fungicide application, and no treatment; each with and without water addition. Emergence of native seeds was significantly lower in die-off plots, but after one growing season (May 2013), there was significantly higher survival and growth of all seeded materials in die-off plots than in adjacent control plots. Commercial squirreltail ('Toe Jam Creek') showed higher survival than locally collected squirreltail, whereas local bluegrass showed higher survival than commercial bluegrass ('Mt. Home'). Litter removal had a positive influence on survival and growth for all materials, and post-seeding, late autumn water addition increased survival of squirreltail but not bluegrass. Soils from die-off plots were more acidic and had significantly higher phosphorus, potassium, and nitrate, but lower calcium and magnesium, than soils from immediately adjacent control plots. These results suggest that cheatgrass die-offs may support increased establishment of native species and may therefore represent valuable opportunities for restoration. Continued (second season) survival will be assessed in late November 2013 and included in the presented poster.

PROJECT UPDATE - CHARACTERIZATION OF MONTANE ECOSYSTEMS, THEIR MICROCLIMATES, AND WILDLIFE DISTRIBUTION AND ABUNDANCE ACROSS THE HYDROGRAPHIC GREAT BASIN

Erik Beever, USGS Northern Rocky Mtn. Science Center; Thomas Albright, University of Nevada-Reno (UNR); Gail Collins, U.S. Fish and Wildlife Service, Sheldon-Hart National Antelope Refuge; Thomas Millette, Mt. Holyoke College; Rachel Mazur, U.S. Forest Service, Humboldt-Toiyabe National Forest; John Axtell, Bureau of Land Management; Solomon Dobrowski, University of Montana

Both across the West and worldwide, mountains represent where we've banked on, for our conservation future: 72-90% of the most-strictly protected areas of the western 11 U.S. states occur in mountains. Western mountains also harbor important biodiversity, as they possess insular and relictual populations of species not found at lower elevations. The American pika (*Ochotona princeps*) is a small mammal that inhabits talus slopes in cooler, more-moist corners of the Great Basin, and has exhibited steep declines there. Despite their great topographic complexity and ecological importance, mountain ecosystems of western North America are typically under-instrumented. We have a network of >200 temperature sensors across the hydrographic Great Basin that have been collecting data for up to 8 years. Hierarchically distributed within 3 km of each of 30 locations of historical pika records, sensors occur in 16 mountain ranges and 5 other hilly regions. Although sensors were placed primarily in talus interstices, we also installed paired sensors above the talus and at typical weather-

station screen heights (1.5-2.0 m), to calibrate the talus-interstice sensors to typical descriptions of weather and climate (e.g., PRISM, HCN). We have used this network of sensors, plus modeled variables of climatic water-balance and other topographic and anthropogenic predictors, to try to understand mechanisms underlying landscape-scale patterns of occupancy, density, and trend of American pikas; we're now seeking to expand their utility and application. In Summer 2013, we: 1) replaced the entire network of sensors, and downloaded data from all sensors that had been out since 2009; 2) supplemented the network with 1 additional sensor/site measuring both temperature and relative humidity, and with additional sensors at weather-station screen heights (N_{total} = 286, now); 3) completed Basin-wide re-sampling of pika persistence and density, thus producing time series of these measures; 4) acquired via remote sensing very-high-resolution (~4-8 cm) color and hyperspectral imagery, as well as absolute surface temperatures at 10 sites in the northwestern Great Basin; and 5) sampled small amounts of foliage from apparently pika-preferred and non-preferred shrubs, to assess whether plant chemistry mediates patterns in persistence and density trends. Sensors span USFS, BLM, USFWS, DOD, and private-landowner jurisdictions. Just over half of the sites occur in Wilderness-designated areas. Whereas pika abundance in the drought year of 2012 averaged only 55% of numbers detected during 2003-2008, pika detections in 2013 suggested mixed trends. Temperatures in talus interstices differ from paired above-talus temperatures by few to >10 °C, and diel amplitudes of temperature swings are dampened in talus interstices. We are currently summarizing the microclimate data for all the sensors and characterizing them with respect to important thresholds (e.g., time below 0° C). This research will help: a) quantify the variability of weather and climate at micro-, meso-, and macroscales across the Basin, and across diel, seasonal, and interannual periods; b) inform management and conservation efforts by better characterizing the climatic 'stage' upon which all biological 'actors' and efforts hinge; and c) feed into other bioclimatic and wildlife studies seeking to describe climate and biotic responses to it.

INFLUENCE OF *BROMUS TECTORUM* INVASION ON SOIL PROPERTIES IN NORTHERN NEVADA

Robert R. Blank and Tye Morgan, Research Soil Scientist and Technician, USDA-ARS, Great Basin Rangelands Research Unit, Reno NV

In the last 50 years, the exotic annual grass, *Bromus tectorum*, has come to dominate rangelands over northern Nevada. Long-term occupation of soil by *B. tectorum* has the potential to alter soil processes particularly carbon and nitrogen cycles. Using a paired design, we compared surface soil properties (0-5, 5-10 cm) between cheatgrass invaded and nearby similar soil occupied by native vegetation for 9 sites in the northern Nevada. Response variables quantified included: total C and N, mineral N, labile C, and soil-solution anions. Pooled over site and depth, soils invaded by *B. tectorum* had significantly greater total C (1.78 vs. 0.93 %), total N (0.145 vs. 0.080 %), labile C (551 vs. 348 mg kg^{-1}), and solution phase ortho-P (71.6 vs. 36.5 µmol L^{-1}). Mineral N was much higher in soil beneath *B. tectorum* than soil beneath native vegetation (0.64 vs. 0.36 mmol kg^{-1}), but statistically similar. These data indicated the invasion by *B. tectorum* affects soil C and N cycles relative to native plant communities. Higher levels of labile C in invaded sites suggest faster turnover of C. These data were collected during a below average precipitation year and the study will be duplicated in a more normal year.

IDAHO BIRD CONSERVATION PARTNERSHIP: A COORDINATION POINT FOR BIRD CONSERVATION IN IDAHO

Jay Carlisle, Idaho Bird Observatory, Boise State University, Idaho Bird Conservation Partnership Coordinator

Idaho Bird Conservation Partnership (IBCP) provides a foundation for state and federal agencies, non-governmental organizations, private industry, and interested citizens to cooperate and collaborate for the management, science delivery, outreach, and conservation of birds and their habitats in Idaho. The IBCP also strives to implement strategic management and conservation efforts that contribute to the achievement of high

priority regional and continental bird objectives aligned with national and state bird conservation initiatives and Idaho's State Wildlife Action Plan. The poster will serve to introduce GBLCC attendees to the IBCP, our seven working groups, our current priorities, and our accomplishments to date.

PREDICTING DESERT SHRUB COMMUNITY DISTRIBUTIONS USING CLIMATIC WATER DEFICIT VARIABLES

Thomas Dilts, Camie Dencker and Peter Weisberg, University of Nevada Reno; Jeanne Chambers and David Board, U.S. Forest Service Rocky Mountain Research Station

In arid environments, soil water is known to be an important variable controlling the distribution of plant communities. However, most geographic models of species distributions rely on variables derived from precipitation and temperature. The problem with such models is that they don't account for the seasonality of water supply and demand, the form of precipitation (snow vs. rain), or the effect of soil water storage or complex topography on water balance. In the Great Basin precipitation and temperature gradients tend to be correlated making it difficult to separate the two using correlative methods. We apply a new method - the climatic water deficit approach (1) - to model the distribution of major desert shrub types in the Great Basin and compare the results to models derived from more traditional bioclimatic variables, based on temperature and precipitation. The climatic water deficit approach is a dynamic GIS model that tracks water inputs (rain and snow melt), water outputs (actual evapotranspiration), and water storage (snowpack and soil) at a monthly timestep. Models derived from climatic water deficit variables were an improvement over the bioclimatic variables for the following shrub types: greasewood, shadscale, winterfat, Wyoming big sagebrush, low sagebrush, and mountain big sagebrush. Only black sagebrush distribution was better predicted by bioclimatic variables. Bioclimatic models tended to omit large geographic areas, such as northeastern Nevada for greasewood and Wyoming big sagebrush, southern Nevada for shadscale, and northern Nevada for winterfat. In contrast, climatic water deficit models tended to spread the errors geographically. In terms of the most important variables, cumulative climatic water deficit was consistently chosen as the most important variable for the climatic water deficit models. The most important variables chosen using the bioclimatic modeling varied by shrub type and included minimum annual temperature, precipitation seasonality, isothermality, and cumulative annual precipitation. Results suggest that models derived from climatic water deficit variables may be more consistent and possibly more reliable when extrapolating to future climates. Results also suggest that at broad spatial scales that all seven shrub types are primarily limited by water availability.

PASSIVE RESTORATION IN SAGEBRUSH ECOSYSTEMS AT HART MOUNTAIN NATIONAL ANTELOPE REFUGE, OREGON

Lisa M. Ellsworth and J. Boone Kauffman, Oregon State University, Corvallis OR; David Dobkin, Greater Hart-Sheldon Conservation Fund; John Kasbohm, Jeff Mackey, and Gail Collins, U.S. Fish and Wildlife Service

The sagebrush desert is among the most endangered ecosystems in western North America, due to land use changes such overgrazing by domestic livestock, invasive species, development, altered fire regimes, and changing climate, which often interact to affect ecosystem structure and function. The long-term effects of domestic livestock and patterns of recovery following their removal are poorly understood in sagebrush ecosystems. A unique opportunity exists to examine the effects of livestock removal at Hart Mountain National Antelope Refuge (HMNAR), which provides critical habitat for sage grouse and pronghorn antelope, and where cattle were removed to promote wildlife habitat in 1990. An understanding of the resultant changes in species composition, structure, and diversity will provide valuable information not only to refuge managers, but to land managers and other stakeholders in the Great Basin and semiarid west. In partnership with the U.S. Fish and Wildlife Service and the Greater Hart-Sheldon Conservation Fund, we addressed this issue by obtaining historical

data and photos from permanently located plots and photo points (*N*=28) in four widespread communities: (*1*) Mountain shrub dominated by antelope bitterbrush (*Purshia tridentata*)-mountain sagebrush (*Artemisia tridentata* subsp*. vaseyana*); (*2*) mountain big sagebrush (*A. tridentata* subsp. *vaseyana*); (*3*) Wyoming big sagebrush (*A. tridentata* subsp. *wyomingensis*); and (*4*) low sagebrush (*A. arbuscula*). All historical plots were previously measured in 1968, 1979, and 1987 by refuge personnel. We resampled and re-photographed all plots in 2013. Across all sagebrush ecosystem types there was a decrease in bare ground ($P<0.01$) following cattle removal, with concomitant increases in shrub, native bunchgrass, and biological soil crust cover that varied by community type. Litter cover was lowest in 2013 ($P<0.05$) than in any prior year. Cheatgrass and other exotic cover was minimal across all dates and communities, with <1% cover present in plots, except for short-lived increases following 1985 fires in two plots. These findings demonstrate that the removal of livestock resulted in positive changes to critical sagebrush communities, and can inform management decisions where restoration of sagebrush habitat is a priority. The acquisition of these historical datasets and relocation of field plots were significantly challenging, however, there is immense value that is gained from long-term data sets such as the one presented here. Since project initiation, collaborations have grown out of this initial work, and research is planned to resample additional historical plots on BLM land as well as on Sheldon National Wildlife Refuge. In addition, we are working with researchers from multiple agencies and academic institutions to address research questions on the interacting influences of wildfire, livestock removal, and invasive species for the restoration of sage grouse habitat on these refuges.

POST-FIRE SAGEBRUSH ESTABLISHMENT ACROSS THE LANDSCAPE: EXPERIMENTAL TESTS TO INFORM RESTORATION SUCCESS

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Loss of big sagebrush (*Artemesia tridentata*) habitat following fire and corresponding impacts to conservation of dependent species has motivated extensive efforts to seed or plant it. However, establishment success has been mixed. We are evaluating how common management treatments of the herbs interact with landscape condition, climate and weather, and factors such as selection of sagebrush seed source to impact restoration success. Additionally, the experiments are deployed in a collaborative fashion between agencies and a large volunteer program at the Birds of Prey National Conservation Area in Idaho, thereby incorporating the true elements of a program capable of enhancing restoration of large upland landscapes. Treatments are all applied at landscape scales and include controlled tests of herbicides for reducing exotic annuals, mowing to reduce fuels, drill seeding of desired herbs, all sagebrush subspecies and ploidy levels, and newly added tests of exposure to wind manipulated by barriers or by density and configuration of outplanted sagebrush seedlings.

THE IMPORTANCE OF PERSISTENT MONITORING OF GREAT BASIN RANGELAND REHABILITATION EFFORTS

Dan Harmon and Charlie Clements, USDA Agricultural Research Service

Collaborators: USDI-BLM Winnemucca District, NRCS, NDOW, Local Livestock operators

It has long been acknowledged the drastic change in fire cycle of the Great Basin due to cheatgrass (*Bromus tectorum*) invasion (Billings 1952, Young and Evans 1974, Wright 1980). An annual grass fire cycle now exists with return intervals less than 5 years compared to historical 60 to110 years (Whisenant 1990). This is too short of a period of time to allow the return of critical browse species (succession). This leaves most habitats in a

perpetual state of early succession dominated by cheatgrass. The chance, rate, spread and season of wildfires must be addressed; hence the reduction of cheatgrass associated fuels. There are various methods to decrease cheatgrass in the short-term (1-2 years) and "open a window of opportunity" to seed degraded rangelands. Mechanical (disking), fire, grazing and herbicide applications can reduce cheatgrass competition and fuels, but are not a sustainable means to reduce cheatgrass. The establishment of competitive long-lived perennial grasses (closed community) is the most reliable means to reduce cheatgrass invasion through soil drought (Robertson 1945). Along with using multiple tools, goals should be clearly stated to judge the successfulness of efforts. We believe that monitoring should occur for more than 5 years or at least greater than the short fire cycle (<5 years) causing the problems. If less than 5 years is not allowing the ecosystem to function or succession to occur we should then judge our rehabilitation effectiveness beyond that time period. The Agricultural Research Service (ARS) has the benefit of having multiple long-term dedicated research sites throughout the north western part of the Great Basin. This gives ARS a valuable breadth of knowledge when it comes to plant community change over time. We present two case studies of integrated cheatgrass management research with monitoring occurring for 10 and 7 years. We contrast and compare similarities and differences of plant material testing, cheatgrass control (prior to seeding), cheatgrass suppression (seed banks) and the ultimate fate of each site after 3 years monitoring and then beyond five years. One study occurred at Orovada, Nevada (2000 collaboration ARS, BLM, NRCS, NDOW) and involved herbicide control and plant material testing. We report the 2nd year perennial grass establishment (usually the only data reported in similar studies) (2002 perennial max 2.3/ft^2) and compare that to 2010 survival (perennial max 1.4/ft2) and cheatgrass suppression (suppressed cheatgrass 2002-1ft^2, 2010- 9/ft^2 and control cheatgrass 62 and 92/ft^2 respectively). The other study occurred at Empire, Nevada (2006 collaboration ARS, BLM, Livestock Operators) and involved plant material testing after a wildfire with mechanical (disking) cheatgrass control treatments. While this site had very similar results to Orovada in the first 2 years; high perennial grass establishment and good cheatgrass suppression (2008 perennial grass 9.3/ft^2, suppressed cheatgrass 1.3/ft^2 and control cheatgrass 57.6/ft^2), the site differed from Orovada long-term results after 5 years of monitoring (2011 perennial grass 0.65/ft^2 and suppressed cheatgrass 69/ft^2). We will discuss the likely causes of the differences and highlight observations gained with continual monitoring.

HIGHLIGHTS FROM THE NEVADA INTEGRATED CLIMATE AND EVAPOTRANSPIRATION NETWORK - NICE NET

Justin Huntington, Desert Research Institute, Division of Hydrologic Sciences; Christian Dunkerly, Desert Research Institute; Austin Chapman, Desert Research Institute; Greg McCurdy, Desert Research Institute; AJ Wolff, Desert Research Institute; Brad Lyles, Desert Research Institute; Richard Allen, University of Idaho

Collaborators: Western Regional Climate Center, U.S. Bureau of Reclamation, Nevada Division of Water Resources

Almost all weather stations in Nevada are located in dry, non-irrigated environments. The lack of water causes the air temperatures to be elevated and the humidity levels to be reduced when compared to climate surrounding irrigated lands. This dry land aridity causes estimated crop water demands to be in error by as much as 30% when compared to estimates derived from well-irrigated climate data. Therefore it is important that weather data be representative of irrigated environments if crop water demands are being estimated. To fill this data gap, the Desert Research Institute's Division of Hydrologic Science, in collaboration with the Western Regional Climate Center (WRCC), U.S. Bureau of Reclamation, and Nevada State Engineer's Office, has developed a weather station network specifically designed for accurately measuring weather variables representative of irrigated agricultural areas similar to the U.S. Bureau of Reclamation's AgriMet, California's CIMIS, and Arizona's AZMET networks for estimating reference ET, crop water use, plant status, and irrigation scheduling. Measured ten minute solar radiation, air temperature, humidity, soil temperature, soil moisture,

windspeed, and precipitation are transferred from the weather stations to the WRCC every hour and posted online, with computed metrics such as growing degree days, dew point, and other variables. In addition, extensive weather data quality assurance and control is performed, and many online graphing and data downloading options are available. So far, NICE Net weather stations have been installed in Western Nevada (Mason Valley, Smith Valley, Carson Valley, Truckee Meadows, Lovelock, Fallon, Hualapai Flat) Central Nevada (Antelope Valley, Paradise Valley), Eastern Nevada (Spring Valley, Snake Valley, North Steptoe Valley, South Steptoe Valley, Clover Valley), and Southern Nevada (Pahranagat Valley, Penoyer Valley, Moapa Valley, Amargosa Valley). Funding for the project is for one more year, so we are pursuing funding for long term maintenance from federal, state, county, and city sources. The NICE Net is already serving as a critical data source for estimating consumptive use for water right transfers from agriculture to municipal, providing information about irrigation scheduling, agricultural drought status and potential monetary subsidies, and providing an accurate picture on the spatial distribution of agricultural water demands across the state. This presentation highlights some interesting weather differences between desert and irrigated environment stations, and provides an overview of the NICE Net web interface.

UTILIZING CLOUD COMPUTING OF LANDSAT IMAGERY AND GRIDDED WEATHER DATA FOR EVALUATING GROUNDWATER DEPENDENT ECOSYSTEMS IN NEVADA

Justin Huntington, Desert Research Institute, Division of Hydrologic Sciences; Charles Morton, Desert Research Institute; Ken McGwire, Desert Research Institute; Andy Joros, Desert Research Institute; Sarah Peterson, U.S. Bureau of Land Management; Noel Gorelick, Google; David Thau, Google; Rick Allen, University of Idaho

Understanding the spatial and temporal variability of groundwater dependent ecosystems in relation to climate and anthropogenic changes is key for developing monitoring strategies, evaluating the effectiveness of restoration and preservation, and identifying potential impacts from groundwater development. Many sensitive species in Nevada rely on habitat areas that are groundwater dependent, such as meadows, spring complexes, and riparian corridors. Annual variations in precipitation and temperature cause significant seasonal and annual variability in vegetation vigor surrounding shallow groundwater areas. In addition, groundwater pumping and water development can cause significant declines in vegetation vigor. To better understand if vegetation changes are natural or anthropogenic, natural background variability must be well understood. In this presentation, we highlight current work using the Google Earth Engine cloud computing and environmental monitoring platform, along with the entire archive of Landsat imagery and downscaled Land Data Assimilation System (NLDAS) gridded weather data to evaluate natural background variability in vegetation vigor for selected areas in Nevada. We also give examples of where groundwater development has caused noticeable changes in vegetation conditions beyond the natural variability.

THE EFFECT OF REPEATED BURNING ON NITROGEN BUDGETS AND CHEATGRASS (*BROMUS TECTORUM* L.) SUCCESS IN AN ANNUAL GRASS DOMINATED ECOSYSTEM

Rachel O. Jones, Natural Resources and Environmental Science, University of Nevada, Reno; Jeanne C. Chambers, Rocky Mountain Research Station, US Forest Service, Reno NV; Dale W. Johnson, Natural Resources and Environmental Science, University of Nevada, Reno NV; David I. Board, Rocky Mountain Research Station, US Forest Service, Reno NV; Robert R. Blank, Great Basin Rangelands Unit, USDA Agricultural Research Service, Reno NV

Although fire has been instrumental in the conversion of cold desert shrublands to invasive annual grasses, it may also be an important restoration tool. Restoration of cheatgrass dominated rangelands depends on controlling cheatgrass while simultaneously providing conditions necessary for native species establishment. Growth and reproduction of cheatgrass is highly responsive to available soil nitrogen (N), and decreasing soil N

levels may decrease the competitive ability of cheatgrass. Burning volatilizes some N, but can result in an immediate increase in NH_4 and longer-term increase in NO_3. Higher N availability increases cheatgrass biomass and N content and, consequently, N loss when cheatgrass is repeatedly burned. We asked if repeated burning of a cheatgrass dominated ecosystem would deplete litter and soil N and consequently, cheatgrass density, biomass, and reproduction. We used a factorial, blocked experiment in two cheatgrass dominated sites in north-central Nevada. Factors included two litter treatments (litter removed and litter intact) and four burn treatments (unburned, burned only, burned and seeded with cheatgrass, and burned and seeded with annual wheat). Burns were conducted in fall 2008-2011 and seeded immediately afterwards. The litter treatment was conducted in the first year only. Soils (0-5 cm) and vegetation were sampled in 2008-2012 during peak biomass and before and after burns. Analyses were conducted with mixed model ANOVAs.

Both the one-time litter removal treatment and the annual burning treatment significantly reduced litter biomass and nutrient contents. Burned and seeded plots, especially those seeded with annual wheat post-fire, had the lowest biomass and nutrient content, which can be attributed to plant competition. Soil total mineral nitrogen (TMN) did not consistently decrease throughout the experiment as originally predicted. Post-burn soil TMN was generally increased by burning in all years, likely due to increased net N mineralization, however, the long-term trends in post-burn and spring soil TMN were highly variable. Variability in the effects of our treatments on soil TMN is likely related to variability in weather conditions throughout the study, specifically precipitation and minimum winter temperature which have been shown to strongly influence nutrient availability in arid ecosystems. Cheatgrass density, biomass, and seed production generally decreased with repeated burning and were lower in litter removed vs. litter intact plots. The effects of the litter removal and burn and seeding treatments on cheatgrass success were likely influenced most by changes in litter biomass as well as competition from seeded and unseeded species. In addition, as with soil TMN, cheatgrass density, biomass, and seed density was strongly affected by variability in weather conditions. Our results indicate that annual repeated burning may be an effective long-term management tool to restore native nutrient cycling and plant communities to invaded ecosystems, especially if accompanied by treatments that reduce available resources such as litter reductions or seeding with a strong competitor like wheat.

THE GREAT BASIN NATIVE PLANT PROJECT (GBNPP)

Frances F. Kilkenny and Corey L. Gucker, USDA Forest Service, Rocky Mountain Research Station, Boise ID

The Great Basin Native Plant Project (GBNPP) encourages cooperation within and between organizations and researchers for the identification and production of genetically appropriate plant materials, restoration technologies, and educational resources to aid management and recovery of native Great Basin plant communities. The GBNPP has been operating successfully for many years, and this year brings big changes. The GBNPP founder and lead, Nancy L. Shaw, has retired, and a new lead, Dr. Francis Kilkenny, has taken on the task of filling her very large shoes. In a project like the GBNPP that has many cooperators and moving parts, moving forward requires reflection on a project's legacy while contemplating its future. Our poster describes the GBNPP legacy of cooperation and collaboration in the production and development of plant materials, restoration technologies, and science delivery as well as our vision of future directions for new and continued collaboration. Dr. Kilkenny will increase the focus on genetics, species-specific seed zones, rapid testing of provisional seed zones, and the establishment of a common garden network to support researchers and land managers in developing sound management and successful restoration practices in the face of threats from invasive species, shifting fire regimes, and rapid climate change. We recognize the importance of preserving and fostering the cooperation, collaboration, and science information delivery that has always been at the core of GBNPP, and we are very excited about developing GBNPP in new directions!

GERMINATION ECOLOGY OF GREAT BASIN FORBS

Elizabeth A. Leger, Natural Resources and Environmental Science Department, University of Nevada, Reno

Native annual forbs are important components of sagebrush steppe communities in the Great Basin, and have potential for use in restoration. Forbs are of interest not only for their value for wildlife, but for the ability of some annual forbs to suppress annual invaders, presumably due to similar phenology and growth requirements. Relatively little is known about the ecology of annual forbs in the Great Basin, and work to date indicates that native annuals vary greatly in their ecology and have distinct germination strategies. This research is investigating seed germination requirements to determine whether species are primarily fall or spring germinating, which may affect their ability to grow in cheatgrass-invaded areas. Additionally, we will identify species that possess high levels of seed dormancy, a characteristic that needs to be overcome for restoration if dormancy prevents seedling establishment over management time scales. Germination studies are focusing on ten species of native forbs (*Agoseris grandiflora, Blepharipappus scaber*, *Chaenactis douglasii*, *Collinsia parviflora*, *Crepis intermedia*, *Cryptantha pterocarya*, *Gilia inconspicua*, *Mentzelia albicaulis*, *Microsteris gracilis,* and *Phacelia hastata*) that are commonly found in sagebrush steppe ecosystems and are of interest due to their potential importance as a food source for sage-grouse during early life stages.

Seed treatments varied after-ripening temperatures (either room temperature or 40° C) and exposure to wet, cold conditions (2°C for 0, 2, 4, or 6 weeks) before placement in a moderate (15° C) temperature in a factorial way. These treatments were designed to determine if seeds require warm or cold temperatures to break dormancy, which are both common dormancy mechanisms in desert annuals. Preliminary data indicate both species level and population level differences in germination strategies. In general, of the 10 species investigated, 4 germinated immediately, regardless of pre-treatment, 2 showed response to short cold treatments, and 4 are showing responses to longer treatments, though as noted, there is considerable variation among populations for even these broad patterns. Overall, approximately 35% of seeds germinated at 2°C within the first 3 weeks of the study, indicating the potential for fall germination exists in this suite of species. Because of the high variance in the timing and amount of annual precipitation in the Great Basin, understanding germination strategies is important for designing restoration mixes, as the ideal mix would include species with contrasting strategies in order to maximize the chance of seedling establishment in a given year. Thus, knowledge about species-specific germination preferences will help managers choose native forbs for incorporation into restoration protocols.

SAGEBRUSH STEPPE TREATMENT EVALUATION PROJECT (SAGESTEP): SUMMARY OF SHORT-TERM RESULTS

James McIver, Eastern Oregon Agricultural Research Center, Oregon State University, Corvallis OR

SageSTEP is a regional experiment that evaluates alternative methods of sagebrush steppe restoration in the Interior West. In 2006, SageSTEP scientists and their manager partners began implementing alternative fuel treatments to reduce woody vegetation -- prescribed fire, clearcutting, mastication, mowing, herbicides -- at 18 study sites, and have studied treatment response in the herbaceous vegetation, the fuel bed, soils, water resources, erosion, wildlife, and invertebrates. After tree removal, prescribed fire and shredding lowered potential wildfire intensity should a fire occur, and plots could serve as defensible space during suppression. Potential wildfire severity would likely be lower only in areas previously treated by prescribed fire, due to the removal of surface fuel. Cheatgrass and native perennial grass cover declined immediately after burning, but increased in post-treatment years 2 and 3; native perennial forbs increased after both burning and mechanical treatments. Biological soil crusts declined after fire and had not recovered by post-treatment year 3. The amount of available soil water was key to vegetation recovery after treatment, as herbaceous species responded

to tree removal. Yet the post-treatment balance between cheatgrass and native perennial grasses shifted markedly from perennials in the mountain big sage systems toward cheatgrass in Wyoming big sage. When pre-treatment cover of perennial tall grasses exceeded 10%, tree removal initiated herbaceous recovery even under phase III conditions. Encroached sagebrush steppe woodlands pose a risk of soil loss in the event of a severe wildfire, especially if followed by convective storms. Tree removal by prescribed fire decreases runoff from tree interspaces but increases runoff from tree coppices, with effects expected to decline after a few years. Mastication decreased runoff across the hillslope by leaving shredded debris that increased water infiltration rates. Carbon management goals parallel those of fuel and vegetation management -- maintaining low density woodlands with healthy herbaceous vegetation pays off in the long run, by incorporating relatively more carbon into the soil. Bird communities shifted slightly after prescribed burning, from those dominated by woodland birds to those more dominated by shrubland species. Tree removal at most woodland sites increased cover of the annual forb component of sage grouse food, and generally improved structural habitat conditions that grouse prefer. Butterflies tended to respond positively to restoration treatments, due to increases in herbaceous vegetation. Links between butterflies and native vegetation suggest that unintended consequences are not likely to arise for butterflies after prescribed fire or its mechanical surrogates.

At lower elevation treeless sites, mowing reduced shrub cover in a spatially homogenous way, and is expected to decrease fire intensity, making these sites more defensible in the event of wildfire. Prescribed fire however, was the only treatment that was effective in decreasing potential fire severity, due to surface fuel reduction. Prescribed fire and mechanical treatments increased both cheatgrass and native perennial grass cover with time. The annual herbicide imazapic reduced cheatgrass cover for three years after treatment, but also decreased native forbs and perennial short grasses.

COLLABORATIVE APPROACHES TO EVALUATING POST-FIRE REHABILITATION EFFORTS IN SAGEBRUSH STEPPE ECOSYSTEMS OF THE GREAT BASIN

Beth A. Newingham[1], Jeff E. Ott[2], Amy C. Ganguli[3], Robert D. Cox[4], and Nancy L. Shaw[2]

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[4]Natural Resources Management; Texas Tech University, Lubbock TX

Post-fire rehabilitation is often carried out with multiple objectives, including soil and site stability, invasive plant control, establishment of desirable plant species, and enhancement of ecosystem services. Consequently, multi-disciplinary research teams are required for studies evaluating rehabilitation success. We report on a collaborative effort among ecologists, botanists, and entomologists, working alongside government practitioners and private consultants, to evaluate effects of post-fire seed drilling techniques. Seed drills used for post-fire rehabilitation are designed to create desirable seedbed characteristics for perennial vegetation re-establishment. With increasing emphasis on utilizing diverse seed mixes in post-fire rehabilitation, drill modifications have been made to improve seedbed conditions and seed placement for plant establishment success. We compared the effects of the rangeland and a minimum-till drill on soil properties, native plant establishment, invasive plant species, and pollinators. Experimental sites were in sagebrush steppe communities dominated by *Artemisia tridentata* subsp. *wyomingensis* and included the Scooby Fire in Utah and the Saylor Creek Fire in Idaho. Seed mixes contained native grasses, forbs, and shrubs, which were planted either in the furrow or broadcast area. Plant measurements included cover, biomass, density, and basal gaps; soil measurements included soil surface relief, stability, dust flux, water infiltration, moisture, compaction, and chemistry; higher trophic levels were sampled for pollinators. While summarizing main points from each collaborator, here we only present results from plant cover, dust flux, and water infiltration to provide an

example on how to integrate data across collaborators. We also present the challenges and values of multi-disciplinary, multi-institutional studies.

LAND TREATMENT DIGITAL LIBRARY

David S. Pilliod and Justin L. Welty, U.S. Geological Survey Forest and Rangeland Ecosystem Science Center

The Land Treatment Digital Library (LTDL) was created by the U.S. Geological Survey to catalog information about land treatments in the western United States. Federal land managers plan and implement hundreds of projects each year with the goal of manipulating vegetation and soils. Common examples include removing plant biomass to reduce hazardous fuels, applying herbicide to control invasive species, improving forage for livestock and wildlife, and seeding burned areas to reduce soil erosion and recover native plant communities. The LTDL was designed to incorporate most aspects of land treatment information, including documentation, photos, tabular data, and spatial data. This design allows data on a land treatment to be housed in a single location for easy access. The data and metadata are currently managed by USGS in cooperation with the Bureau of Land Management. To date, the LTDL contains more than 22,700 treatments. Data entry is ongoing and will be completed within 2-3 years. The database is available in a standalone version for interested users (http://pubs.usgs.gov/ds/749/). The flexible design of the LTDL allows it to function on a single computer or multiple users can enter data at once across a network. Land treatment data entered into this standalone platform can be submitted to the USGS for inclusion in a centralized, master database and displayed as part of an internet tool (http://ltdl.wr.usgs.gov/) that allows users to query and map land treatments across the western United States.

DEVELOPMENT OF TOOLS AND TECHNOLOGY TO IMPROVE THE SUCCESS AND PLANNING OF RESTORATION OF BIG SAGEBRUSH ECOSYSTEMS

Bryce Richardson[1], Nancy Shaw[2], Matthew Germino[3], Hector Ortiz[1,4], Stephanie Carlson[1], Stewart Sanderson[1], Shannon Still[4]
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Successful restoration of sagebrush ecosystems is key to maintaining habitat and forage for sage grouse and other wildlife species. However, restoration of these ecosystems is fraught with challenges. Two major obstacles to sagebrush restoration include: 1) correctly identifying and certifying seed to subspecies and 2) deployment of seed to the appropriate environmental niche. Our research addresses these obstacles by developing diagnostic tests to identify seed to subspecies and seed transfer zones from common garden trials. Two different subspecies diagnostic tests are being developed based upon seed weight and chemical volatile profiles (i.e., smells). Seed size and weight vary among big sagebrush subspecies. Preliminary data from seed collected in common gardens suggests basin big sagebrush has significantly lighter seed than Wyoming or mountain big sagebrush seed. Another diagnostic test utilizes the different volatiles emitted by subspecies. Ongoing research is evaluating these volatile profiles with an electronic nose. We are currently focused on identifying the sensors in the electronic nose involved in detecting methacrolein, a volatile compound principally produced in basin big sagebrush giving this subspecies a more pungent aroma. Growth, mortality, flower phenology, seed yield and ecophysiological data collected from three common gardens of big sagebrush will serve to develop ecological genetic models, the basis of seed transfer zones. Preliminary results suggest an association ($r = 0.53$) between mortality and continentality. Big sagebrush from regions with smaller temperature differentiation between winter and summer were more likely to have higher mortality at the harshest garden (Ephraim, Utah). The goal

of this research is to provide a comprehensive set of tools for land managers in determining subspecies and in deploying seed to appropriate areas. Greater details of these research projects will be provided on the poster.

IDENTIFYING AN INCREASINGLY WIDESPREAD SAGE-GROUSE PREDATOR TO TARGET FUTURE HOTSPOTS: ARE EXPANDING RED FOXES NATIVE OR INTRODUCED?

Benjamin N. Sacks, Mammalian Ecology and Conservation Unit, VGL, UC Davis; Preston Alden, Mammalian Ecology and Conservation Unit, VGL, UC Davis; Randall Stroeberl, RS Gold, Elko NV; Russell Woolstenhulme, Nevada Department of Wildlife, Reno NV; Rachel Mazur, USDA Forest Service, Humboldt-Toiyabe National Forest; Mark Statham, Mammalian Ecology and Conservation Unit, VGL, UC Davis

Most native red foxes (*Vulpes vulpes*) of western North America occur in relictual populations in high montane zones of the Rocky, Cascade, Sierra Nevada, and high-elevation Great Basin Mountain ranges, where cooler habitats more closely resemble those that were widespread during the Pleistocene. In contrast, non-native red foxes originating from fur-farm stock are typically found at lower elevations primarily around urban areas, but also have been known to invade nearby habitats. In Nevada, where red foxes historically occurred among small isolated populations in the highest mountains, they now appear to be increasing in numbers and at several mid-elevation locations. In several such locations, foxes prey on and potentially threaten sage grouse. We report progress on and plans for expansion of a study to investigate the origins and movement pathways of red fox in Great Basin sage-grouse predation hotspots, habitats currently used by these foxes, and climate-based predictions for future predation hotspots of expanding red fox populations. The study will use genetic samples collected from (1) sage-grouse predation hotspots, (2) high-montane locations of indigenous foxes, and (3) surrounding native and nonnative red fox populations potentially serving as sources of population expansion. We present preliminary sampling information that will be used for genetic analysis to determining the identity and origins of foxes and their movement into non-historic low elevation habitat near sage grouse leks in the state. Understanding whether problem foxes reflect downslope expansions from formerly rare indigenous populations, immigration of expanding native foxes from the north, or immigration of invasive nonnative foxes from the east will help inform management efforts aimed at protecting sage grouse. Ultimately, habitat associations of expanding red fox populations (native or non-native) and those of sage grouse will be linked to climate-based projections of habitat composition and used to predict potential hotspots and design appropriate management strategies.

SOCIETY FOR ECOLOGICAL RESTORATION GREAT BASIN CHAPTER

Nancy Shaw, USDA Forest Service, Rocky Mountain Research Station, Boise ID

The Society for Ecological Restoration (SER) is the largest professional organization dedicated to restoration, internationally (www.ser.org). SER promotes ecological restoration through establishing regional chapters, biannual conferences, advising international organizations with policy and legislation, and publications such as the peer-reviewed journals *Restoration Ecology*, *Ecological* Restoration, and *Ecological Management and Restoration*, and the Island Press book series entitled *The Science and Practice of Ecological Restoration.* The SER Great Basin Chapter was established in 2011 with the goal of:

- Contributing to the body of knowledge on ecological restoration
- Promoting ecological restoration as a means of sustaining the diversity of life
- Facilitating communication among practitioners, managers, researchers and the general public and recognizing leadership in the field of restoration ecology

- Promoting the importance of ecological restoration in the community to improve stewardship of Great Basin ecosystems

Membership is open to all who have an interest in restoration in the Great Basin. Visit www.ser.org/greatbasin for additional information.

A NATIONAL CLUSTER EVALUATION OF THE JOINT FIRE SCIENCE PROGRAM

Loretta Singletary, Ph.D., Professor/Interdisciplinary Outreach Liaison; Lorie Sicafuse, Doctoral Candidate, Social Psychology; William Evans, Ph.D., Professor/State Extension Specialist, College of Education; Lisa Maletsky, Doctoral Student, Social Psychology
University of Nevada Cooperative Extension
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This poster will describe the implementation and findings of a national fire science education cluster evaluation. Grounded in the Logic Model, this evaluation employs a mixed-methods approach to measure the outcomes and impacts of fourteen regional fire science network and delivery consortia funded by the Joint Fire Science Program (JFSP). The JFSP consortia are comprised of collaborative partnerships between federal and state organizations designed to improve the access and application of fire science information. Broadly, the current evaluation aims to assess consortia progress toward shared goals on the aggregate level, based on their proposed objectives and educational activities. Common consortia goals include coordinating fire science delivery efforts, increasing communication and collaboration between fire managers and fire scientists, and facilitating the dissemination and application of current fire science information.
The national cluster evaluation of the JFSP is comprised of four components: A national web-based survey targeting fire managers/practitioners, fire researchers/scientists, and members of the general public; a webmetrics piece involving the collection and analysis of both quantitative and qualitative data regarding the individual consortia websites; development and distribution of an evaluation resource guide intended to help consortia build capacity to conduct individualized evaluations; and interviews conducted with consortia PIs aimed at understanding the successes and challenges encountered in efforts towards increasing the accessibility and applicability of fire science information.

This poster will highlight the elements and current findings of this national fire science education cluster program evaluation. We are currently in Year 3 of this longitudinal cohort evaluation. The multiple components of this evaluation, along with a summary of findings to date will be showcased.

PORTER CANYON EXPERIMENTAL WATERSHED: QUANTIFYING THE EFFECTS OF PIÑON AND JUNIPER CONTROL ON ECOSYSTEM PROCESSES

Keirith A. Snyder[1], Tamzen K. Stringham[2], Justin Huntington[3], Rosemary Carroll[3], Amira C. Dittrich[2], and Mark Weltz[1]
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Piñon (*Pinus spp.)* and juniper (*Juniperus spp.)* (PJ) currently occupies approximately 19 million ha in the Intermountain West and prior to European settlement as much as 90% of what is now woodland occurred as sagebrush plant communities. This watershed scale (2428 ha) project will document the impact of PJ treatments, in areas formerly dominated by sagebrush steppe communities, on understory vegetation composition, hydrologic function, and surface runoff and soil erosion at the landscape scale. Water is the

limiting resource in the arid and semi-arid Great Basin. Thus, environmental thresholds controlled by hydrologic processes that alter the availability of water are a major issue for maintaining long-term productivity in sagebrush-steppe ecosystems. Ecological thresholds have been demonstrated in piñon and juniper woodlands when tree abundance increases to the point that the subsequent reductions in understory vegetation change fire frequency and hydrological processes; however the impacts of piñon and juniper control on understory recovery and hydrological processes are not well known. Relatively little data exist that describe large-scale response to piñon and juniper control. In response to these concerns, the USDA-ARS and UNR established the first instrumented watershed in Nevada in 2009. This watershed, Porter Canyon, is located in Central Nevada in the Desatoya Mountains. A network of sensors has been installed to measure hydrologic response in conjunction with vegetation response. To date, canopy interception of rainfall by piñon and juniper has been quantified, as well as water use of individual trees. Additionally, the effects of tree felling on surface run-off and sediment yield have been measured. New sensors to measure snow dynamics and understory green-up have recently been installed. Data from the sensor network will be used to parameterize an integrated surface and groundwater model, GSFLOW. This model will be used to evaluate how vegetation changes potentially influence the spatial and temporal distribution of water consumption from upland and meadow areas. In addition, the model will be used to evaluate the timing and magnitude of different surface and groundwater budget components such as snowmelt, groundwater recharge, runoff, interflow, soil moisture storage, and evapotranspiration. This field research and modeling work will help us to better understand the linkages between changing climate, hydrology, and vegetation distributions within the Great Basin.

THE DEVELOPMENT OF AN UNMANNED AUTONOMOUS SYSTEM INDUSTRY IN NEVADA

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In partnership with the University Center for Economic Development and the Governor's Office of Economic Development, the University of Nevada Cooperative Extension hosted a state-wide Unmanned Autonomous Systems (UAS) Development Workshop on November 18, 2013. With speakers from the Governor's Office of Economic Development, the University of Nevada, Reno, the University of Nevada, Las Vegas, the Desert Research Institute, and the Nevada Institute for Autonomous Systems, the workshop covered a variety of important topics, including potential local, state, and federal regulatory concerns, the role the Nevada System of Higher Education has and continues to play in the development of a supportive workforce and in research and development, and the potential applications of autonomous systems in civilian use, relating to the development of a UAS industry in Nevada. Over 100 attendees participated state-wide. Locally elected and appointed officials, government leaders, private business leaders, and members of the general public all attended and participated.

This poster summarizes the primary issues concerning the potential development of a UAS industry in Nevada as well as the potential opportunities associated with UAS development in Nevada. Public aircraft operations pertaining to unmanned systems, airspace management and spectrum and frequency management issues will each be summarized and presented. The Nevada System of Higher Education is currently working closely with a variety of public and private sector agencies to ensure the proper development of a highly skilled and highly trained workforce needed to support the long-term development of a UAS industry in Nevada. Faculty at the University of Nevada, Reno, the University of Nevada, Las Vegas, and the Desert Research Institute are also all engaged in numerous research and development efforts exploring both next generation unmanned systems and potential applications. Civilian applications of unmanned systems range from the use of unmanned autonomous systems in agricultural and rangeland management, natural resource management, reclamation of mine sites,

the development of water policy, and further integration with other civilian application systems.

REGIONAL RESILIENCE VS. EXOTIC DOMINATION AFTER MOWING WYOMING BIG SAGEBRUSH FUEL BREAKS

Sherman Swanson[1], John Swanson[1], Peter Murphy[1], Kent McAdoo[2], Brad Schultz[3]
[1]Natural Resources and Environmental Science and University of Nevada Cooperative Extension
[2]University of Nevada Cooperative Extension Natural Resources Specialist, Elko NV
[3]University of Nevada Cooperative Extension Educator, Humboldt County

Wyoming big Sagebrush (*Artemisia tridentata ssp. wyomingensis*) rangelands across Nevada's various regions, major land resource areas (MLRA), ecological sites, and elevation zones have been mowed for fuels management and to improve rangeland health. Shrub mowing can promote healthy and more resilient, Wyoming big sagebrush plant communities that are less flammable and less likely to transition to a state dominated by exotics following wildfire. Or, mowing can favor exotic and highly flammable vegetation. Responses vary by geographic location ($p \leq 0.05$). We tested hypotheses across northern and central Nevada by analyzing soil surface and vegetation cover data from 76 unmowed and adjacent sites mowed between 2001 and 2010. Cheatgrass *(Bromus tectorum*) and exotic forb responses were negatively correlated with elevation and were not a problem above 6000 feet. Bare soil decreased (mowed minus unmowed) most and cheatgrass increased most in Northwest Nevada and the Malheur High Plateau and Humboldt Area MLRAs (23 & 24). Sagebrush cover decreased most in Northeast Nevada and Owyhee High Plateau MLRA (25). Exotic forbs increased most in Northwest Nevada and the Humboldt Area MLRA (24). In Northwest Nevada (MLRA 23), with a lower proportion of summer precipitation, cheatgrass and exotic forb increases were greater and they correlated with the relative cover of sagebrush. Native or perennial grass increases correlated with unmowed cover of sagebrush at low elevations and in northeast Nevada (MLRA 25). Litter increased more in the loamy 8-10 than either the drought loam 8-10 or loamy 10-14 ecological sites. Differing responses by geographic area suggest why different mowing studies may show conflicting results.

TEMPORAL RESILIENCE VS. EXOTIC DOMINATION AFTER MOWING WYOMING BIG SAGEBRUSH FUEL BREAKS

Sherman Swanson[1], John Swanson[1], Peter Murphy[1], Kent McAdoo[2], Brad Schultz[3]
[1]Natural Resources and Environmental Science and University of Nevada Cooperative Extension
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Mowing Wyoming big Sagebrush (*Artemisia tridentata ssp. wyomingensis*) rangelands can provide short-term to long-term benefits for management of fuels, wildlife habitat, and rangeland health depending on changes in the plant community through time. Shrub mowing can promote healthy Wyoming big sagebrush plant communities that are more resilient, less flammable and less likely to transition to domination by exotics following wildfire. Or, mowing can favor exotic vegetation. Either immediate response could change with time and management. We tested hypotheses across northern and central Nevada by analyzing soil surface and vegetation cover data from unmowed and adjacent sites mowed up to 10 years previously. Mowing occurred only once at 69 of the 76 locations. Live sagebrush cover was lower in mowed areas in all age classes. Dead sagebrush declined with time ($p \leq 0.001$) and always became lower than in unmowed adjacent sites after nine years. Sagebrush relative cover differed by age class and was up to 30-35% after 5-6 years. However the shift in live sagebrush cover (unmowed minus mowed) did not vary across age classes, suggesting the relative cover difference was caused by annual or perennial herbaceous plants. Mowed perennial and native grass cover was greater than in unmowed areas in all age classes. Litter cover was higher whereas bare soil and cryptogam cover was lower than in unmowed areas in

all age classes. Cryptogam and native forb cover declined with age of the mowing ($p \leq 0.001$ & $p \leq 0.02$). Native grass increased with age of mowing ($p=0.01$). Exotic forbs were significantly greater than in unmowed areas only in the 1-2 year increment and appeared to greatly diminish by year seven. Cheatgrass (*Bromus tectorum*) did not change significantly with age and was significantly ($p \leq 0.05$) greater than in unmowed areas only in age classes 1-2 and 9-10. Its increase was greater than perennials at only 15 of 76 locations. Mowed areas become more resilient with age except in areas where cheatgrass appeared to persist or increase as native forbs declined.

PERENNIAL RESILIENCE VS. EXOTIC DOMINATION AFTER MOWING WYOMING BIG SAGEBRUSH FUEL BREAKS

Sherman Swanson[1], John Swanson[1], Peter Murphy[1], Kent McAdoo[2], Brad Schultz[3]
[1]Natural Resources and Environmental Science and University of Nevada Cooperative Extension
[2]University of Nevada Cooperative Extension Natural Resources Specialist, Elko NV
[3]University of Nevada Cooperative Extension Educator, Humboldt County

Extensive Wyoming big Sagebrush (*Artemisia tridentata ssp. wyomingensis*) rangelands of the Great Basin have been mowed for fuels and habitat management. Shrub mowing can promote healthy Wyoming big sagebrush plant communities that are more resilient, less flammable and less likely to transition to a state dominated by exotics following wildfire. Or, mowing can favor exotic vegetation. Given these divergent potential effects, managers need enhanced capabilities for predicting mowing outcomes. We tested hypotheses across northern and central Nevada by analyzing soil surface and vegetation cover data from 76 unmowed and adjacent strips mowed between 2001 and 2010. Mowing increased litter, basal live vegetation cover, and foliar cover of perennial grasses, herbaceous exotics, cheatgrass, and exotic forbs. It decreased cover of sagebrush, cryptogams, and bare soil. Only 15 of 76 mowed plots had more exotic than native herbaceous cover. Response of native grass correlated with native grass, cheatgrass, and native and exotic forbs in paired unmowed areas. Native herb dominance in mowed areas increased with up to 15-20% native grass cover. Mowing increased herbaceous cover of native perennials more than exotic annuals where unmowed exotics were not dominant or subdominant. Foliar, absolute, and relative cover of mowed cheatgrass and exotic forbs inversely correlated ($p<0.01$) with unmowed sagebrush relative cover. Cover shifts (from control to mowed) of bare soil, rocks, native graminoids, all graminoids, and other shrubs correlated with unmowed sagebrush cover and relative cover. Low native grass cover appears to increase risk of post-mowing exotics domination, especially where cheatgrass was greater than about 10%. Mowed cheatgrass cover correlated with both native and exotic forbs in unmowed areas. The best herbaceous cover variables for predicting herbaceous responses following mowing are native grass and cheatgrass. Fuel breaks should be placed where they will most likely increase resilience and decreased risk of shifting to dominance by annuals. Locations most likely to respond positively have herbaceous vegetation dominated by perennial grasses, have little cover of cheatgrass or other annuals, and are dominated by sagebrush, especially if it is not too large.

SURPRISE VALLEY HIGH SCHOOL NATIVE PLANT PROJECT

Alexandra Urza, BLM Surprise Field Office; Liz Carey, Ivan Coronado, Anna Estill, Savanna Fee, Makenzie Godby, Hank Linker, Deyci Lopez, Dianna Lopez, Taylor Thornton and Phil Bentz (advisor), Surprise Valley High School; Hector Elias, BLM Surprise Field Office and Chicago Botanical Garden; Scott Soletti, BLM Surprise Field Office

The Surprise Valley High School Native Plant project was started in 2010 to provide an opportunity for a rural non-profit school district to partner with the BLM to propagate native plants. The purpose of the partnership is for high school agricultural science students to gain awareness of the ecology of the northern Great Basin while helping with conservation and restoration efforts on public lands.

Students collect seeds from native plant species of management priority for the BLM. Locally-collected and commercial seeds are then cold-stratified and grown to the seedling stage in the high school greenhouse. When the seedlings are ready, they are transplanted to burned areas to facilitate restoration and recovery of wildlife habitat. Thus far, the focus of the project has been growing antelope bitterbrush (*Purshia tridentata*), an important source of forage and cover for many wildlife species.

For the BLM, the benefits of this partnership include local community involvement and a local source of native plants that can be used in restoration and recovery of degraded or damaged habitats. The ability of bitterbrush to regenerate following fire is highly variable due to several factors including the intensity of fire, age of bitterbrush plants, seed bank availability, and seed quality. Bitterbrush seed dispersion is limited to rodent caches that generally are not greater than 80ft from the plant. Therefore, bitterbrush can take decades to revegetate the interior of large burns, and the landscape is vulnerable to soil erosion and reduced or degraded wildlife habitat. Replanting shrubs helps to speed up the recovery of important habitat, and seeds produced by the new plants help naturally regenerate a larger area.

The high school students involved in the partnership benefit from the presence of the school greenhouse, which allows for hands-on experience with plant materials development. FFA students use the greenhouse for annual projects, and they can trade work on the project for the opportunity to participate in regional leadership events. Currently, students are working on an experiment on the stratification process of bitterbrush seed in an effort to improve the germination rates of local seed and therefore increase seedling yields.

So far, the numbers of seedlings produced through the project have been steadily increasing each year. Several thousand bitterbrush seedlings have been planted on BLM lands, and another batch of plantings is planned for next spring.

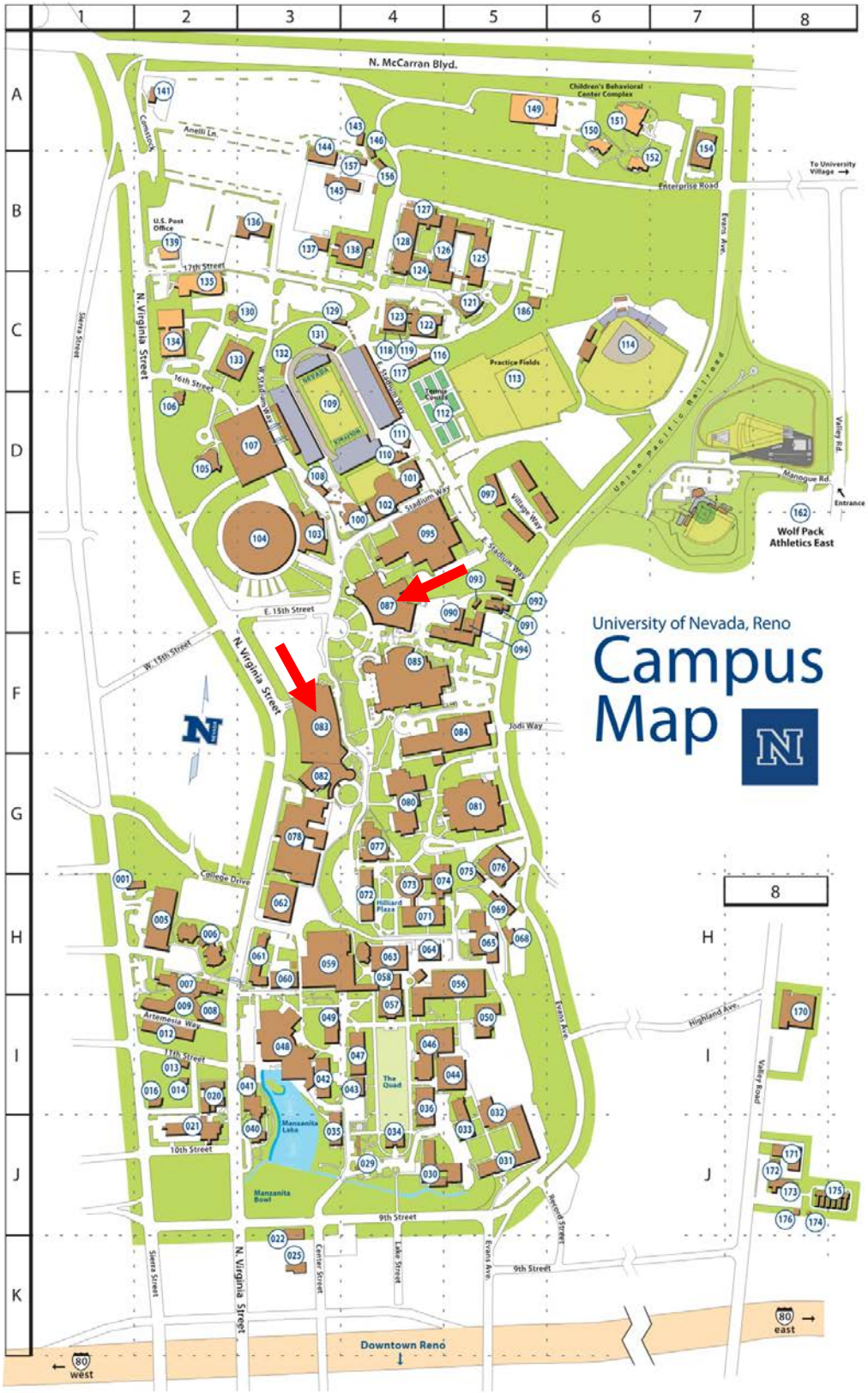
Timing of work cycles has been a significant challenge related to the partnership, since BLM's restoration plans are often mismatched with the school year. For example, seeds are collected when most students are on summer vacation, and seedlings are planted in the fall or late winter. These timing requirements are not well-suited for student projects, which are expected to follow a school calendar. Other challenges stem from reconciling age-appropriate teaching goals with the demand for production yields that are in line with BLM's restoration objectives. To improve the process and increase efficiency, the BLM and Surprise Valley High School work together to regularly re-evaluate the project.

CLIMATE CHANGE ADAPTATION FOR NATIVE TROUT: PUTTING THEORY INTO PRACTICE IN A NEVADA WATERSHED

John Zablocki[1], Helen Neville[1], Carol Evans[2], Paul Pettit[3], and Jon Griggs[4]
[1]Trout Unlimited; [2] US Bureau of Land Management, Elko NV; [3]Newmont Mining Corporation; [4]Maggie Creek Ranch, Carlin NV

There is a growing awareness of the diversity and severity of climate change threats to the long-term persistence of salmonid (salmon + trout) populations in North America. Meeting these threats requires that scientific insights into climate change adaptation be synthesized and implemented on the ground. The Maggie Creek Watershed Restoration Project (MCWRP) in Northeastern Nevada presents a successful example of this, and illustrates the potential to implement successful climate change adaptation programs in other Great Basin watersheds. The Maggie Creek drainage contains one of the last remaining interconnected populations of the federally listed Lahontan Cutthroat Trout (LCT: *Oncorhynchus clarkii henshawi*) in the Humboldt River Basin. Historically, poor habitat condition and stream fragmentation threatened the persistence of LCT populations in the watershed. In order to address this issue and meet the looming threat of climate change, Elko BLM, Maggie Creek Ranch, 26 Ranch, TS Ranch, and Newmont Mining Corporation launched the MCWRP in 1993 to enhance

82 miles of stream, 2,000 acres of riparian habitat, and 40,000 acres of upland watershed in the Maggie Creek basin. Twenty years of hydrological monitoring data have shown dramatic improvements in watershed functionality (e.g., sediment capture, groundwater storage, and riparian vegetation recovery). Trout population monitoring has shown a positive response to the reconnection of three previously isolated tributaries to the main stem river via fish passage structures. A recently completed physical barrier in the lower section of the main-stem river now armors the system against the increasing threat of non-native species invasion. Combined, these measures have made dramatic and quantifiable improvements in building resilience in the watershed against the threats of climate change. Importantly, the MCWRP has also resulted in noted benefits to ranching partners. The MCWRP serves as a model for the ecological, social, and economic effectiveness of watershed climate change adaptation in the Great Basin.



University Buildings

Grid	Building Name		Bldg. No.
J 8	Agricultural Education	AE	173
B 4	Anderson Health Sciences	AHS	128
H 4	Ansari Business Building	AB	063
E 5	Applied Research Facility	ARF	090
E 5	ARF (Clean Fuels Research Bldg.)	—	094
E 5	ARF (Ore Bins)	—	093
E 5	ARF (Annex 4)	—	092
E 5	ARF (Annex 2)	—	091
I 2	Argenta Hall	AH	008
I 2	Artemesia Building	ARTM	012
C 4	Bioinformatics, Center for	BC	116
F 3	Brian J. Whalen Parking Complex	BWPC	083
G 5	Buildings & Grounds	BG	076
B 3	B & G Storage Bldg. (North)	BGSN	144
H 5	B & G Storage (South)	BGSS	068
H 5	B & G (Modular 1)	—	075
A 4	B & G (Modular 2)	—	143
B 4	B & G (Modular 3)	—	146
B 4	B & G (Modular 4)	—	156
B 4	B & G (Modular 5)	—	157
H 2	Canada Hall	CH	006
H 4	Central Heat Plant	CHP	064
B 3	Central Services	CS	136
H 4	Chemistry Building	CB	071
I 2	Child Care Center	CCC	013
A 2	Child Care Facility	CCF	141
G 3	Church Fine Arts	CFA	078
J 3	Clark Administration	CA	035
A 7	Claude Howard (System Administration Building)	SAB	154
C 2	Computing Center	CC	133
I 2	Continuing Education Building	CEB	020
I 2	CEB Annex G	—	014
H 5	Custodial Building	CUSB	069
I 2	Dining Conference Center	DCC	009
G 5	Edmund J. Cain Hall	EJCH	081
C 2	Environmental Research Facility	ERF	130
I 8	Equestrian Center	EC	170
H 4	Facility Services Building	FS	058
C 4	Family Medicine Center (Brigham Building)	FMC	123
C 4	FMC (Storage Building)	—	118
G 3	Fitzgerald Student Services Bldg.	FSSB	082
J 5	Fleischmann Agriculture	FA	031
I 5	Davidson Mathematics and Science (under construction)		
D 2	Fleischmann Planetarium	FP	105
C 5	Football Practice Field (John Sala Intramural Fields)	—	113
I 3	Frandsen Humanities	FH	042
H 3	Getchell	GL	059
H 5	Harry Reid Engineering Laboratory	HREL	065
B 5	Howard Medical Sciences	HMS	125
J 4	Information Kiosk	IK	029
K 3	International Center	IC	025
E 4	Joe Crowley Student Union	CSU	087
I 4	Jones Center	JV	043
I 3	Jot Travis Student Union	JTSU	048
I 3	Juniper Hall	JH	041
J 8	Knudtsen Resource Center	KRC	171
E 3	Lawlor Events Center	LEC	104
E 3	Legacy Hall	LEGH	103
H 4	Leifson Physics	LP	074
J 5	Life Science	LS	032
H 3	Lincoln Hall	LH	060
E 4	Lombardi Recreation Center	LRC	095
H 4	Mack Social Science	MSS	072
I 4	Mackay Mines	MM	057
I 4	Mackay Science	MS	036
D 3	Mackay Stadium	S	109
C 3	M. Stadium (North Restroom)	—	129
C 3	M. Stadium (N/E Restroom)	—	131
C 3	M. Stadium (N/W Restroom)	—	132
C 3	M. Stadium (S/E Restroom)	—	111
C 3	M. Stadium (S/W Restroom)	—	108
B 4	Manville Health Science	MHS	126
J 3	Manzanita Hall	MAH	040
D 4	Marguerite W. Peterson Bldg. (Athletic Academic Center)	MWPB	100
F 4	Mathewson-IGT Knowledge Center	MIKC	085
J 4	Morrill Hall Alumni Center	MH	034
B 3	Motor Pool	MP	145
F 5	National Judicial College	NJC	084
C 4	Nell J. Redfield Building (Speech Pathology & Audiology, Student Health Center)	NJR	122
C 4	NJR (Student Health Storage)	—	119
B 4	Nellor Biomedical Sciences	NBS	127
B 4	Nevada State Health Laboratory	NSHL	138
H 2	Nye Hall	NH	007
J 5	Orvis School of Nursing	OSN	033
I 5	Palmer Engineering	PE	050
D 2	Parking Services	PS	106
I 4	Paul Laxalt Mineral Engineering	LME	046
I 5	Paul Laxalt Mineral Research	LMR	044
C 4	Pediatrics, Dept. of	PDO	117
C 5	Pennington Annex	PA	186
C 5	Pennington Medical Education Building	PMB	121
B 3	Purchasing Department	PD	137
K 3	Real Estate Office	REO	022
J 8	Renewable Resource Center	RRC	172
I 2	Residential Life Maintenance Office	RLMO	016
G 4	Reynolds School of Journalism	RSJ	077
D 4	Robert Cashell Fieldhouse	CFH	102
I 4	Ross Hall	RH	047
H 1	Sagebrush Newspaper Office	SNO	001
J 4	Sarah H. Fleischmann Building	SFB	030
B 4	Savitt Medical Science	SMS	124
H 4	Schulich Lecture Hall	SLH	073
H 5	Scrugham Engineering/Mines	SEM	056
H 2	Sierra Street Parking Complex	SPC	005
D 4	Reno Orthopedic Sports Med. Complex	ROSMC	101
D 4	Stadium Visitors Locker Room	SL	110
D 4	Tennis Courts	—	112
I 3	Thompson Building	TB	049
J 2	Sierra Hall	UI	021
D 5	University Village	UV	097
J 8	Valley Road Greenhouse Complex	VRGC	175
J 8	Valley Road Research Modular	VRRM	176
J 8	Valley Road Storage Building	VRSB	174
H 3	Virginia Street Gym	VSG	062
D 3	West Stadium Parking Complex	WSPC	107
H 3	White Pine Hall	WPH	061
C 6	William Peccole Park	WPP	114
G 4	William J. Raggio Building	WRB	080
D 8	Wolf Pack Athletics East	WPAE	162
Non-University Buildings			
A 6	Children's Behavioral Center	CBC	151
A 6	Children's Behavioral Center Unit A	CBCA	150
A 6	Children's Behavioral Center Unit B	CBCB	152
C 2	Nevada Historical Society	NHS	134
C 2	Reno KNPB Building	KNPB	135
A 5	Special Children's Clinic	SCC	149
B 2	U.S. Post Office	USPO	139

ABOUT THE VENUE | JOE CROWLEY STUDENT UNION

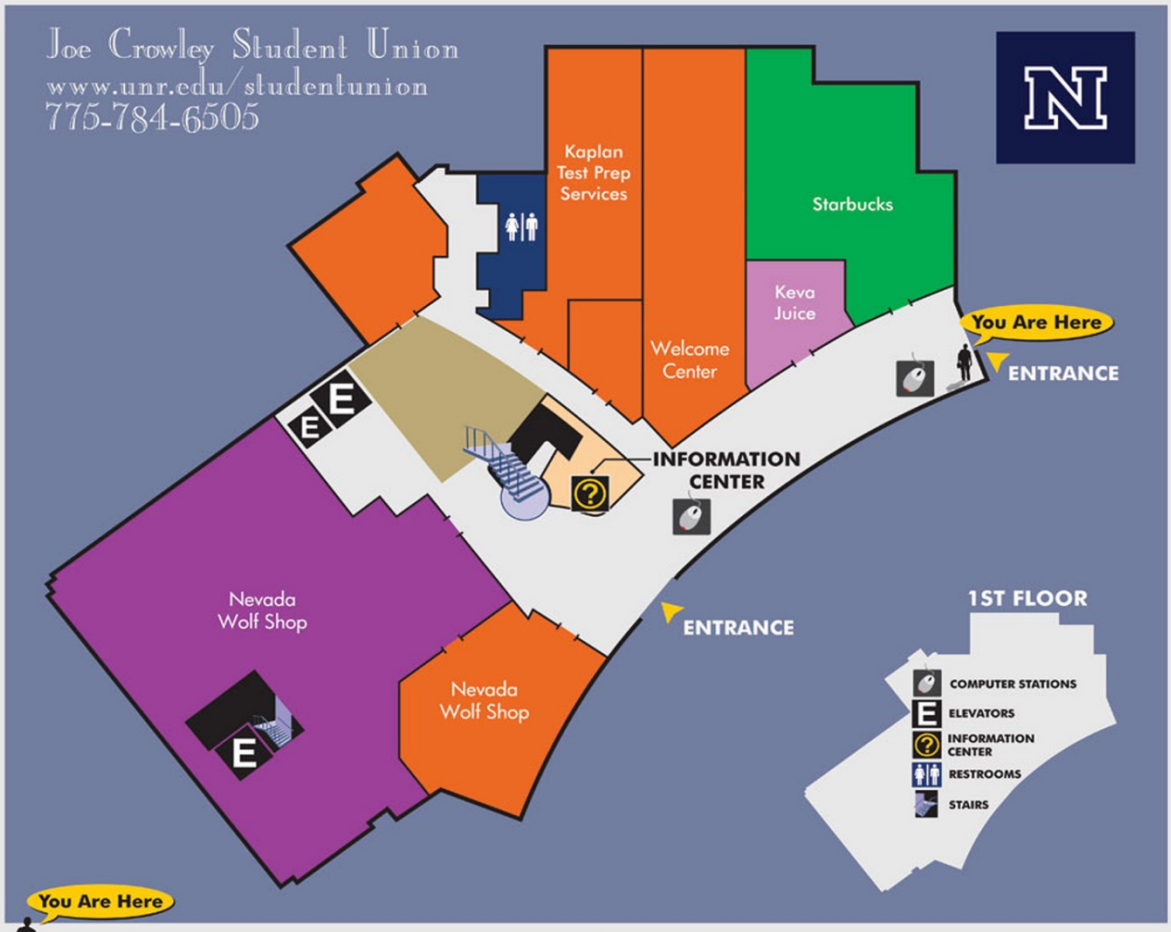
Completed and formally dedicated in November 2007, the Joe Crowley Student Union is one of the most transformational buildings ever built on the campus of the University of Nevada, Reno. The 167,000-square-foot, environmentally friendly facility signals a shift in campus expansion, offering the campus and community a new centrally located “front door” to the University from Virginia Street.

Named in honor of former University President Joe Crowley, whose 23-year tenure as the institution’s chief executive is a record, the Joe Crowley Student Union features a two-story ASUN Bookstore, a variety of food and drink retailers, a 1,200-seat grand ballroom, a 220-seat, two-level movie theater, a 2,000-square-foot student organization center, and is home to the Associated Students of the University of Nevada and the Graduate Student Association.

WIRELESS ACCESS

Wireless Internet access is available in the Joe Crowley Student Union. Please check at the registration desk for a guest user name and password.

JOE CROWLEY STUDENT UNION – LEVEL ONE MAP



Floor1

Information Center
Kaplan Test Prep Services
Keva Juice
Nevada Wolf Shop
Starbucks
Welcome Center

Floor 2

ATM's
- 15th St. Food Court
- Einstein Bros Bagels
- Panda Express
- Port of Subs
- Villa Fresh Italian Kitchen

Loading Dock
Nevada Wolf Shop
WolfCard Office

Floor 3

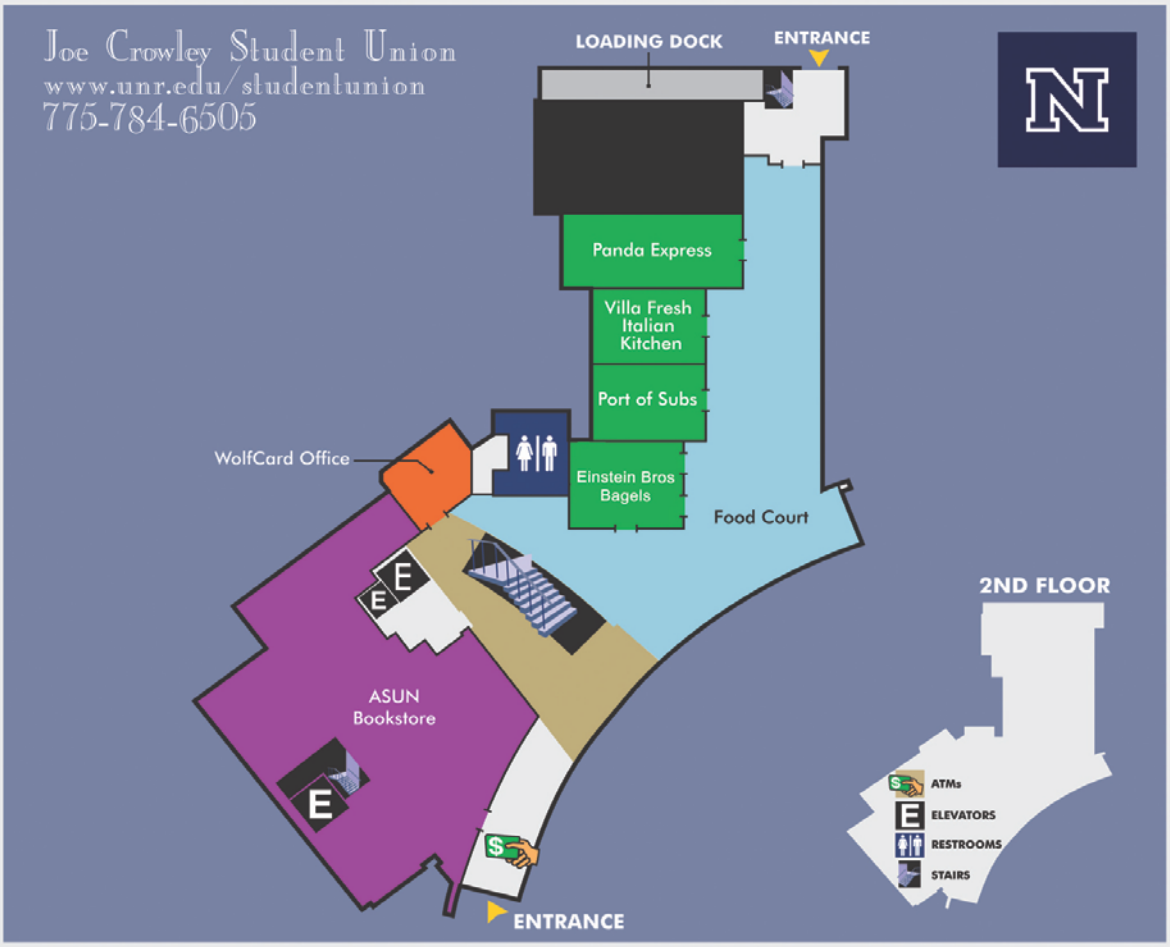
Associated Students of the University Of Nevada (ASUN)/Student Activities Center

Box Office/Concessions
Cantina del Lobo
Computer Lounge
Conference Rooms 317, 320, 232, 324
Graduate Student Association (GSA)
Graduate Student Lounge
Rita Laden Senate Chambers
The Center For Student Cultural Diversity
Theatre

Floor 4

Ballroom A, B, C
Conference Rooms 402, 405, 406, 420 422, 423
Pre-Function Lounge
Silver & Blue Catering
Student Union Administration
The Great Room

JOE CROWLEY STUDENT UNION – LEVEL TWO MAP



FLOOR 1

ASUN Bookstore
ASUN Pack Pit Stop
College Optical Express
Information Center
Kaplan Test Prep Services
Keva Juice
Silver State Schools Credit Union
Starbucks
Welcome Center

You Are Here

FLOOR 2

ASUN Bookstore
ATMs
15th St. Food Court
- Einstein Bros Bagels
- Panda Express
- Port of Subs
- Villa Fresh Italian Kitchen

Loading Dock
WolfCard Office

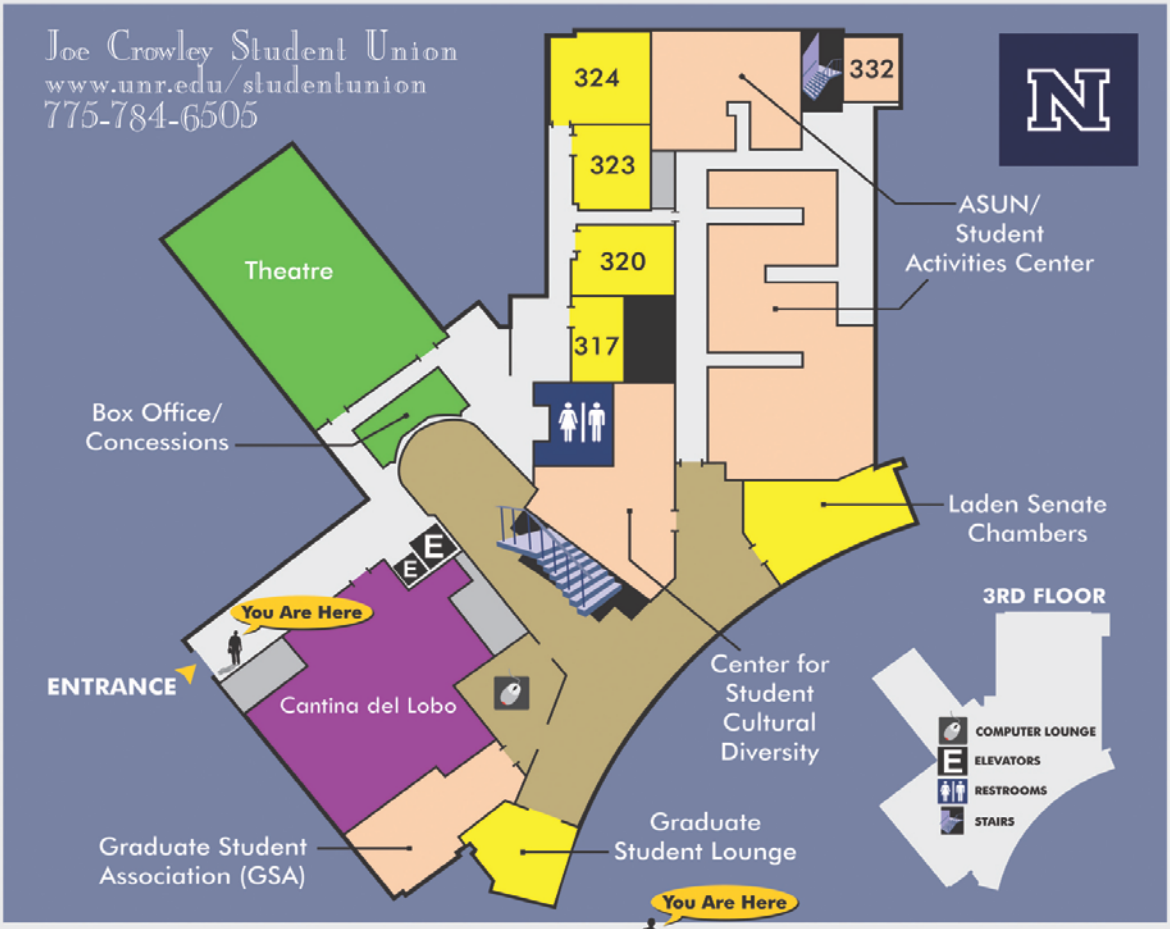
FLOOR 3

Associated Students of the University of Nevada (ASUN)/Student Activities Center
Box Office/Concessions
Cantina del Lobo
Computer Lounge
Conference Rooms 317, 320, 323, 324
Graduate Student Association (GSA)
Graduate Student Lounge
Laden Senate Chambers
The Center for Student Cultural Diversity
Theatre

FLOOR 4

Ballroom A,B,C
Conference Rooms 402, 405, 406, 420, 422, 423
Pre-Function Lounge
Silver & Blue Catering
Student Union Administration
The Great Room

JOE CROWLEY STUDENT UNION – LEVEL THREE MAP



FLOOR 1

ASUN Bookstore
ASUN Pack Pit Stop
College Optical Express
Information Center
Kaplan Test Prep Services
Keva Juice
Silver State Schools Credit Union
Starbucks
Welcome Center

FLOOR 2

ASUN Bookstore
ATMs
15th St. Food Court
- Einstein Bros Bagels
- Panda Express
- Port of Subs
- Villa Fresh Italian Kitchen

Loading Dock
WolfCard Office

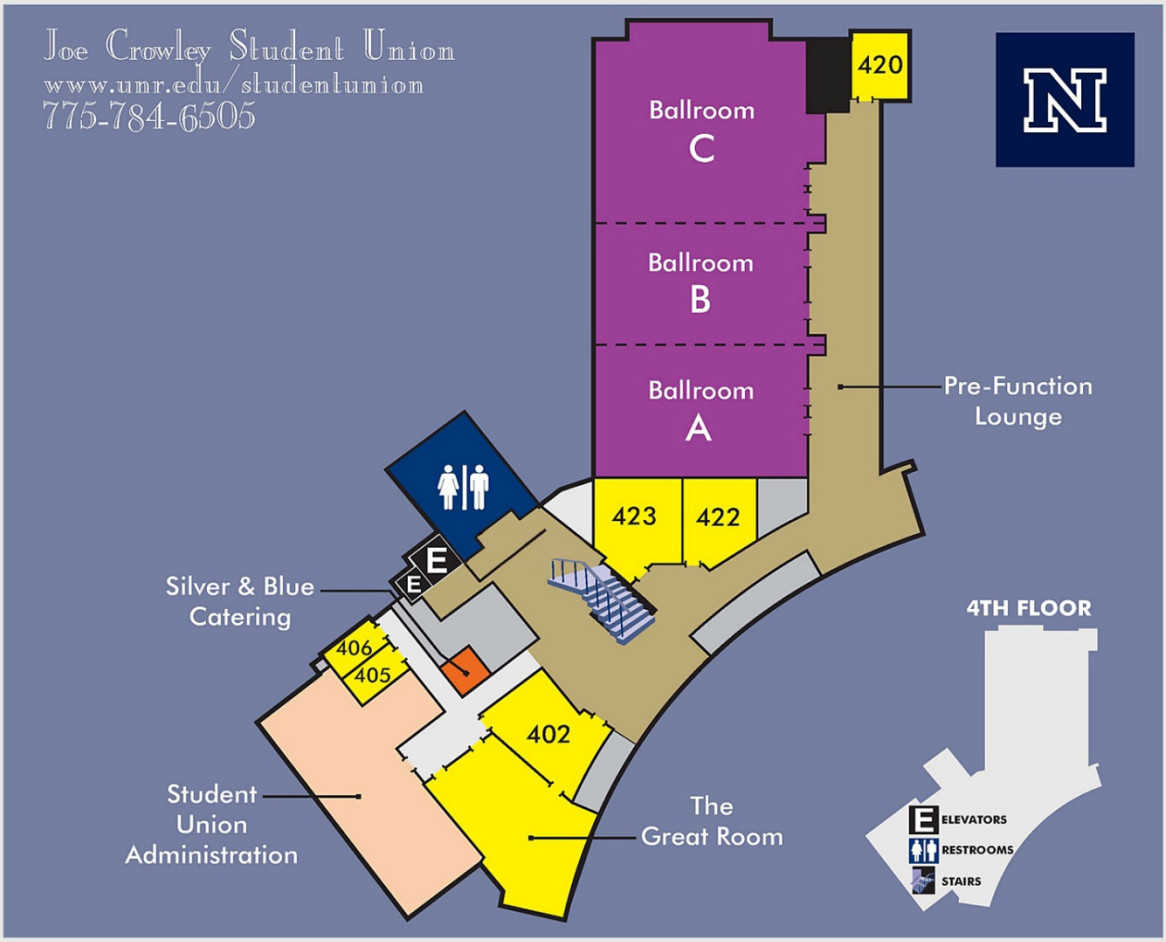
FLOOR 3

Associated Students of the University of Nevada (ASUN)/Student Activities Center
Box Office/Concessions
Cantina del Lobo
Computer Lounge
Conference Rooms 317, 320, 323, 324
Graduate Student Association (GSA)
Graduate Student Lounge
Laden Senate Chambers
The Center for Student Cultural Diversity
Theatre

FLOOR 4

Ballroom A,B,C
Conference Rooms 402, 405, 406, 420, 422, 423
Pre-Function Lounge
Silver & Blue Catering
Student Union Administration
The Great Room

JOE CROWLEY STUDENT UNION – LEVEL FOUR MAP



FLOOR 1

ASUN Bookstore
Information Center
JC&C Wireless
Kaplan Test Prep Services
Keva Juice
Pack Pit Stop
Silver State Schools Credit Union
Starbucks
Wolf Package

FLOOR 2

ASUN Bookstore
ATMs
Food Court
Loading Dock
Panda Express
Port of Subs
Tahoe Creamery
Villa Fresh Italian Kitchen
WolfCard Office

You Are Here

FLOOR 3

Associated Students of the University of Nevada (ASUN)/Student Activities Center
Box Office/Concessions
Computer Lounge
Conference Rooms 317, 320, 323, 324
Graduate Student Association (GSA)
Graduate Student Lounge
Laden Senate Chambers
Sports Grille
The Center for Student Cultural Diversity
Theatre

FLOOR 4

Ballroom A,B,C
Conference Rooms 402, 405, 406, 420, 422, 423
Pre-Function Lounge
Silver & Blue Catering
Student Union Administration
The Great Room

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ACKNOWLEDGMENTS

First, we wish to express our appreciation for conference support provided by the Joint Fire Science Program through BLM Cooperative Agreement #L13AC00294 (JFSP 13-2-01-4; The Great Basin Consortium 3: A Landscape under Fire) with the University of Nevada, Reno.

We also would like to thank the many people who have helped make this conference a reality.

This meeting was conceived and developed by the Great Basin Consortium coordinating committee (Stuart Hardegree [GB-RMP], Mike Collopy [GB-CESU], Stan Johnson [GB-EP], Génie MontBlanc [GB-FSD], Todd Hopkins [GB-LCC], and Mike Pellant [GB-RI]); their efforts have helped further our collective goal of increasing communication among the many organizations and stakeholders committed to managing, conserving and restoring the Great Basin.

The conference program committee did a great job identifying speakers that are working on highly relevant issues in the Great Basin. Committee members included Stuart Hardegree, Todd Hopkins, and Génie MontBlanc.

Several offices at the University of Nevada, Reno, provided significant assistance in hosting this conference. We would like to thank Jane Tors and Mike Wolterbeek in the Office of Media Relations for their assistance in getting the word out on the conference. John Trent from the Office of Integrated Marketing developed a story for the university website that highlighted faculty and student involvement in Great Basin research, and their role in the conference. Staff at the Joe Crowley Student Union prepared the venue and assisted with logistics throughout the meeting. Lori Davis and staff at Silver and Blue Catering assisted with the catered reception and refreshment breaks.

We also want to thank John Mourelatos and Kathleen Sachs from the Silver Legacy for assistance with lodging arrangements for meeting participants.

Finally, we want to offer our special thanks to Christina Clack and Amber Gallop from UNR's Office of Undergraduate and Interdisciplinary Research and Academy for the Environment. Christina is an event planner extraordinaire, as she managed all logistics associated with the conference, including lodging, registration, refreshments (both the evening reception and meeting breaks), development of the GBC website and on-line conference page, and production of the printed meeting program. Amber worked with Christina to facilitate the many fiscal processes needed to support the conference. Without their hard work this conference would not have been possible.


http://environment.unr.edu/consortium/