

Long-Term Monitoring of Shrublands in the Great Basin: An Example for the Future

Long-term monitoring of shrublands that have burned or otherwise been altered can provide information that is invaluable for the successful restoration of similar sites. However, lack of funding and personnel commonly prevent such monitoring—and subsequent analysis of resulting data—from taking place. By looking at examples of instances where data have been collected at the same sites over long periods of time, we are beginning to see how important long-term information is in the process of restoring and sustaining healthy shrublands in the Great Basin. These examples are encouraging to SageSTEP scientists as we seek funding for continued monitoring at our study sites.

One such example is the Bureau of Land Management (BLM) Winnemucca District where Mike Zielinski has been working as soil scientist for over 30 years. When Zielinski began working with the BLM in 1977, he probably didn't realize what a wealth of data he would collect over the course of his career, or the value that this information would have for those working to protect and restore shrublands. What began as routine post-fire emergency stabilization and rehabilitation has turned into decades of tracking the recovery of burned sites. Zielinski has gone far beyond the standard 2 or 3 years of post-fire rehabilitation and monitoring that serve primarily to determine whether or not there has been enough growth to support the reintroduction of livestock, and in



Over 2.5 million acres burned in the BLM Winnemucca District between 1984 and 2008. Long-term monitoring of burned areas is helping managers learn how best to restore disturbed shrublands.

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 Sagebrush Steppe
SageSTEP
Treatment Evaluation Project
www.sagestep.org

some cases he has collected data for 10 or 20 years or more to determine the long-term health and viability of these landscapes.

Due to his longevity in the Winnemucca District, Zielinski has been able to see changes on the landscape that could not be detected within the duration of most management or research projects. The messages he is beginning to extract from this wealth of information are providing valuable insights to managers in his office as well as others working on similar landscapes. At the recent Wildfire in American Deserts Workshop in Reno, Zielinski gave a presentation focused on the recovery of shrubs after wildfires, the importance of perennial grasses in the restoration process, and the sometimes surprising observations he has garnered over the years.

BLM post-fire monitoring has generally included 2-3 years of funding—enough for seeding in the first year (if necessary) and then 1-2 years of monitoring re-growth. While this post-fire monitoring is valuable, many species (especially shrubs) take longer than 3 years to re-establish. Additionally, due to fire effects on nutrients and increases in cheatgrass (*Bromus tectorum*) seed production, Zielinski has observed that cheatgrass often peaks in the third year post-fire, indicating that if monitoring ends after three years the data cannot adequately represent the long-term potential of a site.

Zielinski has taken it upon himself to re-visit burned areas years, and even decades after a fire to evaluate the status of various sites. Generally, funding is not available for this type of longer-term monitoring, so Zielinski has found opportunities to collect data as part of his other work responsibilities. For example, he has returned to burned sites to collect data for management plans, grazing permit renewals, or in response to litigation. Additionally, newer and faster data collection methods have allowed him to stop and quickly collect information at nearby sites on his way to fulfill other obligations.

By watching the recovery of sites that burned in the 80s and 90s and collecting intermittent data, Zielinski has observed that in many cases shrubs may recover more quickly than previously thought by scientists and managers. Also, under the right conditions, this recovery can occur without seeding. In the Winnemucca District, seeding has generally not taken place in mountain big sagebrush sites except around drainages for erosion control. These sites, especially at higher elevations, tend to have sufficient native perennial grasses present and

relatively high precipitation rates (>14 in/yr) that can support recovery. Of the 11 such burned sites that Zielinski has observed over time, 90% have recovered on their own. On the lower precipitation mountain big sagebrush sites (12-14 in/yr) and on Wyoming big sagebrush sites, recovery rates for non-seeded shrublands have been lower, though at some of these sites the shrubs have returned over time.



Figure 1a. Monitoring plot on the Montana Fire 1 year after burning; cheatgrass dominates the area and there are no sagebrush plants present on the site.



Figure 1b. This photo, taken 20 years after the Montana Fire, shows recovery of Wyoming big sagebrush, in addition to a variety of native bunchgrasses.

In the case of the Montana Fire that burned through Wyoming big sagebrush (*Artemisia tridentata* ssp. *wyomingensis*) in 1985, and was not seeded, cheatgrass covered the site the year after the fire (Fig. 1a). However, 20 years after the fire, monitoring plots showed an increase in cover percentages of Wyoming big sagebrush, Sandberg bluegrass (*Poa secunda*) and Thurber's Needlegras (*Achnatherum thurberianum*) and a reduction in cheatgrass (Fig. 1b). While Zielinski considers 20 years to be a relatively quick recovery time for shrubs, it is much longer than even so-called "long-term" research projects.

In his presentation, Zielinski emphasized the importance of perennial grasses in the recovery process. If a site does not have sufficient quantities of native perennial grasses present prior to burning (as determined by Ecological Site and status of the site), seeding in a timely manner is needed to improve the odds of recovery. In instances where time and funding were not sufficient for seeding, and adequate quantities of perennials were not present prior to burning, Zielinski has observed sites that have essentially become cheatgrass monocultures. Photos and data from the Sentinel Fire of 1985 show thick stands of cheatgrass one year after the fire and very little change in vegetation composition 20 years later (Fig. 2).

The Winnemucca BLM is currently compiling three decades of post-fire monitoring data into a database that will be analyzed, and will likely provide a starting point for the development of future studies. Zielinski

acknowledges that his data collection over the years has not been part of a scientifically designed experiment, but points out that in the absence of empirical evidence, managers use the information that is available to help inform their decisions.

As land managers in the West face increasingly large wildfires, invasion of exotic species, and other obstacles, they need the best information possible to aid in decision-making. SageSTEP researchers are adding to that pool of information. Yet while SageSTEP is one of the longest funded research projects of its kind, current funding only allows for post-treatment data collection for a maximum of 4 years even at sites that were treated in the first year of the project (which most were not). Longer-term monitoring of SageSTEP sites will increase the utility of resulting information for managers and researchers alike.

We are providing information on several commonly used management treatments, including prescribed fire and cutting and felling in pinyon-juniper woodlands, and prescribed fire, sagebrush mowing and herbicide applications in sagebrush steppe. Unlike many management projects, we were able to collect pre-treatment data that will enable us to more easily tease out which effects are a result of the treatments, and which are a result of other factors. Longer-term monitoring will allow us to more clearly define the thresholds at which sites recover naturally and to help managers determine when and where to invest limited resources in seeding. Because our research is occurring across an extensive network of study sites, we can provide information that can be used throughout the Great Basin and other similar areas. Additionally, the project is multidisciplinary in nature, and we will provide information to researchers and managers dealing with issues ranging from soil erosion to plant invasions and species conservation as we continue to try to improve these landscapes for future generations.

Photos accompanying this article were provided by Mike Zielinski, BLM Winnemucca Field Office.

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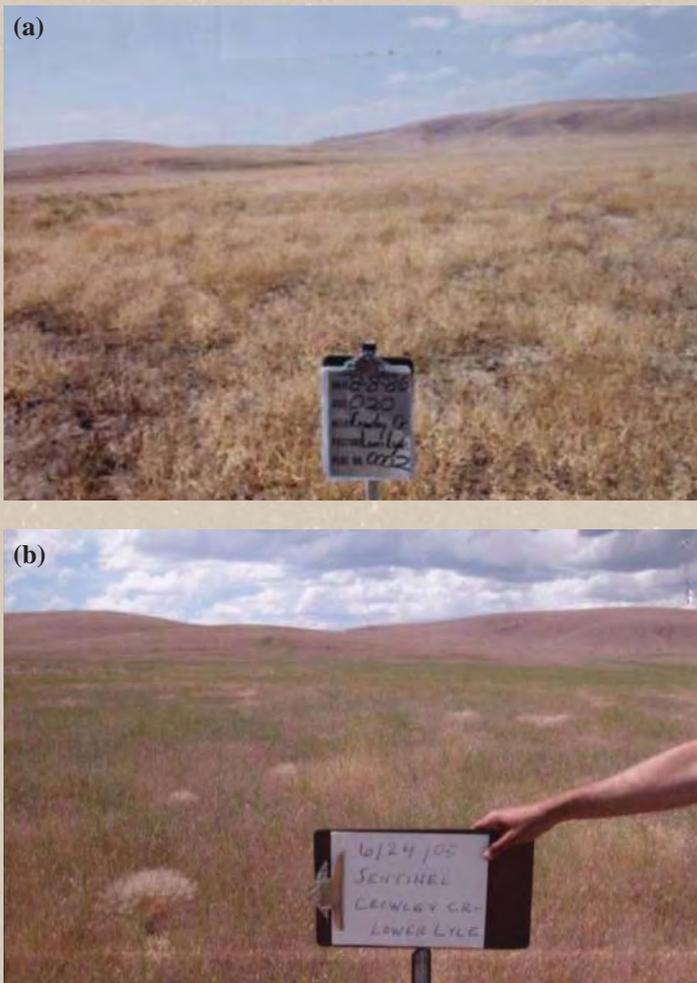


Figure 2. Monitoring after the Sentinel Fire of 1985 showed virtually no change at this site one year after the fire (a) and 20 years after the fire (b). Lack of perennial grasses allowed cheatgrass to establish and the site has remained in a steady state of annual grass dominance.

Communication and Outreach in the Great Basin

Bruce Shindler & Ryan Gordon, Oregon State University

Mark Brunson, Utah State University

Public land management is much more difficult when citizens don't support or understand the practices recommended by managers. Therefore it's important to understand how citizens obtain information about Great Basin rangelands and how they view the information they receive. As SageSTEP social scientists studying public acceptance of management options, we asked citizens to rate the usefulness and trustworthiness of common communications and outreach sources. Here we present results of 1,345 surveys mailed to residents in three urban areas (Boise, Reno, and Salt Lake City) and three rural areas (Elko and White Pine Counties, Nevada; Lake and Harney Counties, Oregon; and Millard and Beaver Counties, Utah) where SageSTEP experimental treatment sites are located. Our findings are shown in the accompanying table (p. 5); urban and rural responses are separated to highlight differences between these populations.



Photo by Ryan Gordon.

When citizens understand public land management practices, they are more likely to be supportive.

We asked respondents if they had used or been exposed to 17 different information sources. If so, they rated the usefulness and trustworthiness of each method. Ten of the items are common forms of communication used by agency personnel (lower section of table). The "Exposure" column indicates the percentage of total respondents who had some experience with the listed information source. These individuals then rated the usefulness of each source on a basis of not useful, slightly useful, or very useful. Only very useful scores are reported. Trustworthiness scores indicate the percentage of participants who rated a source as trustworthy given the choice of yes or no. Differences between urban and rural respondents are noted.

Overall, methods or sources most often rated as very useful (over 40%) were guided field trips, visitor centers and interpretive programs, demonstration sites, university researchers, ranching and range groups, and family and friends. Trustworthiness scores largely followed the same pattern.

Among the communication methods specifically used by the BLM and Forest Service, the highest-rated methods offer a more personal two-way form of citizen-agency interaction. Citizens seem to prefer the open give-and-take that can occur in less formal settings such as demonstration sites, guided field trips, and interactive workshops. It should also be noted these are sources that fewer people have been exposed to. These results clearly indicate an opportunity for agencies to create more positive and useful experiences for community members by focusing their efforts on these forms of outreach.

Other highly rated forms—ranching and range groups, family and friends (community members), and researchers—also suggest a more interactive approach is preferable. Thus, agencies might choose to engage outside groups more often to help promote the healthy rangeland message.

Perhaps not so surprising, more standard one-way forms of communication such as newspapers, television and radio, agency brochures, and newsletters tend to be sources with which people are more familiar. However, these also garnered relatively low scores for usefulness and trustworthiness. These results are in line with other research that indicates these methods may be useful for building an initial awareness of issues, or reaching elements of the general public who are rarely seek information about rangelands, but they should not be relied upon as the staple of an outreach program (Toman et al. 2006). Interactive forms of communication tend to be more effective for influencing citizens' attitudes and behavior.

There are also some interesting differences between urban and rural communities. Perhaps most compelling is that with the exception of public meetings, rural respondents consistently rated the usefulness and trustworthiness of agency communication methods lower than urban residents. Citizens in rural communities expressed a preference for getting their information from ranching and

range groups, extension agents, or family and friends. Thus a one-size-fits-all approach to communicating with various publics is not sufficient. A full suite of communication strategies that includes opportunities for meaningful interaction will ensure that the greatest number of citizens, including key members of local communities, will be involved in land management planning and decision processes.

A Regional Survey of Citizens in the Great Basin Ratings of Information and Communication Methods

Information Source	Percent of Exposure ^a	Information is:	Percent Rating Source as Very Useful or Trustworthy		
			Total	Urban	Rural
University Researchers [◇]	82	Useful Trustworthy	43 83	49 89	40 79
Family/Friends/Relatives [◇]	90	Useful Trustworthy	42 87	33 83	49 91
Ranching/Range Groups [◇]	79	Useful Trustworthy	42 66	25 51	53 75
Extension Agents [◇]	76	Useful Trustworthy	38 80	29 74	43 84
Newspapers/Magazines [*]	93	Useful Trustworthy	35 56	39 59	31 54
Television & Radio [◇]	93	Useful Trustworthy	26 49	31 53	23 45
Environmental Groups [◇]	88	Useful Trustworthy	18 30	29 46	10 17
Information Specifically from the BLM and Forest Service					
Guided Field Trips [◇]	67	Useful Trustworthy	46 84	58 91	39 79
Demonstration Sites [◇]	66	Useful Trustworthy	44 80	54 88	37 74
Visitor Centers and Interpretive Programs [◇]	80	Useful Trustworthy	44 83	57 93	34 75
Public Meetings	77	Useful Trustworthy	41 75	39 72	42 77
Interactive Workshops [◇]	58	Useful Trustworthy	39 81	50 90	33 75
Conversations with Agency Personnel [◇]	71	Useful Trustworthy	36 71	39 77	35 67
Brochures [◇]	80	Useful Trustworthy	35 74	40 80	31 70
Environmental Impact Statements [◇]	78	Useful Trustworthy	28 55	37 65	22 48
Newsletters/Mailings [◇]	75	Useful Trustworthy	26 69	28 74	25 66
Agency Websites [◇]	64	Useful Trustworthy	25 67	33 74	19 61

^a Exposure indicates the percentage of total respondents who had some experience with the listed information source and responded to the additional questions accordingly.

^{*} Significant difference between urban and rural responses about **usefulness**.

[◇] Significant difference between urban and rural responses about **trustworthiness**.

References

Toman, E., B. Shindler, and M. Brunson. 2006. Fire and fuel management communication strategies: Citizen evaluations of agency outreach activities. *Society and Natural Resources* 19:321-336.

Seed Bank Response to Juniper Expansion in the Sagebrush Steppe

Expansion of western juniper (*Juniperus occidentalis*) into the sagebrush steppe has resulted in significant changes in understory composition. A consequence of increased western juniper dominance may be a depletion of the seed bank. Depletion is problematic because it has the potential to lower site resiliency through a reduction of species availability. Research conducted by Corinne Duncan and Dr. Richard Miller of Oregon State University and Dr. David Pyke of the U.S. Geological Survey evaluated the effects of the relative abundance of western juniper on the soil seed bank.

Questions addressed in this study include:

- 1) Does the number of ruderal (weedy) species increase along a gradient of western juniper abundance?
- 2) Does seed density decrease as western juniper abundance increases?

Two eastern Oregon sagebrush steppe sites were chosen to represent the juniper woodland-sagebrush steppe region, the control plots of the SageSTEP Devine Ridge and Bridge Creek study sites. These sites displayed a range of western juniper canopy cover from open to closed stands. Soil samples were collected at these sites in the fall of 2006 and 2007 and subjected to both cold-wet and warm-dry stratification. Germination of the samples occurred over a period of eight months under greenhouse conditions, and then linear regression was employed to evaluate relationships.



Collection of seed bank samples took place at the SageSTEP Devine Ridge and Bridge Creek sites.

No statistically significant relationships were detected between western juniper cover and ruderal species richness at either site in either year. The results for seed density were more complex. In 2006, western juniper cover was strongly related to seed density at Devine Ridge but in 2007 there was no evidence of a correlation. At Bridge Creek in 2006, there was a weak relationship between increasing western juniper cover and decreasing seed density but in the second year no relationship was detected.



Above: Seep monkeyflower (*mimulus guttatus*) in bloom in the greenhouse. Below: Greenhouse germination of collected seeds.

During the period of this study, the degree of western juniper cover did not appear to affect ruderal species richness. However, seed density of the seed bank did appear to be affected. Positive relationships were detected at both sites during the first year of the study in which precipitation was above average. It is possible that during a wet year understory response, as measured by seed density, is greater in areas of low western juniper cover indicating that site resiliency may be higher in areas of low western juniper cover. Though three out of four related studies concur, a lengthier period of study is required to test this hypothesis.

This study was part of Corinne Duncan's master's thesis, which can be viewed online at <http://www.sagestep.org/pubs/pubs/DuncanThesis.pdf>.

Photos in this article were provided by Corinne Duncan.

This study was conducted in collaboration with SageSTEP. A collaborative project is a study outside of the core SageSTEP study that takes place on or in relation to one or more of the SageSTEP study plots. More information about current collaborative projects and how to submit proposals can be found at http://www.sagestep.org/collaborative_projects.html.

Learning Together: SageSTEP Progress Report Nevada and Idaho Manager Workshop



The SageSTEP Owyhee study site in Elko County, NV.
Photo by Jeff Burnham.

The workshop will begin on June 10 with an all-day field tour to the SageSTEP Owyhee study site located in Elko County near the McCleary Wells in the southern Owyhee Desert. This is a sagebrush site found on land managed by the Bureau of Land Management. Restoration treatments, including prescribed fire, mowing, and herbicide applications, were implemented at the Owyhee site in the fall of 2008.

The following day we will meet at the Winnemucca Convention Center for a review of study results from sites implemented earlier in the project and discussion among researchers and managers about how information resulting from this project can be made most useful to those working on the ground.

The workshop will focus on SageSTEP research at study sites in Nevada and Idaho. We would like to ask managers at our partner offices in these states to put this workshop on your calendars. Others who are interested in attending any portion of the workshop, please contact Summer Olsen, SageSTEP Outreach Coordinator, summer.c.olsen@usu.edu.

SageSTEP will be hosting a workshop for managers and other interested individuals in Winnemucca, Nevada, June 10-11, 2009. The purpose of this workshop is to provide an opportunity for scientists and managers to come together and discuss the progress of the project at the eastern sagebrush/cheatgrass and pinyon-juniper SageSTEP study sites located throughout Nevada and Idaho. We will also discuss lessons learned from working together, and plans for continued collaboration as the study progresses. A similar workshop was held in Oregon in 2008, and both managers and researchers benefitted from this interaction.



A prescribed burn was conducted at the SageSTEP South Ruby Mountains study site in Elko County, NV in the fall of 2008. *Photo by Travis Miller.*

2008 Treatment Implementation at SageSTEP Study Sites

In the fall of 2008, treatments were implemented at five SageSTEP study sites: Hart Mountain-Gray Butte, Owyhee, Saddle Mountain, South Ruby Mountain, Moses Coulee (a network map can be viewed at <http://www.sagestep.org/locations.html>). Treatments included prescribed fires, mechanical removal of trees and shrubs, and herbicide application. We appreciate the hard work of the Bureau of Land Management, Forest Service, Fish and Wildlife Service and The Nature Conservancy in helping with treatment implementation. 2008 was the third and final year for treating our study sites, and ongoing data collection will be used to analyze post-treatment recovery of the sites. In total, 17 of the 19 SageSTEP study sites have received their full range of treatments, and only one site (Spruce Mountain) has not received any treatment due to ongoing litigation. Spruce Mountain treatments and a prescribed fire at Moses Coulee are planned for 2009, but will not be included in the same statistical analyses as sites that were previously treated. When SageSTEP researchers originally proposed the project, they could not have anticipated that the years in which treatment implementation was planned (2006 and 2007) would turn out to be two of the worst fire years in our country's recorded history. Land managers and fire crews in our collaborating offices have done a tremendous job of helping the project move forward in the face of numerous obstacles. As our study progresses, we hope to be able to provide information that will improve the quality of rangelands in the Great Basin and prevent large-scale disastrous wildfires in the future.

Upcoming Events

The 5th Intermountain Native Plant Summit

Boise, Idaho

March 24-26, 2009

For more information, email
dale.nielson@ars.usda.gov

SageSTEP Nevada and Idaho Manager Workshop

Winnemucca, Nevada

June 10-11, 2009

<http://www.sagestep.org/events.html>

94th Ecological Society of America Annual Meeting

Ecological Knowledge and a Global Sustainable Society

Albuquerque Convention Center

Albuquerque, New Mexico

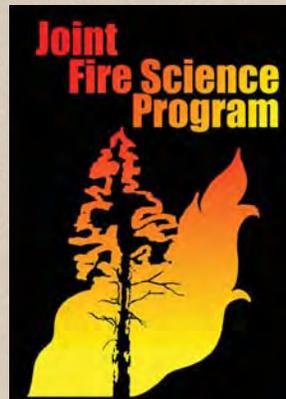
August 2-7, 2009

<http://www.esa.org/albuquerque/>

SageSTEP is a collaborative effort among the following organizations:

- Brigham Young University
- Oregon State University
- University of Idaho
- University of Nevada, Reno
- Utah State University
- Bureau of Land Management
- Bureau of Reclamation
- USDA Forest Service
- USDA Agricultural Research Service
- US Geological Survey
- US Fish & Wildlife Service
- The Nature Conservancy

Funded by:



For more information and updates, visit our website:

www.sagestep.org

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