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Sagebrush Steppe **SageSTEP** Treatment Evaluation Project

In this Issue:

- DOI Order on Sage Grouse and SageSTEP Research
- Spider Response to Treatment in Sagebrush Steppe

Issue 26, Spring 2015

SageSTEP Answers Secretarial Order with Research Insight

A Secretarial Order issued by Interior Secretary Sally Jewell in January 2015 called for a comprehensive science-based strategy to address the more frequent and intense wildfires burning through sagebrush landscapes in the Great Basin. This order is part of a campaign addressing threats to Greater Sage-grouse prior to the U.S. Fish and Wildlife Service's court-ordered 2015 deadline to consider proposing the bird for protection under the Endangered Species Act. It asks managers to make current restoration practices more efficient and effective and it prompts them to be more proactive in their efforts to reduce the size of wildfires. In general, the Order calls for longer-term science that focuses on sagebrush systems, particularly as they relate to sage-grouse habitat.

In order to convert cheatgrass-riddled and juniper-encroached communities back to functioning sagebrush communities that include wildlife, land managers need information about what treatments will trigger beneficial change, and how long it will take. SageSTEP researchers are uniquely positioned to provide insight about creating and sustaining high quality sage-grouse habitat in several areas – long-term monitoring, treatment comparison and adaptive

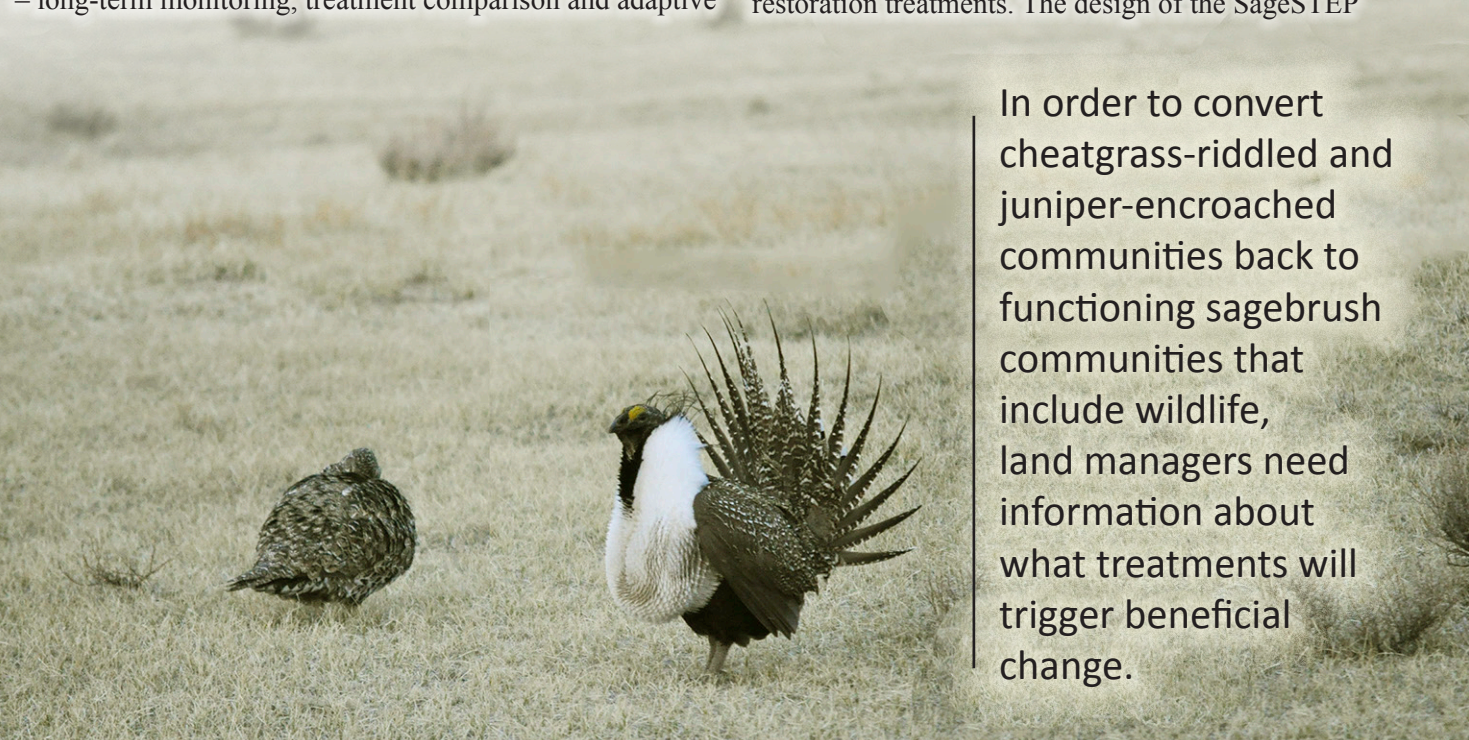
management, fuel reduction efficiency and effectiveness, fuel treatment longevity, and resilience in ecosystems.

Long-term monitoring

The SageSTEP research project was designed to study long-term outcomes of commonly used sagebrush ecosystem fuel reduction and restoration techniques, such as prescribed fire, tree cutting, tree shredding, shrubland mowing and herbicides. Nearly a decade of information now exists at multiple sites across the Great Basin.

Fire tips the balance in many arid systems towards cheatgrass, but if it is dominant in the short-term, will it remain dominant for the long term? “There is a great need for long-term information on the effects of vegetation treatments in arid environments,” said U.S. Geological Survey ecologist David Pyke. “Understanding an ecosystem’s resilience and its ability to recover requires a long perspective. The long-term dataset we are collecting is crucial to that understanding.”

SageSTEP has established a robust monitoring network, focused around commonly applied fuel reduction and restoration treatments. The design of the SageSTEP



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network
enables
researchers to
systematically
gather and process
long-term data in a way
no other project has been able to do.



“SageSTEP is the only program where we have the ability to look at effects of fire and vegetation treatments over time. We now have information from nearly a decade on multiple sites across the Great Basin,” said Mike Pellant, Rangeland Ecologist with the Bureau of Land Management. “SageSTEP’s strength is the scope of the project and the time it has been in place.”

SageSTEP data has direct application to the Secretarial Order and its call for adaptive management approaches. SageSTEP includes development and refinement of monitoring protocols that assess if vegetation management efforts are working. “Long-term habitat monitoring provides good information about changes over time, something that is sorely lacking in a lot of research and even some of our monitoring,” said Pellant. “A three year perspective with research is typical, but inadequate. The ability to monitor and collect data over longer periods is a big plus.”

Treatment comparison and adaptive management

Although SageSTEP has identified protocols that detail complex ecological interactions and assesses progress toward management goals, additional long-term work continues to refine these protocols. It isn’t enough to evaluate just one treatment in one area. “What SageSTEP does is to compare treatments – to look at several approaches including fire, mowing, herbicides, and mechanical treatments such as cutting and shredding,” said Pellant. “We try more than one and see which works best in different circumstances. Based on those results, managers can modify their management strategies,” he said. “That is truly adaptive management – the comparison of different treatments on the same site as well as the selection of treatments across the Great Basin.”

Longer-term work continues to refine these protocols in an adaptive management style. For example, hydrology work by Fred Pierson and others shows that even though prescribed fire can cause short-term increases in runoff and erosion, herbaceous recovery after disturbance will tend to decrease erosion significantly after just a few years. This

ultimately is a better scenario than leaving encroached sagebrush steppe untreated because tree dominance causes more erosion in the interspaces.

Fuel reduction efficiency and effectiveness & fuel treatment longevity

SageSTEP researchers are able to address the mandate for fuel reduction efficiency and effectiveness and fuel treatment longevity in the Secretarial Order. “We have fuel treatments located in lower-elevation arid Wyoming sagebrush communities to mountain sagebrush communities,” said Pyke. “The long-term monitoring data provides us with information to anticipate potential ecosystem responses and provide managers with the likelihood of achieving their objectives given the pre-treatment conditions and the applied treatment.”

“We’ve also identified which factors are most important in determining how well a particular site will perform after a disturbance, such as soil type, aspect, slope, precipitation, temperature regimes, and pre-treatment vegetation condition,” said Jim McIver, Ecologist and SageSTEP Project Coordinator. “We better understand what it takes to sustain native herbaceous functionality given various disturbances, especially when cheatgrass is present before treatment.”

“SageSTEP addresses the most critical elements for understanding whether an ecosystem has already crossed a threshold to a vegetation state where recovery may be more challenging,” said Pyke. “Our research asks if fuel treatments will result in recovery of native plant communities or in losing the battle to cheatgrass in the long term. Fuel treatments may tip the balance if ecosystems are not resilient enough to withstand vegetation treatments and recover.”

Resilience in ecosystems

The Secretarial Order seeks to define what constitutes resistant and resilient sage-grouse habitat. Since SageSTEP directly studies both resistance and resilience as part of its core experiment, our scientists are defining these concepts with respect to vegetation, hydrology, and wildlife habitat. SageSTEP research indicates a habitat resilient to disturbance has perennial herbaceous vegetation, especially native perennial bunchgrasses, in sufficient quantities to provide cover and density adequate to outcompete cheatgrass after fires. These perennial bunchgrasses give landscapes a chance to recover and maintain the kind of habitat functionality sage-grouse need. Land management practices that reduce the ability for perennial bunchgrass to successfully outcompete cheatgrass are likely to reduce the capacity for that landscape to recover after a disturbance.

In plant communities, SageSTEP work is showing that within a few years after a fire, sagebrush seedlings are also appearing and are present in about 40 percent of our moni-

tored sites. This indicates that given time, sagebrush may re-colonize sites and along with native herbaceous vegetation, may contribute to the kind of habitat conditions sage-grouse need.

Sage-grouse recovery is not only dependent on vegetation recovery, but also on where the recovery occurs on the landscape. “We need to recognize that restoring sagebrush is not the same thing as restoring a sagebrush community that can support wildlife,” said USGS ecologist Steve Knick. “Managers cannot arbitrarily burn the landscape and assume that it will become habitat suitable in supporting sage-grouse recovery.”

Managers need information about the whole ecosystem’s response to treatment. By studying the entire community instead of focusing on a single factor, SageSTEP scientists have obtained a range of information useful to managers as they focus on sage-grouse, fire and invasive species in response to the Secretarial Order.

SageSTEP also collects information about bird response to disturbance over time. Sage-grouse were not included in the original research plan because of challenges, such as

large home ranges, slow recolonization after disturbance, and lag periods in response by sage-grouse populations to habitat changes. Instead, sagebrush-obligate passerine birds were used as surrogates, and researchers have monitored and tracked changes in bird communities directly related to disturbance in fourteen juniper sites.

“We now have some information that tells us what treatments work for the birds and what doesn’t,” said Knick. “Complete removal of trees and restoration on the edge of an existing sagebrush expanse works. Treatment projects embedded in an inhospitable landscapes and restoration too far away from existing leks, does not.”

Research from SageSTEP supports meeting the objectives in the recent Secretarial Order. We are committed to making this information available and applicable to land managers who have the difficult assignment of tackling this challenge on public lands in the Great Basin.

Illustration adapted from photos by Pacific Southwest Region from Sacramento, US (Greater Sage-Grouse) [CC BY 2.0 (<http://creativecommons.org/licenses/by/2.0>)], via Wikimedia Commons

Research Highlight

A look at what SageSTEP scientists are studying:

Spider Populations Illustrate Short-term Change after Restoration Treatments

By Jim McIver

While SageSTEP is primarily focused on understanding plant response to restoration treatments, considerable effort has been expended to document and explain the response of animals as well. SageSTEP faunal work has at least three principal objectives: 1) To determine the extent to which fuel reduction/restoration treatments may have unintended consequences; 2) To measure response of the wider ecosystem, including variables that land custodians do not directly manage; and 3) To determine if treatments influence the function of ecological systems. Previous newsletter issues have reported on birds (issues 17, 18), ants (issues 4, 6), and butterflies (issues 13, 20). In this issue, we provide a glimpse into the world of sagebrush steppe spiders, a group of invertebrates that are known to be sensitive indicator species of environmental change. We ask: What is the composition of spider communities across the Great Basin? Which types of spiders are most

abundant in various habitats? How do spider communities correspond with primary patterns of vegetation structure? Do sagebrush steppe restoration treatments change these patterns?

We sampled spider communities by deploying 2350 pitfall traps in 65 SageSTEP plots at 18 sites across the Great Basin. Although pitfall traps do capture some spiders that hunt on the vegetation, this sampling method is biased toward ground-hunting species. A total of 10,139 individual spiders were collected and identified between 2006 and 2014, comprising 94 species in 54 genera and 17 families. While this sounds like a lot of spiders, this total represents only 2% of the 545,000 arthropods collected during the study, 242,000 of them ants.

By far the most abundant group of ground-hunting spider were species in the family ‘Gnaphosidae’, or the nocturnal running spiders, which comprised 23% of the



Callilepis eremella
(Nocturnal Running Spider: Gnaphosidae)

spider species richness (Photo 1), 45% of species abundance, and roughly 55% of species biomass. Other important groups were jumping spiders (Family Salticidae: 13%, 12%, 13%; Photo 2), crab spiders (Thomisidae: 9%, 8%, 13%; Photo 3), and wolf spiders (Lycosidae: 5%, 13%, 16%; Photo 4). Interestingly, of the 94 identified species, seven species (8%) are new to science, never having received a species name. One of these is a trap-door spider in the tarantula group (Photo 5), which is one of the largest-bodied spiders in our collection. That this trap-door spider is yet to be named attests to the fact that Great Basin spiders are poorly known overall.

Prior to treatment, and in control plots after treatment, spider communities varied greatly across the SageSTEP network, with geographic location and woodland



Phidippus johnsoni
(Jumping Spider: Salticidae)



Photo by Trygve Steen

Xysticus montanensis
(Crab Spider: Thomisidae)



Schizocosa mccooki
(Wolf Spider: Lycosidae)



***Aptostichus* sp.**
(Trap Door Spider)

phase standing out as the most important factors behind variation at the community level. For instance, nocturnal running spiders were five times as common at the Devine Ridge western juniper site than they were at the juniper-pinyon Scipio site, while jumping spiders were most common at Scipio and nearly absent from the Bridge Creek site. Spiders as a whole group were least common at the pinyon-juniper site Marking Corral. The chance of seeing a spider in a treeless (Phase 1) woodland plot was nearly twice as high as the chance of seeing a spider

in a highly tree-encroached sagebrush steppe plot (Phase 3 woodland plot). This pattern of lower abundance in Phase 3 woodlands was followed by numbers of trap-door spiders, hackled-band weavers, nocturnal running spiders, and crab spiders. Wolf spiders, black widows, and dwarf spiders, on the other hand, were equally abundant across all phases. Interestingly, lower numbers of the most abundant ground-hunting spider group in Phase 3 woodlands – the nocturnal runners – was apparently due to low persistence of individuals, not lack of colonization. Patterns for adult spiders versus juveniles (Figure 1) show that while juveniles do colonize all woodland sub-plots about equally (probably by ‘ballooning’ – riding silk lines on the wind), the adult numbers show that these juveniles either leave Phase 3 sub-plots or die trying, as indicated by their lower numbers in encroached sub-plots.

When trees were removed by either prescribed fire or mastication, running spiders persisted for longer in former Phase 3 sub-plots, indicating that ‘restoration’ success for running spiders mirrored restoration success for vegetation (Figure 2). However, for sub-plots in which trees were killed by cut and leave treatments, adult running spiders showed the same aversion to remaining in those sub-plots as for pre-treatment conditions. The reasons for these patterns are unclear, largely because virtually nothing is known about nocturnal running spiders in any system, let alone poorly studied desert systems like sagebrush steppe. In fact, we could not find a single published paper on the biology of nocturnal running spiders worldwide. Thus, identifying the mechanisms behind response to Phase 3 infilling, and the removal of trees will have to await further study on the biology of these enigmatic critters.

Figure 1.

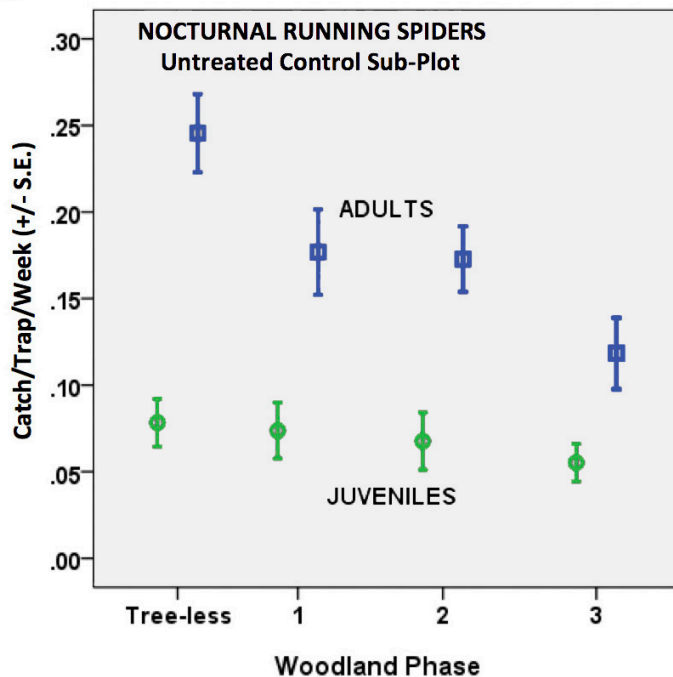
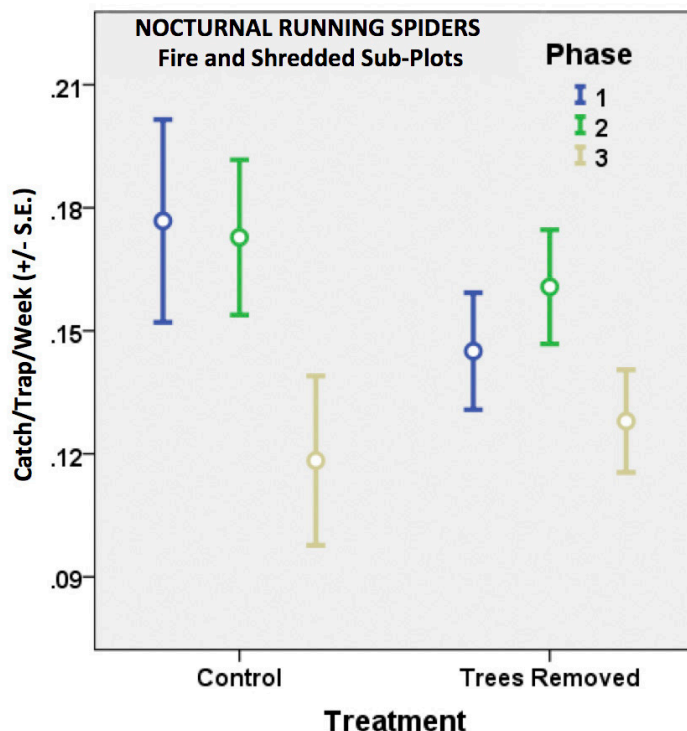


Figure 2



SageSTEP

is a collaborative effort among the following:

- Brigham Young University
- Bureau of Land Management
- Bureau of Reclamation
- Joint Fire Science Program
- National Interagency Fire Center
- Oregon State University
- The Nature Conservancy
- University of Idaho
- University of Nevada, Reno
- US Geological Survey
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