

## SageSTEP Hydrologists Look at Hydrologic and Erosional Impacts of Pinyon and Juniper Encroachment

The hydrology component of SageSTEP is investigating how pinyon and juniper encroachment into Great Basin sagebrush steppe influences surface runoff and erosion from these systems, as well as the hydrologic and erosional impacts of restoration treatments that reduce tree cover. Historical research of woodland expansion in the western U.S. suggests that pinyon and juniper encroachment into sagebrush steppe may reduce shrub and herbaceous cover and increases the expanse of interspace areas (areas between shrub and tree canopies). Studies from woodland sites in the southwestern United States indicate that surface runoff and erosion rates are highest from interspace areas and lowest near bases of shrubs and trees protected by canopy and litter.

The primary hydrology research questions for the SageSTEP hydrology study are:

- Do critical thresholds exist in vegetation and ground cover that significantly influence runoff and erosion in pinyon and juniper woodlands?
- How will tree reduction applications influence the hydrologic stability on woodland sites?

Hydrologic experiments are being conducted at one western juniper (Castlehead, ID), one Utah juniper (Onaqui, UT), and one pinyon-Utah juniper (Marking Corral, NV) site within the greater SageSTEP study area (see map on p.5). Experiments are implemented within woodland areas prior to tree removal (pre-treatment) and within areas that have been treated by burning, cutting and bullhog tree removal methods. Artificial rainfall simulations at the small (0.5 m<sup>2</sup>) and large plot (13 m<sup>2</sup>) scales, and concentrated flow experiments are being used to quantify runoff



Runoff and sediment sampling on large rainfall simulation plot.

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and erosion across a gradient of vegetation and ground cover in interspace areas and areas underneath tree and shrub canopies (coppices). Soil water repellency and ground cover factors that influence runoff and erosion are measured at each site. Pre-treatment data were collected at the Marking Corral and Onaqui sites in 2006 and serve as a baseline data set to evaluate hydrologic effects of woodland control treatments. Data collection at the Castlehead site began in May of 2008. This article presents preliminary results from the 2006 pre-treatment data collected at the Marking Corral and Onaqui study sites.



**Small plot rainfall simulation at the Marking Corral site.**

Preliminary results from small plot rainfall simulations suggest runoff was greater on interspaces even though soils were strongly water repellent under juniper and pinyon canopies. The average runoff rate on interspaces was twice that observed under juniper canopies and 17 and 6 times greater than observed under pinyon and sagebrush canopies respectively. Strong soil water repellency was observed under juniper and pinyon litter, while soils under sagebrush canopies and in interspace areas were easily wettable. Litter depths under juniper and pinyon canopies were 70 to 90% greater than under sagebrush canopies and in interspaces. Higher runoff rates in interspaces are attributed to the low amounts of litter and ground cover present. The stronger water repellency under juniper and pinyon canopies is mitigated by dense litter cover that increases storage of simulated rainfall, allowing more time for infiltration. Lower runoff rates on sagebrush microsites are attributed to interception and storage of simulated rainfall.

Runoff and erosion at the large plot scale were greater from shrub-interspace (varying amounts of shrub and interspace areas) than tree patches (area under trees with varying amounts of interspace area). Greater average runoff rates are related to greater proportions of interspace to coppice area within shrub-interspace patches. Tree coppice mounds cover a larger surface area than shrub coppices and have greater litter depths. These data indicate tree patches have greater rainfall storage and/or infiltration



**Large plot rainfall simulation after tree cutting at the Marking Corral site.**

capacity than canopy and ground cover in shrub-interspace patches at the large plot scale.

Sediment yield from shrub-interspace patches at the Onaqui site was significantly greater than that measured on tree patches. Differences in erosion between shrub-interspace and tree patches at Marking Corral were minor, indicating a site difference in erodibility. Differing erosion rates between the two sites are likely related to the site differences in soil properties and hillslope angles. Surface soils at Marking Corral contain more gravel sized particles thought to protect underlying fine soils from erosion and to reduce the velocity and erosive energy of overland flow. Hillslope angles are lower at Marking Corral (9%) than Onaqui (14%), implicating greater resistance to overland flow velocity and erosive energy at the Marking Corral site.

These results are preliminary, but indicate different portions of the landscape in pinyon and juniper woodlands exhibit different hydrologic responses. Storage and infiltration of rainfall are greater in tree than in shrub-interspace patches and the differences are largely dependent on the amount of cover present. The impact of woodland encroachment on runoff and soil loss on invaded sagebrush steppe sites likely depends on how woodland encroachment influences the spatial extent and continuity of interspace areas. Furthermore, more static site characteristics like soil properties and hillslope angle and spatially and temporally variable influences like soil water repellency may mitigate or accelerate the influence of woodland encroachment on runoff and erosion processes.

The full article *Hydrologic and erosional impacts of pinyon and juniper encroachment into sagebrush steppe communities of the Great Basin, USA*, is available at [http://www.sagestep.org/pubs/articles/Pierson\\_et\\_al\\_2008-2.pdf](http://www.sagestep.org/pubs/articles/Pierson_et_al_2008-2.pdf). The SageSTEP hydrology research is being conducted by Fred Pierson, Jason Williams, and Patrick Kormos of the USDA Agricultural Research Service, Boise, Idaho. For more information email [Jason.Williams@usda.ars.gov](mailto:Jason.Williams@usda.ars.gov).



# Learning Together in SageSTEP: Oregon Manager Workshop Brings Researchers and Managers Together on the Ground

The Learning Together in SageSTEP 2008 Oregon manager workshop was held May 6-7, in Burns, Oregon. There were over 60 participants from Oregon, Idaho, California, Utah, and Nevada representing SageSTEP, the Bureau of Land Management (BLM), USDA Forest Service, Natural Resource Conservation Service (NRCS), and non-governmental organizations. The workshop was conducted to give participants an overview and update of the SageSTEP experiment and to bring researchers and managers together to discuss how study results can be most useful to those working on the ground.



Workshop participants listen to an overview of the SageSTEP study.

The workshop began the morning of Tuesday, May 6, in Burns. During the indoor session, researchers from various disciplines (vegetation, wildlife, entomology, soils, and hydrology) gave presentations outlining their experiments, progress to date, and in some cases, preliminary results. The indoor session also included presentations about the SageSTEP sociopolitical and economics research, including results from a ranch-scale economic modeling study and from a 2006 citizen survey about the use of restoration treatments on public lands. **PowerPoint presentations with audio from the indoor session can be viewed on the SageSTEP website at [http://www.sagestep.org/events/or\\_wkshp\\_2008.html](http://www.sagestep.org/events/or_wkshp_2008.html).**

The workshop also included two field tours to areas representing the two types of vegetative communities where experiments are being conducted in this region. Tuesday afternoon the group visited a sagebrush site on land managed by the BLM Burns District that

had been mowed in 2002 and 2004, and then burned in a wildfire in 2005. Discussion at this site focused on how to treat sagebrush systems and encourage regrowth of the native understory.



Workshop participants listen to Dave Pyke as they tour a sagebrush site.

For many participants, the highlight of the workshop was the Wednesday field tour to the SageSTEP Walker Butte western juniper site located near Christmas Valley, Oregon, on land managed by the BLM Lakeview District. Prescribed burn and mechanical thinning treatments were implemented at the Walker Butte site in the fall of 2006, so workshop participants were able to see how the site is recovering after a full growing season. Discussion at the site focused on fire history of the region, western juniper ecology, and the role of passerine birds and ants in western juniper systems.

One thing that researchers and managers at the workshop agreed on without question is the value of monitoring the SageSTEP study plots past current funding date of 2010. The data collected in the current 5-year time frame of the project will provide a wealth of information about these systems. Further monitoring of these sites would tell researchers whether initial post-treatment response endures and which treatments are most effective in the long-term.

Thanks to everyone who participated in the Oregon workshop. If you would like to be notified of future SageSTEP manager workshops or field tours, send a message to [summer.c.olsen@usu.edu](mailto:summer.c.olsen@usu.edu).



# Collaborative Project Highlight

## *The Role of Harvester Ant Foraging Behavior in the Restoration of Cheatgrass-Degraded Sagebrush-Steppe Rangelands*

Dr. Scott Newbold, a post-doctoral research associate at Colorado State University, is conducting a study in collaboration with SageSTEP researchers, Drs. Gene Schupp and James McIver, looking at the role of seed-harvesting ants in the restoration of sagebrush-steppe habitats. This study is investigating the interactions between seed-harvesting ants and the seeds of native and non-native plant species in cheatgrass-degraded reference plots and plots that have been experimentally treated using a suite of restoration management techniques.



Western harvester ants (*Pogonomyrmex occidentalis*) removing millet from a seed tray in a seed-removal trial. Photo by Scott Newbold.



Ant nest on Onaqui burn plot. Photo by Scott Newbold.

The researchers are looking at how ant foraging behavior, fate of ant-collected seeds, and seedling establishment with and without harvester ants are influenced by cheatgrass density and management treatment. This study is being conducted at the SageSTEP Onaqui sagebrush/cheatgrass study site, which includes four management treatments on 75-acre plots: prescribed burn, mechanical thinning (mowing), herbicide (tebuthiuron), and control. Western harvester ant (*Pogonomyrmex occidentalis*) colonies have been selected throughout the plots at various cheatgrass densities (low, medium, high) and across the range of treatments. Data collection began in 2006 and will continue until 2010 and takes place twice a season (early June and late July).

Preliminary findings suggest that:

1. Counter to original expectations, ants primarily collected and moved non-native seeds, mainly curvseed butterwort (*Ceratocephala testiculata*), but also collected native seeds such as *Elymus elymoides* and *Poa secunda*;
2. Seeds of native species seemed to be disproportionately targeted by ants in cheatgrass-dominated areas; and

(continued on **page 5**)

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. Each issue of SageSTEP News highlights a different collaborative project. More information about current collaborative projects and how to submit a proposal can be found at [http://www.sagestep.org/collaborative\\_projects.html](http://www.sagestep.org/collaborative_projects.html). We welcome proposals for non-invasive research on aspects of sagebrush ecosystems that are not covered in the SageSTEP proposal. If you are interested, please contact Jim McIver, SageSTEP Project Coordinator, at 541-562-5396 or [james.mciver@oregonstate.edu](mailto:james.mciver@oregonstate.edu).

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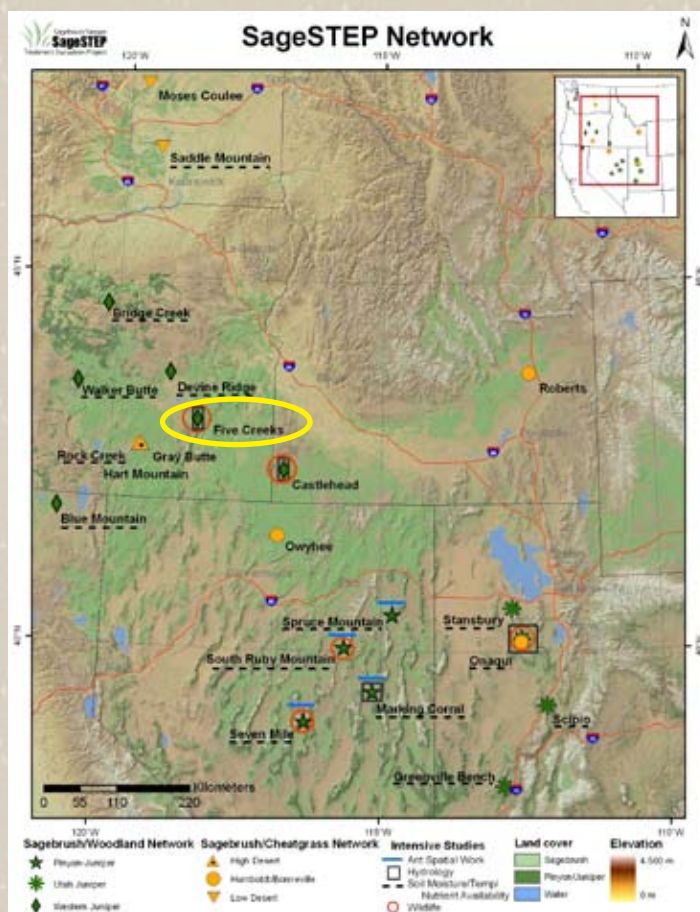
3. Ant foraging behavior appeared to increase strikingly in response to fire --- presumably in response to decreased seed resources following the burn ---with foragers in burned areas finding and removing seeds from significantly more seed “patches” compared to unburned areas.

These results have strong implications for current reseeding/revegetation practices being employed following wildfires in the Great Basin. The researchers intend to continue monitoring ant colonies at the Onaqui study site and expand their work to quantify the effect of harvester ants on vegetation recovery following natural wildfires.

For more information about this study, contact Scott Newbold at [snewbold@lamar.colostate.edu](mailto:snewbold@lamar.colostate.edu) or visit [http://www.sagestep.org/collaborative\\_projects/projects/newbold\\_seeds\\_ants.html](http://www.sagestep.org/collaborative_projects/projects/newbold_seeds_ants.html).

## New Five Creeks Site in Southeastern Oregon

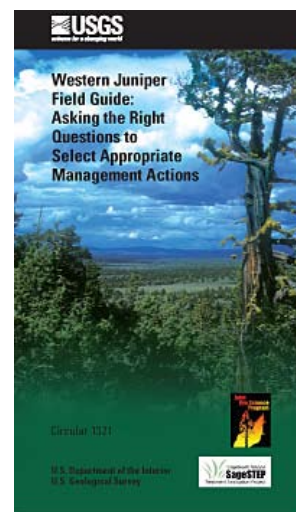
A new site has been added to the SageSTEP network for the 2008 field season. The Five Creeks site is located on Steens Mountain in southeastern Oregon on land managed by the BLM Burns District. This site is part of the western juniper region and will be used as an extensive plot for vegetation and fuels research, and the wildlife study focusing on passerine birds. Pre-treatment data will be collected at the site this summer and treatments are scheduled for fall of this year.



**Don't Forget,** copies of the publication *Western Juniper Field Guide: Asking the Right Questions to Select Appropriate Management Actions* are now available. Please

send all requests to [Summer.C.Olsen@usu.edu](mailto:Summer.C.Olsen@usu.edu) and include your name, mailing address, and the number of copies you would like.

The guide is also available online at [www.sagestep.org](http://www.sagestep.org).





# Upcoming Events

## Society of American Foresters 2008 National Convention: Forestry in a Climate of Change

Reno-Tahoe, Nevada

November 5-9, 2008

<http://www.safnet.org/natcon-08/>



## SageSTEP Site Visit

The annual SageSTEP summer research meeting will be taking place in Utah this July. Managers and other interested individuals are welcome to accompany the research team on their site visit on Wednesday, July 16.

The site visit will take place at the Stansbury pinyon-juniper woodland site located in the Stansbury Mountains near Tooele, Utah. This area is part of the Wasatch-Cache National Forest. Prescribed fire and mechanical thinning and mulching treatments were implemented at the site in the fall of 2007.

If you are interested in accompanying the research team to the Stansbury site, please contact Summer Olsen at 435-797-8455 or [summer.c.olsen@usu.edu](mailto:summer.c.olsen@usu.edu).

### 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:



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**[www.sagestep.org](http://www.sagestep.org)**