Science to Solutions

Conifer Removal Restores Sage Grouse Habitat

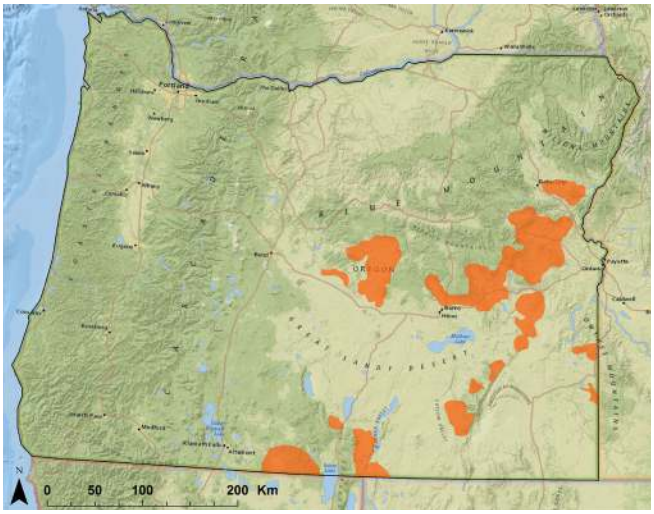
In Brief: The invasion of juniper and other conifers into sagebrush rangelands degrades habitat for sage grouse. A new study in eastern Oregon found no active leks where conifers covered more than 4% of the land area. As important, active leks were nonexistent not only where trees were well established, but even in early stages of encroachment where many small trees were scattered across the landscape. The most cost effective approach for conifer treatment is to target early encroachment stands (Phase I and II), where small trees can be completely removed and the existing sagebrush community sustained.

Cutting junipers invading the sagebrush-steppe is cost-effective. Photo: Jeremy Roberts, Conservation Media

Targeted Conifer Removal Can Help Restore Sage Grouse Habitat

If you could stand back and watch a timelapse video of the West's sagebrush country over the past 150 years, you would see a wave of juniper and pinyon pines sweeping across the landscape. Conifers have expanded well beyond their historical limits due to a combination of fire suppression, historic overgrazing by domestic livestock and favorable climate conditions. This invasion of the trees is not good for sage grouse or the many other species that depend on sagebrush-steppe habitats.

A recent study in eastern Oregon, carried out by The Nature Conservancy (TNC), University of Idaho and SGI, asked not only *how much* conifer invasion is detrimental to grouse, but what size and spatial patterns of trees affect sage grouse lek activity (Baruch-Mordo et al. 2013). They found that *no* leks were active at even very low levels of conifer encroachment: as little as 4% conifer cover on the landscape. Further, the pattern of trees was important: active leks disappeared where small trees were scattered throughout the sagebrush, typical of early juniper encroachment.

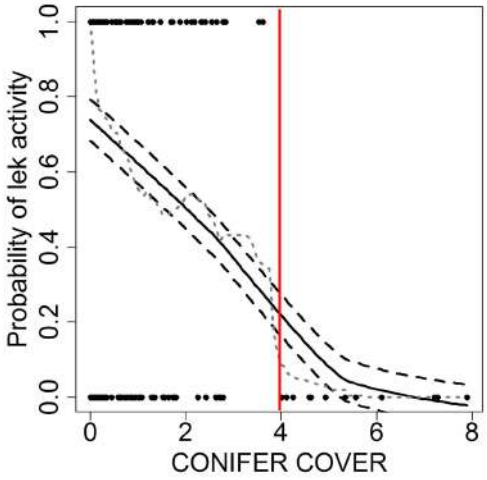


The researchers examined western juniper spatial patterns in relation to active and inactive leks across 6.2 million acres of eastern Oregon. Map courtesy S. Baruch-Mordo et al.

The project began with a need to map where western juniper *(Juniperus occidentalis)* is encroaching on sagebrush rangelands of eastern Oregon. The researchers examined high-resolution remote sensing imagery across more than 6 million acres (2.5 million ha). They then used a refined method of spatial analysis that allowed them to examine not only where juniper occurred but, at a very fine scale, the size of trees and their spatial patterns on the landscape. The researchers then analyzed how those patterns related to sage grouse lek activity.

To account for other factors that are known to influence lek activity, the researchers also examined the ruggedness of the terrain, amount of sagebrush cover, climate factors, fire and the level of human-related disturbance on the landscape, such as roads, agriculture, and development.

"We had a pretty comprehensive picture of the landscape in relation to sage grouse," says Jeffrey Evans, Senior Landscape Ecologist with TNC.



The probability of lek activity in relationship to percent conifer cover (black dots denote leks: for active leks probability = 1, and for inactive leks probability = 0.). Where conifer cover in sagebrush rangeland exceeded 4%, no active leks were found. Chart courtesy S. Baruch-Mordo et al.

Shrub-steppe to Woodland: A Problem for Sage Grouse

When conifers invade sagebrush shrub-steppe, "they act like millions of little straws sucking up what little moisture we get" explains Jeremy Maestas, SGI National Technical Lead. "It eventually dries up the springs and streams that are so critical to this desert environment." The trees alter soil acidity, shade out other plants and compete with understory grasses and herbs for water and nutrients, which eventually reduces food and cover for grouse and eliminates forage for other wildlife and livestock (Miller et al. 2005). Larger trees also serve as perches and roosts for hawks, ravens, crows and other birds that prey on sage grouse eggs and nestlings.

In the early stages of conifer encroachment (Phase I), sagebrush still dominates but small trees are dispersed across the landscape. In Phase II, trees co-dominate with sagebrush, and the understory grasses and herbacous plants critical to sage grouse and other wildlife begin to decline. By Phase III, conifers are well-established, shrubs begin to disappear, and the area is transformed into juniper or pinyon-juniper woodland, supporting an entirely different array of birds and plants (Miller et al. 2005).

Patterns in the Trees

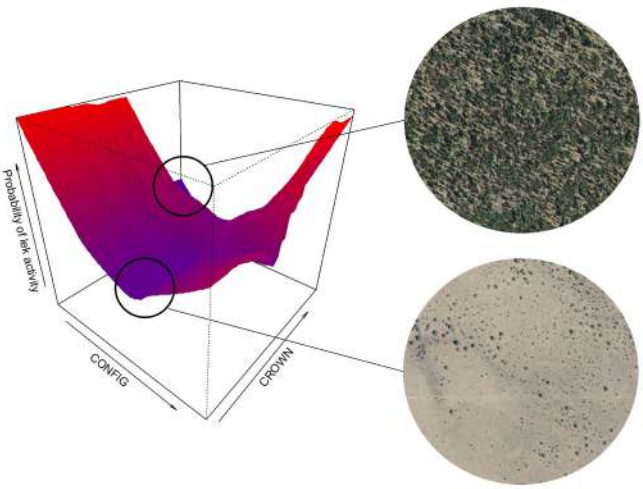
In the Oregon study, the spatial patterns of trees on the landscape proved enlightening. Leks were more likely to be active in areas where trees were clustered or clumped and large clear patches of sagebrush remained.

Predictably, the probability of finding active leks was low in established woodlands with densely clustered mature trees. More surprising, the probability of activity also dropped off even where small trees were widely scattered across the landscape. This suggests that grouse avoid areas with active encroachment as well as established woodlands.

"The spatial configuration and size of trees is critical–the amount of conifer encroachment in the landscape is only part of the story." ~Sharon Baruch-Mordo, TNC

"Sage grouse are just a really picky species," explains Jeff Evans. "With small young trees uniformly dispersed through a lekking display area the birds just don't like it–there's stuff in their way. When you start getting into the bigger trees, you start changing some of the inherent ecological processes of the site, and you start bringing in other species."

The importance of spatial configuration applies to other disturbances in sage grouse habitat as well, stresses Sharon Baruch-Mordo, TNC Spatial Scientist and lead author. Whether it is conifer encroachment or human development, "it's not just how much [disturbance], but how that disturbance is arranged on the landscape." *(see chart on page 3)*



The probability of lek activity in relation to conifer crown area (CROWN) and the spatial configuration of trees in the landscape (CONFIG). Lek activity drops off where large conifers are clustered in well-established woodlands (top circle) and where small trees are scattered across the landscape (bottom circle). Chart courtesy S. Baruch-Mordo et al.

Targeting Investment for Conifer Removal

Based on these findings, managers can get the most bang for their buck by focusing conifer removal treatments on early encroachment stands in and around landscapes that are already pretty good for grouse. Prioritizing Phase I stands—those with young scattered trees, <10% conifer canopy cover and intact sagebrush and understory vegetation—for complete removal of conifers will likely prove the most effective for restoring and sustaining habitat. Treating early Phase II stands can also prevent conversion to conifer woodlands and help functionally restore sagebrush habitat for several decades (Baruch-Mordo et al. 2013). Emphasizing mechanical treatment techniques that surgically remove trees while retaining the shrub community is key to improving habitat suitability in the near term.

A recent study by the U.S Geological Survey reinforces the importance of using the right techniques in the right places. The project evaluated prescribed burn treatments of mature pinyon-juniper woodlands and found that 6 to 24% of conifer cover remained after burning. In the short time frame of the study (3 to 5 years) they found no positive response by sagebrush birds to woodland burning. However, on two sites that had existing sagebrush and were adjacent to large sagebrush expanses, sagebrush-obligate songbirds returned after mechanical removal reduced junipers to <0.2% (Knick et al. 2014).

This suggests that although prescribed fire is a cost effective tool for greatly reducing woodland cover, the full restoration of shrubsteppe communities from mature woodland is a long-term process of regeneration, and may require more complete tree removal. In the short term, targeted mechanical removal of conifers where sagebrush is still intact can produce more immediate benefits for sagebrush wildlife.

These results provide some practical guidelines for conifer treatment and sagebrush habitat restoration:

- target stands in early stages of encroachment with still-intact sagebrush;
- remove all conifer trees to reduce conifer cover to <4%;
- use treatment methods that maintain the sagebrush and understory cover.

Sagebrush shrub-steppe restored: a 1-square mile area before (above) and after mechanical conifer removal. SGI has helped treat hundreds of thousands of acres of early phase conifer invasion to sustain sagebrush habitats. Photo credit: Andy Gallagher.

"Early tree removal is highly effective and less costly than a delay-and-repair approach that tries to turn a forest back into a sagebrush ecosystem again," states Dave Naugle, SGI National Science Advisor at the University of Montana.

Sharon Baruch-Mordo and her co-authors took their study one step further and calculated the economic cost of large-scale conifer removal. Even at large landscape scales, say the authors, treatment that targets early invasion sites would be within reach for public agency investment and for the public-private partnerships that are already well underway through SGI.

"SGI is plucking the low-hanging fruit," says Dave Naugle, by targeting mechanical treatment of early invasion sites for immediate conservation returns. Since 2010, SGI has invested in conifer removal on hundreds of thousands of acres of Phase I and II landscapes—successfully pushing back the march of the junipers to restore the sagebrush sea.

While SGI has adopted this strategy to target investments for immediate habitat restoration, it is also sponsoring studies to better understand bird response to conifer treatments. Two long-term research studies in the Warner Mountains of southeast Oregon are currently underway to quantify how sage grouse and shrub-nesting songbirds respond to targeted conifer removal. The findings will help improve future efforts to reduce the threat of conifer encroachment.

To learn more about conifer removal, sage grouse habitat conservation and the Sage Grouse Initiative, visit the SGI website at visit **http://www.sagegrouseinitiative.com/.**

Contacts

Dr. Sharon Baruch-Mordo, Spatial Scientist, Development By Design, The Nature Conservancy: sbaruch-mordo@tnc.org.

Dr. Dave Naugle, SGI science advisor, University of Montana: david.naugle@umontana.edu



Scientists Sharon Baruch-Mordo (left) and Jeff Evans (center) of TNC, and John Severson (right) of the University of Idaho lead this spatial modeling study that revealed the strong effects of conifer encroachment on sage grouse lek activity.

Photo: Tatiana Gettelman

Sources

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Additional Resources

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Writer: Christine Paige, Ravenworks Ecology, lchristinepaige@gmail.com
Designer: Maja Smith, MajaDesign, Inc. majadesignvt@comcast.net
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