

## Woodland Expansion



# Strategically Tackling Woodland Expansion

Photo: Jeremy Roberts/Conservation Media

**W**oodland expansion into grasslands and shrublands is a global problem as trees displace wildlife and reduce the productivity of grazing lands (Nackley et al. 2017). Scattered trees across the sagebrush biome may look harmless to a casual observer, but science shows woodland expansion erodes rangeland resilience when left unchecked. In the Intermountain West, conifer trees—including juniper, pine, and fir—have increased up to 600 percent since the 1800s, with 90 percent of expansion occurring at the expense of sagebrush rangelands (Miller et al. 2011). Woodland expansion results in sagebrush wildlife habitat loss and fragmentation, reduced forage production, decreased resilience to fire, and less resistance to cheatgrass invasion.<sup>1</sup>

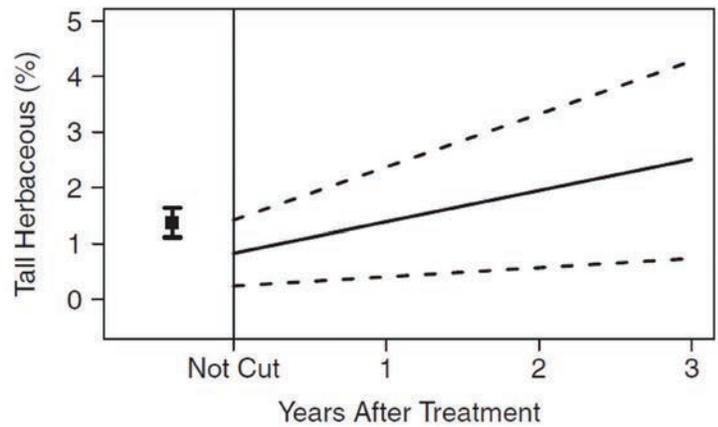
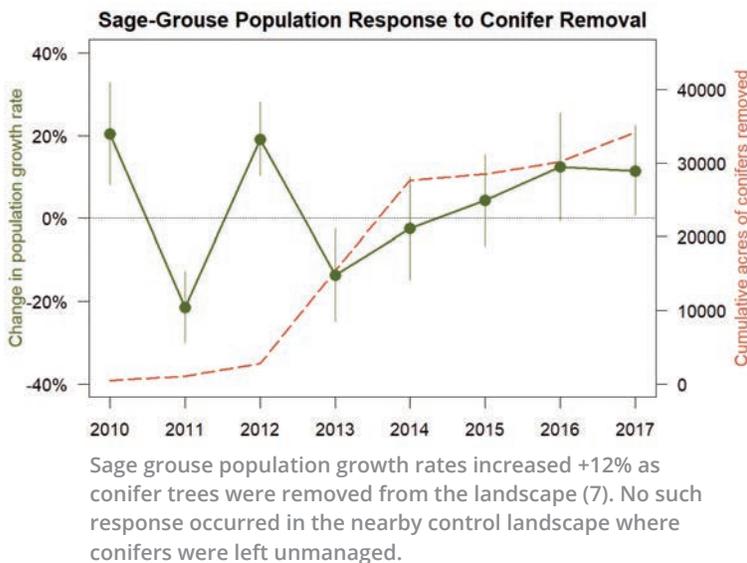
The extent and severity of woodland expansion as a primary threat to sage grouse was poorly understood a decade ago. WLFW-sponsored

science showed sage grouse are particularly sensitive to trees, abandoning otherwise suitable breeding habitat with just a few trees per acre (i.e., 4 percent canopy cover) thereby elevating awareness of this threat to grouse.<sup>2</sup> To help practitioners better target tree removal, WLFW coproduced the first high-resolution mapping of tall woody plant cover across sagebrush habitats<sup>3</sup> and made this tool freely available via the SGI interactive web application for partners to identify areas of early tree invasion and visualize potential areas in need of treatment. Today, this tool has been replaced by newer tree mapping technology available through the Rangeland Analysis Platform (see Sagebrush Conservation Tab; <http://rangelands.app>). Under WLFW's proactive "Protect the Core, Grow the Core" strategy, participants focus on conserving core areas of key sage grouse habitat with little or no tree cover and then expanding into areas where woody species are present but not dominant.

**In Brief:** Targeted removal of expanding conifers improves ecosystem resilience and benefits sage grouse and other sagebrush-dependent wildlife.

Woodland expansion also reduces available forage for wildlife and livestock across U.S. rangelands. West-wide, livestock producers lose more than \$300 million annually in revenue as a result of lost production from woodland expansion.<sup>4</sup> In the western Dakotas, Montana, and Wyoming, woodland expansion and cropland conversion threaten biome connectivity and biodiversity. As these lands are critical habitat for grassland birds and home to some of the last remaining big game migrations in the contiguous U.S., halting woodland expansion and conserving intact shrublands is crucial. To support outreach and project targeting WLFW scientists developed a web application (<https://rangelands.app/yield-gap>). This free online app helps producers estimate the productivity and forage gains that accompany the restoration of grazing lands through woodland management.

WLFW scientists also quantified wildlife outcomes in a decade-long evaluation of juniper removal in Oregon. Findings show that restored rangelands are rapidly recolonized by sage grouse<sup>5</sup> with higher survival rates inside than outside of treatments,<sup>6</sup> resulting in a +12% increase in population growth rate.<sup>7</sup>



Restoring sagebrush communities with conifer management increased understory vegetation critical for sage grouse nesting habitat three years post-treatment (8). Square symbol on the left represents the average cover found at radio-marked bird nest sites.

Nesting hens were quick to use restored habitats made available by conifer removal. Within three years of initiating treatments, a third of marked females were nesting near or within restored habitats; no such response was apparent in the nearby control landscape where conifers were not removed. The relative probability of nesting in newly restored sites increased by 22 percent annually, and females were 43 percent more likely to nest near treatments. Herbaceous vegetation responded favorably when nutrient-robbing trees were removed from sagebrush rangelands.<sup>8</sup>

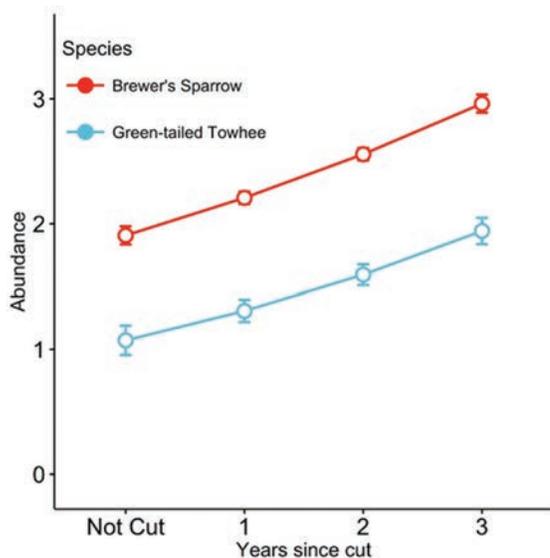
From 2011 to 2017, the amount of newly available open space used by marked grouse increased six-fold (from five to 31 percent) with no change in probability of use in the untreated control landscape.<sup>9</sup>

These outcomes demonstrate that targeted conifer removal works and is one of the few management actions available to increase sage grouse population growth rates. Next-generation modeling continues to explore how to enhance targeting of restoration cuts to improve seasonal habitats for sage grouse, facilitate their movement between seasonal habitats, and maintain connectivity among sage grouse strongholds.<sup>10</sup>

## Woodland Expansion

Targeted removal should be scaled up further as conifer expansion continues in unmanaged landscapes in the sagebrush biome.<sup>11,12</sup>

Additional outcomes from southern Oregon show that abundances of Brewer's sparrow, green-tailed towhee, and vesper sparrow more than doubled following mechanical conifer removal.<sup>13</sup> Annual increases each year post tree removal suggest that Brewer's sparrow use may increase even more with time. Findings illustrate that conifer removal conducted for sage grouse that retained shrub cover can result in immediate benefits for other sagebrush songbirds of high conservation concern.



Songbird abundance increased after sagebrush communities were restored through conifer management (13).

### WLFW-SUPPORTED SCIENCE PUBLICATIONS:

1. Maestas, J.D., D.E. Naugle, J.C. Chambers, J.D. Tack, C.S. Boyd, J.M. Tague. 2021. Conifer expansion. In T.E. Remington, P.A. Deibert, S.E. Hanser, D.M. Davis, L.A. Robb, and J.L. Welty (editors). Sagebrush conservation strategy—Challenges to sagebrush conservation. U.S. Geological Survey Open-File Report 2020–1125, 327 pages. <https://doi.org/10.3133/ofr20201125>.
2. Baruch-Mordo, S., J.S. Evans, J.P. Severson, D.E. Naugle, J.D. Maestas, J.M. Kiesecker, M.J. Falkowski, C.A. Hagen, and K.P. Reese. 2013. Saving sage-grouse from the trees: A proactive solution to reducing a key threat to a candidate species. *Biological Conservation* 167:233–241.
3. Falkowski M.J., J.S. Evans, D.E. Naugle, C.A. Hagen, S.A. Carleton, J.D. Maestas, A.H. Khalyani, A.J. Poznanovic, and A.J. Lawrence. 2017. Mapping tree canopy cover in support of proactive prairie grouse conservation in western North America. *Rangeland Ecology and Management* 70:15–24.
4. Morford, S.L., B.W. Allred, D. Twidwell, M.O. Jones, J.D. Maestas, and D.E. Naugle. 2021. Biome-scale woody encroachment threatens conservation potential and sustainability of U.S. rangelands. *bioRxiv* <https://doi.org/10.1101/2021.04.02.438282>
5. Severson J.P., C.A. Hagen, J.D. Maestas, D.E. Naugle, J.T. Forbes and K.P. Reese. 2017. Short-term response of sage-grouse nesting to conifer removal in the northern Great Basin. *Rangeland Ecology and Management* 70:50–58.
6. Severson J.P., C.A. Hagen, J.D. Maestas, D.E. Naugle, J.T. Forbes and K.P. Reese. 2017. Better living through conifer removal: A demographic analysis of sage-grouse vital rates. *PloS One* 12:e0174347.
7. Olsen, A.C. Olsen, J.P. Severson, J.D. Maestas, D.E. Naugle, J. Smith, J.D. Tack, K.H. Yates, and C.A. Hagen. 2021. Reversing tree expansion in sagebrush steppe yields population level benefit for imperiled grouse. *Ecosphere* 12:e03551.

8. Severson J.P., C.A. Hagen, J.D. Maestas, D.E. Naugle, J.T. Forbes and K.P. Reese. 2017. Restoring sage-grouse nesting habitat through removal of early successional conifer. *Restoration Ecology* 25:1026–1034.
9. Olsen, A.C., J.P. Severson, B.W. Allred, M.O. Jones, J.D. Maestas, D.E. Naugle, K.H. Yates and C.A. Hagen. 2021. Reversing tree encroachment increases usable space for sage-grouse during the breeding season. *Wildlife Society Bulletin: In Press*.
10. Reinhardt J.R., D.E. Naugle, J.D. Maestas, B. Allred, J. Evans, and M. Falkowski. 2017. Next-generation restoration for sage-grouse: A framework for visualizing local conifer cuts within a landscape context. *Ecosphere* 8:e01888.
11. Reinhardt, J.R., S. Filippelli, M. Falkowski, B. Allred, J.D. Maestas, J.C. Carlson, and D.E. Naugle. 2020. Quantifying pinyon juniper reduction within North America's sagebrush ecosystem. *Rangeland Ecology and Management* 73:420–432.
12. Filippelli, S.K., M.J. Falkowski, A.T. Hudak, P.A. Fekety, J.C. Vogeler, A.H. Khalyani, B.M. Rau, and E.K. Strand. 2020. Monitoring pinyon-juniper cover and aboveground biomass across the Great Basin. *Environmental Research Letters* 15:1–15.
13. Holmes A.L., J.D. Maestas and D.E. Naugle. 2017. Bird responses to removal of western juniper in sagebrush-steppe. *Rangeland Ecology and Management* 70:87–94.
- Beck. 2018. Understanding biological effectiveness before scaling up range-wide restoration investments for Gunnison sage-grouse. *Ecosphere* 9:e02144.
- Donnelly J.P., J.D. Tack, K.E. Doherty, D.E. Naugle, B.W. Allred and V.J. Dreitz. 2017. Extending conifer removal and landscape protection strategies from sage-grouse to songbirds, a range-wide assessment. *Rangeland Ecology and Management* 70:95–105.
- Nackley, L.L., A.G. West, A.L. Skowno, and W.J. Bond. 2017. The nebulous ecology of native invasions. *Trends in Ecology and Evolution* 32:814–824.
- Maestas, J.D., C.A. Hagen, J.T. Smith, J.D. Tack, B.W. Allred, T. Griffiths, C.J. Bishop, K.M. Stewart, and D.E. Naugle. 2019. Mule deer juniper use is an unreliable indicator of habitat quality: Comments on Coe et al. (2018). *Journal of Wildlife Management* 83:755–762.
- Miller, R.F., S.T. Knick, D.A. Pyke, C.W. Meinke, S.E. Hanser, M.J. Wisdom, A.L. Hild. 2011. Characteristics of sagebrush habitats and limitations to long-term conservation. Pages 145–185 In S.T. Knick and J.W. Connelly, Editors. *Greater sage-grouse: Ecology and conservation of a landscape species and its habitats*. Studies in Avian Biology Volume 38. Berkeley, California, University of California Press.
- Miller R.F., D.E. Naugle, J.D. Maestas, C.A. Hagen and G. Hall. 2017. Targeted woodland removal to recover at-risk grouse and their sagebrush-steppe and prairie ecosystems. *Rangeland Ecology and Management* 70:1–8.

## RELATED READINGS:

Doherty, K.E., J.D. Hennig, J.B. Dinkins, K.A. Griffin, A.A. Cook, J.D. Maestas, D.E. Naugle, and J.L.

Severson J.P., C.A. Hagen, J.D. Maestas, D.E. Naugle, J.T. Forbes and K.P. Reese. 2017. Effects of conifer expansion on greater sage-grouse nesting habitat selection. *Journal of Wildlife Management* 81:86–95.