Restoration of Sagebrush Habitats through Conifer Removal

Frequently Asked Questions (FAQs)

Adapted from this FAQ prepared by USDA-NRCS Working Lands for Wildlife/Sage Grouse Initiative, Intermountain West Joint Venture, and The Nature Conservancy of Montana (April 2020)

Background. Expansion of native conifers (evergreen trees such as juniper, pinyon pine, ponderosa pine, and Douglas-fir) into sagebrush ecosystems is degrading and reducing rangelands important to wildlife and people. As conifers expand into previously treeless shrublands, predictable changes occur resulting in the loss of sagebrush habitats and imperiled species, like sage grouse (Fig. 1).

Conifer expansion is recognized as a primary threat to the conservation of sage grouse and sagebrush ecosystems and land managers are working together to scale up targeted conifer removal to maintain dwindling shrubland habitats. Below are some answers to frequently asked questions related to these efforts.

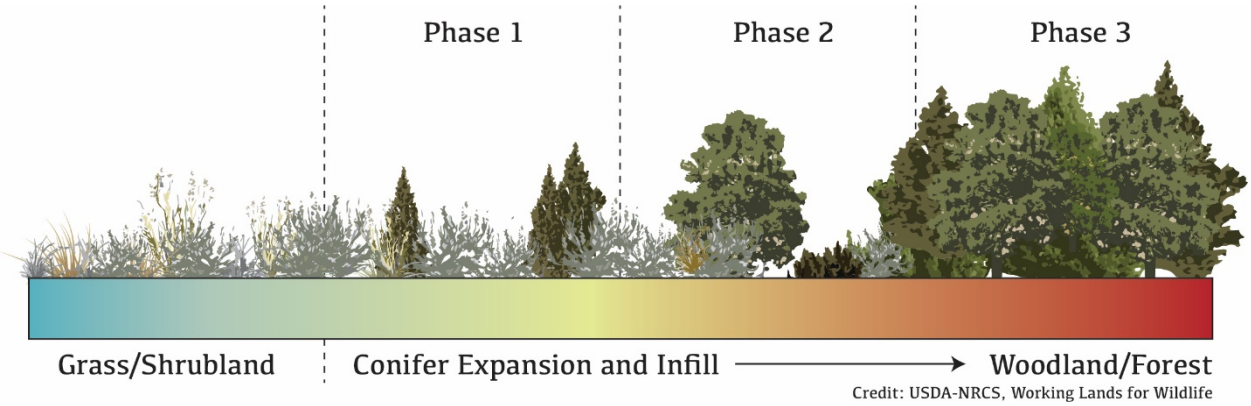

Figure 1. As conifer expansion occurs, native grass and shrublands transition slowly into woodlands and forests as trees become denser (infill) and outcompete understory vegetation.

Is conifer expansion into sagebrush habitats really happening?

Extensive conifer expansion has occurred over the past 150 years and woodland change continues to affect sagebrush habitats today.

- Tree expansion into grasslands and shrublands is happening across the globe. In North America, conifers are invading native grass and shrublands from the Great Basin to the Great Plains.
- Pinyon-juniper woodlands experienced an unprecedented increase in the rate of expansion and infill (increased density) since the late 1800s.[1] Pinyon-juniper woodlands are an important native

ecosystem, but their expansion is contributing to the imperilment of adjacent shrublands with 90% of tree expansion estimated to have occurred in sagebrush ecosystems. Today, pinyon-juniper woodlands occupy roughly 100 million acres in the Intermountain West[2], making it the 3rd largest vegetation type in the U.S.

- Conifer cover is changing in two primary ways:
    - Conifer trees continue to colonize new areas where trees did not previously exist. Estimated rates of tree expansion are 0.4%-1.5% per year.[3] Since 2000, 1.1 million acres of new pinyon-juniper forests (>10% canopy cover) have established in the Great Basin at a rate of 0.46% per year.[4]
    - Recently colonized areas are getting denser (infilling), becoming the dominant vegetation type and completely replacing former sagebrush habitats. Since 2000, 80% of pinyon-juniper increases in the Great Basin were due to infilling.[4]
- Management to preserve sagebrush habitats is likely just keeping pace with conifer expansion. From 2011-2017, the extent of conifer cover in sage grouse habitats decreased by 1.6% due to both human-caused (prescribed fire, cutting) and natural (wildfire) conifer removal.[5] Human management efforts are responsible for 2/3 of the total reduction; the other 1/3 is due to wildfires.

Why are conifers expanding into sagebrush habitats?

Causes of conifer expansion are not well understood but are often attributed to periods of favorable climate conditions and reduced fire occurrence.

- Dramatic increases in pinyon-juniper establishment documented between the late 1800s and early 1900s are believed to be due primarily to a favorable climate during that time but altered land use patterns also played a role.[1]
- More recently, human suppression of wildfires facilitates conifer expansion. Historically, conifers were kept in check by regular, natural fire occurrences. Reduced fire frequency allows more conifers to establish and grow.

Does conifer expansion into sagebrush habitats cause problems?

Conifer expansion causes a cascade of negative impacts to sagebrush habitats that affect ecosystem function, wildlife, and rural communities.

- Conifer expansion results in the loss of shrubs and grasses that are necessary for sage grouse and other shrubland wildlife to survive.
- Sage grouse abandon otherwise suitable breeding habitat when conifer trees cover just 4% of a landscape.[6]
- Conifer expansion reduces soil moisture needed in arid sagebrush habitats to grow native plants.
- Wildfires burn hotter and are more severe as conifers invade sagebrush habitats and become denser.
- Livestock ranching income can be cut by one third as sagebrush habitats are converted to juniper woodlands.[7]

Does conifer removal result in benefits to sagebrush habitats?

Well-planned removal of expanding conifers from historic sagebrush habitats benefits ecosystem function, wildlife, and rural communities.

- Removing conifers reduces the risk of high-severity fires that limit post-fire recovery of existing understory vegetation.
- Removing conifers makes more water available in the soil later in the summer season for other native plants to stay greener longer.
- Conifer removal typically increases grasses and wildflowers. Two- to 20-fold increases have been documented.[8]
- Removal of conifers in early stages of expansion is more cost-efficient and effective at maintaining ecosystem function and sagebrush habitats than waiting until dense woodlands become well-established.
- Conifer removal is one of the only habitat restoration techniques that has been scientifically shown to benefit sage grouse populations. Sage grouse population growth rates increased 12% following well-planned conifer removal in Oregon.[9]
- Overwinter survival of mule deer fawns increased 15% following mechanical pinyon- juniper reduction, seeding, and weed control in Colorado.[10]
- Sagebrush-dependent songbirds can benefit from well-planned conifer removal projects. Abundance of Brewer's sparrow, a species of high conservation concern, doubled following mechanical juniper removal in Oregon.[11]
- Removing conifers can preserve, or increase, livestock forage resulting in more management flexibility and ranch economic viability.

How do managers determine which type of conifer removal treatment to use and when?

Removal of conifers before they become dominant on the landscape allows for a more passive type of sagebrush restoration than does removal when conifers are dominating the landscape.

- Site conditions (dominant vegetation, climate, topography) are thoroughly assessed and considered with respect to the advantages and disadvantages of the removal treatment and non-treatment options.
- Good guidance and site evaluation can reliably predict the recovery of existing vegetation following conifer removal treatments.[13,14,15]
- Prescribed fire is a more severe treatment than mechanical tree removal. While prescribed fire can be an effective removal method on cooler and moister sites, prescribed fire on warmer and drier sites, postfire establishment of sagebrush establishment is low for at least 10 years following fire and cheatgrass increases are common.
- Generally speaking, conifer removal treatments are most effective in conserving sagebrush-grassland ecosystems when tree cover is limited (Phase 1 or early Phase 2).
- When conifer removal is performed in late Phase 2 or Phase 3, restoration approaches are often necessary to reestablishing shrubs, grasses, and forbs that do not exist in great enough

abundance to fill spaces created through tree removal. Without active restoration, sites are vulnerable to tree, weed, and other invasions that jeopardize meeting rangeland and wildlife habitat conservation objectives.

Are conifer removal efforts for sage grouse targeted?

Conifer removal efforts for sage grouse are not randomly placed, but rather, are designed and located in sage grouse habitats so the birds can benefit from restoration.

- Conifer removal for sage grouse is often strategically placed in, or next to, priority habitats where grouse already live to expand existing habitats.
- Conifer removal for sage grouse is often done in sagebrush habitats in the early stages of conifer expansion where shrubs and grasses have not yet been lost.
- Mechanical techniques (as opposed to fire) are typically used when conducting conifer removal for sage grouse. This allows managers to be highly surgical in their project implementation, while often creating instant habitat improvement since the understory of forbs, grasses and shrubs are preserved following the treatment.

Is conifer expansion due to livestock grazing?

While the accelerated rate of conifer expansion and infill in the late 1800s and early 1900s has primarily been attributed to climate, the effects of climate cannot be separated from other factors like the introduction of livestock grazing.[1] There is no experimental evidence showing grazing causes conifer expansion. Historic overgrazing is hypothesized to alter natural fire regimes by removing fine fuels (i.e., grasses) that would have helped fires spread more frequently and kept trees in check. It is also hypothesized that removal of perennial grasses by overgrazing favored tree seedlings. Overgrazing led to the passage of the Taylor Grazing Act of 1934, which then set up a system of base properties, allotments, and eventually better management across the West.

Is conifer expansion just due to natural tree recovery following large fires, logging, etc.?

While some conifer establishment can be attributed to recovery after historic stand-replacing fires or logging related to mining activities, those instances are isolated and do not account for the widespread expansion of conifers across the West. The limited distribution and abundance of charred snags, stumps, logs, and large charcoal in young woodlands suggests widespread tree establishment is due to expansion of trees into shrub and grasslands.[1]

Is conifer expansion being offset by tree loss due to climate change or drought?

Significant drought-induced tree mortality is happening in some locations, but the scale is not currently outpacing conifer expansion and infill overall. Large-scale die-offs of pinyon pine have been documented in central Nevada and the Southwest, resulting in shift of stand structure to more drought-tolerant juniper. However, comprehensive remote-sensing data show that total pinyon-juniper cover and biomass continue to increase across the Great Basin at a rate of 0.46% per year.[4]

That said, changes in the area occupied by pinyon-juniper woodlands need to be monitored, especially given the predicted increase in drought severity in the southwestern US in the coming decades.[16]

Does conifer removal in sagebrush habitats negatively impact woodland-dependent birds?

Many songbirds that rely on pinyon-juniper woodlands (e.g., ash-throated flycatcher, juniper titmouse, gray vireo, gray flycatcher) are displaying stable to increasing long-term population trends, even as managers work to reduce expanding conifers in sagebrush habitats. Pinyon jay are one songbird species of concern that have exhibited declining long-term population trends, but conifer removal efforts for sage grouse have largely avoided habitats where most pinyon jays live.[12] Pinyon jay population declines may be more related to the overall health and structure of pinyon-juniper stands than to the removal of trees from sagebrush habitats. Pinyon jay nesting is closely linked to the health of pinyon pine trees which declines as woodlands get thicker and has been impacted by severe drought. See the Additional Learning Opportunities section for links to a webinar discussing conifer removal and woodland-dependent birds.

Does conifer removal in sagebrush habitats negatively impact big game like mule deer?

While mule deer do use trees when available in sagebrush habitats for cover, there is no scientific evidence that removal of expanding conifers negatively impacts mule deer populations. In contrast, scientific evidence does show that forage availability and quality is a limiting factor impacting mule deer success on their winter range that can be improved with conifer removal.[10]

Does conifer removal cause cheatgrass invasion?

Conifer removal does not cause cheatgrass invasion, but cheatgrass can increase after treatment. If cheatgrass fills in following conifer removal, the cheatgrass was already present prior to the removal project and is just taking advantage of a void and additional water and nutrients. Science-based tools are used to evaluate site-specific risks and predict vegetation response to conifer removal to mitigate those risks.

Cheatgrass risk depends on site conditions and the existing vegetation before conifer removal. Warmer and drier sites are known to be a higher risk for cheatgrass. Maintaining abundant, healthy perennial bunchgrasses is key to preventing cheatgrass spread after conifer removal. Where cheatgrass is present, managers can mitigate the risks of making it worse by planning follow-up weed control, seeding desirable plants, or selecting less ground-disturbing treatment techniques.

Does conifer removal in sagebrush habitats negatively affect carbon sequestration?

Since the vast majority (over 90%) of carbon in sagebrush habitats is stored below ground in the roots of shrubs, grasses, and forbs, conifer removal does not substantially affect the potential for ecosystem carbon sequestration. While conifer expansion can increase above-ground carbon sequestration, that carbon is also more susceptible to being lost during high intensity fires.

Do all conifer removal projects have the same effects?

Conifer removal is conducted for a variety of project goals, using multiple techniques, and is informed by conditions on the ground; therefore, outcomes vary. Common goals include wildlife (sage grouse habitat, mule deer forage), fuels reduction, watershed condition and ecosystem function, and improved livestock forage. Conifer removal solely for livestock production was common in the 1950s to 1970s but today it is not the primary driver of publicly funded projects. Most projects today are designed for wildlife or fuels-reduction purposes.

A variety of techniques are used to remove expanding conifers, but mechanical removal (cutting or shredding) and burning are the two primary removal methods. The specific technique used depends on the site characteristics and project goals. Both mechanical and prescribed fire methods can be beneficial, but each has trade-offs that land managers consider when planning conifer removal. Generally, removing conifers through fire provides desired conservation results that last longer than mechanical removal because tree seedlings are removed, although short term negative impacts include the loss of shrubs. Removing conifers through mechanical methods provides more immediate habitat benefits for shrub dependent species because the understory shrubs and grasses are preserved, which is why this method is preferred for sage grouse habitat projects.

Not all treatments are effective. Sometimes treatments are misapplied, or results do not turn out as planned. Outcomes of land treatments are affected by variable weather, invasive species, land use, and other factors. Land managers are continually trying to learn from mistakes and improve project efficacy through adaptive management informed by science.

Additional Learning Opportunities

Webinars –

New tools for pinyon-juniper management: Balancing needs of sagebrush and woodland obligate birds- View recording

Ecology, history, ecohydrology, and management of pinyon-juniper woodlands in the Great Basin- View recording

Answering questions about the appropriateness of woody vegetation treatments- View recording

Fact Sheets -

Pinyon-juniper ecology

Pinyon-juniper history

Pinyon-juniper ecohydrology

Pinyon-juniper management and restoration

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