



*Collaboration on the  
Malheur National Forest*

# **ASPEN RESTORATION ZONES OF AGREEMENT**

**BLUE MOUNTAINS FOREST PARTNERS  
OCTOBER 2017**



# Preface

---

The [Blue Mountains Forest Partners](#) (BMFP), established in 2006, is a diverse group of stakeholders who work together to create and implement a shared vision to improve the resilience and wellbeing of forests and communities in the Blue Mountains. The work of the BMFP takes place on the 1.7 million acre Malheur National Forest (MNF) located in Grant, Harney, and Baker counties in eastern Oregon. The MNF is one of 23 priority landscapes that receive funding under the Collaborative Forest Landscape Restoration Program (CFLRP, Public Law 111-11) to accomplish accelerated restoration to restore forest resiliency (Schultz et al. 2012). The CFLRP explicitly encourages collaborative, science-based restoration and the MNF currently has the most ambitious forest restoration targets of any national forest in the Pacific Northwest Region.

This document includes the BMFP's Zones of Agreement (ZOA) for Aspen Restoration. These ZOA began as a compilation of notes from field trips, subcommittee meetings, and presentations given at Full Group meetings in John Day, Oregon throughout 2015 and 2016. A drafting subcommittee was then formed to create this document, and several subcommittee conference calls were held during 2015 and 2016 to develop agreement on the first iteration of the ZOA.

Zones of Agreement serve two purposes.

1. ZOA allow BMFP members and others to clearly understand what BMFP has discussed and agreed to with respect to a particular topic; here, aspen restoration. By documenting our own decisions, and the scientific and social rationale behind them, BMFP will be better able to track our agreements and progress towards addressing disagreements about forest management. This purpose can be thought of as “internal accounting and tracking” of our agreements.
2. The ZOA can be used by the United States Forest Service (Forest Service) to assess and track the level of social agreement around management of a particular forest resource (here, aspen ecosystems) for use in Accelerated Restoration, implementation of the Southern Blues Restoration Coalition's Collaborative Forest Landscape Restoration Program, and other planning efforts.

These Zones of Agreement rely heavily upon already published scientific research, USFS General Technical Reports, aspen social agreements, and USFS restoration strategies specific to eastern Oregon (see Table 1.0). While citations can be found throughout, this document avoids replicating these extensive works on aspen in the Blue Mountains and on the Malheur National Forest.

# TABLE OF CONTENTS

Preface.....	2
Introduction .....	4
Aspen Restoration Zones of Agreement .....	5
1. Priority Habitat.....	5
2. Habitat Complexity .....	5
3. Habitat Transition .....	6
4. Conifer Encroachment and Retention.....	6
5. Livestock Permittes .....	7
6. Over Browsing and Grazing.....	7
7. Mapping and Placement on the Landscape .....	8
8. Aspen Expansion.....	9
9. Reinitiation.....	9
10. Resistance and Resilience .....	10
11. Genetic Diversity and Seeds.....	10
Old Growth Conifers.....	12
Ungulate Barriers .....	13
Fire .....	16
Supporting Documents.....	17



# Introduction

---

Quaking aspen (*Populus tremuloides*) is one of the few hardwood tree species on the Malheur National Forest (MNF), and one of the only deciduous trees found outside of riparian areas. Aspen on the MNF are found in small, isolated stands within the conifer matrix and wet meadow systems. This is very different from the aspen forest and cover type found in the Rocky Mountains. The small stands on the MNF play an important role for wildlife, especially cavity nesting birds. Over 70 species of diurnal breeding birds were detected in aspen communities on the MNF (Salabanks 2005). Aspen are important for many social and biological reasons, from camping, hunting, and birding, to habitat for the Red-napped Sapsucker (Seager et al. 2015).

Aspen accounts for less than 1% of all forested lands in eastern Oregon, and the region has lost up to 50-80% of its aspen cover (Seager 2010, Swanson et al. 2010, Seager et al. 2013a). Most stands have diminished in size while other stands have been lost all together. Conifer encroachment (competition for water, light, nutrients) in the absence of the historical fire regime and ungulate herbivory (chronic browsing from domestic and wild ungulates) are the primary suppressors of aspen. Disturbance to the encroaching conifers, such as fire, insects, drought, and logging can release aspen overstory from competition and release aspen suckers and understory vegetation. Recent research on the MNF shows that aspen restoration through the removal of all conifers that are not old growth increased aspen sucker density, aspen sucker growth, and aspen basal area growth in the overstory (Seager 2017). Aspen basal area growth continued for more than 10 years after the removal of conifers (Seager 2017).

Because aspen ecosystems: (1) provide habitat for diverse wildlife species; (2) are less than 1% of the vegetation cover; and (3) overstory cover has experienced a 50-80% loss, aspen stands should be prioritized for restoration treatment. Aspen stands within project areas should be treated as part of the larger project for efficiencies and for landscape level moisture release and dispersal of domestic and wild ungulates. For stands that are at-risk of loss and are not slated to be part of a larger project in the near future, the Forest Service should consider non-commercial thinning (<12" dbh) and fencing where needed to help the stand persist until more effective treatment can occur. This could include the use of volunteers, as Rocky Mountain Elk Foundation and chapters of the Oregon Hunters Association have shown a long-term interest in aspen restoration in the Blue Mountains and the MNF.

While little research has occurred on aspen in the Inland Pacific Northwest compared to the Rocky Mountain and Intermountain West regions, the Blue Mountains and Malheur NF have site specific data, research, and compilation on aspen (see Table 1.0).

# Aspen Restoration Zones of Agreement

---

For each Zone of Agreement on Aspen Restoration, we include the Science Background from Seager, Ediger, and Davis (2015). The direct text with some modification to fit the Malheur National Forest is provided in italics. The full text and information can be found in the [Aspen Restoration and Social Agreements](#) (Seager et al. 2015) published by The Nature Conservancy.

## 1. Priority Habitat

Aspen communities are a *sensitive plant habitat type* on the Malheur NF, where the forest-wide standards are to maintain or enhance quaking aspen stands (USDA 1990). Aspen are a priority for restoration as they are biodiversity hotspots and provide critical habitat to wildlife. Aspen supports different and higher numbers birds, plants, and wildlife species than the conifer vegetation types that aspen is found within (dry pine, dry mixed conifer, moist mixed conifer).

*Science Background: aspen stands are important habitat for many species of plants and wildlife across the Blue Mountains, where aspen cover and extent has decreased extensively (Shirley and Erickson 2001, Strong et al. 2010, Swanson et al. 2010, Seager 2010).*

*From Seager et al. 2013, "The structural diversity and productivity in aspen forests creates habitat for a wide diversity of wildlife (Reynold 1969; Debyle 1985; Turchi et al. 1995; Hollenbeck and Ripple 2007; McCullough et al. 2012). Aspen understories are a rich in small mammal diversity (Oaten and Larsen 2008) and provide important habitat for elk (Cervus elaphus) and deer (Odocoileus spp.) (Preble 1911; Murie 1926–1954; Beck and Peek 2005). Aspen's predisposition to heart-rot creates excellent habitat for primary and secondary cavity nesting species, including birds, squirrels, and mice (Flack 1976; Martin and Eadi 1999; Griffis-Kyle and Beier 2003; Martin et al. 2004). Additionally, aspen forests host dynamic food webs that support a diverse guild of predators including, goshawks (Accipiter gentilis), coyotes (Canis latrans), bobcats (Lynx rufus), bears (Ursus spp.) and wolves (Canis lupus) (Debyle 1985; Fisher and Wilkinson 2005)."*

## 2. Habitat Complexity

Aspen stands that have a complex overstory, midstory, and understory of aspen trees and other shrubs are more productive and support more wildlife and food webs. Stands that are missing one or more of those aspen story components should be prioritized for restoration. Different aspen tree sizes (DBH) and stand sizes (acres) are important for wildlife, and restoration efforts should keep these in mind to meet diverse wildlife needs.

For aspen that are part of wet meadow systems, flood plain connectivity and raising of the water table (see BMFP Riparian ZOA) will help keep conifers from encroaching and release moisture important for aspen growing during late summer and fall (Seager 2017). While flooding of aspen stands will cause some stems to die, the raising of the water table will allow aspen expansion and growth.

*Science Background: structurally complex aspen stands provide more habitat for more diverse wildlife species (Rogers et al. 2014, Shepperd et al. 2006). An aspen restoration strategy in Oregon outlined the different sizes of stands (acres), trees sizes (dbh), and understory, midstory, and overstory structure that specific species of birds and mammals require (see Seager et al. 2013a). While aspen stands can persist for decades without an understory or midstory structure, they are not providing complex habitat for many wildlife species and are at-risk of being lost when the overstory becomes decadent (Strong et al. 2010, Swanson et al. 2010).*

### **3. Habitat Transition**

Conifer removal should not just focus on in and around aspen stands. The aspen sprouting zone is 100-150 feet from the last mature stem in all directions. As such, 100-150 around aspen stands in all directions should be treated with removal of non-old growth conifers to allow the aspen stand to expand through root sprouting. Aspen can be limited by summer and late season moisture. Conifer competition from the area around the stand decreases available moisture. Removal of competing conifers (non-old growth) should be done to at least 100-150 feet. This open area around the aspen stand provides important wildlife habitat of shrubs, grasses, herbs, and forbs.

*Science Background: the greatest area of aspen suckers and shrubs is the area around the aspen stand, sometimes called the aspen sprouting zone or regeneration periphery (Keyser et al. 2005, Seager 2010). Elk, deer, and other wildlife species depend on open areas or connectivity of open spaces for migration and movement across a landscape. Aspen stands and aspen-meadow complexes were more extensive and played a critical habitat role historically. Open space around the aspen stand allows it to expand, be more resilient, and to provide habitat for species that depend upon it (Shepperd et al. 2006, Swanson et al. 2010, Seager et al. 2013a).*

### **4. Conifer Encroachment and Retention**

On the Malheur National Forest, aspen occur primarily in small, discrete patches within a conifer matrix. Because aspen grow on highly productive sites, conifer encroach the areas and take advantage of the increase in soil moisture and nutrients. Some conifer trees in aspen stands may be large in diameter (>21" dbh) but not old because of the productivity of the site. BMFP supports retention of old trees as outline in previous ZOA and Franklin, Johnson, Van Pelt. These non-old

growth conifers should be removed from aspen stands. Removal of conifers within and around an aspen stand releases moisture, light, and soil resources, allowing the mature aspen to persist and the stand to expand in total area by suckering into areas released by conifer removal. Some conifers remaining in the stand increase biodiversity and may cause little to no decrease in stand viability. Since aspen are moisture demanding, conifers with high leaf area indexes are more competitive. Ponderosa pine have lower leaf area, and at low density causes little shading and competition, as seen by pines hundreds of years older than the aspen within the same stands. Conifer retention may vary based on the associated forest type and potential vegetation type (PVT). Retention should be based on old growth characteristics and wildlife needs. Since aspen are moisture demanding, conifers growing within the moister part of the stand are less impactful than conifers growing around or in the dry part of the aspen stand. Placement and species of conifers are important considerations to reduce impact on the aspen stand.

*Science Background: in the absence of fire and other disturbances, conifer encroachment had greatly impacted aspen stands across Oregon (Wall et al. 2001, Bates et al. 2006, Seager 2010, Strong et al. 2010, Swanson et al. 2010, Seager 2017). Retention of some conifers may increase avian diversity (Griffis-Kyle and Beier 2003, Seager et al. 2013a). Old growth ponderosa (>150 years) was shown to have little impact on aspen recruitment, as were openly spaced conifers (Seager 2010; Seager 2017). Conifers showing old growth characteristics (Franklin et al. 2013) and potentially replacement old growth conifers should be retained in and around the aspen stands, as long as their density doesn't impact aspen persistence and expansion (Seager 2010, Seager et al. 2013a, Seager 2017).*

## **5. Livestock Permittees**

BMFP understands that the Forest Service will work with permittees to facilitate livestock management along with recovery of aspen ecosystems.

## **6. Over Browsing and Grazing**

Chronic browsing or grazing from wild ungulates (elk, deer) and livestock (cattle, sheep, horses) can suppress aspen suckers and remove the mid story and future overstory. Chronic herbivory is especially a concern after fire or other disturbance where the overstory is lost, as the suckers are all that remains of the aspen stand. Generally, deer browse aspen suckers spring-summer-fall; livestock graze the understory of grasses, forbs, and shrubs in the summer then eat aspen suckers in the fall; elk graze during summer and browse aspen in the fall and winter. Elk can eat many years' worth of growth on an aspen sucker, and are therefore more impactful than deer. Aspen stands in winter elk range are at higher risk for chronic browsing. Monitoring is an effective way to determine which stands are being over-browsed. If browsing is suppressing the suckers (50-100% browsed), and none are growing above browse height of 6'-8', then fencing, deterrents, or alternate grazing

patterns should be used (Seager 2010, Seager 2013a). For stands that are identified as being heavily browsed by wild ungulates before treatment, management should minimize leaving heavy cover that would encourage ungulate use. Beaver may browse aspen and fall overstory trees in perennial stream systems. The flooding from beaver can also enhance aspen habitat. Fencing individual trees or stands to remove beaver impacts have been effective on the Deschutes NF.

*Science Background: elk and deer use aspen stands for food and cover throughout the seasons. Healthy aspen stands should have plenty of suckers, allowing up to 50% of suckers to show signs of herbivory from elk and deer. Chronic herbivory (high levels over decades of time) suppress the suckers. This removes the midstory and stops new cohorts of small diameter aspen trees from recruiting into the overstory (Seager et al. 2013b) and suppresses shrubs and understory plants that are important for wildlife habitat (White et al. 1998). Increased forage across the landscape should help disperse elk and deer herds, decreasing their herbivory impact on aspen. For the short-term, fencing or other deterrents (jackstraw, coarse woody debris) can help exclude these ungulates. After 10-15 years, suckers should be trees and above the height of elk herbivory (8' or 2.5m). Cattle and livestock use of aspen on National Forest land is usually limited to grazing season. Research shows that early season use of aspen was least impactful on sucker growth and survival (Jones et al. 2009). Areas that experience late season grazing should be considered for resting the following year or have short early season grazing. This is of particular importance in areas where fencing can be avoided by alternate grazing strategy. In areas so large that fencing creates an economic barrier, deterrents or removal of livestock should be considered until aspen recovers (Seager et al 2013b).*

## **7. Mapping and Placement on the Landscape**

Aspen stands in project areas should be mapped so restoration can be prioritized, spatially analyzed for connectivity, and condition of a stand can be put into context of status of nearby stands (which ones are persisting versus which ones are decadent).

*Science Background: mapping of aspen stands allows for spatial analysis to answer many ecological and scientific questions about: landscape-level restoration, connectivity and permeability, Aspen stands with diverse structure and varying size support more wildlife (Seager et al. 2013a). Some decadent aspen stands may need to be reinitiated through prescribed fire, clear-fell coppicing (cutting aspen overstory), or other overstory or root disturbance (Shepperd 2001). Such disturbances greatly increase clonal root-sprouting density and area, allowing the stand to expand. Mapping stands allows for spatial analysis of stands in a watershed or project area to emphasize diverse size (acres) and trees sizes (dbh).*



## 8. Aspen Expansion

The Malheur National Forest has lost up 50-80% of its aspen cover. Most stands have been diminished in size while other stands have been lost all together. Expansion of aspen stands should be the priority and approach rather than preserving existing trees and acreage. Aspen will sucker 100-150' out from the last mature stems in the stand. Restoration treatment, conifer removal, fencing, and browsing deterrents should include this area so as to let the stand expand.

*Science Background: aspen stands can expand through their sprouting zone (area around the stand), which can be as far out as 100 to 150 feet out from the last mature stem during successful treatment (Shepperd 2001). Aspen can sprout prolifically when moisture, light, and herbivory pressure are released (Seager 2010, Swanson et al. 2010, Seager et al. 2013a, Seager 2017). Expansion of aspen stands makes them more resistant to disturbances, resilient to drought and climate change, and better meets the historical range of variation (HRV) of aspen occurrence (acreage, placement) on most National Forests in Oregon.*

## 9. Reinitiation

Due to the complete loss of stands and the decrease in the sizes of stands remaining on the landscape, some stands should be considered for reinitiation (overstory disturbance from fire, coppicing, etc.). The goal should be to increase the stem density through clonal root sprouting and increase overall stand size by initiating suckering far from the stand center or edge (distance of the lateral roots of mature trees). During stand reinitiation, most of the aspen overstory may be lost with 30-40 years needed to recruit large diameter trees back into the overstory. As such, careful spatial analysis should be done to assure aspen stands on the landscape are not the same age or receiving overstory disturbance at the same time. Within that spatial analysis, the Forest Service should consider fire or coppicing when aspen stands are deteriorating or in need of expansion.

Fire has been effective in expanding aspen stands on the Malheur and surrounding National Forests. Additionally, local landowners have tried different aspen management techniques, including different prescribed fires. Collectively, these represent different fire treatments of: cool burns, preserving the aspen overstory while stimulating the soil and roots; hotter with complete aspen overstory kill; and small burn piles in and around the stand. BMFP and the Forest Service can learn from these local and regional examples of what is effective for aspen reinitiation.

[note: during the October 2017 BMFP meeting to accept these ZOA, concern was raised that conifer removal alone may not allow restore enough soil moisture. It was discussed that if an area has lost its water table connectivity, such as meadow systems, then soil moisture via hydrological processes and connectivity should be addressed before an aspen stand is considered decadent and in need of burning. See [BMFP Riparian ZOA](#) for further discussion on hydrological processes.]

## 10. Resistance and Resilience

Aspen are more resistant to drought and stressors and more resilient to fire and disturbance when they are restored to multi-storied stands with open areas around them. Younger stands are more resistant to climate disturbances, including sporadic drought.

*Science Background: the effect of increased frequency, duration, and severity of drought on aspen includes widespread occurrence of root mortality and crown loss in mature stands (SAD) in the Rocky Mountain region (Worrall et al. 2013). Efforts around the western US have focused on increasing aspen sustainability by moving past restoration to resiliency (Rogers et al. 2013). Still, climate projections suggest drought will drive substantial loss of aspen across its current distribution (Worrall et al. 2013), including much of Oregon (Rehfeldt et al. 2009). Moisture can be increased at the stand scale to support aspen persistence, growth, and expansion during normal and drought years by removing competing conifers (Jones et al. 2005, Seager 2010, Swanson et al. 2010, Seager et al. 2013a, Seager 2017). Aspen that occur in small patches (such as those in Oregon) depend on fire to remove competing conifers more than to reinitiate the aspen stand (Kurzel et al. 2007). Fire suppression has increased competition stress on aspen (Seager 2010) leading some managers to mimic fire through conifer removal (Jones et al. 2005). Aspen stands that have competing conifers removed show increased resiliency as measured by increase in: basal area, stand size, and recruitment of midstory and overstory (Seager 2010). Multi-storied and aspen stands with recruiting sprouts were more likely to persist during drought and other disturbances (Worrall et al. 2010, Seager 2010).*

## 11. Genetic Diversity and Seeds

Current aspen stands expand through cloning and root sprouting, limiting genetic diversity. Aspen seeds can provide new genetics on the landscape if seedlings can persist. If aspen seedlings are found in new areas (post-fire, disturbance, or other bare mineral soils), they should be fenced and protected from browsing

*Science Background: aspen resiliency can be increased through greater: stand area, stem density, and stem age classes, and thus most restoration efforts focus on existing stands (Seager et al. 2013a). However, current aspen genetics might have originated under a different climate pattern during a previous era (Long and Mock 2011), though new stems and root systems grew between fire, disturbance, or stem senescence (~ 100 years). Aspen genetics show diverse responses to climate change, herbivory and other stressors (Lindroth and St. Clair 2013). This may be more important than previously thought, as predicted climate scenarios suggest stressors that may decrease available aspen habitat (Worrall et al. 2013). In a burned area that had not previously contained aspen, seedlings were found inside an enclosure in the Blue Mountains (Swanson et al. 2010), showing the importance of both finding aspen seedlings and protecting them. With aspen seeding events occurring in Oregon, new genetics and new locations should be*

*seen as important to aspen persistence, as they could offer insight into where aspen can establish and grow during current (and thus more likely, future) climate stressors. To better understand seeding potential, it is important to: delineate aspen clones, assess landscape genetics, and look at the adaptive variation of those individual clones (Mock et al. 2013), some of which has occurred in Oregon (Shirley and Erickson 2001).*

## OLD GROWTH CONIFERS



**Photo 1:**

Pictured here: Old growth ponderosa pine (>150 years) in an aspen stand on the MNF. Some ponderosas dated back over 200 years, showing the two tree species co-existed for generations of aspen. The aspen stand here has little overstory left, yet a strong flush of sucker regeneration occurred after fir, lodgepole, and young ponderosa pine removal and fencing.

Old growth ponderosa are usually limbed from historical fires and have low leaf area index compared to other conifers, and thus require less water and create less competition with aspen. *Photo: Emigrant Creek RD, MNF; by Trent Seager.*



**Photo 2:**

Pictured here: Old growth ponderosa pine in an aspen stand. This meadow system aspen (Logan Valley, Lake Creek, MNF) has scattered old growth ponderosa that would have persisted in a meadow fire regime. Nearly all other conifers were young lodgepole that had encroached in the absence of fire. While the young aspen stand is healthy with many stems, few to no suckers are making it past knee height to grow into trees. While not at risk now, the stand would need new recruitment of aspen in the next 20 years. *Photo: Prairie City RD, MNF; by Trent Seager.*



## UNGULATE BARRIERS



### Photo 1:

Pictured here: **hinging** (cutting encroaching conifers higher up and leaving them attached as a barrier) was shown to work in some other western states, but failed to stop chronic and heavy browsing on aspen suckers on the MNF.

Prairie City RD was the only site in central and eastern Oregon with herbivory heavy enough to suppress sucker growth outside of exclosures (Seager 2017). Not all aspen need fencing. In areas where elk do not overwinter (such as Emigrant Creek RD), field fencing, alternative grazing, and other techniques were effective in aspen recruitment and restoration without fencing. In areas of wintering elk, fencing is one of the few options for aspen restoration until recruitment occurs (8-10 years). *Photo: Prairie City RD, MNF; by Trent Seager.*



### Photo 2:

Pictured here: upon close inspection, you can see an aspen sucker growing under the hinged tree. The dead branches and fallen log is protecting one sucker. This shows that the release of moisture from conifers worked, and the aspen roots are suckering in the area. However, the suckers are not being adequately protected from ungulate browsing. *Photo: Prairie City RD, MNF; by Trent Seager.*



## UNGULATE BARRIERS cont.



### Photo 3:

Pictured here: **buck and pole fence** (local lodgepole trees cut to use for fence) to exclude livestock only (<8' high) was shown to remove enough browsing pressure to allow aspen suckers to grow into trees. On the southern end of the MNF, deer and elk leave the forest to overwinter on BLM land, removing a lot browsing pressure from aspen stands. Fences in the northern end of the MNF need to be 8' high as elk overwinter on National Forest land. *Photo: Emigrant Creek RD, MNF; by Trent Seager.*



### Photo 4:

Pictured here: **buck and pole fences** are susceptible to damage from falling trees. They should be monitored to make sure they are effectively maintained for as many years as needed to get aspen suckers into trees (>8' in height). The fences can then be removed. Having one or two breaches can be worse than an open fence as deer, elk, and livestock can get trapped inside. *Photo: Prairie City RD, MNF; by Trent Seager.*



## UNGULATE BARRIERS cont.



### Photo 5:

Pictured here: **buck and pole fence** at Big Creek Campground in Summit Prairie. This fence was placed around the sprouting zone of the mature aspen trees (100-150 feet). However, the fence is extensive around the entire stand and may encourage deer and elk to challenge it. Including runways within the fencing of larger stands and making smaller fenced areas decreases the chances of elk challenging the fence (Shirley and Erickson 2001). *Photo: Prairie City RD, MNF; by Trent Seager.*



### Photo 6:

The same **buck and pole fence** is pictured here at Big Creek Campground in Summit Prairie. Where the dog is standing is an access gate for people to get through. The local deer figured out that they could 'bump' the poles to get into the enclosure. Inside the fence were deer with a deer trail leading to the access gate. Note that in the picture above there are no aspen suckers growing above grass height. They were all browsed by deer. *Photo: Prairie City RD, MNF; by Trent Seager.*



## FIRE



**Photo 1:**

Pictured here: small aspen stand with conifer removal and prescribed burn. Note the aspen suckers flushing post-burn.

Removal of conifers followed by fire can reinitiate an aspen stand. Once the overstory aspen are killed, their roots will send up 100s to 1000s of suckers. Fire is an effective way to expand a stand that is otherwise struggling or dying. The aspen overstory is lost for 30-40 years to nesting birds, so burning stands should be very strategic and intentionally done with a landscape-level plan. Once burnt, the suckers are the only living component of the stand left. If these aren't protected, they can be overbrowsed and the entire stand can be lost. *Photo: Prairie City RD, MNF; by Trent Seager.*



**Photo 2:**

Pictured here: the same aspen stand that had scattered aspen trees. Treatment included conifer removal and prescribed burn. Some of the stand was fenced. Aspen are more likely to produce heavy suckering when they are older (>40 years).

To exclude deer and elk, aspen stands need to be fenced with barriers 8' tall or a combination of height and width. For small areas, fencing does not need to be 8' tall, as shown here. Deer and elk avoid jumping into small areas. Note that while aspen suckers exist on the outside of the fence, they were heavily browsed. Partially fenced stands allow passage through by elk, whereas fencing large areas may result in breaches by wintering elk herds (Shirley and Erickson 2001). *Photo: Prairie City RD, MNF; by Trent Seager.*

**Table 1.0 Aspen research and publications for the Malheur NF, Blue Mountains, and Oregon.**

Research or Publication	Component of Aspen Ecosystem or Restoration	Area of Research
Seager et al. 2015	social agreements, aspen ecology and science	Central & Eastern Oregon
Seager 2017	aspen overstory and understory response to conifer removal	Prairie City, Emigrant Creek RDs, MNF
Seager 2010	overstory and understory response to conifer encroachment and ungulate herbivory	Deschutes and Fremont-Winema NFs
Swanson et al. 2010	aspen biology and management	Blue Mountains NFs
Seager et al. 2013	forest-wide restoration strategy	Fremont-Winema NF
Shirley and Erickson 2001	restoration in NE Oregon	Umatilla NF

### Supporting Documents

We encourage the Forest Service to use the extensive review of aspen ecology and science provided in these documents about aspen on the Malheur National Forest, Blue Mountains, and central and eastern Oregon, and cite them in the environmental analysis:

Seager, ST. 2017. Competition release and climate change effects on a moisture-demanding tree species in a dry system. Doctoral dissertation. Oregon State University, Corvallis, OR. 168 p. [\[PDF\]](#)

Seager, ST., Ediger, V., and Davis, EJ. 2015. Aspen Restoration and Social Agreements: An Introductory Guide for Forest Collaboratives in Central and Eastern Oregon. The Nature Conservancy, Portland, OR. 64 p. [\[PDF\]](#)

Swanson, D.K., Schmitt, C.L., Shirley, D.M., Erickson, V., Schuetz, K.J., Tatum, M.L., Powell, D.C., 2010. Aspen biology, community classification, and management in the Blue Mountains. Gen. Tech. Rep. PNW-GTR- 806. Portland, OR: U.S. Department of Agriculture, Forest Service, Pacific Northwest Research Station. 117 p. [\[PDF\]](#)

## Further Supporting Documents

In addition, there are these documents on aspen restoration in Oregon:

Seager, ST., 2010. Quaking aspen persistence in three Oregon landscapes. Master's thesis. Oregon State University, Corvallis, OR. 88 p. [\[PDF\]](#)

Seager, ST, Markus, A., Krommes, A.J. 2013a. Aspen Restoration Strategy for the Fremont-Winema National Forest. Oregon State University, Corvallis, OR. 51 p. [\[PDF\]](#)

Seager, ST., Eisenberg, C., St. Clair, S.B., 2013b. Patterns and consequences of ungulate herbivory on aspen in western North America. *Forest Ecology and Management*, 299, 81-90. [\[PDF\]](#)

Shirley, D.M., Erickson, V., 2001. Aspen restoration in the Blue Mountains of Northeast Oregon. Pages 101-115 in Shepperd et al., compilers. *Sustaining aspen in western landscapes: Symposium Proceedings*. USDA Forest Service Rocky Mountain Research Station, RMRSP 18, Grand Junction, Colorado. [\[PDF\]](#)

As noted in these scientific documents, not all of the aspen research and science from other regions (e.g., Rocky Mountains) applies to eastern Oregon and the Blue Mountains. Research from Oregon and the Inland PNW should be used to direct aspen management, and care should be used before applying management techniques from other western regions.

For citations found in the Science Background under each numbered Zone of Agreement, see: [Seager, Ediger, and Davis 2015](#).