Restoration and Management of Pinyon and Juniper Woodlands

Purpose

This factsheet is an abbreviated version of the restoration and management section of the book ***The Ecology, History, Ecohydrology, and Management of Pinyon and Juniper Woodlands in the Great Basin and Northern Colorado Plateau of the Western U.S.*** by Richard Miller and others. The book is a thorough review the current knowledge of pinyon and juniper ecosystems, both persistent and newly expanded woodlands. This factsheet provides just highlights—the full text draws from a large volume of research on semi-arid woodlands with reviews and citations from hundreds of sources.

History

Vegetation management of pinyon and juniper woodlands began primarily after World War II, when fuel costs were low, and a large surplus of heavy mechanical equipment became available. The primary goals were to increase livestock forage production, improve watershed understory vegetation to prevent downstream flooding of towns (which occurred along the Wasatch Range in Utah), and improve declining big-game winter habitat. In the 1950s and 60s, the primary method for tree removal was chaining. At the time there was little distinction made between pre- and post-settlement woodlands or the resilience and resistance to invasive species of the areas to be treated, which led to mixed results. Two-way chaining with broadcasting seeding (often with introduced species) between chaining treatments provided the best results for increasing perennial grass cover. By the 1970s, the acres of rangelands chained annually declined significantly, but chaining is still used at smaller scales. When applied properly, chaining and other treatments can provide good results.

Mastication and Cutting

Since 2000, shredding (mastication) and cutting have become the most common mechanical methods of tree removal. Both treatments often ultimately result in an increase in soil water, length of growing season, shrub cover, and perennial grass and forb cover. Variation in cutting treatments include cut-and-leave, cut-limb-and-scatter; cut-and-broadcast burn, and cut-pile-and-burn—all with advantages and disadvantages. Tree removal in Phase III woodlands by mastication or cutting can increase the growing season by two or more weeks. Response of invasive annual grasses is always a concern and is closely linked to pretreatment tree and perennial herbaceous cover, and soil moisture and temperature regimes (fig. 1).

Locations with warmer fall temperatures are especially susceptible to cheatgrass dominance, while those with cooler fall seasons and relatively wet winters and springs are more resistant. A major disadvantage of mechanical treatments compared to prescribed fire is the survival of small trees (less than six feet tall) and resprouting from remaining basal limbs, which can significantly reduce the longevity of the treatment, often requiring follow up treatments.

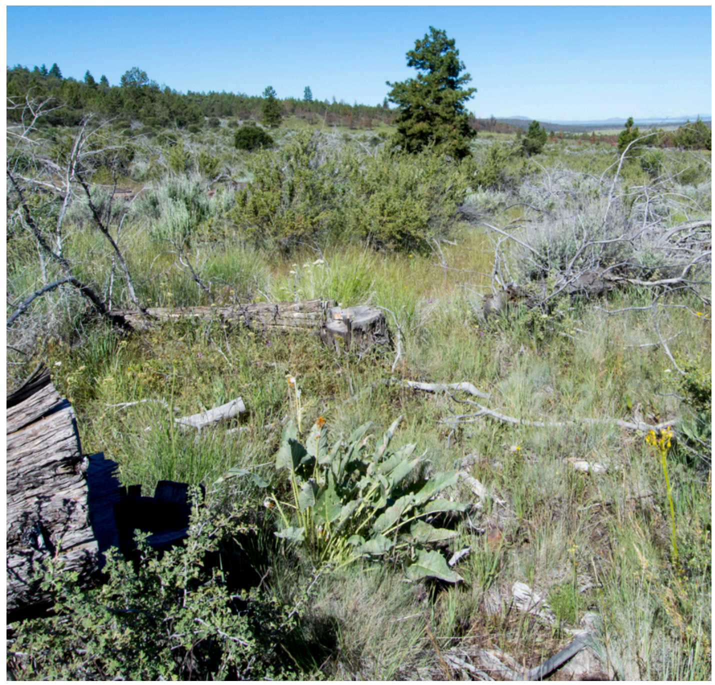

Figure 1. *Ten years following cutting of a Phase II woodland with an intact understory. The treatment resulted in a significant increase in shrubs and perennial grasses and forbs. This mountain big sagebrush/Idaho fescue site has high resilience and resistance to invasive annual grasses resulting from relatively cool falls and wet winters and spring. In comparison, locations with warmer fall temperatures are especially susceptible to cheatgrass dominance Cline et al. 2018b) Modoc Plateau, northeastern California. (Photo by Rick Miller, Oregon State University.)*

Herbicide

The broad-scale application of herbicides to mature woodlands has been limited due to mixed results and concerns related to impacts on native perennials and water. But the use of Picloram has proven to be an effective tool following mechanical treatment when applied selectively on small trees or resprouts at the base of the trees. It has also been used to treat invasive annuals following tree removal, a consideration on sites with low resistance to invasive plants.

Fire

Although early studies evaluating the effects of prescribed fire were conducted in the early 1950s, the use of prescribed fire was very limited until the 1970s. Federal and state agencies were hesitant to use prescribed fire for fear of escaped fires, and limited surface fuels in many pinyon and juniper woodlands required extreme weather conditions to carry fire. In the early 1970s, a survey of burned woodlands reported increases in post-fire perennial grasses. Between 2002 and 2016, 5.5 million acres were prescribed burned in the West.

Prescribed fire has proven to be a useful tool under the right conditions. However, under the wrong conditions (closely linked to characteristics of the site), it can significantly increase invasive annuals. The vast majority of studies comparing mechanical versus prescribed burning reported larger increases (at least in the first few years following treatment) of invasive annuals in the burn treatments, especially on warm-dry compared to cool-moist sites. The advantages of fire are the removal of small trees, little to no resprouting, and costs that are typically less than most mechanical treatments.

However, disadvantages are the removal of important non-sprouting shrub species (although these are often lacking in Phase III sites) and a greater threat of invasive species. The lack of surface fuels in late Phase II and III areas also usually requires a pretreatment such as cutting a portion of the trees to conduct a prescribed burn under moderate weather conditions. Recovery of the perennial herb layer to preburn or greater levels typically takes two to three years versus in mechanical treatments—for which increases can occur in the first post-treatment year. Burning Phase III woodlands, requiring more severe conditions, will significantly increase perennial grass mortality (more than 80 percent) (fig. 2). Prescribed fire also greatly reduces residual cover of sagebrush and bitterbrush if they are still present in the understory. Recovery of sagebrush canopies to 20 to 30 percent cover on cool and moist sites usually takes 20 to 35 years. On warm and dry sites, sagebrush recovery takes considerably longer, and seedling establishment is severely limited by cheatgrass competition.

Seeding

Seeding is an important consideration where native perennials are depleted, and soil moisture temperature regimes are favorable for invasive annuals. Successful seeding can significantly reduce the abundance of annual grasses following treatment.

Considerations for Increasing Success

When treating woodlands, the key components to success are an adequate level of residual perennial herbs present on the site and favorable ecological site characteristics—including soil texture, depth, and soil moisture and temperature regimes (Miller et al. 2013). The relative dominance of trees to perennial understory vegetation at the time of treatment is closely linked to plant succession following treatment.

Future

Over the past 70 years, our goals for restoration have broadened to maintaining or restoring ecosystem function. We have also learned that short- and long-term vegetation responses following treatment are closely related to the woodland successional phase, residual understory vegetation at the time of treatment, and important ecological site characteristics—including soil moisture and temperature regimes. However, invasive plants have proven to be an ever-increasing challenge, especially on warmer and drier sites with warm springs and falls. Sites with drier or cooler falls, and wet winters and springs favor native perennial herb cover.

Figure 2. *Fire is a useful tool – however the threat of invasive plants following a burn is of major concern. Increases in invasive annuals following a fire is often greater than following cutting and shredding treatments. Site characteristics – including moisture and temperature regimes – and surface vegetation present on the location prior to treatment are key components that influence resistance to invasive plants. Egan Range, Nevada. (Photo by Rick Miller, Oregon State University.)*

More

To see references, specific details and a discussion of many other topics, see the full text of the book available **HERE**. Refer to section three for a synthesis of the research available on restoration practices.