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Vegetation Responses to Pinyon–Juniper Treatments in Eastern Nevada

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Abstract

Comparisons of tree-removal treatments to reduce the cover of single-leaf pinyon (*Pinus monophylla* Torr. and Frém.) and Utah juniper (*Juniperus osteosperma* [Torr.] Little), and subsequently increase native herbaceous cover in black sagebrush (*Artemisia nova* A. Nelson), are needed to identify most cost-effective methods. Two adjacent vegetation management experiments were initiated in 2006 and monitored until 2010 in eastern Nevada to compare the costs and efficacy of various tree reduction methods. One Department of Energy (DOE) experiment compared a control to five treatments: bulldozing imitating chaining ($\$205 \cdot ha^{-1}$), lop-pile-burn ($\$2\,309 \cdot ha^{-1}$), lop-and-scatter ($\$1\,297 \cdot ha^{-1}$), feller-buncher and chipper ($\$4\,940 \cdot ha^{-1}$), and mastication ($\$1\,136 \cdot ha^{-1}$), whereas a second Bureau of Land Management (BLM) experiment compared one-way chaining ($\$205 \cdot ha^{-1}$) to a control treatment. Chaining and bulldozing resulted in the least reduction of tree cover among the treatments. In the DOE experiment, forb cover only decreased in the mastication treatment. Litter increased in all methods. Slash cover was lowest in the control and lop-pile-burn treatments, intermediate in the feller-buncher and mastication treatments, and highest in the bulldozing and lop-and-scatter treatments. By 2010, forb cover and the combined cover of dead shrubs and trees were increased and decreased, respectively, by chaining in the BLM experiment. Nonnative annual grass and biotic crust were absent or uncommon before and after treatment implementation. In both experiments, tree removal resulted in a nonsignificant increase in perennial grass cover even 4 yr post-treatment. An ecological return-on-investment (EROI) metric was developed to compare perennial grass cover and tree cover per unit area cost of each active treatment. By 2010, chaining or bulldozing, followed by mastication, showed the highest EROI for improving perennial grass and decreasing tree cover. Mastication is recommended for restoration of smaller tree-encroached areas, whereas land managers should reconsider smooth chaining, despite its negative perceptions, for rapid and cost-efficient restoration of large landscapes obligates.

Key Words: black sagebrush, chaining, feller-buncher, Great Basin, mastication, perennial grass

INTRODUCTION

Vegetation management of Intermountain West rangelands has increased recently to meet the specific needs of various stakeholders (Miller et al. 2005; Wisdom et al. 2005; Hood and Miller 2007). Common reasons for managing vegetation have been to protect homes from wildfires by changing fire behavior (Agee et al. 2000; Stratton 2008) and improve wildlife habitat (Tausch and Tueller 1977; Skousen et al. 1989), livestock forage (Vernon et al. 2001), and habitat for sensitive or listed species (Connelly et al. 2000; Dahlgren et al. 2006). In the Great Basin, recent and century-old challenges that land managers routinely contend with are: encroachment of pinyon and juniper into shrublands, invasion by nonnative plant species, shrublands depleted of native herbaceous cover, and low successional heterogeneity across landscapes (Blackburn and Tueller 1970; Young and Sparks 2002; Wisdom et al. 2005; Kitchen and McArthur 2007; Provencher et al. 2008).

Vegetation treatments are generally expensive, especially for pinyon and juniper control and when the cost of planning mandated by the National Environmental Protection Act (NEPA) and litigation are factored in the management of public lands. Common methods of pinyon–juniper control have varied over the decades: 1) prescribed burning remains a widespread and increasingly economical method at higher elevations when nonnative grasses are at low abundance (Miller et al. 2005); 2) chaining or bulldozing of trees (although limited to few areas today) was frequently deployed to improve livestock forage and big game habitat from the 1950s to 1980s (Tausch and Tueller 1977; Skousen et al. 1989; Miller et al. 2005); 3) chainsaw cutting of western juniper and leaving them intact on the ground is the most commonly used and inexpensive mechanical method in Oregon (Miller et al. 2005); 4) other more expensive forms of chainsaw cutting frequently used in many states include lopping branches and scattering woody material, or piling branches and stems that are subsequently burned, usually when the ground is covered with snow (Miller et al. 2005; Owen et al. 2009; O'Connor et al. 2013); and 5) heavier machines, such as masticators and feller-buncher-chippers grind trees and are increasingly used at the wildland–urban interface, but also in small wildland projects (Miller et al. 2005; Owen et al. 2009; Baughman et al. 2010).

Few pinyon–juniper control projects are monitored before and after treatment implementation with the established quantitative methods required in sagebrush systems (Miller et al. 2005; Baughman et al. 2010). Finally, only a few projects incorporate multiple mechanical treatments with proper control treatments and replication (Miller et al. 2005). Given the high cost of vegetation manipulation, quantitative comparisons of alternative treatments would greatly benefit land managers who are faced with limited resources and who want to achieve the highest ecological return-on-investment (EROI).

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