Long-term Plant Succession after Juniper Cutting

Jon Bates, Rick Miller, and Tony Svejcar

Introduction

The expansion and development of western juniper woodlands is of significant concern in the northern Great Basin. Woodland dominance can result in reduced wildlife diversity, increased erosion and runoff, and reduced understory productivity and diversity of shrub-steppe plant communities. To address these undesirable consequences, western juniper has been controlled by a variety of treatments. Current control methods are primarily prescribed fire and hand cutting using chainsaws. Control of juniper increases availability of soil water and nutrients and thus commonly results in large increases in biomass and cover of herbaceous species. There is a lack of long-term, post-treatment assessments of fire or cutting in the western juniper system.

Experimental Protocol

The purpose of this study was to evaluate long-term vegetation changes after cutting of western juniper. This study was conducted from 1991 through 2003 on private land on Steens Mountain in southeast Oregon. Cut treatments consisted of cutting all the trees on 1-acre plots. We then compared changes in herbaceous and shrub composition between cut and uncut woodlands. Juniper had dominated this site, thereby eliminating the shrubs and suppressing herbaceous species (Fig. 1). Juniper tree density was 100 trees per acre prior to cutting. In the cut treatment we also compared herbaceous response among three zones (old canopy, under-juniper debris, and intercanopy) and evaluated how quickly shrubs and juniper reestablish after cutting.

Figure 1. Woodland plot, 1991, before trees were cut, Steens Mountain, Oregon. Bareground and rock in the interspace is 95 percent. Herbaceous plant cover is about 4 percent.

Figure 2. Cut plot in 1993, 2 years after junipers were felled, Steens Mountain, Oregon. By 2003, cover of herbaceous plants was 28 percent and litter cover was 12 percent. Bareground in the interspace in 2003 was 53 percent.

Results and Discussion

Cutting resulted in increased total herbaceous biomass and cover and density of perennial grasses when compared to the woodland (Fig. 2). Density of perennial grasses increased from 2 plants/yd^2 in 1991 to 10–12 plants/yd^2 in 1997 and 2003.[2] Perennial grass density was about five times greater in the cut compared to the woodland. Herbaceous biomass has, since 1993, been about 10 times greater than biomass values in the woodlands (Fig. 3). Biomass increased about 300 percent between 1993 and 2003 in the cut treatment. Biomass and perennial grass density did not change significantly between 1997 and 2003, suggesting that it took about 6 years for understory vegetation to fully develop and occupy the site. It appears that a minimum of two plants/yd^2 are necessary to successfully recover this site with desirable species.

Within the cut treatments herbaceous composition has changed over time and has been influenced by microsite. In intercanopy zones of the cut treatment, perennial grasses were the dominant functional group, with higher cover and biomass than other functional groups in all years. However, between 1996 and 2001, cheatgrass dominated litter deposition areas (old tree canopies and under-juniper debris) (Fig. 4). The increase in cheatgrass in these areas may have been due to more favorable seedbed characteristics and increased nutrient and water availability. However, cheatgrass decreased dramatically in debris and canopy zones by 2003, with corresponding increases in perennial grass biomass and/or cover. In 2003, perennial grass biomass was two times greater than annual grass in canopy and debris zones. The cheatgrass decline may be a result of dry conditions over the past several years that reduced cheatgrass establishment and growth, less favorable seedbed properties as litter is incorporated into the soil and exposure increases, and increased competition from perennials. The main perennial grass that moved into litter deposition zones was squirreltail. Other perennial grasses have been slow to establish and develop in old canopy and debris sites.

Sagebrush and other shrubs have increased steadily since cutting, but cover remains far below potential for this site. Juniper has also reestablished in the cut treatment. One source of these trees is small individuals that are often not controlled in the initial treatment. In addition, it appears that many new trees started from seed. Juniper density in 2003 was 200 trees per acre. These trees are either seedlings or juveniles less than 18 inches tall. Unless controlled, there are presently enough young trees to redominate the site within 50–60 years.

[2] Perennial grasses included bluebunch wheatgrass, squirreltail, Thurber's needlegrass, and Indian ricegrass. Sandburg's bluegrass is a perennial grass but was not included in this total.

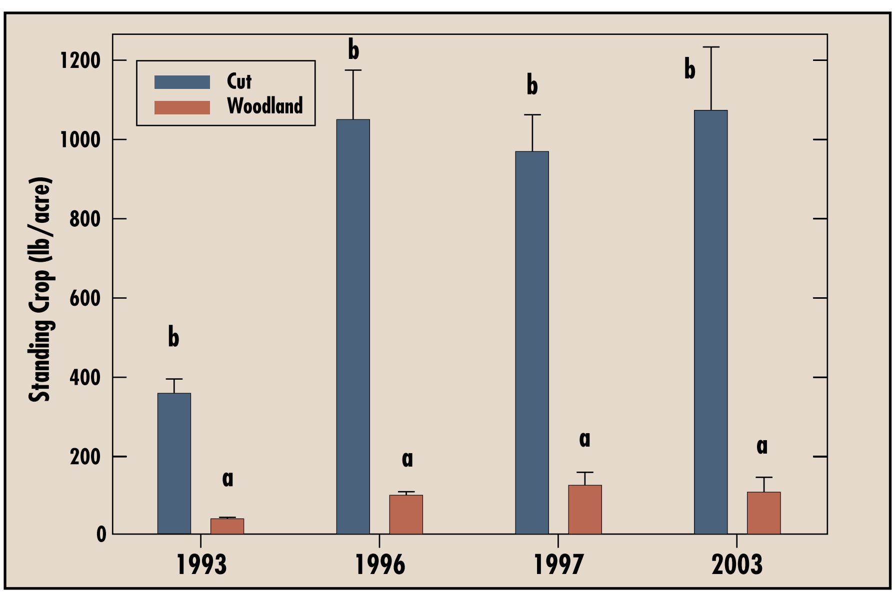

Figure 3. Herbaceous standing crop (lb/acre) in cut and woodland treatments in 1993, 1996, 1997, and 2003, Steens Mountain, Oregon. Data are in means plus one standard error. Significant differences between treatments are indicated by different lower-case letters.