Control of Cut Juniper Stumps and Small Trees in Northeastern California

David F. Lile, Donald L. Lancaster, Rob G. Wilson
University of California Cooperative Extension, Lassen and Modoc Counties

Western juniper (*Juniperus occidentalis*) has invaded over three million acres of sagebrush rangeland in northeastern California. In the absence of fire, juniper will spread into a variety of sagebrush habitats. Prior to settlement fire frequencies are thought to have limited juniper to fire safe sites, such as rim-rocks, and shallow soils that lacked sufficient understory fuel. With the advent of fire control efforts and reduction in fine fuels by livestock, fire has been largely suppressed which has contributed to a tremendous increase and spread of western juniper over the past century (Miller and Rose 1999) (Soule et al. 2002). The proliferation of juniper is easily borne out in many areas by comparing photos from the early 1900's with the same landscape today. Likewise, efforts to age juniper, indicate the vast majority of trees are from 80 to 120 years old.

The potential negative impacts from juniper invasion are well documented (Miller et al. 2000) (Bedell et al. 1993). On most range sites, once juniper reaches approximately 10% canopy cover it begins to have a serious impact on the understory, shrubs grasses and forbs. At 30 to 50% canopy cover, almost all the understory vegetation is lost from the site, and highly accelerated rates of erosion may result. Juniper dominated sites have far lower value habitat for most native wildlife, reduced forage for livestock, and at times impaired watershed function. Despite these widespread impacts, the proliferation of juniper continues to far out pace any efforts to control or remove it on a meaningful scale.

Mechanical shearing and chipping operations that harvest juniper to produce biomass fuel is one approach that does have the potential to clear significant acreages of juniper dominated rangeland. Using feller-buncher logging equipment independent operators have begun supplying biomass power plants with juniper chips. Several ranches have participated in these operations. The typical arrangement is that the chipping operators do not pay or receive payment for taking juniper off the ranch. Their income is based only on selling the chips. The benefit to the ranch is that removal of juniper usually results in increased understory production, biomass and plant diversity which equates to more livestock forage and better wildlife habitat (Bates et al. 2000). Concurrently the Bureau of Land Management in northeastern California is developing an EIS to allow substantial juniper chipping on the lands they manage.

Objective

From a rangeland forage and wildlife habitat standpoint, there are two key shortcomings of shearing operations. First is that there are often live stumps with low growing limbs below the cutting level that are left to re-grow, and many smaller trees (2 to 6 feet in

height) that are impractical for the shearing/chipping equipment are left in place, poised to reclaim the site. Furthermore there are vast areas that make up the "advancing front" of juniper encroachment that are made up entirely of small trees that are not practical for chipping operations. The objectives of this study were to test chemical, mechanical and fire treatments on the control of living juniper stumps and small juniper trees that are left behind following the shearing operation.

Methods: Juniper shearing was conducted at two locations in Lassen County in 2000 and 2001. Sites were within the Willow Creek drainage south of Adin, CA and the other was just below sagehen summit south of Likely, CA. The Sagehen site is at approximately 5100 ft elevation, with a northeasterly aspect. The soils are mapped into the Searles-Orhood-Davada association characterized as a well-drained, very stony loam with 20 to 40" rooting depth. Plant community is dominated by big sagebrush, juniper, and perennial bunch grasses. The Willow Creek site is at approximately 4900 feet elevation with a southwesterly aspect. Soils are mapped into the Pass Canyon-Los Gatos family complex characterized as a well-drained very cobbly to gravelly loam with a rooting depth from 10 to 40 inches. Plant community is dominated by juniper, big sage brush, bitterbrush, low sagebrush and perennial bunch grasses.

This study can be separated into two parts; first, treatment of cut stumps of larger trees (6 to 14" dbh) and second, treatment of small trees (1 to 6 ft in height). Living cut stumps were treated with different formulations of imazapyr (Arsenal and Chopper). Herbicide applications were applied by thoroughly wetting the stump surface with a backpack sprayer. Small trees were treated with hexazinone (Velpar L and Pronone Power Pellet), imazapyr (Arsenal AC and Chopper), hand-held brush saws, and a weed propane burner. Spray treatments consisting of basal, thin-line, and overtop techniques were applied and compared for effectiveness on the small trees. Treatments were applied both in the fall of 2001 and spring of 2002 at both locations. Twelve individual trees were treated and tagged per each herbicide treatment at each location. Treatment effectiveness was assessed in the fall of 2002 about 10 and 6 months after the respective treatments. A control rating was recorded for each individual tree.

Results

Cut Stumps

Stump treatments with imazapyr were effective (Figure 1). Spring applied treatments were significantly more effective than treatments applied in fall ($p<.01$). This is likely a result of more active growth that occurs during the spring. Arsenal was marginally more effective than Chopper formulations.

Small Trees

Herbicidal treatments were also very effective on small juniper trees (Figure 2). While Velpar L was slightly more effective in the fall than spring, this is likely due to the extremely dry weather conditions that occurred during the spring of application. Fall applied Velpar L however, had the benefit of winter precipitation.

The extremely dry spring may well have reduced the effectiveness of the Pronone Power Pellet as well. Earlier application to take advantage of winter moisture or more typical spring rains would have probably moved the herbicide further into the root zone therefore improving effectiveness. It appears as if less precipitation is needed to move the liquid concentrate form of hexazinone than the pelleted form in to the root zone.

Similar to the cut stumps, the small tree spray applications with imazapyr were significantly ($p<.01$) more effective in the spring.

Comparison of spray techniques are shown in Figure 3. Although the overtop method takes a bit more time and herbicide it is significantly more effective than thin-line or basal applications.

Results were similar at both locations. We had better control with the spring Velpar treatments at the Sagehen site than at Willow Creek. We suggest that because of the very dry spring, better herbicide activity was attained at Sagehen which is a little wetter site with deeper soils and probably experienced better herbicide movement and longer growing conditions than at Willow Creek.

Mechanical sawing and the propane burner also effectively killed the small trees, each providing better than 90% control. However, both these techniques were approximately three times slower to apply than the herbicide treatments. A two-man crew is required to use the propane burner, one to manage the tank and hose while the other handles the torch. The propane burner is very cumbersome on rangeland sites and was not at all practical on slopes over 20 percent. The brush cutter saw is easier to use but its effectiveness is limited to trees under 2 inches in diameter and only on sites that have very few rocks.

Conclusions

This research shows that herbicidal applications can enhance the benefit of juniper shearing operations by efficiently and selectively killing the living stumps and small trees that are left behind. Herbicide treatments were much more easily applied and more feasible on rangeland conditions than the hand held saw or the propane burner. For limited applications where herbicides are not desired, those methods may be effective as well.

An important attribute to these control treatments, is that the remaining plant community can be kept intact. Small juniper trees or stumps can be selectively removed, leaving the existing vegetation in place to provide wildlife habitat, livestock forage, or other land use objectives. Although fire is the natural process to control the spread of juniper, realistically we need to recognize the many obstacles to the widespread use of fire both from a biological and social/cultural standpoint. Alternatively, combinations of mechanical and chemical juniper control have the potential to provide short and long-term benefits to rangeland health and productivity over a vast landscape.

References

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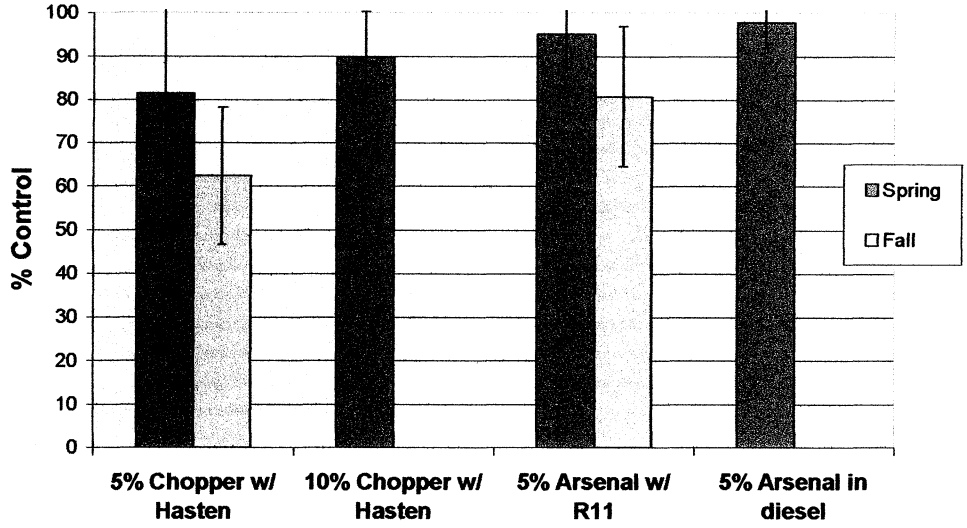

Figure 1. Herbicide effectiveness on live cut juniper stumps.

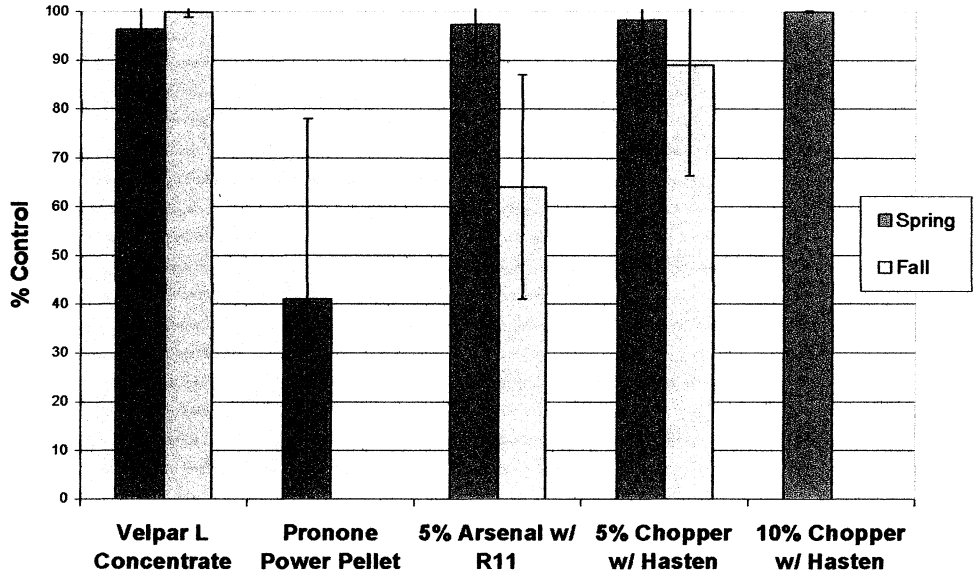

Figure 2. Herbicide effectiveness on small juniper trees < 6' ht..

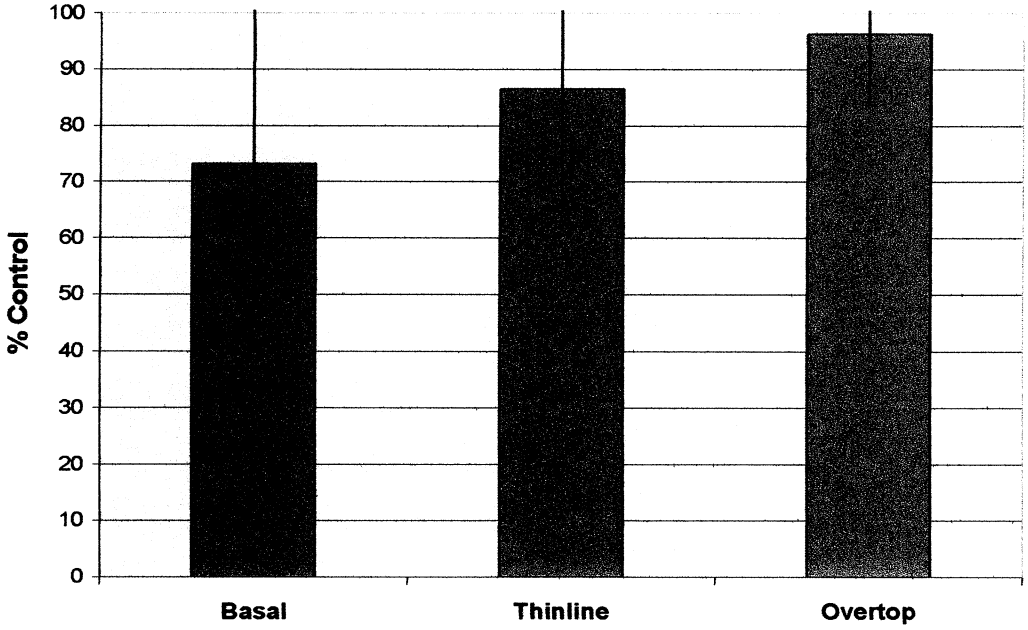

Figure 3. A comparison of spray technique on the effectiveness of imazapyr for controlling small juniper trees < 6' ht.