PRESCRIPTION GRAZING TO INCREASE TREE GROWTH

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INTRODUCTION

From 1984-1991, a research program was initiated in Southwest Oregon to determine the feasibility of using cattle grazing to promote growth of young conifer seedlings. In this area, reforestation has been particularly difficult due to the combined effects of competitive understory vegetation and dry climatic conditions (Hobbs et al. 1983). An important factor contributing to successful reforestation has been the control of competing vegetation for the first several years after planting (Stewart et al. 1984, Walstad et al. 1987). While silviculturists have often favored the use of herbicides, restrictions on their use have necessitated alternative vegetation management such as manual clearing and paper-mulching to control competing vegetation.

Another vegetation management tool that holds promise is controlled cattle grazing to increase site resources available to tree seedlings (Doescher et al. 1987). Past research has demonstrated that livestock grazing is often compatible with the objectives of forest management (Leininger 1983; Kosco and Bartolome 1983; Krueger 1986).

The research program was designed to determine the feasibility of using cattle to enhance growth of ponderosa pine (*Pinus ponderosa* Laws) and Douglas-fir (*Pseudotsuga menziesii* (Mirb.) Franco) seedlings. Specifically, it was felt that controlled cattle grazing would improve the availability of soil moisture, and ultimately benefit the vigor and growth of conifer seedlings.

STUDY AREA AND METHODS

The study areas were on lands administered by the Bureau of Land Management (BLM). Vegetation of the area was characterized by species common to the hotter, drier portions of the mixed-conifer vegetation zone found in the western Cascade physiographic and geologic province (Franklin and Dyrness 1973). To assess availability of soil moisture, xylem potential measurements (Waring and Cleary 1967) of Douglas-fir and ponderosa pine were made using a pressure chamber (PMS Instrument Co.). In addition stomatal conductance (i.e. amount of water flowing through the tree) was assessed using a null balance porometer. Stem diameter and volume of seedlings were also measured to determine the effectiveness of the grazing treatments.

GRAZING MANAGEMENT

Grazing was performed to encourage highest utilization and greatest reduction in vigor of the herbaceous vegetation. Criteria used in developing the grazing treatments were:

1. Grazing early to decrease soil moisture depletion by herbaceous vegetation and provide cattle with a high palatable forage.

2. Grazing at high intensities to remove transpiring leaf area.

3. Grazing regrowth to further reduce leaf area and suppress vigor of plants competing with tree seedlings.

Put-and-take grazing was used to control competing vegetation (Wheeler et al. 1973). Cattle were placed onto the plantation when the grasses were in the 4-6 leaf stage and just prior to initiation of flowering culms. Stocking rate and cattle numbers varied as dictated by the availability of forage. Grazing was monitored on a daily basis and animals removed when reduction of forage reached a stubble height of approximately 5 cm. Careful monitoring of grazing led to minimal browsing and trampling of conifer seedlings. If warranted, regrowth was grazed.

RESULTS

Plant Water Relations

In general, seedlings growing in grazed plots tended to exhibit less negative xylem potentials (less water stress) than those in ungrazed plots (Figures 1 and 2). In addition, measurement of stomatal conductance indicated seedlings on grazed areas had greater physiological activity than seedlings on the ungrazed area (Figure 3). Growth of seedlings was also shown to increase on grazed areas. An example of growth increase is shown in Figure 4.

DISCUSSION AND CONCLUSIONS

Results of this research lend support to the ideas that appropriately timed grazing can improve the availability of soil moisture and ultimately benefit the vigor and growth of tree seedlings. We believe that several mechanisms enhance seedling performance. First, intensive grazing of competing vegetation reduces transpirational surface area and increases soil moisture availability to tree seedlings. This contention is supported by several researchers who have found that heavy defoliation of pasture grasses by cattle increased soil moisture, particularly during the early portions of the growing season (Svejcar and Christensen 1987, Wraith et al. 1987). Second, intensive defoliation reduces root development of competing vegetation (Crider 1955, Richards 1984). Smaller root systems of grazed plants could ultimately result in a greater soil volume available for exploitation by root systems of conifer seedlings. Third, grazing may also enhance availability of light to young tree seedlings. In forested ecosystems where adequate soil moisture is present for seedling growth, grazing during the early years of plantation establishment could help reduce competition for light from aggressive seral vegetation. Fourth, there is speculation that livestock, through the deposition of dung and urine, may help enrich soil nutrients such as nitrogen (Leininger 1984). Finally, cattle through hoof action may have modified soil surface characteristics, such as surface roughness, and allowed for greater infiltration of precipitation.

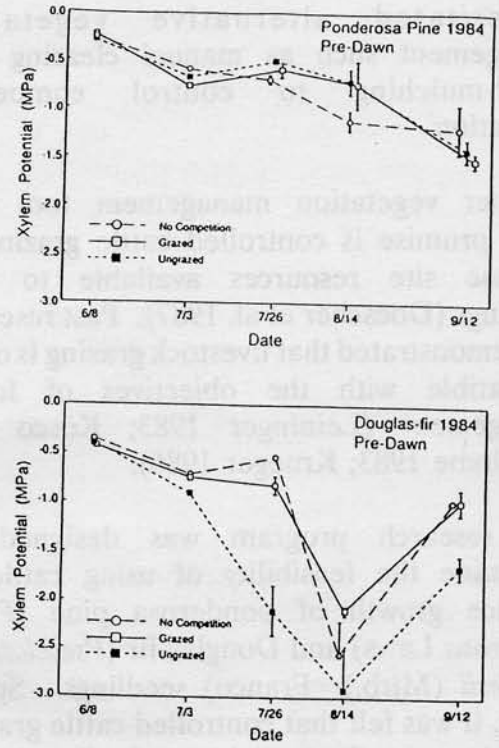

Figure 1. Xylem potential (a reflection of soil water availability) of Douglas-fir and Ponderosa Pine seedlings on a grazed and ungrazed site. The less negative the value, the more soil water is available to the seedling.

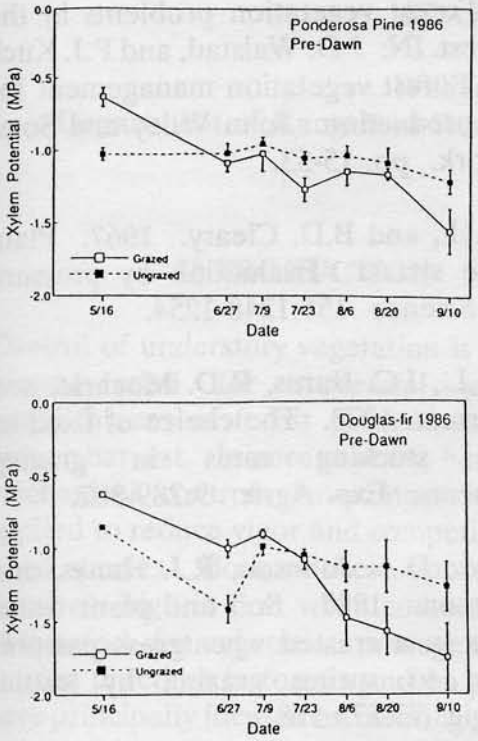

Figure 2. Xylem potential (a reflection of soil water availability) of Douglas-fir and Ponderosa Pine seedlings on a grazed and ungrazed site. The less negative the value, the more soil water is available to the seedling.

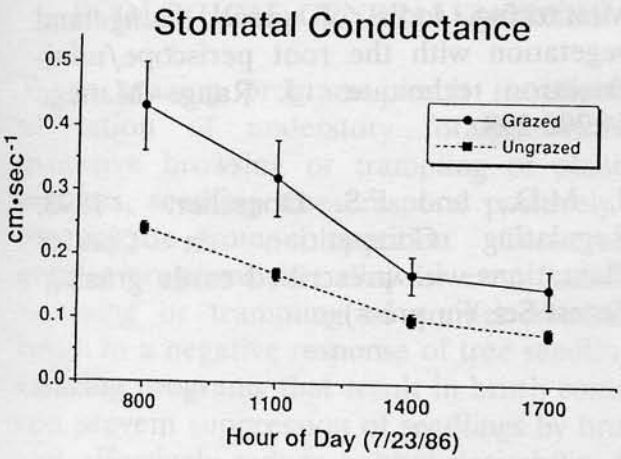

Figure 3. Stomatal conductance (flow of water through the leaves) of ponderosa pine seedlings growing on a grazed and ungrazed site.

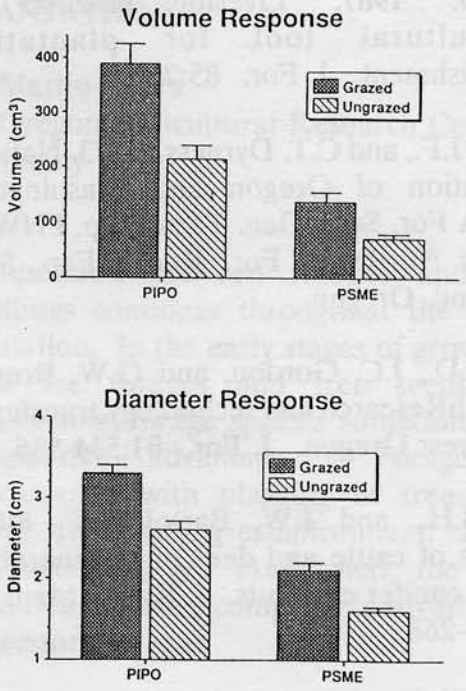

Figure 4. Diameter and volume growth of Ponderosa pine (PIMO) and Douglas-fir seedlings growing on a grazed and ungrazed site.

In conclusion, research suggests that application of appropriately timed cattle grazing, like application of herbicides, may provide ecological benefits to planted conifer seedlings in southwest Oregon. Enhanced water availability promoted by cattle grazing appears to be one factor leading to larger conifer seedlings. Other factors not measured in this research, such as changes in nutrients, light and soil properties, may have also contributed to improved growth of conifer seedlings.

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