# GRAZING FOREST PLANTATIONS

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## INTRODUCTION

Control of understory vegetation is frequently recommended for successful growth or establishment of forest plantations following timber harvest. In recent years, herbicides or mechanical controls have most often been applied to reduce vigor and competitiveness of weed species. Both of these approaches are relatively high in cost when contrasted to use of livestock for vegetation management. Past grazing practices in forests and on plantations have principally focused on meeting production or maintenance requirements of livestock with little attention given to integration of grazing into forest management or to utilizing livestock specifically for benefit of the developing forest plantation. The purpose of this paper is to provide a background of information that forest range managers can utilize to effectively develop specific grazing prescriptions to control vegetation in forest plantations.

## ECOLOGICAL GENERALIZATIONS

When grazing programs result in effective utilization of understory forages without extensive browsing or trampling of planted conifers, seedling trees respond positively to the release from competition. Conversely, grazing programs that allow or even facilitate browsing or trampling of conifer seedlings result in a negative response of tree seedlings. Grazing programs that result in brush control can prevent suppression of seedlings by brush and effectively reduce habitat desirability for rodents. Grazing of forage followed by digestion and excretion of waste products as well as trampling of litter greatly accelerates nutrient cycling in forest plantations. Competition between forages and conifer seedlings continues throughout the life of a plantation. In the early stages of growth while both the forages and tree seedlings are establishing, forage species sometimes have a competitive advantage. Forages sown concurrently with planting of trees do not retard tree seedling establishment. After the tree seedlings are established, the growing trees clearly have a competitive advantage over understory forages.

### Tree Response to Browsing

Several studies have been conducted to evaluate the impact on growth of conifer seedlings from browsing or other stress caused by grazing animals. Where livestock are managed to integrate forestry and livestock objectives there is little correlation between mortality of conifer seedlings and intensity of livestock grazing. Mortality of conifer seedlings from livestock damage in managed plantations is insignificant in comparison to other causes of mortality. In studies of browsing, trampling, defoliation and girdling of slash pine *(Pinus elliottii)* only complete girdling caused significant mortality. Young conifer seedlings are the most sensitive to damage from browsing or trampling. This has led to recommendations to defer grazing of plantations for one to three years after planting. However, ponderosa pine *(Pinus ponderosa)* plantations in southern Oregon have been successfully grazed by cattle during the year of planting. Several studies of conifers, including pines and Douglas Fir *(Pseudotsuga menziesii)* have indicated that browsing of lateral stems does not decrease subsequent growth as long as the terminal is

intact. Browsing of the terminal leader will reduce growth of conifer seedlings. If the terminal leader is browsed, growth is affected in the year of browsing, when browsing ceases subsequent growth is similar to that of unbrowsed trees. It is often recommended that forest plantations be seeded to exotic forages since they are more palatable and easier to manage and they are no more competitive with planted conifers for site resources than native plants.

**Tree Browsing Conditions**

In managing conifer plantations for grazing by sheep or cattle a principal concern has been to prevent browsing of tree seedlings by livestock. Understanding the circumstances that result in browsing of Douglas-fir, white fir *(Abies concolor)* and various pines is necessary to develop management strategies to minimize browsing effects. Browsing of tree seedlings is usually confined to current year's growth, especially the period following bud break when the new growth is succulent. However, conifer plantations have been successfully grazed during and following bud break with insignificant browsing of seedlings. When grazing sheep on Douglas-fir or pine plantations, no grazing of terminals is experienced in any season when the terminal bud is one meter off of the ground. To some extent, younger animals may be damaging to plantations than older animals and livestock with experience in grazing plantations are less likely to browse tree seedlings. Development of water for livestock will reduce browsing on trees, since thirsty animals are more likely to utilize and trample new growth of tree seedlings.

## MULTIPLE USE AND MANAGERIAL GENERALIZATIONS

Forests are important sources of many products other than timber. Production or preservation of multiple products is an important aspect of forest management. Utilization of livestock for vegetation management in conifer plantations can produce a variety of benefits to the forest manager. Obviously, consumption of fine fuels by livestock significantly decreases the probability of wildfire. Grazing can also open brushstands to increase ease of tree planting or plantation maintenance.

Researchers involved in grazing management within plantations agree that when livestock are managed according to existing environmental conditions damage to plantations is negligible, but when livestock are not managed, plantation damage is to be expected. When forage in the plantation is green and succulent damage to the plantation from browsing and trampling is least likely. Extending the grazing period beyond the green feed period increases the risk of damage to conifer seedlings. Typically, forage growing on plantations matures earlier in the summer than does that on similar uncut sites. The area should be observed and grazing entry modified if necessary to include the green and succulent period.

As grazing continues, the variety of available forage species decreases due to animal preference. Eventually the level of forage utilization in a plantation will increase to a threshold at which damage to seedlings becomes probable. This threshold level varies with season, time of stocking, weather, previous grazing programs kind of stock and site specific factors. When developing grazing programs, the selection of sheep or cattle as the grazer is influenced by availability of the animals and the nature of the plantations. Where browsing is to be minimized, cattle are often desired

since they rarely browse conifer seedlings and where concern is principally for damage to seedlings from trampling, sheep are often selected. Seeding plantations with palatable forages has been successful in reducing weeds and increasing the ease of grazing them properly.

From the existing literature and experience of forest managers, it is clear that livestock grazing can be an effective tool the forester can integrate into management programs for forest plantations. Success in application is largely a function of application of existing knowledge to site specific management programs. Not all plantations can be successfully grazed and not all areas of grazeable plantations can necessarily be grazed. Livestock are limited by slope, water availability, behavioral characteristics, slash, accessibility of clearcuts and other factors. To use grazing successfully, the forest manager must understand how to encourage livestock to graze in a time and way that benefits the plantation as well as provides for livestock benefits of growth or maintenance.

## HALL RANCH STUDY

On the Hall Ranch portion of the Eastern Oregon Agricultural Research Center, we have studied response of trees, cattle and herbaceous plants on an area of mixed coniferous forest that was clearcut in 1963.

Following clearcutting in 1963, a 30 acre area was broadcast burned in the summer of 1964. Half of each of three pastures was seeded to forage species using a split plot design in the fall of 1964 and in the spring each pasture was planted to trees at a density of 1000 seedlings per acre. Equal numbers of ponderosa pine, Douglas-fir, western larch (*Larix occidentalis)* and western white pine *(Pinus monticola)* were planted on a 6 by 7 foot spacing. In summer, 1966, cattle grazing was begun. Three pastures, each five acres in size, were grazed. The livestock grazing season was during the green feed period in late June or early July continuing for 30 days at a rate of 1.3 acres/animal unit month. From 1966 to 1972, one pasture was grazed by cattle only and two were grazed by cattle and big game. In 1972 cattle were removed from one pasture grazed by cattle and big game previously. Water and salt were located in each pasture to encourage uniform grazing.

### Vegetation Response

Responses of vegetation were measured periodically. By 1982, 20 years after logging, long term changes in succession were evident. The understory of the plantations were made up of a mixture of native and introduced herbaceous plants. Areas that were not seeded were dominated by Kentucky bluegrass *(Poa pratensis)* and elk sedge *(Carex geyeri)*. Tall oatgrass *(Arrhenatherum elatius)*, orchardgrass *(Dactylis glomerata)* and blue wildrye *(Elymus glaucus)* were persistent. Timothy *(Phleum pratense)* was important in the 1970s but was sparse by 1982. Smooth brome *(Bromus inermis)*, mountain brome *(Bromus marginatus)* and white clover *(Trifolium repens)* never established in large amounts. Forbs were abundant but contributed little to the forage supply. Shrubs were evident where big game were excluded, consisting predominantly of ninebark *(Physocarpus malvaceous)* redstem ceanothus *(Ceanothus sanguineus)*, birchleaf spirea *(Spirea betulifolia)* and snowberry *(Symphoricarpos albus)*. Under this grazing program cattle alone were ineffective in controlling shrubs.

Seeding of forage species reduced establishment of many native species. All native grasses, except pinegrass *(Calamagrostis rubescens)* and tall trisetum *(Trisetum canescens)*; large and abundant forbs; and all shrubs, except baldhip rose *(Rosa gymnocarpa)* were reduced by forage seeding. Seeded

forages moved into unseeded areas to a limited extent with tall oatgrass and orchardgrass being the most aggressive. Forage yield peaked at 950 to 1600 lbs/acre in the middle 1970s and by 1982 yield had declined to a maximum of 850 lbs/acre. The decline in forage yield was a result of increasing growth of the tree overstory. By the end of the grazing season each year, utilization of orchardgrass was about 55% and other grasses were utilized from 40-59%. None of the dominant forbs were utilized heavily by the cattle.

**Tree Response**

Survival of planted trees was similar for all grazing treatments. Ponderosa pine and Douglas-fir had a survival rate of about 60% and survival of western larch and western white pine was about 30%. Most losses had occurred by the fourth year after planting. Losses due to damage by livestock accounted for 8% of total mortality and damage from big game and rodents accounted for 18% of the total mortality. There were no differences in height growth or survival of planted conifers in the plots seeded to forages compared to the unseeded plots. Even though the seeded areas were more productive of herbaceous vegetation, the grazing impact on the understory probably reduced moisture losses in the seeded areas.

In 1982, height growth of all conifers was significantly greater in the pasture grazed by cattle and big game when compared to the pasture where cattle were excluded (Table 1). Where cattle were grazed alone, height growth of the planted trees was equal or better than areas where cattle were excluded. If we consider the practical comparison, cattle and game grazing, compared to game only grazing, is the same as grazed by livestock or not grazed since control of big game is not feasible on a large scale. In this situation grazing by cattle resulted in increased height growth of ponderosa pine by 13%, Douglas-fir by 18%, western white pine by 44% and western larch by 38% when compared to trees in pastures not grazed by cattle.

Table 1. Height growth (feet) of four conifer species in 1982, eighteen years after planting.

| Species | Cattle & Game Grazing | Game Grazing Only | Cattle Grazing Only |
|---|---|---|---|
| Ponderosa Pine | 19.9 | 17.6 | 18.6 |
| Douglas-fir | 25.5 | 21.6 | 21.7 |
| Western white pine | 24.0 | 16.7 | 22.4 |
| Western larch | 29.2 | 21.2 | 28.6 |

Diameter at breast height (DBH) was also significantly higher for planted conifers in the pasture grazed by cattle and big game when compared to the pasture where cattle were excluded (Table 2). Where cattle grazed alone, DBH was also greater for all species than where cattle were excluded. The comparison assuming control of big game is not practical, indicated cattle grazing enhanced diameter growth for ponderosa pine by 9%, Douglas-fir by 26%, western white pine by 56% and western larch by 61% when compared to trees in pastures not grazed by cattle. These increases in growth were probably a result of improved moisture relationships and increased nutrient cycling in the pastures grazed by cattle.

In this study an additional benefit was about 50 lbs/acre growth on the yearlings that grazed the plantation. If yearlings are worth 80¢ /lb, this would be a gross return from grazing of $40.00 per acre.

Table 2. Diameter at breast height (inches) of four conifer species in 1982, 18 years after planting.

| Species | Cattle & Game Grazing | Game Grazing Only | Cattle Grazing Only |
|---|---|---|---|
| Ponderosa pine | 4.8 | 4.4 | 4.6 |
| Douglas-fir | 4.4 | 3.5 | 3.7 |
| Western white pine | 3.9 | 2.5 | 3.9 |
| Western larch | 5.0 | 3.1 | 4.5 |

## CONCLUSION

The studies and experiences reported indicate it is feasible and practical to utilize livestock for vegetation control in forest plantations. The manager will face a multitude of site, social, livestock and economic factors that make each situation somewhat unique. Success depends on developing prescriptions for management of plantations that integrate the many tools available for vegetation control. Within a plantation, it may be necessary to control vegetation with herbicides or mechanically where the plantations cannot be grazed and to develop grazing prescriptions where grazing is practical. When properly used, grazing of livestock is probably the most economical method available for weed control.