# CHAPTER 10:
# Applying Targeted Grazing to Coniferous Forest Management in Western North America

By Steven Sharrow

*Steve Sharrow* is a Professor of Rangeland Ecology and Management at Oregon State University, Corvallis, OR.

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## 10 KEY POINTS

- Concern over mechanical and chemical treatments is prompting forest managers to opt for grazing to manage vegetation.
- Grazing in open-canopy forests can manage vegetation that competes with trees for water and nutrients.
- Several factors determine animal selection, especially the type of plants growing under and between the trees.
- Livestock accustomed to being managed as a herd will likely remain together when moved in a forest.
- Sheep grazing young plantations need adequate palatable forage.
- Flock tightness may need to be adjusted to meet specific prescription needs.
- The palatability of conifer foliage declines rapidly as it matures.
- Lower quality forage in silvicultural prescriptions may cause seasonal weight changes.
- Increased conifer growth is a main benefit from targeted livestock grazing.
- Browsing seldom kills planted conifers unless the trees are totally defoliated.

## INTRODUCTION

Forestlands in North America have long served as important forage sources for both wildlife and livestock. In the West, forest management has progressed from an emphasis on livestock grazing as the primary land use up to around 1910, then through a period emphasizing tree production until the 1960s, and now to a period emphasizing multiple use management and environmental values. Intensive forest management that focused on commercial tree production since the 1950s is being reevaluated in light of new interest in forest ecosystem health and environmental concerns about clear cutting, slash burning, and chemical weed control.

Traditionally, understory vegetation in established forests and plantations was managed by mechanical and chemical removal. Mechanical methods are expensive, often several times more costly than using livestock or herbicides. Public concern about using chemicals to suppress unwanted vegetation in plantations of young trees is prompting many forest managers to take a closer look at livestock grazing as a more environmentally acceptable and cost-effective management tool.[14, 32]

Livestock grazing has long been recognized as having an impact – either negative or positive – on forest vegetation. Colville commented in 1898 about browsing damage to young conifers from heavy sheep grazing that had been under way in the Oregon Cascades for about 11 years prior to his report. On the other hand, Sparhawk noted in 1918 the usefulness of sheep grazing to reduce fire hazard in central Idaho.

### Vegetation Management Opportunities

Targeted livestock grazing offers many opportunities for managing coniferous forests including pines, firs, spruce, hemlock, and larch. Grazing applications include removing biomass from grasses, forbs, and shrubs to prepare a site for planting tree seedlings; to reduce competition with young trees; to reduce snow press from tall grasses and forbs; as a pre-thinning treatment to remove shrubs and make thinning easier; as a post-thinning treatment to reduce slash; and to remove forest floor and ladder fuels to reduce fire risk or to create firebreaks.

In open-canopy forests such as ponderosa pine, lodgepole pine, or pinyon pine, grazing can be used to manage ground vegetation that competes with trees for soil water and nutrients. Decades of fire suppression in these historically open forests has resulted in expansive closed-canopy forests today. The accumulation of combustible fuels in these forests has rendered them highly vulnerable to wildfire. Targeted grazing can reduce vegetation fuel loads and ladder fuels to help minimize the risk of destructive wildfires and protect fences, houses, and other rural infrastructure.

Successes in using targeted grazing on forestlands are widely reported. In young conifer plantations, livestock grazing has controlled both brush[21, 38, 43, 44] and herbaceous vegetation.[8, 39] Thomas (1985) reported that sheep grazing in newly established conifer stands in the Tahoe National Forest reduced deerbrush canopy cover from 35-45% before grazing to 10-20% after grazing with only 1-2% of conifers damaged. In Oregon's coastal forest, sheep grazing substantially reduced vine maple, salmonberry, thimbleberry, and red alder with little accompanying damage to Douglas fir trees.[38, 40] Sheep graze agroforests (trees grown in improved pastures) in New Zealand,[20, 29] Australia,[4] and Chile[36] as a means of harvesting the understory grass crop without harming young Radiata pine being grown for saw timber. In western Oregon, up to 50% of the grass-clover forage produced in young Douglas fir agroforests can be harvested by sheep without significant damage to trees.[39] Kabzems (1992) mentioned the successful use of sheep grazing in British Columbia boreal forests to reduce the height of Canada reedgrass and fireweed in young conifer stands, which reduces the danger of young trees being crushed by snow press. Sheep also have grazed brush from sites in preparation for tree planting.[44]

### Criteria for Animal Selection

When selecting animals for grazing in forests and plantations, one must consider the type, breed, and class of livestock and the size and topography of the area to be managed with targeted grazing. Of particular importance is whether the plant community between and under coniferous trees is predominantly herbaceous grasses and forbs or woody shrubs. Cattle have

been used in some open forest plantations to reduce biomass of grasses and forbs between plants. However, cattle generally cause greater trampling damage than sheep or goats.[1] Sheep tend to avoid browsing coniferous trees in favor of forbs and grasses. Sheep also travel frequently while grazing, so tree browsing is generally spread fairly evenly among trees in grazed areas.[39] Goats are more likely than sheep to strip bark from woody plants. While this can damage trees, it also provides an opportunity to use goats to girdle and kill target brush and hardwood tree species, even after the vegetation has grown quite large. Although cattle can damage young conifers by browsing and trampling, sheep and goats impact trees predominantly by browsing[15, 39] and, to a lesser extent, by stripping bark.[3, 39]

Dry ewes or nannies, because of their lower nutrient requirements and greater ease of herding, generally are preferred over those with lambs or kids. Little has been published about grazing rams or wethers in timbered pasture, but practitioners have noted that they can be used quite effectively.

Yearlings have been used to manage forest understory, but they browse both shrubs and young conifers more readily than do older ewes or lambs.[14, 31] Gillingham et al. (1976) observed that on agroforests grazed in the spring, yearling Romney ewes browsed at least twice as many Radiata pine trees as mature Romney ewes. Thomas (1985) preferred using ewes older than four years over younger sheep because the older sheep appeared to more selectively avoid browsing conifers.

The breed of sheep appears to make little difference in the risk of grazing damage to young trees.[31] However, breed selection may be important because breeds differ in their herding tendencies. Merino or Rambouillet crossbreeds like Columbia are easier to herd because of their greater tendency to form a tight flock. Farm sheep breeds like Suffolk, Romney, and Hampshire have been used successfully for fenced agroforest grazing[39] and for open-herded forest grazing.[26] However, their tendency to form numerous small groups makes controlling large numbers of them a challenge in steep, brushy country.

Learning is an important part of animal behavior. Livestock that are accustomed to being managed as a herd are more likely to remain together when moved to the forest. Likewise, animals that are wintered under trees or otherwise accustomed to eating conifer needles are more likely to continue this habit. Because livestock can learn from observing each other, it is advisable to quickly identify and remove individuals that are causing problems.

Livestock used in targeted forest grazing are entering habitat that most often supports other native grazing and predatory animals. It is important that health protocols be adequate to ensure that parasite or disease transfer does not occur between livestock and deer, elk, big horn sheep, or other native herbivores. It is equally important that bears, cougars, wolverines, or other local predators do not become aware of livestock as possible prey by consuming carcasses of livestock that have died in the forest. Bringing healthy livestock onto the forest and properly disposing of any dead animals are crucial in avoiding problems with local wildlife.

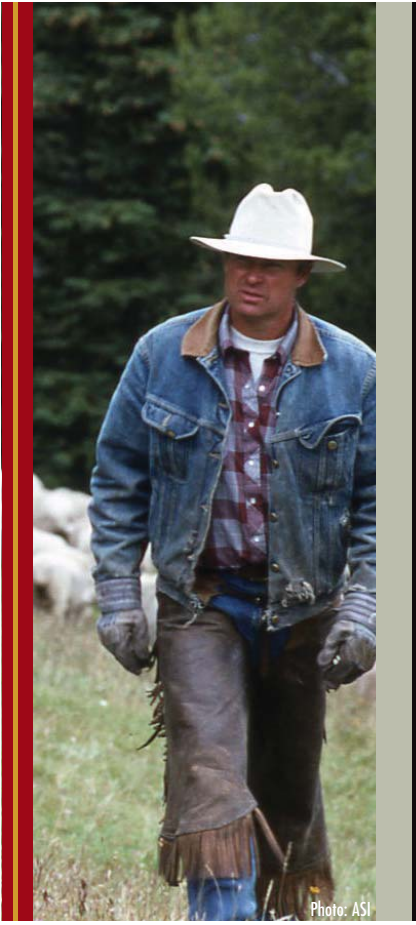
## Grazing Strategies in Coniferous Forests

Using livestock to control weeds in young conifer stands depends on 1) the willingness of animal to consume target weed species, 2) the ability to minimize conifer damage, and 3) slow regeneration of the target species. Given the opportunity, sheep often eat a small amount of browse even when young herbaceous forage is plentiful. This may explain the observation that conifer browsing by sheep is a greater problem when timber plantations lack alternative browse plants.[14, 39] When sheep are grazed in young tree plantations, adequate palatable forage should always be available. When grass is mature and other browse is unavailable, sheep will eat conifer foliage.[31]

Small areas without stumps, steep slopes, stream channels, or other impediments may be fenced for livestock control. Areas where fencing is impractical because of size or terrain are best grazed using open-herded techniques with a shepherd and herding dogs. Generally, the economic minimum for open-herded forest grazing is 600 to 1,000 sheep, with flocks of 1,500 animals being common.

The herd impact includes both foraging and physical effects. Tight flocks actively moved through a site tend to trample and walk down more plants than they eat. This impact can be especially useful in northern forests for reducing snow press, where tall herbaceous vegetation collapses under the weight of snow, crushing and deforming the trees. Trees with weakly attached buds, like spruce, may be damaged by rubbing as animals pass by. Managing loose flocks that are allowed to move slowly through an area can reduce damage from trampling. To meet specific prescription needs, flock tightness may be adjusted by altering herding practices and herd composition.

Tree species vary in palatability. Generally, sheep and goats prefer to browse hardwoods over conifers.[22, 24] Phelps (1979) reported little browsing on trees in a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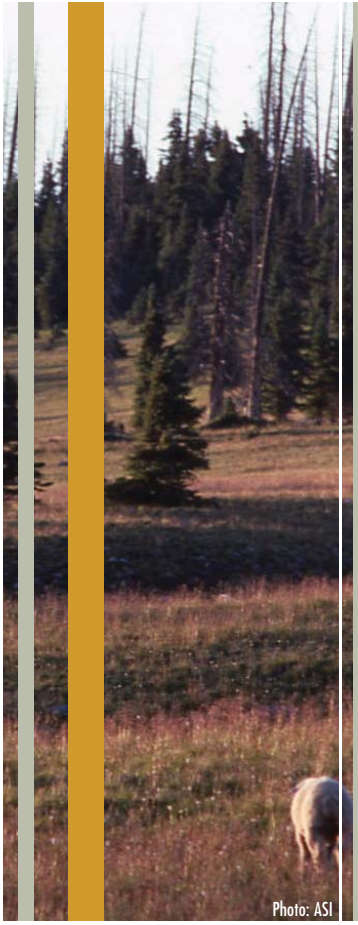
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mixed stand of Pacific silver fir, Douglas fir, and western hemlock in which herded sheep consumed about 47% of the understory vegetation. Among conifers, spruce is unlikely to be browsed even under high grazing pressure[2, 29] while Douglas fir, ponderosa pine, western hemlock, western white pine, and western larch are frequently grazed.[13] Ellen (1990) listed pine, Douglas fir, and spruce in order of decreasing susceptibility to sheep browsing. White fir has been reported to be more readily browsed than Douglas fir, ponderosa pine, or sugar pine.[35] Western red cedar is more palatable to browsing than Douglas fir.[17]

Season strongly affects the levels of browsing on conifers. The palatability of conifer foliage declines rapidly as it matures.[24] Sheep and goats are more likely to browse trees shortly after bud break in the spring when new light-green needles are present.[12, 25] Mature needles (fully expanded and dark green) are much less attractive to browsing animals than immature needles, and old needles from previous years' growth are seldom consumed. Spring bud burst in conifers often coincides with initiation of spring growth of associated grasses and forbs, both of which are more palatable than young conifers. By the time grasses and forbs have matured, conifer foliage has also matured. During the summer, forest shrubs and young hardwood trees generally are more palatable to sheep and goats than conifers. So, while palatability of conifer foliage varies substantially throughout the season, sheep seldom seek it over other available forage.[24]

The seasonal pattern of forage value and palatability suggests a two-pass grazing strategy where both grasses and shrubs compete with young trees. A flock or herd can be moved quickly from plantation to plantation during the spring to harvest the fresh green forage, then returned for a longer stay after grasses and forbs have matured in early summer to consume brush, walk down tall vegetation, reduce fire fuel loads, and achieve other silvicultural prescription goals.

Sheep rarely chew or strip bark from conifer trees in forest plantations. Debarking in open-forest grazing has generally been negligible except in areas where livestock are concentrated, as on bedding grounds. Research has reported that in intensively grazed pastures sheep debarked 2-7% of trees to some extent.[3, 39] Debarking was concentrated on smaller trees in the stand,[3] especially near bedding areas.[39] Debarking rarely kills the tree. However, trees stripped of bark are more susceptible to attack by insects or pathogens. Tree growth is unaffected by debarking unless more than 50% girdling occurs.[28, 39]

## Animal Production Considerations

Sheep or goats applied in silvicultural prescriptions to manage woody plants in timber plantations often consume lower quality forage than if allowed to graze freely, resulting in lower diet quality and seasonal weight gains. Most woody species targeted for grazing, including woody vines, shrubs, and young hardwood trees, are green in the summer when grasses and forbs have matured, so sheep and goats will readily eat them. Several studies have compared weight gains of sheep browsing in forest clear cuts and local pastures. Phelps (1979) reported that ewes lost an average of 23 pounds per ewe during a summer of grazing Douglas fir/western hemlock forest in the Cascade Mountains of Washington. Producers grazing sheep in clear-cut spruce forest in British Columbia reported that while sheep gained weight on the forest, it was 68% less than sheep grazing local irrigated pasture.[41] During a four-year study, ewes grazing young Douglas fir forest in the spring lost weight, while ewes and lambs grazing local improved pasture gained weight.[26] In the summer, however, weight losses were similar for dry ewes on both forest and local pasture. Poor summer weight gains were probably caused by forcing sheep to eat brush that was relatively high in tannin, which reduces protein availability in the animal's stomach. Few studies have been done to examine goat production in the management of coniferous forests. However, goats are better able to tolerate plant chemical defenses such as tannins, and their performance grazing shrubs would be expected to be better than that of sheep or cattle. Goats, like sheep, are very selective grazers that are trying to obtain a highly nutritious diet. Although more likely to consume shrubs than are cattle or sheep, they often select young green grasses and forbs before making shrubs a large part of their diet.

### *Effectiveness and Integrated Management*

Increased growth of conifers in grazed plantations is often reported as a main benefit of livestock grazing (Table 1). Silvicultural management, including grazing treatments, generally affects conifer diameter growth more than height growth.[40] While diameter grows any time resources and climate are adequate, height and branch length increase only from bud break until the cells contained in the bud are all fully extended. Reduction of competing vegetation will have its greatest impact on tree growth during the resource-limited portion of the growing season when trees have completed height growth but are still increasing in diameter. As a result of livestock grazing, ponderosa pine height increased 13-15% more than without grazing while the diameter increased 9-27%. The increases were 38% in height and 61% in diameter for western larch and 44% in height and 56% in diameter for western white pine.[9, 21] Conifers in these grazed pastures increased their growth because they have less competition,[9, 40] more retained soil moisture,[9, 15, 23] and more rapid nutrient cycling.[23]

**Table 1.** The increased diameter and height of Douglas firs in a targeted grazing situation compared to ungrazed sites. Values are expressed as a percent greater than trees on an ungrazed site.

| Livestock | Diameter | Height | Age * | Source of Data |
|---|---|---|---|---|
| | ----- % increase ---- | | | |
| Sheep | 8 | 10 | 33 | Jaindl and Sharrow 1988 |
| Sheep | -- | 27 | 12 | Hedrick and Keniston 1966 |
| Cattle | 31 | 7 | 3 | Doescher et al. 1989 |
| Sheep | 7 | 5 | 6-8 | Sharrow et al. 1989 |
| Cattle | 26 | 18 | 18 | Krueger and Vavra 1984 |
| Sheep | 22 | 6 | 11 | Sharrow et al. 1992b |
| Sheep | -- | 20 | 10 | Cleary 1978 |

* Years since planting at time of measurement

Another long-term benefit of grazing results from a process called competitive exclusion, in which one species benefits when a potentially troublesome competitor is excluded. An example can be found in Oregon where growth of Douglas fir trees was initially reduced by sheep browsing trees in a grass-seeded, clear-cut coastal forest. The combination of grass competition and grazing slowed establishment of red alder (the potentially troublesome competitor) such that 10 years later, Douglas fir timber basal area was 50% greater in grazed portions of the clear cut.[40] Total tree basal area was similar for grazed and ungrazed units, but the ungrazed areas were half Douglas fir and half alder, while almost all of the tree basal area where sheep grazed was Douglas fir. Short-term studies of tree response may be misleading about the true benefits of grazing.

Conifer regeneration can be damaged by browsing, particularly when sheep are poorly controlled or plantations are overgrazed.[30] In his review of the impacts of mammal damage in temperate forests, Gill (1992) noted that the potential of tree seedlings to survive after browsing is directly related to tree size. Younger trees are generally less likely to survive a browsing event than older ones. Tree mortality is greatly reduced after trees reach a critical age and size. The time needed to reach this stage varies with tree species and appears to be about one year for Douglas fir[7] and slash pine.[27] Two-year-old trees are planted most commonly in commercial forests, so browsing seldom kills planted conifers unless the trees are totally defoliated.[7, 27] For example, Sharrow et al. (1992b) reported no mortality of trees in a three- to four-year-old Douglas fir plantation heavily grazed by both deer and sheep even though some trees lost 90% of their new needles each of two consecutive years. Pearson (1931) observed that ponderosa pine seedlings completely defoliated by livestock generally died, while those with even a single fascicle of needles remaining after grazing often survived. Reduced tree growth rather than mortality is the most likely result of browsing damage.

When conifers are browsed, the associated understory plants are generally also defoliated. The benefit to the conifer trees from reducing competition of grasses and shrubs often makes up for the damaging effect of losing tree foliage to browsing.[15] Conifers tolerate high levels of lateral branch defoliation without appreciable loss of growth. More than 50% of a tree's foliage must by defoliated before growth is measurably reduced.[27] Even then, growth reductions may not be dramatic. Loss of the terminal leader (the uppermost stem that is the extension of the main trunk) is more detrimental to future tree growth than is the removal of lateral foliage[33, 40] perhaps because of the role the terminal buds play in hormonal regulation (apical dominance) or the potential for future growth that their buds represent.[40] When the terminal leader on young Douglas fir trees remained intact after 75% defoliation of current year's lateral branch foliage, the height was not reduced and the diameter growth was reduced by only 1.5%.[33] This is why tree producers are more concerned about protecting terminal leaders than lateral branches.



Photo: ASI

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