SHEEP AND TIMBER: ARE THEY COMPATIBLE?

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The Douglas-fir (Pseudotsuga menziesii) forests of western Oregon and Washington are among the most productive forests in the world. Following timber harvest, herbaceous and woody plants rapidly establish themselves and compete with planted crop trees for soil nutrients and light. In the past, foresters have mainly relied on phenoxy herbicides to control the competing vegetation. Due to increasing costs, and public concern over possible health risks associated with herbicides, silviculturists are becoming increasingly interested in the potential usefulness of sheep as a biological control agent for brush. Sheep grazing also offers the potential for increased red meat production and improvement of wildlife habitat.

Past research on sheep grazing in the Pacific Northwest has produced conflicting results. Some information indicates that controlled sheep grazing can increase soil moisture and enhance tree growth, while other data show high levels of browsing on young timber regeneration and, consequently, reduced growth rates.

A study was initiated in 1980 to evaluate the potential of using herded sheep as a silvicultural tool to suppress brush in Douglas-fir plantations. A major objective of this research was to determine methods of grazing clearcuts which are compatible with forestry objectives.

EXPERIMENTAL PROCEDURE

The study was conducted in the Coast Range approximately 10 miles west of Alsea, Oregon. Five clearcuts within the vine maple (Acer circinatum) - sword fern (Polystichum munitum) vegetation type were selected for observation. Included in the study were plantations which were three years old and forage-seeded with a mixture of grasses (GS1 and GS2), and five- to six-year-old plantations which had not been forage seeded (NS1, NS2, and NS3).

A 100-foot-by-100-foot livestock exclosure was established in each study clearcut to serve as an ungrazed reference area. Differences in standing crop of vegetation at the end of the growing season were determined by comparison of material harvested inside to material clipped outside the exclosure. Soil moisture inside the exclosure was compared to levels in grazed areas on sites NS1 and GS1 in mid-summer each year. The effects of sheep grazing on tree growth was evaluated by comparing yearly height and diameter growth for 100 permanently marked trees within the exclosure to those of 100 adjacent trees in the grazed region of the clearcut. Browsing and mechanical damage (trampling and debarking) to 150 permanently marked trees were visually assessed prior to and immediately after sheep grazed each study clearcut.

A band of 600 ewes and their lambs in 1981 and a band of 900 dry ewes in 1982 grazed the forest from May to September. Clearcuts GS1 and NS1 were grazed in the spring (May), GS2 and NS2 in the summer (July), and GS1 (regrazed) and NS3 in the late summer (August) each year.

RESULTS AND DISCUSSION

Heavy browsing of Douglas-fir regeneration was largely confined to the spring period when new, soft needles were present (Table 1). Spring-grazed clearcuts (NS1 and NS2) showed obvious browsing with 13 to 44 percent of all new conifer growth being consumed by the sheep. High levels of forage utilization on both plantations undoubtedly contributed to the amount of tree browsing observed.

In contrast to the spring period, little browsing of Douglas-fir occurred during the summer through fall periods. An exception to this was on GS1 where a new flush of growth from secondary bud break coincided with a second grazing period, producing conditions similar to those encountered in the spring. When Douglas-fir was browsed by sheep in the summer, use was generally confined to nipping one or two small lateral branchlets on the browsed trees. This pattern of use often resulted in the apparent severity of damage being greatly overstated by the percent of trees browsed (Table 1). The actual amount of browsing which occurred on Douglas-fir trees during the summer period was so light as to be detectable only by careful examination.

No effects of sheep grazing on height growth of Douglas-fir trees was evident on sites GS2, NS1, NS2, and NS3 (Table 2). Trees on grazed plantations, however, had diameter growth which ranged from 7 to 14 percent greater than that of trees in ungrazed control areas. Failure of tree growth to be reduced by loss of as much as 13 percent of current year's foliage growth (NS1) indicated that, while browsing of terminal leaders may reduce height growth, moderate browsing of lateral branches alone is unlikely to adversely affect tree growth.

Repeated, severe browsing of young trees may reduce their growth, especially if terminal leaders are consumed. This occurred on GS1, where two periods of heavy grazing in both 1981 and 1982 resulted in consumption of approximately 65 percent of current year's foliage growth together with extensive use of terminal leaders each year. Tree height growth was reduced by 51 percent, and 24.9 percent less diameter increase was recorded for grazed compared to ungrazed trees in GS1. The long-term effects of such growth losses are unclear.

Table 1. Percent of Douglas-fir trees damaged as a result of sheep grazing, height of trees, and utilization of ground vegetation by sheep on five study clearcuts in 1981 and 1982.

Item	Study clearcuts					
	NS1	GS1 Spring	NS2	GS2	GS1 Summer	NS3
1981						
Terminals browsed (%)	5	59	0	2	--	0
Laterals browsed (%)	75	98	37	11	--	12
Mechanical damage (%)	2	3	5	1	--	2
Douglas-fir CYG consumed (%)+	13	41	2	1	--	1
Ground vegetation CYG consumed (%)+	65	67	57	37	--	40
Average Douglas-fir height (ft)	5.4	2.3	9.7	3.1		10.1
1982						
Terminals browsed (%)	0	70	0	1	58	0
Laterals browsed (%)	87	100	14	21	87	50
Mechanical damage (%)	1	1	1	0	2	0
Douglas-fir CYG consumed (%)+	18	44	1	2	19	3
Ground vegetation CYG consumed (%)+	59	36	26	44	35	24
Average Douglas-fir height (ft)	7.5	2.7	12.3	4.3	3.1	13.0

+ CYG is current year's growth within the reach of sheep (4.9 ft above the soil surface).

Table 2. Diameter growth and height growth of Douglas-fir trees from grazed (G) and ungrazed (U) portions of five study clearcuts during the 1981-82 growing season.

Clearcut	Diameter (in)		Height (in)	
	G	U	G	U
GS1	0.17**	0.22	4.3	8.9**
GS2	0.29	0.27	15.0	16.3
NS1	0.53*	0.51	27.1	28.1
NS2	0.68*	0.60	41.2	41.3
NS3	0.70**	0.61	36.4	89.9

*, ** Grazed differs from ungrazed $P < .05$, $P < .01$, respectively.

Mean standing crop of brush species at the end of the growing season in October each year was consistently higher on ungrazed compared to grazed plots (Table 3) regardless of season of grazing use. Biomass of vine maple, one of the principal target species, was reduced 57, 88, and 67 percent on units NS1, NS2, and NS3, respectively, as a result of grazing in 1981. These data suggest that brush suppression was occurring. Target brush species such as vine maple, salmonberry (Rubus spectabilis), and thimbleberry (Rubus parviflorus) did not regrow substantially following defoliation even when grazed early in the spring.

Table 3. Mean standing current year's growth of browse (lbs/acre) on grazed (G) and ungrazed (U) treatments in 1981 and 1982.

Clearcut	Year			
	1981		1982	
	G	U	G	U
GS1	210	270	280*	450
GS2	330	450	600	700
NS1	230**	950	610**	1640
NS2	180	290	200*	370
NS3	460	730	150*	330

**, * Grazed less than ungrazed $P < .01$, $P < .05$, respectively.

Defoliation of ground vegetation by sheep apparently reduced soil moisture withdrawal by the deeply rooted brush species, while stimulating regrowth, and therefore soil moisture use, by herbaceous plants. Spring-grazed plantations had similar or slightly less soil moisture in the upper two feet of soil, but more soil moisture below two feet, than did the controls in August each year.

In addition to suppressing competing vegetation, sheep grazing may enhance tree growth by increasing the effective fertility of a site. The amount of nitrogen consumed by sheep was estimated for each clearcut in 1981 by multiplying the amount of forage consumed by its percent nitrogen content. This was done for each major plant species and the resulting values were summed to get a total for each clearcut. Estimates were 17, 21, 11, 10, and 10 lbs per acre of nitrogen consumed by sheep for clearcuts NS1, GS1, NS2, GS2, and NS3, respectively. The majority of nitrogen consumed will pass through the animal and will be excreted in the clearcut as urine. Urine nitrogen, because of its solubility in water, is readily available to plants. The resulting increase in nitrogen fertility is equivalent to application of about 80 lbs per acre of ammonium sulfate to spring-grazed plantations and 50 lbs per acre of ammonium sulfate to summer-grazed clearcuts.

MANAGEMENT IMPLICATIONS

Our observations suggest that sheep may be successfully employed as a silvicultural tool to suppress the growth of brush in Douglas-fir plantations. When proper season and degree of use are observed, growth of the tree crop may be enhanced by grazing. Brush suppression is more easily achieved in the summer through fall period than it is during the spring. Relative palatability of Douglas-fir to sheep and, therefore, potential for tree damage are greatest in the spring following bud break. Proper livestock management, including careful selection of bedding grounds and light to moderate use of forage plants (less than 35 percent utilization), should allow even young plantations to be safely grazed in the spring. Unfortunately, the relatively high levels of utilization which will force sheep to consume substantial amounts of brush in the spring also will result in considerable use of Douglas-fir new growth. Once needles have matured, Douglas-fir is not readily eaten by sheep. In addition, as herbaceous plants mature in late spring, sheep were observed to more readily consume browse. Greater inclination of sheep to accept browse, together with the relatively high grazing pressures which may be safely applied to plantations in the summer, make it an attractive season to manage livestock for brush suppression.

Information gathered to date indicates that a grazing system employing light to moderate utilization of clearcuts in the spring by either dry ewes or ewes with 12-plus-week-old lambs, followed by heavy utilization of units targeted for brush reduction in the summer through fall period, should provide both brush suppression and acceptable levels of animal production. Damage to Douglas-fir trees under this system should be minimal.