Trampling Damage by Cattle on Northern Idaho Forest Plantations

D.M. EISSENSTAT, J.E. MITCHELL, AND W.W. POPE

Abstract

The effects of cattle trampling in a Douglas-fir plantation the first year after planting were assessed. Trees partially girdled due to trampling were much more likely to die than untrampled trees ($\alpha = .0001$). An average of 19% of the trees in the plantation had been trampled; however, the damage was uneven due to clumped cattle distribution. The results reflect the hazard of grazing Douglas-fir plantations in the northern Rockies during the first year after establishment.

In the northern Rockies, forest managers are concerned with the potential deleterious effect that livestock grazing has on tree regeneration failure. Transitory ranges are defined here as forested areas that are only suitable for grazing over a temporary number of years following logging, fire, etc., before the overstory canopy closes in, thereby intercepting the light needed for forage production. Several workers have reported significant mortality from high intensity or poorly controlled livestock grazing (King et al. 1978, Hedrick and Keniston 1966, Young et al. 1942). These workers also found properly controlled grazing to be compatible with tree regeneration. There is confusion, however, on the kinds of grazing systems that do not hinder regeneration of different tree species in different regions.

In the Southeast, slash pine *(Pinus elliotti)* is very resistant to livestock damage (Lewis 1980a). Pearson et al. (1971) found that neither light nor moderate grazing affected slash pine survival for the first 5 years after planting. Heavy grazing did result in 306 fewer trees per ha (124 per acre), but losses were fairly well distributed. The authors concluded that slash pine plantations can be heavily grazed the first year if cattle are witheld until June.

In the Northwest interior, trees appear to be variably resistant to livestock damage. Young et al. (1941) and Tisdale (1960) found moderately heavy grazing by sheep had no effect on the natural regeneration of white pine *(Pinus monticola),* grand fir *(Abies grandis),* and Douglas-fir *(Pseudotsuga menziesii),* but inhibited the regeneration of larch *(Larix occidentalis)* and western redcedar *(Thuja plicata).* Heavy grazing inhibited the regeneration of all conifers. McLean and Clark (1980) found negligible cattle damage to lodgepole pine *(Pinus contorta)* and Engelmann spruce *(Picea engelmannii)* where intensity and period of grazing were adequately controlled. High intensity grazing over a 3-year period caused large numbers of lodgepole pine and spruce seedlings to be killed or damaged, primarily from repeated trampling.

This study reports on the susceptibility of Douglas-fir to browsing and trampling damage in the redcedar zone of northern Idaho the first year after planting.

At the time of the research, authors were graduate research assistant and assistant professor, College of Forestry, Wildlife and Range Science, University of Idaho, Moscow, and research forester, Potlatch Corp., Lewiston, Idaho. D. Eissenstat's present address is: Dept. of Range Science, Utah State Univ., Logan 84322; J. Mitchell's is: USDA Forest Service, Rocky Mtn. Forest & Range Exp. Station, Ft. Collins, Colo. 80526; W. Pope's is: Potlatch Corp., Warren, AR 71671. This research was supported by grants from Potlatch Corporation, Idaho Research Foundation, and Clearwater-Potlatch Timber Protective Association, for which the authors are grateful.

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Study Area

The study site was located 16 km north of Headquarters, Idaho, and is generally classified as a western redcedar/myrtle pachistima *(Pachistima myrsinites)* habitat type (Daubenmire and Daubenmire 1968). It grades into a subalpine fir *(Abies lasiocarpa)*/myrtle pachistima habitat type at the slope base. A mature stand of western redcedar was logged in 1976 and thus created a 75-ha clearcut. In 1977 the slash was dozer-piled and burned, and in April 1978 the site was planted with container-grown Douglas-fir seedlings to an 8-ft (2.4-m) spacing. The seedlings have an average height of 24 cm and an average diameter of 3.0 mm.

Although a grazing allotment encompassed the plantation, the permittee was instructed to keep his livestock away from it by using temporary fences, riders, and different salting patterns. Nonetheless, about 5 to 25 cows and calves were periodically on the plantation from June until the end of October 1978. Only minimal and largely unsuccessful attempts were made to keep the livestock off the plantation. An actual stocking rate could not be calculated; however, estimates based on the plantation size and forage abundance indicated grazing intensities to be much less than intensities under conditions of normal permitted use. The number of seedlings trampled can serve as a relative index to grazing intensity (King et al. 1978). Animals congregated at the bottom of slopes and routinely traveled over low saddles and along hilltops.

Methods

A total of 842 seedlings were monitored every 3 weeks from 15 June until 1 October, 1978, for browsing and trampling damage. The seedlings were examined from three .3-ha (.75-acre) macro-

Fig. 1. *Illustration of cattle trampling scar at the base of 1-year-old Douglas-fir seedling in a western redcedar/myrtle pachistima habitat type.*

Table 1. Frequency response of Douglas-fir seedlings to animal damage in the first year of planting in a western redcar/myrtle pachistima habitat type in northern Idaho. Condition measurements were made 6 months after planting, in October 1978.

	Trampled			Browsed		No apparent animal damage	Total
	Cattle	Elk	Unknown	Deer	Gopher		
Bottomland							
Alive	1	0	7	2	0	118	128
Dead	45	3	17	0	8	60	133
Total	46	3	24	2	8	178	261
Southwest Slope							
Alive	7	1	4	2	0	192	206
Dead	22	1	11	0	5	41	80
Total	29	2	15	2	5	233	286
Northeast Slope							
Alive	9	0	11	11	0	211	242
Dead	9	0	12	2	3	32	58
Total	18	0	23	13	3	243	300

plots, selected to represent a cross section of the study area. The 3 sites were a northeast slope, a southwest slope, and a shallow draw (bottomland).

Trampling was strictly defined as any mechanical damage causing removal of the bark and exposure of the cambium (Fig. 1). The amount of bark removed was not measured, although a few scars exceeded 30% of the stem's circumference. Other forms of injury associated with trampling such as bending of the stem, soil compaction, or soil erosion and subsequent exposure of the roots were not classified as trampling because of their poorly defined nature and relatively high risk of biasing the results. Trampling was only attributed to a particular animal if a track was seen within 0.5 m of the tree seedling.

Browsing was determined by the location, angle, and sharpness of the cut. Ungulate browsing creates torn edges due to the lack of upper incisors, while browsing by rodents generally creates a clean cut (Lawrence et al. 1961). Different types of rodents can often be distinguished by the angle and location of the cut, or by the width of the gnawing marks. Early spring ungulate browsing was classified as deer or elk if it occurred prior to cattle entering the plantation. Pocket gopher browsing was generally characterized by the presence of soil mounds or soil casts with frequent removal of the root system.

Results and Discussion

A total of 160 trees or 19% were trampled during the first summer (Table 1). Cattle were responsible for at least 60% of the trampling damage. Of the total trees trampled, only 36% survived until October 1978 (Table 2). The overall rate of survival for untrampled seedlings was 77%. Trampling damage was negligible the second and third years after planting, since a much better effort was made to keep cattle out of the plantation. During this time period several trees were observed bruised by deer and elk hooves, but few had their cambium exposed to drying or infection. Douglas-fir bark by the second year after planting apparently is much firmer and less susceptible to tearing.

Few trees were browsed in the plantation (Table 1). Although no trees browsed by gophers survived, deer and elk browsing apparently had no effect on tree survival.

Table 2. Mortality probabilities of trampled Douglas-fir seedlings compared to untrampled seedlings. Measurements are for 6 months after planting in a western redcedar/myrtle pachistima habitat type of northern Idaho (sample size in parentheses).

	Bottom	SW Slope	NE Slope	Average
Trampled	.89 (73)	.52 (46)	.51 (41)	.64
Untrampled	.36 (188)	.23 (240)	.10 (259)	.23

Trees that had been trampled the first growing season were much more likely ($\alpha = .0001$) to die than untrampled trees (Table 2). The probability of a trampled seedling dying in the bottomland site was higher than on the slopes, but so was the mortality not associated with trampling. Testing the site by trampling mortality interaction (Snedecor and Cochran 1967) failed to show any significance ($\alpha = .05$).

Container-grown Douglas-fir seedlings are extremely susceptible to trampling damage the first year after planting. Unlike slash pine (Lewis 1980b), exposure of just a portion of the cambium in Douglas-fir (partial girdling) greatly increases the chances of the seedlings dying. Although a clumped livestock distribution had not been addressed in other studies (Clark and McLean 1978, Pearson et al. 1971), the uneven trampling damage common to plantations in northern Idaho further enhances the danger of grazing plantations too early. Timing of plantation grazing needs to be assessed with regards to the relative susceptibility of the difference trees species as well as the topography and habitat type.

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