

TWELVE YEARS OF PLANT SUCCESSION ON A SEEDED CLEARCUT UNDER GRAZING AND PROTECTION FROM CATTLE

Richard F. Miller, William C. Krueger and Martin Vavra

Forested foothills in northeastern Oregon are an important resource providing timber, and forage for livestock and wildlife. Work has shown the importance of seeding forage species after logging, to provide forage for big game and livestock (Miller and Krueger 1976, Miller et al. 1981). But little information, which evaluates changes in plant composition in seeded logged communities or the influence of grazing by domestic livestock on this successional process, is available. The primary purposes of this study were to evaluate changes in plant composition over 12 years in three habitat types after logging and seeding, and to measure the impact of cattle grazing on plant composition in these sites.

STUDY AREA

The study area is a 66-acre clearcut in the foothills of the Wallowa Mountains in northeastern Oregon on the Hall Ranch, part of the Eastern Oregon Agricultural Research Center. Three habitat types represented within the clearcut are grand fir/pachistima (Abies grandis/Pachistima myrsinites), Douglas-fir/ninebark (Pseudotsuga menziesii/Physocarpus malvaceus) and ponderosa pine/snowberry (Pinus ponderosa/Symphoricarpos albus). Aspect and soil depth are the two key factors influencing water availability for plant use across the three habitat types represented on the clearcut. Elevation ranges from 3,300 and 4,000 feet. Annual precipitation averages 25 inches, the majority falling as winter snow. The clearcut was logged in 1969, burned in July of 1970 and seeded at a rate of 6 pounds per acre in September 1970 to a mixture made up of orchardgrass (Dactylis glomerata), timothy (Phleum pratense), Manchar smooth brome (Bromus inermis), blue wildrye (Elymus glaucus), tall oatgrass (Arrhenatherum elatius) and white Dutch clover (Trifolium repens).

METHODS

Plant composition measurements were recorded in the third year after logging (1973) and again in 1984, across all three habitat types. During the summer of 1972, a 1-acre exclosure was constructed on each of the three habitat types to exclude cattle grazing from a portion of each habitat type. The exclosure did not exclude deer and elk. In 1984, similar plant measurements were recorded on the same sites, both where cattle had grazed and where cattle had been excluded since logging in 1969. Beginning in the summer of 1973 and continuing through 1984, cattle were grazed on the pasture under a deferred rotation system. Utilization levels on the clearcut ranged from 50 to 75 percent (ocularly estimated). Plant measurements recorded in 1973 and 1984 were frequency and peak standing crop for all herbaceous species and frequency, density and canopy cover for shrubs in 1984 only. Percent composition for the herbaceous component is based on a percent dry weight basis.

Frequency: Frequency of occurrence of plant species was recorded in 40 plots (1 x 2 foot²) in all three habitat types in 1973 and inside and outside the cattle enclosure in all three habitat types in 1984.

Standing Crop: Near peak standing crop, by each species, was sampled by the weight estimate method (Pechanec and Pickford 1937) on twenty 4.8 foot² circular plots in all three habitat types in 1973 and inside and outside the cattle enclosure in all three habitat types in 1984.

Shrub Canopy Cover: Canopy cover, by species, was measured with four 100-foot line intercepts on all three habitat types, inside and outside the enclosure, in 1984.

Shrub Density: Density, by species, was recorded in four belt transects 100 x 6 feet inside and outside the cattle enclosure in each habitat type. Density of shrubs was separated into height classes of 1 foot increments.

RESULTS AND DISCUSSION

Precipitation in 1973 was only 71 percent of average; in 1984 it was 150 percent. Herbaceous production was 2 to 5 fold higher in 1984 than 1973 across the three habitat types. A large part of this increase in production came from increased soil moisture availability in 1984, especially on the ponderosa pine/snowberry habitat type. The of 3 to 5 fold increase in the two wetter habitat types, however, cannot be explained by precipitation alone. This large increase probably is also caused by seeded grass species becoming well established and fully occupying the site.

Major changes in vegetation composition occurred from 1973 to 1984 on both the grazed and ungrazed (Tables 1,2,3). Twelve years of grazing by cattle, however, had little effect on the successional process of herbaceous species but did influence the shrub component (Table 4). Bull thistle (*Cirsium vulgare*) and California mullein (*Verbascum thapsus*) made up a large portion of the biomass (14 to 32 percent) during the early stages of succession following logging. However, both species declined during the 12-year period to less than 1 percent on all three habitat types. All the seeded grass species increased over the 12-year period with the exception of timothy. In 1973, both timothy and orchardgrass were the two most abundant grasses within the grand fir/pachistima and Douglas-fir/ninebark habitat types. In 1984, orchardgrass had maintained its superiority in abundance while timothy had declined. Tall oatgrass, smooth brome and blue wildrye contributed only a small portion of the total forage production on these two habitat types in 1973, but had become important forage producers by 1984. In the ponderosa pine/snowberry habitat type, seeded grass species established poorly. Factors attributing to seeding failure were the site being drier and competition from Kentucky bluegrass which had established before logging. Percent composition of seeded grasses declined in the ponderosa pine/snowberry habitat type while Kentucky bluegrass increased both on the grazed and ungrazed portions of this site. White Dutch clover contributed little to production across the three habitat types in either 1973 or 1984.

Very few shrubs occurred in the frequency or production plots in 1973 so neither cover or density were recorded. However, by 1984, they had increased.

Cover, density and size of shrubs were influenced by livestock grazing (Table 4). On the grand fir site, only a trace of redstem ceanothus (Ceanothus sanguineus) occurred on the grazed area. On the Douglas-fir and ponderosa pine sites, shrubs were both fewer and smaller on the grazed as compared to the area ungrazed by cattle. Holechek et al. (1982) reported shrubs contributed a significant part in the diet of cattle on forested range in the Blue Mountains.

CONCLUSIONS

Orchardgrass and timothy established rapidly during the early stages of succession along with less desirable plants such as bull thistle and California mullein. As succession progressed, orchardgrass maintained its dominance while smooth brome, blue wildrye and tall oatgrass increased and timothy, bull thistle and California mullein decreased. Cattle grazing had little effect on plant composition of herbaceous species across the three habitat types. However, 12 years of cattle grazing influenced the presence of shrubs, reducing both density and size.

LITERATURE CITED

- Holechek, J.L., M. Vavra, J. Skovlin and W.C. Krueger. 1982. Cattle diets in the Blue Mountains of Oregon II. Forest. Journal Range Management. 35:239-242.
- Miller, R.F. and W.C. Krueger. 1976. Cattle use on summer foothill rangelands in northeastern Oregon. Journal Range Management. 29:367-371.
- Miller, R.F., W.C. Krueger and M. Vavra. 1981. Deer and elk use on foothill rangelands in northeastern Oregon. Journal Range Management 34:201-204.

Table 1. Frequency, standing crop and percent composition of the abundant herbaceous species in 1973 and 1984 ungrazed (UG)¹ and grazed (G) grand fir/pachistima habitat type

Species	Frequency			Standing crop			Percent composition		
	1973 ²	1984		1973	1984		1973	1984	
		UG	G		UG	G		UG	G
Graminoids									
Orchardgrass	30	88	98	181	1493	1346	34	50	51
Timothy	80	T	48	129	25	207	25	1	8
Smoothbrome	5	65	43	7	463	337	1	15	13
Blue wildrye	15	48	45	35	184	337	7	6	13
Tall oatgrass	5	45	60	30	458	284	6	15	11
Kentucky bluegrass	5	18	53	7	T	26	1	T	1
Sedge sp.	12	5	1	21	6	T	4	6	T
Total Graminoids				416	2790	2537	80	92	95
Forbs									
Bull thistle	40	7	5	84	15	14	16	0.5	0.5
California mullein	23	2	3	12	2	T	2	T	T
Total biennial				96	17	14	18	0.5	0.5
Total perennial				12	221	116	2	7	4
Total forbs				108	237	130	20	8	5
Total herbaceous				523	3027	2667			

¹ Ungrazed refers to the lack of cattle use only. These plots were grazed by deer and elk.

² Plant frequency across the 1984 UG and G treatments was significantly different ($P < 0.05$) than 1973 using Chi-square.

Table 2. Frequency, standing crop and percent composition of the abundant herbaceous species in 1973 and 1984 ungrazed (UG)¹ and grazed (G) Douglas-fir/ninebark habitat type

Species	Frequency			Standing crop			Percent composition		
	1973	1984		1973	1984		1973	1984	
		UG	G		UG	G		UG	G
Graminoids									
Orchardgrass	5	50	85	104	409	418	19	25	25
Timothy	55	3	45	50	15	135	9	1	7
Smoothbrome	3	43	53	4	356	394	1	22	23
Blue wildrye	8	40	55	6	159	329	1	10	19
Tall oatgrass	8	28	28	13	136	111	2	8	6
Kentucky bluegrass	53	100	85	127	288	93	24	17	5
Sedge sp.	8	5	25	11	174	4	2	11	T
Mountain brome	8	15	38	0	14	7	0	9	T
Total Graminoids				345	1560	1531	64	94	89
Forbs									
Bull thistle	55	0	8	49	0	3	9	0	T
California mullein	35	0	0	120	0	T	23	0	T
Total biennial				169	0	3	32	0	T
Total perennial				27	92	182	4	6	11
Total forbs				196	92	187	36	6	11
Total herbaceous				541	1652	1718			

¹ Ungrazed refers to the lack of cattle use only. These plots were grazed by deer and elk.

² Plant frequency across the 1984 UG and G treatments was significantly different ($P < 0.05$) than 1973 using Chi-square.

Table 3. Frequency, standing crop and percent composition of the abundant herbaceous species in 1973¹ and 1984 ungrazed¹ (UG) and grazed (G) ponderosa pine/snowberry habitat type

Species	Frequency			Standing crop			Percent composition		
	1973 ²	1984		1973	1984		1973	1984	
		UG	G		UG	G		UG	G
Graminoids									
Orchardgrass	5	23	5	17	27	7	3	3	1
Timothy	25	3	0	52	0	0	10	0	0
Smoothbrome	3	20	3	0	29	0	0	3	0
Blue wildrye	18	50	18	52	90	51	10	10	5
Tall oatgrass	3	18	3	4	T	T	1	T	T
Kentucky bluegrass	35	98	100	134	588	678	25	68	64
Sedge sp.	5	T	T	3	38	20	T	4	2
Mountain brome	T	30	15	2	21	0	T	2	0
Total Graminoids				292	797	841	55	92	79
Forbs									
Bull thistle	28	0	0	91	T	21	17	T	2
California mullein	26	0	0	15	T	T	3	T	T
Total biennial				106	T	21	20	T	2
Total perennial				131	66	205	25	8	19
Total forbs				237	66	226	45	8	21
Total herbaceous				529	863	1067			

¹ Ungrazed refers to the lack of cattle use only. These plots were grazed by deer and elk.

² Plant frequency across the 1984 UG and G treatments was significantly different ($P < 0.05$) than 1973 using Chi-square.

Table 4. Shrub canopy cover and number of plants/0.1 acres for three habitat types in 1984

	Percent cover	Density (size classes inches)					Total
		0-12	12-14	24-36	36-48	48+	
Grand fir/pachistima							
Redstem ceanothus							
ungrazed ¹	2	22	9	4	0	0	35
grazed	T	0	0	0	0	0	0
Total ungrazed	2.2	34	121	13	0	0	168
Total grazed	T	0	0	0	0	0	0
Douglas-fir/ninebark							
Ninebark							
ungrazed	6	40	34	43	41	27	111
grazed	0.6	18	39	11	0	0	68
Total ungrazed	7	56	45	43	43	27	214
Total grazed	0.7	32	40	11	2	0	85
Ponderosa pine/snowberry							
Snowberry							
ungrazed	3	90	76	0	0	0	166
grazed	0	22	14	0	0	0	36
Oceanspray							
ungrazed	0.8	0	2	0	2	0	4
grazed	0	0	0	0	0	0	0
Ninebark							
ungrazed	2.5	14	20	18	2	0	54
grazed	1	20	0	0	0	2	22
Total ungrazed	6	104	97	18	4	0	223
Total grazed	1	38	14	0	0	2	54

¹ Ungrazed refers to the lack of cattle use only. These plots were grazed by deer and elk.