

PERSISTENCE OF CHEATGRASS (*BROMUS TECTORUM*) AMID BUNCHGRASS/SHRUB STEPPE COMMUNITIES

S.B. Monsen¹ and N.L. Shaw²

Intermountain Research Station, Forest Service, U.S. Department of Agriculture, Provo, UT 84606¹ and Boise, ID 83702², U.S.A.

ABSTRACT

Semi-arid bunchgrass/shrub steppe communities throughout the Intermountain region were degraded by early livestock grazing and invasion of annual weeds. Patterns of secondary succession were investigated through establishment and maintenance of four exclosures on granitic soils in south-central Idaho. Species composition and plant cover were estimated periodically in grazed and protected areas at each site from 1930 to 1977. Cheatgrass (*Bromus tectorum*), an alien invader, occupied the sites initially, declining between 1933 and 1937 during a prolonged drought, and reappearing erratically after 1940. Perennial grasses recovered slowly in protected areas, requiring more than 45 years to increase in cover from about 1.4 to 6.7 percent. Complete recovery of native perennials has not been attained, particularly on grazed areas and more arid sites.

KEYWORDS

Bluebunch wheatgrass, *Psuedoregneria spicata*, natural restoration, secondary succession

INTRODUCTION

Severe overgrazing by livestock in the late 1800s and early 1900s disrupted many bunchgrass/shrub steppe communities in the Intermountain region. Condition of these sites was further impacted by invasion of annual weeds, particularly cheatgrass (*Bromus tectorum*). Regulating grazing to enhance reestablishment of native species and displacement of annual weeds is a primary concern. Understanding factors affecting rates and patterns of secondary succession is critical in management of weed infested sites. Documentation of vegetation changes in response to grazing systems and climatic conditions requires maintenance of field study sites over an extended period of time.

STUDY AREA AND METHODS

The study area is located within the Boise River drainage in southwestern Idaho, a highly dissected area with deep, V-shaped valleys, and residual granitic soils (Renner 1936). Annual precipitation ranges from about 40 to 53 cm with 70% falling in winter and spring (Voth 1979). Four exclosures, Wood Creek (1,188 m elevation), Lower Bellmare (1,401 m), Upper Bellmare (1,554 m), and Elk Creek (1,280 m) were constructed between 1927 and 1931 on sites representative of habitat types from dry *Artemisia tridentata* ssp. *vaseyana*/*Psuedoregneria spicata* (mountain big sagebrush/bluebunch wheatgrass) to more mesic *Artemisia tridentata* ssp. *vaseyana*/*Symphoricarpos oreophilus* (mountain snowberry) / *Psuedoregneria spicata*. Slopes vary from about 37 to 67% and aspects generally from south to southeast. All exclosure sites were subjected to heavy grazing by sheep, cattle, and horses from late 1800s to the 1920s when reductions were imposed. All plant communities had been seriously disrupted by early grazing. Allotments were converted to cattle use by the mid-1960's and modifications of rest-rotation grazing systems instituted. Species composition and foliar cover were estimated ocularly on ten 5 X 5 m plots in both the grazed and protected areas at each exclosure site in each of 8 years from 1930 to 1977. Plots were subdivided and vegetation measured separately in strips 1 X 5 m in size. Percent cover provided by perennials was determined by measuring the diameter of each plant, cover of annuals was carefully estimated.

RESULTS AND DISCUSSION

Cheatgrass was present inside and outside all four exclosures in 1931 (Table 1), but declined from 1933 to 1937 following several drought years (Fig. 1). A similar pattern of cheatgrass loss was reported by Voth (1979). Presence of cheatgrass was erratic in both grazed and protected areas from 1940 to 1977 (Table 1), with its cover never exceeding 6%.

Perennial grass cover was initially low in grazed and protected areas at all sites and showed little or no improvement through 1940 (Table 1). It did not, however, diminish appreciably during the period of drought. Cover provided by perennial grasses in protected areas at all exclosures generally increased between 1955 and 1977. The effect was most pronounced at the more mesic Elk Creek site where perennial cover exceeded 10% in 1977. Perennial grass cover showed only slight, if any improvement in grazed areas over this period and did not exceed 4.5% at any site. Sanders and Voth (1983) also reported slow improvement of perennial grasses, but reported little difference between protected and grazed locations. Total ground cover of all species increased during the study period, with the most significant changes also recorded between 1955 and 1977 (Table 2). Bluebunch wheatgrass was the most prevalent perennial grass at all study sites and increased in ground cover more rapidly than any other species (data not shown). Only small amounts of Sandburg bluegrass (*Poa secunda*) and June grass (*Koeleria cristata*) were recorded at any location during the study period.

Recovery of native perennial bunchgrasses has occurred slowly with only moderate improvement in protected areas after 47 years. The rate of recovery was likely slowed by extreme deterioration of the watershed early in the century, leaving unstable, eroded soils and limited seed sources of native plant species. Drought conditions continuing after grazing reductions and exclosure construction may have further impeded recovery. Cheatgrass has persisted over time, even with protection from livestock grazing in two exclosures. This species is capable of proliferating following fire or other disturbances and competing with establishment of perennial grass seedlings.

REFERENCES

- Voth, A.S.** 1979. Successional patterns of sagebrush-bunchgrass rangeland of the Boise National Forest. Univ. Idaho, Moscow. M.S. Thesis. 139 p.
- Renner, F.G.** 1936. Conditions influencing erosion on the Boise River Watershed. Tech. Bull. 528. U.S. Dept. Agric., Washington, D.C. 32 p.
- Sanders, K.D. and A.S. Voth.** 1983. Ecological changes of grazed and ungrazed plant communities, p. 176-179. In: Monsen, S.B. and N.L. Shaw, compilers. Managing intermountain rangelands—improvement of range and wildlife habitats: proceedings; 15-17 Sept. 1981; Twin Falls, Ida. 22-24 June 1982; Elko, Nev. USDA Forest Serv. Gen. Tech. Rep. INT-276. Ogden, Utah.

Table 1

Percent ground cover of cheatgrass and perennial grasses in protected and grazed areas at 4 exclosures as estimated in each of 8 years, 1930 to 1977.

Vegetation Treatment	Year							
	1930	1931	1933	1934	1937	1940	1955	1977
Cheatgrass								
Protected								
Wood Creek	—	6.0	0.6	0.0	0.0	0.0	0.4	1.0
Lower Bellmare	4.9	1.8	0.1	0.0	0.0	0.9	0.2	3.1
Upper Bellmare	0.7	0.5	0.0	0.0	0.0	0.5	0.2	0.0
Elk Creek	<u>0.7</u>	<u>0.3</u>	<u>0.0</u>	<u>0.0</u>	<u>0.0</u>	<u>0.0</u>	<u>0.0</u>	<u>0.0</u>
Mean	1.6	2.2	1.2	0.0	0.0	0.4	0.2	1.0
S.D. ¹	0.7	1.0	0.2			0.3	0.2	1.2
Grazed								
Wood Creek	—	4.9	0.5	0.2	0.0	0.0	0.6	0.0
Lower Bellmare	0.8	2.4	0.0	0.0	0.0	5.1	0.2	1.7
Upper Bellmare	1.2	1.9	0.7	0.0	0.0	5.9	0.5	0.2
Elk Creek	<u>0.3</u>	<u>2.1</u>	<u>1.6</u>	<u>0.0</u>	<u>0.0</u>	<u>0.0</u>	<u>0.8</u>	<u>0.0</u>
Mean	0.6	2.8	0.7	0.0	0.0	2.8	0.5	0.5
S.D.	0.3	2.5	1.0			2.7	0.8	0.7
Perennial Grasses								
Protected								
Wood Creek	—	0.0	0.2	0.1	0.2	0.4	2.4	3.8
Lower Bellmare	1.7	0.7	1.1	1.0	1.3	0.6	4.8	6.2
Upper Bellmare	1.0	3.1	4.4	3.2	2.1	4.1	2.3	4.8
Elk Creek	<u>2.8</u>	<u>1.9</u>	<u>2.9</u>	<u>1.6</u>	<u>1.4</u>	<u>3.1</u>	<u>3.5</u>	<u>11.9</u>
Mean	1.4	1.4	2.2	1.5	1.2	2.0	3.2	6.7
S.D.	0.8	0.5	0.8	0.6	0.5	0.6	1.3	1.8
Grazed								
Wood Creek	—	0.0	0.0	0.0	0.0	0.8	1.5	2.6
Lower Bellmare	1.1	2.0	0.4	0.3	0.3	0.5	1.7	4.2
Upper Bellmare	2.2	0.7	1.4	1.0	1.0	1.4	2.2	4.2
Elk Creek	<u>0.7</u>	<u>1.5</u>	<u>2.2</u>	<u>1.3</u>	<u>1.7</u>	<u>2.1</u>	<u>2.0</u>	<u>0.7</u>
Mean	1.0	1.0	1.0	0.6	0.8	1.2	1.8	2.9
S.D.	0.8	0.9	0.6	0.3	0.4	0.7	0.9	1.8

¹ Standard Deviation

Table 2

Total vegetative cover in protected and grazed sites at 4 exclosures in each of 8 years, 1930 to 1977.

Exclosure	1930	1931	1933	1934	1937	1940	1955	1977
	%							
Wood Creek								
Protected								
Wood Creek	—	7.1	3.0	1.1	1.5	1.5	4.8	16.0
S.D. ¹	3.0	1.5	0.6	0.6	0.5	4.0	6.9	
Grazed								
Wood Creek	—	7.1	2.2	1.3	0.9	4.3	3.2	12.8
S.D.	4.1	1.1	0.8	0.5	1.6	0.6	6.5	
Lower Bellmare								
Protected								
Lower Bellmare	11.3	5.2	5.9	8.6	6.4	6.8	10.7	16.5
S.D.	4.9	2.8	7.9	9.9	9.5	4.7	4.0	7.8
Grazed								
Lower Bellmare	10.9	8.2	3.6	2.8	3.5	11.7	15.8	23.2
S.D.	7.8	4.0	2.4	2.1	2.9	3.9	4.8	7.3
Upper Bellmare								
Protected								
Upper Bellmare	13.7	5.4	8.7	5.0	3.9	7.6	12.4	21.0
S.D.	4.1	1.2	3.6	1.9	1.3	1.3	3.3	6.2
Grazed								
Upper Bellmare	10.1	6.3	9.2	3.3	3.8	11.0	11.4	22.4
S.D.	1.6	0.3	4.9	1.1	0.3	3.6	2.2	4.5
Elk Creek								
Protected								
Elk Creek	13.8	8.3	11.1	5.6	5.2	8.1	10.5	43.0
S.D.	1.6	2.7	1.6	0.9	0.3	1.9	2.1	25.0
Grazed								
Elk Creek	5.1	6.9	10.6	3.5	3.9	7.6	10.6	22.7
S.D.	5.8	3.6	6.5	2.0	2.4	2.5	2.3	9.1

¹ Standard Deviation

Figure 1

Annual precipitation at Arrowrock Dam, Idaho from 1920 to 1977.

