Broadcast Seeding as a Means of Restoring Depleted Western Juniper Woodland

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In central Oregon there is a general lack of understory vegetation in western juniper (*Juniperus occidentalis* ssp. *occidentalis*) woodlands. In many areas ground cover other than that of juniper is essentially absent. Restoration of understory vegetation cover appears difficult to accomplish and may require innovative and perhaps costly approaches to be successful. Broadcast seeding may need to be used as a means of introducing new plant propagules into the system.

Changing resource values require methodologies which are low impact and conserve on-site plant and soil resources. As a first step,a study was initiated to evaluate the effectiveness of broadcast seeding without soil surface treatment but with retention of juniper boles and branches. Wood debris were retained to ameliorate the near-ground environment and to allow cycling of their nutrients back into the ecosystem.

METHODS

The study was located on Comb's Flat, 5.5 miles southeast of Prineville, Oregon, at an elevation of 3,740 feet on land under ownership of L S Ranches. Topography is gentle with a NNW facing aspect. Soils are moderately deep, averaging 24 inches, with a sandy loam surface grading into clay loam and finally into a loamy clay to clay just above fractured basalt bedrock. Long-term precipitation at Prineville, 2,850 feet elevation, is 10 inches but are approximately 11 inches at Comb's Flat.

During the last week in February 1988 and 1989, each of nine grass varieties were broadcast seeded on a set of five 807 ft^2 plots. Following seeding trees were cut and limbs were lopped and scattered. One set of plots was not seeded and one additional set was neither seeded nor slash covered.

Seeding rates were an adjusted estimate for each grass variety based on seed vigor (germination value) and seed size, and on suggested seeding rates which were further adjusted for to allow for no site preparation. Rates were high, ranging from 9 to 21 pounds per acre. At least minimal establishment was desired for each variety.

Vegetation was sampled by density counts and by cover estimates using twenty 2.15 ft^2 sample plots in each seeded plot and five sets of 20 plots each in the woodland. Broadcast seeded plots were sampled for establishment at 2 and 3 years after planting. Periodic soil moisture samples were taken in 1988, 1989, and 1990.

Vegetation was dominated by a 20 percent western juniper canopy cover. Shrubs were a well scattered mixture of Basin big sagebrush (*Artemisia tridentata* ssp. *tridentata*) and mountain big sagebrush (*A. t.* ssp. *vaseyana*). Primary perennial grasses were Bluebunch wheatgrass (*Agropyron spicatum*) Thurbers needlegrass (*Stipa thuberiana*), squirreltail (*Sitanion hystrix*), junegrass (*Koeleria pyramidata*) and native bluegrass (*Poa sandbergii*).

Characteristics of the ground surface cover were as follows for 1988 and 1989 respectively: bare soil 65 and 70 percent, total plant cover 11.8 and 7.4 percent, perennial bunchgrasses 4.6 and 5.4 percent of which native bluegrass made up 61 percent and 59 percent of the bunchgrass total, and annual grasses 0.7 percent and 0.9 percent. In 1988 annual lupine (*Lupinus microcarpus*) contributed 4.8 percent cover but only 0.6 percent in 1989.

RESULTS

Non-seeded plots — Plots in which no seeding took place were measured for plant cover in 1992. Bare ground in the woodlands had not changed and remained high (Table 1). In treated plots total understory plant cover had increased particularly on those plots with scattered juniper slash. Both perennial bunchgrass cover and annual grass, primarily cheatgrass (*Bromus tectorum*) appear to be increasing following treatment.

Table 1. 1992 ground cover percent in woodlands, open plots and slash covered plots. Comb's Flat, 5.5 miles southeast of Prineville, Oregon.

	JUNIPER WOODLAND	NO SEEDING NO SLASH		NO SEEDING SLASH COVERED	
Year treated	No	1988	1989	1988	1989
Bare ground	65	56	46	37	20
Juniper slash				30	48
Understory	11	18	13	23	28
All Bunchgrass	6	10	5	9	8
Native bluegrass	[3]	[2]	[2]	[2]	[2]
Annual grass	< 1	5	3	10	6

Response in plant cover was undoubtedly influenced by the general low input of precipitation amounts in 1987-88 and in the intervening period through 1992. Potentially effective moisture was considered to be precipitation received from October through September. Using an 11 inch average for Comb's Flat precipitation inputs were as a percent of average; 1987-88 (70 percent), 1988-89 (104 percent), 1989-90 (59 percent), 1990-91 (76 percent), 1991-92 (82 percent).

Seeded plots — Broadcast seeded grass varieties did manage to successfully establish some plants (Table 2). With the exception of GOLDAR (bluebunch wheatgrass) and NORDAN (crested wheatgrass), overall establishment rates were roughly double or more than double for the 1989 seeding as compared to the 1988 seeding.

As noted above potential effective moisture was 70 percent and 104 percent of average in 1987-88 and 1988-89 respectively. Precipitation was below average for the May through September period in both years. However during the growth initiation period of March through April, precipitation was less than 2 inches in 1988 and nearly 5 inches in 1989. Inputs of moisture during the 1988 growth initiation period more closely approximate the long-term average for the area.

Table 2. Seeding rates and plant establishment in each of two consecutive late winter seedings, 1988 and 1989. Comb's Flat, 5.5 miles southeast of Prineville, Oregon.

	SEEDING RATE	SEED PLANTED	ESTABLISHED PLANTS #/m²		ESTABLISHED PLANTS % of seed	
GRASS VARIETY	lb/ac	[a] #/m²	1988	1989	1988	1989
GOLDAR[b]	21	513	7	12	1.8	3.2
SECAR	14	822	1	4	0.1	0.5
NORDAN	20	972	6	6	0.6	0.6
EPHRAIM	19	925	5	12	0.5	1.3
RUSH	17	168	5	24	3.0	14.3
TEGMAR	9	212	3	18	1.4	8.5
ROSANA	16	477	6	15	1.3	3.1
CRITANA	14	471	7	23	1.5	4.9
SHERMAN	14	2929	7	13	0.2	0.4

[a] Divide by 10.76 for number per square foot.

[b] Grass varieties are: GOLDAR bluebunch wheatgrass, SECAR bluebunch wheatgrass, NORDAN crested wheatgrass, EPHRAIM crested wheatgrass, RUSH intermediate wheatgrass, TEGMAR intermediate wheatgrass, ROSANA western wheatgrass, CRITANA thickspike wheatgrass, SHERMAN big bluegrass.

Observations on plant growth, including seeded species, in the treated plots indicated that soil moisture conditions were suitable for continued plant growth through September for two growing seasons post treatment. In general plant available soil moisture was found at 4 inches and below as of August 1 the first and second year post treatment. Herbaceous plant growth and development had ceased in the woodlands by mid-June 1988 and by late June 1989.

CONCLUSIONS

The apparent release of soil moisture and nutrients due to tree cutting and amelioration of the near-ground environment allowed significant increase in the existing understory vegetation suggesting that seeding may not have been necessary even with the low levels of existing understory plants. Reduced bare ground and greater vegetation response favor slash retention and dispersal.

Establishment of plants from the 1988 seeding is likely closer to reality than that of the 1989 seeding. Although some of these grass varieties can be established by broadcast seeding

in stressful environments using juniper slash as the only seedbed modifier, the seeding rate is too costly for practical purposes.

If broadcast seeding is to be usable on degraded woodland areas, minimal seedbed preparation is needed to reduce the seeding rate. Seedbed preparation could be accomplished with a 4-wheel off-road vehicle with mounted whirlwind broadcast seeder and towing a drag or soil pitter at a time when soils are moist. Such a project is underway in Jefferson County.