Evaluating Conservation Practices and Plant Material on Cheatgrass Invaded Landscapes: A 10 Year Case Study

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Cheatgrass (*Bromus tectorum*) is an exotic and invasive annual grass that was accidentally introduced to western North America in the late 19th century. Initially identified as being abundant along railways and roadsides, it soon spread across millions of acres of Wyoming big sagebrush (*Artemisia tridentata* ssp. *wyomingensis*)/bunchgrass rangelands.

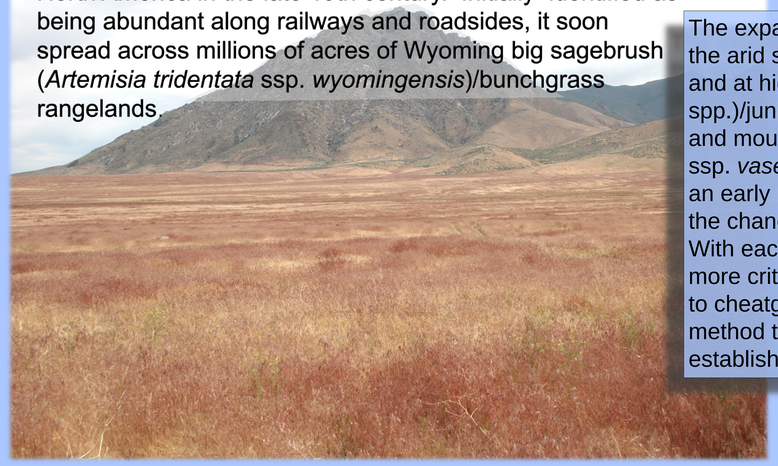

Figure 1. Cheatgrass dominated habitat at Orovada, Nevada.

The expansion of cheatgrass continues today into the arid salt desert shrublands of the Great Basin and at higher elevations into the pinyon (*Pinus* spp.)/juniper (*Juniperus* spp.) woodlands and mountain big sagebrush (*Artemisia tridentate* ssp. *vaseyana*) communities. Cheatgrass provides an early maturing, fine textured fuel that increases the chance, rate, spread and season of wildfires. With each passing wildfire season, more and more critical habitats are burned up and converted to cheatgrass dominance. The best known method to suppress cheatgrass is through the establishment of long-lived perennial grasses.

The ultimate goal of this project was to identify those plant species, best adapted to the Antelope Creek site, that ultimately have the inherent potential to establish in the face of cheatgrass competition and to suppress cheatgrass to a point where the absence of wildfire would allow critical shrub communities to return.

Plant Species		g/Ha (lbs/ac)
'Hycrest' Crested Wheatgrass	*Agropyron cristatum*	3,178g/ha (7 lbs/ac)
'Sherman' Big Bluegrass	*Poa ampla*	908g/ha (2 lbs/ac)
Bottlebrush Squirreltail	*Elymus elymoides*	3,178g/ha (7 lbs/ac)
Needle and Threadgrass	*Stipa comata*	1,816g/ha (4 lbs/ac)
Thurber's Needlegrass	*Achnatherum thurberianum*	1,816g/ha (4 lbs/ac)
Bluebunch Wheatgrass	*Pseudoroegneria spicata*	1,816g/ha (7 lbs/ac)
Sandberg Bluegrass	*Poa secunda*	908g/ha (2 lbs/ac)
Antelope bitterbrush	*Purshia tridentata*	908g/ha (2 lbs/ac)
Four-wing Saltbush	*Atriplex canescens*	1,816g/ha (4 lbs/ac)
Wyoming Big Sagebrush	*Artemisia tridentata wyomingensis*	115g/ha (.25 lbs/ac)
'Immigrant' Forage Kochia	*Kochia prostrata*	908g/ha (2 lbs/ac)
Snake River Wheatgrass	*Elymus wawawaiensis*	1,816g/ha (7 lbs/ac)
Sainfoin	*Onobrychis viciaefolia*	4,540g/ha (10 lbs/ac)
'Ladak' Alfalfa	*Medicago sativa*	1,816g/ha (4 lbs/ac)
Lewis Flax	*Linum lewisii*	908 g/ha (2 lbs/ac)
Western Yarrow	*Achillea millefolium occidentalis*	227g/ha (.50 lbs/ac)

Table 1. Plant species seeded and seeding rates.

In the fall of 2000 we seeded 16 native and introduced species (Table 1) with both a no-till drill (Fig. 2) and rangeland drill applying various seeding rates (Table 1). Each plot was 1.5 m x 30 m (5'x100') and replicated three times. In May of 2001 we started recording seedling densities, which were monitored for the next 10 years. Each plot consisted of five randomly located 1 m² (3.3 ft²) fixed quadrats to measure seedling mortality and densities.

Methods

This research was conducted at Antelope Creek, near Orovada, Nevada at an elevation of 15,180 m (4,600') (Fig. 1). The site had repeatedly burned since the big firestorm of 1939. The soils are a silty loam in a 20-25 cm (8-10") precipitation zone. In the fall of 1999, Sulfometuron Methyl, trade name 'Oust', was applied at .10 g/ha (1 oz/ac) rate to the study site and fallowed for one year.

Figure 2. Seeding specific species using the kincaid no-till drill on herbicidal fallowed plot.

Results

Prior to the herbicide application cheatgrass densities averaged 4,900/m² (1,480/ft²). Cheatgrass density following herbicidal control in the summer prior to the fall seeding averaged 9.24/m² (2.8/ft²).

Plant Species	2001 Seedlings/m²	2010 Established Plants/m²
Hycrest'-Crested Wheatgrass	16.5/m² (5/ft²)	4.6/m² (1.4/ft²)
'Sherman' Big Bluegrass	8.6/m² (2.6/ft²)	3.6/m² (1.1/ft²)
Bluebunch Wheatgrass	4.6/m² (1.4/ft²)	0.5/m² (.15/ft²)
Bottlebrush Squirreltail	2.8/m² (.85/ft²)	0.3/m² (.09/ft²)
Snake River Wheatgrass	2.8/m² (.85/ft²)	0.3/m² (.09/ft²)
Antelope bitterbrush	4.0/m² (1.2/ft²)	0
Sandberg Bluegrass	3.2/m² (.97/ft²)	0
'Ladak' Alfalfa	2.2/m² (.67/ft²)	0
Thurber's Needlegrass	1.4/m² (.42/ft²)	0
Needle and Threadgrass	1.2/m² (.36/ft²)	0
'Immigrant' Forage Kochia	1.0/m² (.30/ft²)	0

Table 2. Recorded 2001 seedlings and 2010 established plants/m² (ft²).

In May 2001 'Hycrest' crested wheatgrass and 'Sherman' big bluegrass (*Poa secunda* formerly *P. ampla*) had the highest seedling density at 16.5/m² (5/ft²) and 8.6/m² (2.6/ft²), respectfully. Bluebunch wheatgrass (*Pseudoroegneria spicata* ssp. *spicata*) also showed fairly good seedling densities in May 2001 at 4.6/m² (1.4/ft²). Of the 16 species tested, five had no emergence including Wyoming big sagebrush and sainfoin (*Onobrychis vicifolia*). Antelope bitterbrush (*Purshia tridentata*) initially had decent seedling numbers at 4/m² (1.2/ft²), but by late July all the seedlings had dried up and died. (Table 2).

Figure 4. 'Hycrest' crested wheatgrass (left) and 'Sherman' big bluegrass (right) were the two species that were successfully seeded at this site. Open space is where 14 other species were seeded however did not establish.

The site received 19.41 cm (7.67") of precipitation, recorded from October 1st-September 30th) in 2000/2001 and 21.66 cm (8.56") in 2001/2002. By June 2010, 'Hycrest'crested wheatgrass and 'Sherman' big bluegrass were the two plant species that performed the best (Table 2) indicating good revegetation candidates at this site with densities at 4.6/m² (1.4/ft²) and 3.6/m² (1.1/ft²) (Fig. 4).

Cheatgrass densities in June 2010 in the 'Hycrest' and 'Sherman' plots averaged 7.3/m² (2.2/ft²) and 10.2/m² (3.1/ft²) (Fig. 3) compared to 817.4/m² (247.7/ft²) in the control, 204/m² (62/ft) in the bluebunch wheatgrass and 301.62/m² (91.4/ft²) in the squirreltail (*Elymus elymoides*) plots.

Figure 3. Notice the cheatgrass suppression along these perennial grass rows.

Better understanding of the inherent potential of seed species to germinate, emerge, and establish in the face of such fierce competitors as cheatgrass is critical if land mangers are going to be successful in reversing the tide of cheatgrass dominance, frequent wildfires, and loss of critical wildlife habitat and grazing resources.