EFFECTS OF GRAZING AND FIRE ON SEED DYNAMICS AND SPECIES COMPOSITION OF CHEATGRASS DOMINATED RANGELAND

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Introduction

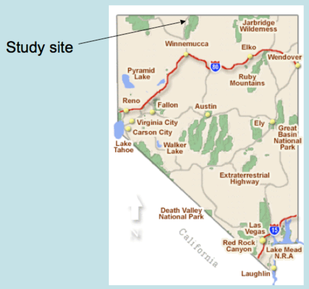
Federal Wildland Management Policy (2001) encourages a more proactive approach to reduce the threat of catastrophic wildfires, including research and development on fuel reduction alternatives. Targeted grazing of cheatgrass (*Bromus tectorum*) at the flowering stage can reduce biomass and seed production (Mosley and Roselle 2006). Prescribed burning can reduce the number of cheatgrass seeds entering the soil seed bank (Rasmussen 1994). Little is known about the integration of cattle grazing and prescribed burning to reduce cheatgrass fuel accumulation and seed input, or about the subsequent changes in species composition of treated areas.

Objectives

- Evaluate the effects of targeted cattle grazing on cheatgrass fire behavior.
- Assess the impact of targeted cattle grazing and prescribed fire on seed dynamics of cheatgrass and associated species.
- Evaluate the effects of targeted cattle grazing and prescribed fire on species composition.

Site Description

The study was conducted in the Quinn River Valley, about 20 km southeast of McDermitt, Nevada.



Historically, the site supported a sagebrush / perennial grass community. The site has been grazed April-June by cattle the past 50 years, and it burned in 1983 and 1996. It is dominated by cheatgrass. Associated species include:

- Sandberg bluegrass (*Poa secunda*)
- Bulbous bluegrass (*Poa bulbosa*)
- Tumble mustard (*Sisymbrium altissimum*)
- Clasping pepperweed (*Lepidium perfoliatum*)
- Redstem filaree (*Erodium cicutarium*)

Site characteristics:

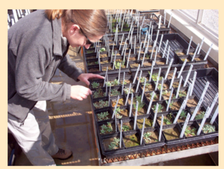
- 5% slope, western aspect, 1400 m elevation
- Gravelly fine sandy loam soil
- 228 mm average annual precipitation

Methods and Materials

Four grazing-burning treatments were replicated in three blocks: graze and burn (GB); no-graze and burn (NGB); graze and no-burn (GNB); and no-graze and no-burn (NGNB). Treatment plots were 60 x 60 m. GB and GNB plots were grazed to 80-90% utilization in May 2005 and 2006. GB and NGB plots were burned in October 2005 and 2006. Flame lengths in the GB treatment (0.25 m) were about 1/8 as long as those in the NGB treatment (2.3 m). Rate of spread was slower in the GB treatment (7 m min^{-1}) than in the NGB treatment (12 m min^{-1}).

Seed Dynamics: Seed rain was collected from May-August 2006 using buried funnel traps at 10 sampling points along three 30 m transects in each treatment. Seeds from each funnel were placed in a controlled environment to estimate germinability.

Seed bank composition and density were estimated by collecting soil core samples at 40 points in a 5 x 8 matrix in each treatment three times per year (post-graze before dispersal, peak biomass after seed dispersal, and post-burn) in 2005 and 2006. Soil core samples were spread across a sand medium in a greenhouse, and emerged seedlings were identified and counted.

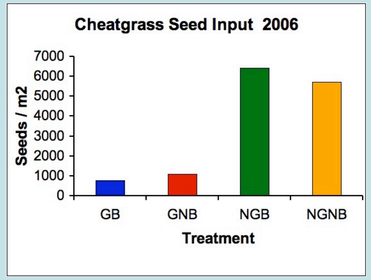


Species Composition: Aboveground species composition was determined from peak biomass clipped in 0.5 x 0.5 m quadrats at 10 sampling points along three 30 m transects in each treatment. Clipped vegetation was separated by species, oven-dried, and weighed.

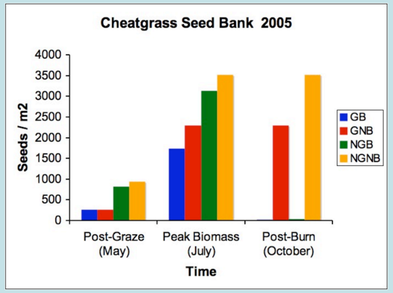
Plant cover, frequency, and density were also measured in each treatment plot, but data will not be presented for these attributes.

Results

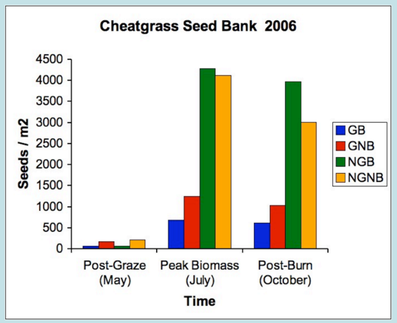
Seed Dynamics: After implementing grazing and burning in 2005 and grazing in 2006, the graze and burn (GB) and graze and no-burn (GNB) treatments had significantly lower cheatgrass seed input than the no-graze and burn (NGB) and no-graze and no-burn (NGNB) treatments.



In 2005, cheatgrass seed bank densities were lower in grazing treatments (GB, GNB) than in non-grazing treatments (NGB, NBNB) after grazing in May and at peak biomass in July. Cheatgrass seed bank densities were minimal (~30 seeds m^{-2}) after implementing burning treatments (GB, NGB) in October.



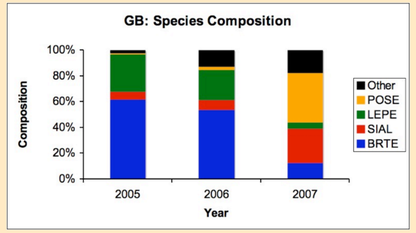
In 2006, trends in cheatgrass seed bank densities after grazing in May and at peak biomass in July were similar to those in 2005. However, burning treatments (GB, NGB) in October did not impact seed bank densities as much as in 2005.

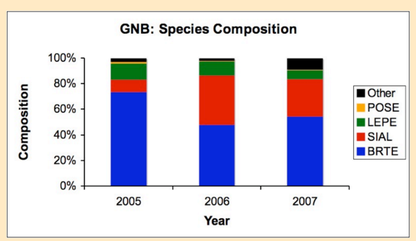


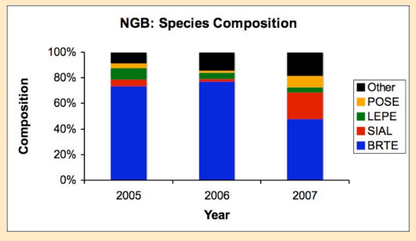
Results

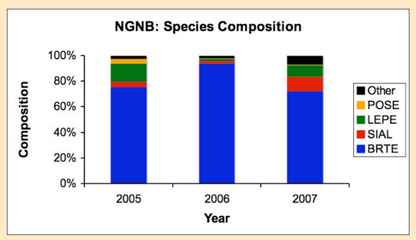
Species Composition: After grazing and burning in 2005 and 2006, the graze and burn (GB) treatment had the greatest shift in species composition from cheatgrass dominance to greater proportions of Sandberg bluegrass and annual forbs in 2007. Cheatgrass dominance decreased to a lesser extent in the graze and no-burn (GNB) and no-graze and burn (NGB) treatments by 2007. Cheatgrass comprised at least 75% of the community in the no-graze and no-burn treatment from 2005 to 2007.

In the four figures below, the abbreviations in the legends are: BRTE = *Bromus tectorum*, SIAL = *Sisymbrium altissiumum*, LEPE = *Lepidium perfoliatum*, POSE = *Poa secunda*, and Other = other grasses and forbs.









Discussion and Conclusions

Seed Dynamics: Grazing 80-90% of cheatgrass biomass at the flowering stage in May significantly reduced seed input in the GB and GNB treatments, but remaining, ungrazed culms still produced seed heads that dispersed seeds. The first prescribed fires in October 2005 consumed much of the dispersed seed in the continuous litter layers in the GB and NGB treatments. Low fuel loads and discontinuous litter layers resulted in lower intensity, patchy fires in the GB and NGB treatments in October 2006, which consumed less seed in the litter layers. In a study in Utah, fire consumed almost all of the cheatgrass litter on burned plots, reducing the seed bank to < 3% of that in unburned plots; yet within 2 years, the seed bank density of burned plots was ≥ that of unburned plots (Humphrey and Schupp 2001).

Species Composition: Implementing the graze and burn (GB) treatment for two consecutive years (2005, 2006) suppressed cheatgrass, released Sandberg bluegrass, and promoted the establishment of tumble mustard, clasping pepperweed, and redstem filaree by the third year (2007). This shift in species composition could decrease the flammability of fuels and competition with desirable revegetation species.

Literature Cited

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