Effect of fire season and spring grazing on soil seedbank in the Northern Great Plains

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Introduction

Fire and grazing are known to affect plant communities, but little is known of their effects on soil seedbank. Japanese brome (*Bromus japonicus*) is an invasive annual grass in the Northern Great Plains. It can increase suddenly and significantly following wet fall and spring periods. However, its annual life cycle and dependence on moist conditions for fall germination may leave it susceptible to grazing and fire management. Our objective was to determine the effects of spring, summer, or fall fire and spring grazing on soil seedbank of Japanese brome and other native and introduced species.

Site Description

This study was located at the Fort Keogh Livestock and Range Research Laboratory near Miles City, in southeastern Montana. Average annual precipitation is 326 mm. The area is located in the mixed-grass prairie of the Northern Great Plains. Dominant grass species at this claypan range site are Japanese brome, western wheatgrass, Sandberg's bluegrass, blue grama, and buffalo grass.

Spring burn March 26, 2007

Methods

- 2x4 factorial with 4 replicates of 2 grazing treatments and 4 fire treatments

Fire applied

- August 25, 2006 (summer fire)
- October 24, 2006 (fall fire)
- March 26, 2007 (spring fire)
- Non-burned

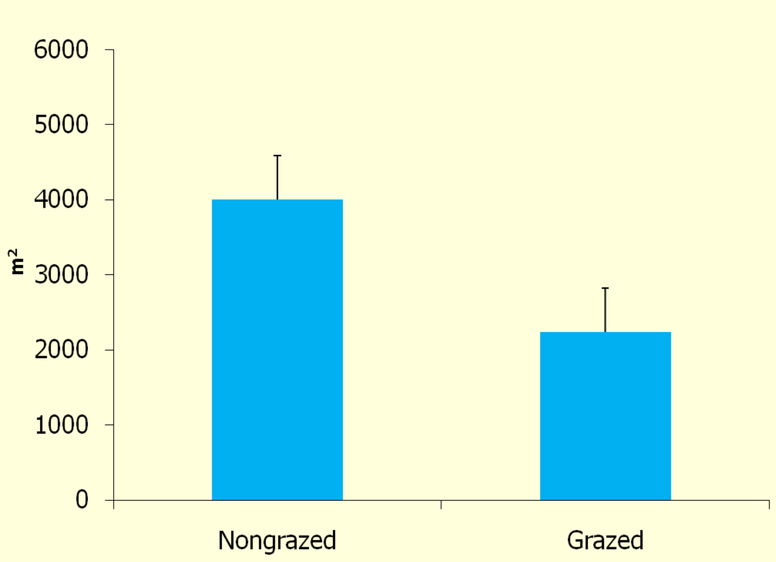
Spring grazing

- Early June (07), grazed once (50% use)

Soil samples

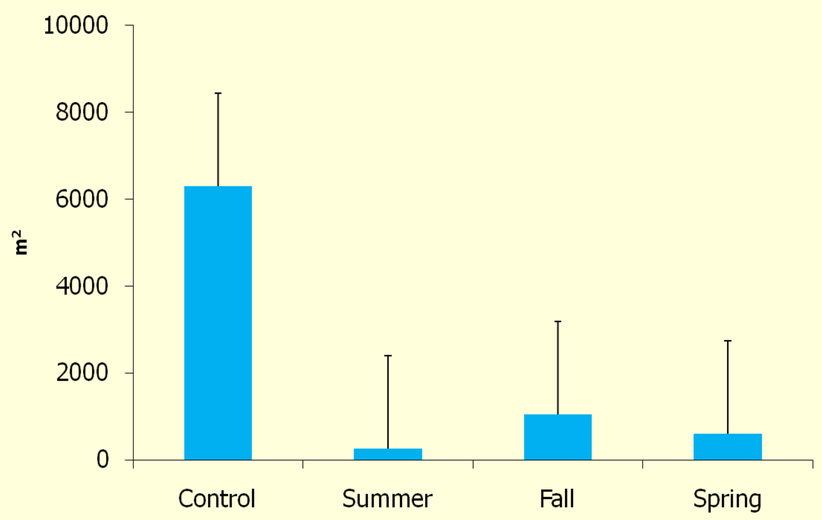
- Ten soil cores (10 cm dia.) were collected to 3 cm depth September 25-26, 2007, spread in flats and seeds germinated in greenhouse

Japanese Brome



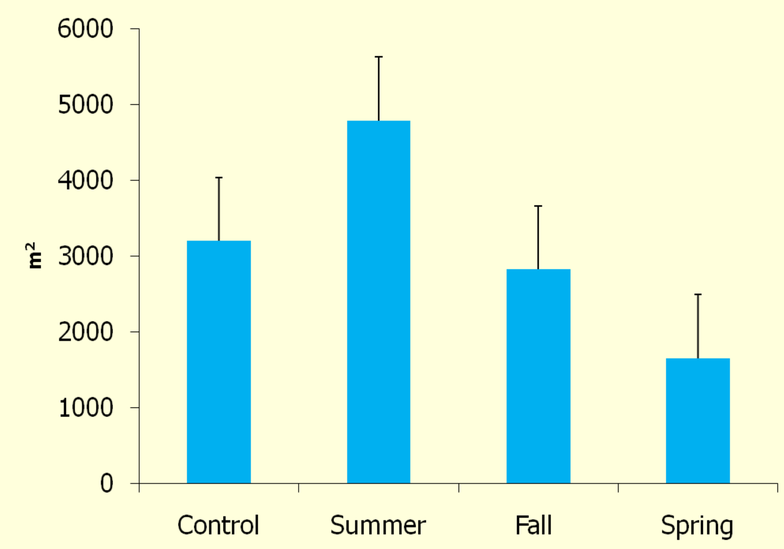
Means followed by the same letter do not differ (P < 0.05).

***Logfia arvensis* (Introduced Annual)**



Means followed by the same letter do not differ (P < 0.05).

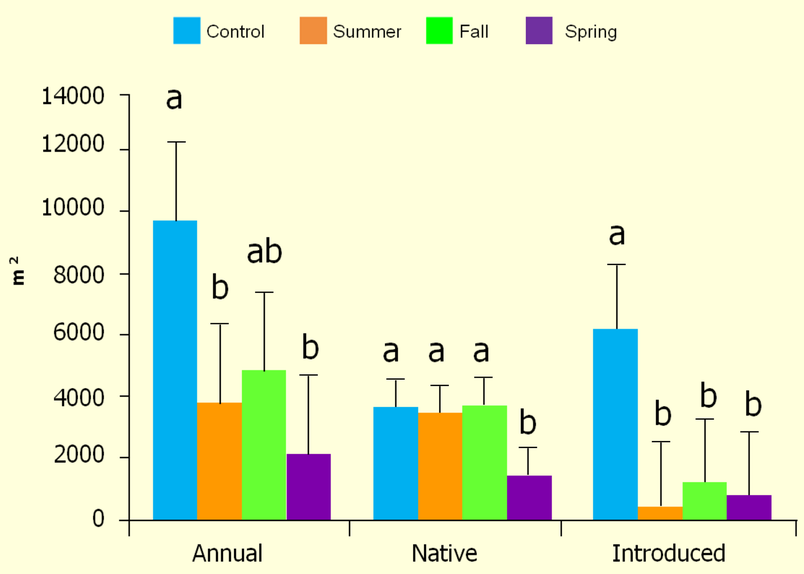
Japanese Brome



Means followed by the same letter do not differ (P < 0.05).

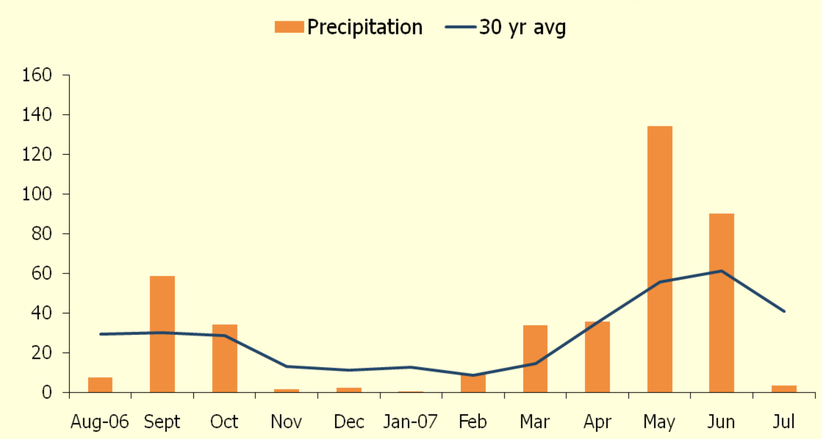
Soil seedbank trays in greenhouse

Forbs



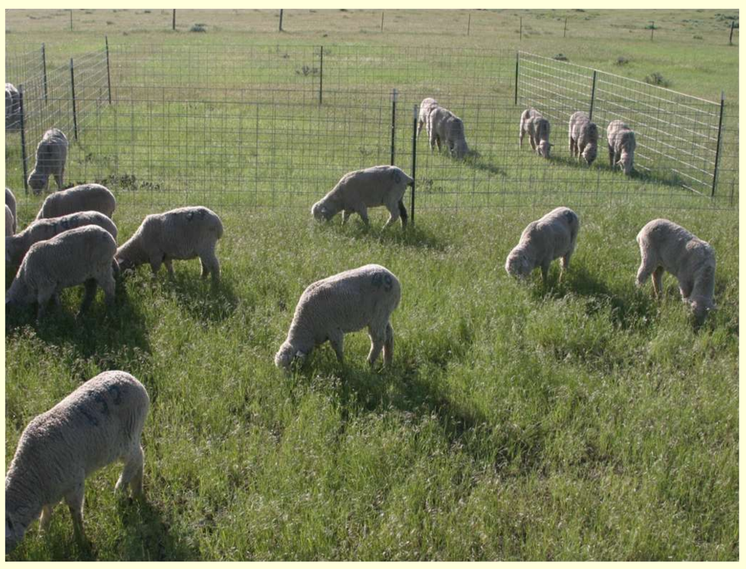
Means within a species group followed by the same letter do not differ (P < 0.05).

Annual Precipitation August 06-July 07



Conclusions

- 39 species emerged from soil samples and 7, representing 77% of the average total seedlings (10,206 m^2), were effected by fire or grazing
- Japanese brome (30.6%), was reduced 44% by grazing
- Spring and summer fire reduced total annual forbs 70%
- Spring fire reduced native forbs 61% compared to non-burned sites
- Fire in any season reduced introduced forb species 81% from 6457 to 810 ± 2188 seedlings/m^2
- *Logfia arvensis* (20.0%, introduced annual) was reduced 90% by fire in any season
- Perennial grasses and forbs were not affected
- Grazing effects were primarily limited to Japanese brome as timing was set to coincide with inflorescence emergence from the sheath
- Although fire in any season reduced introduced forbs, fall fire may be preferable for restoration because summer fire did not reduce Japanese brome and spring fire reduced native forbs



Sheep grazing June 2007

Take home message:
Grazing when seedheads emerge reduces Japanese brome seedbank
Other Fort Keogh research indicates fire reduces Japanese brome density and biomass
Fire had minimal effects on Japanese brome seedbank
Seedbanks of forbs, especially introduced species, were sharply reduced by fire in any season