Seed pools, aboveground vegetation, and prescribed fire in the context of sagebrush restoration

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Abstract

Degraded sagebrush communities in the Great Basin are at risk of conversion to cheatgrass-dominated systems. Restoration of these communities is often attempted without understanding potential impacts of either restoration treatments on the seed pool or the seed pool on restoration. The seed pool can affect vegetation recovery by serving as a source of new recruits, both desirable and undesirable. As part of a regional scale restoration experiment (SageSTEP), seed pools in control and prescribed burn plots at one restoration site were quantified and compared to aboveground vegetation before and after burning. Here we present results comparing the seed pool and the aboveground vegetation, and the effect of fire and aboveground cheatgrass abundance on the seed pool community. These results will help land managers determine the most effective restoration treatment for a site by providing information on potential impacts of treatments on the seed pool.

Research Questions

Relative abundance data for aboveground vegetation and for the seed pool before and after prescribed fire were used to address the following questions:

1) What is the relationship between the seed pool and the aboveground vegetation?

2) Does prescribed burning affect the seed pool species composition and species abundances?

3) Does cheatgrass abundance aboveground influence the seed pool composition?

Methods

•Seed pool and vegetation data were collected on the eastern toeslope of the Onaqui mountains, Tooele County, Utah, USA.

•Line-point intercept data was used to quantify the presence and relative abundance of species aboveground.

•Seed pool soil samples were collected before and after prescribed fire from all phase 1 (least invaded by cheatgrass) and phase 3 (most invaded by cheatgrass) subplots in the control and burn treatment plots.

•11 soil sample points were randomly selected along 4-30m transects per subplot.

•Soil samples were cold-moist stratified for 60 days to initially break dormancy.

•Seed pools were evaluated by direct germination in a greenhouse; samples were kept moist.

•Seedlings were identified, counted, and removed.

•After 115 days, samples were dried out, mixed, rewatered and emergence was censused for an additional 21 days.

•Individuals that were not identified as seedlings were transplanted and grown to maturity.

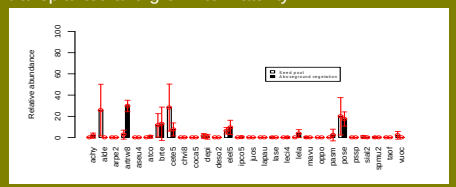

Figure 1. Relative abundances of species found below and aboveground.

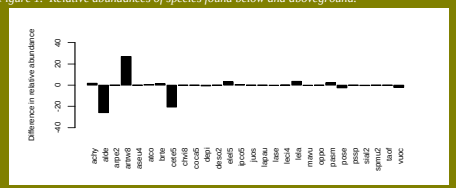

Figure 2. Differences in relative abundance between below and aboveground communities as calculated by subtracting the relative abundance of species in the seed pool from the vegetation.

Results

Relationship between seed pool and aboveground vegetation

The seed pool and aboveground vegetation shared 9 of 28 species found before fire. However, for species present in both the seed pool and aboveground vegetation, relative abundances were similar (Fig. 1) except that *Alyssum desertorum* and *Ceratocephala testiculata* were vastly over-represented in the seed pool and *Artemisia tridentata* aboveground (Fig. 2). Species found either only in the seed pool or in the aboveground vegetation were at low abundances.

Effect of fire on seed pool composition and seed abundances

Fire affected the seed pool composition in terms of species presence (Fig. 3). *Apocynum androsaemifolium* was only found after fire while *Achnatherum hymenoides*, *Ceratocephala testiculata*, *Conyza canadensis*, *Descurainia sophia, Lactuca serriola,* and *Taraxacum officinale* were only found before fire. Fire also affected the relative abundances of a few species (Fig. 3). *A. desertorum* was much more common after fire than before. Most notably, fire completely eliminated one of the most common species found in the seed pool prior to fire; the relative abundance of *C. testiculata* shifted from 40% before fire to no seeds after fire.

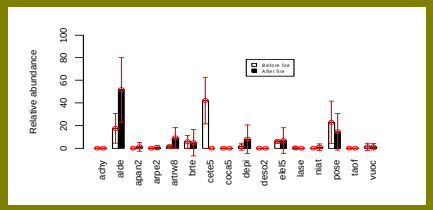

Figure 3. Relative abundances of species in the seed pool before and after fire.

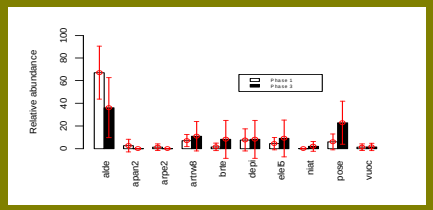

Figure 4. Relative abundances of seed pool species in low cheatgrass abundance (Phase 1) and high cheatgrass abundance (Phase 3).

Effect of aboveground cheatgrass abundance on post-fire seed pools

The relative abundance of cheatgrass aboveground was reflected in the seed pool, with phase 3 communities (most invaded by cheatgrass) having a higher relative abundance of cheatgrass seeds than phase 1 communities (least invaded by cheatgrass). Otherwise, phase 1 and phase 3 seed pools were similar, although phase 1 communities were slightly more diverse (Fig. 4). However, for species present in both phase 1 and phase 3 communities, relative abundances were higher for most species in phase 3 communities. These species included shrubs, native and exotic grasses, and exotic annuals.

Conclusion

The seed pool and aboveground vegetation were moderately similar before fire.

Fire did affect the seed pool composition and altered the relative abundances of a few annual species.

The abundance of cheatgrass aboveground was reflected in the seed pool. Communities with low cheatgrass abundance were slightly more diverse. However, seeds of many species were more abundant in communities with higher cheatgrass abundance.

Land managers and restoration practitioners should consider these effects on the seed pool when making management decisions.

Acknowledgements

This research was supported by the Joint Fire Science Program/SageSTEP and the Ecology Center. Thanks to Casey Addy, Jeff Burnham, Christo Morris, Drew Rayburn, Dara Scherpenisse, and Dan Zamecnik for field and greenhouse assistance. Also thanks to Peter Adler and Susan Durham.