Can herbicide treatment of cheatgrass enhance rare Susanville beardtongue (*Penstemon sudans*) occurrences?

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BACKGROUND

In 2013, we identified occurrences of rare Susanville beardtongue (*Penstemon sudans*, CRPR 1B.2) that were heavily invaded by cheatgrass (*Bromus tectorum*) in Lassen County, California.

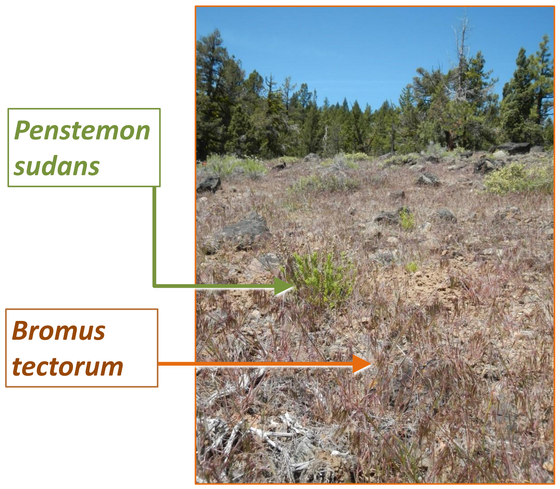


Fig. 1: Scattered plants of *Penstemon sudans* among nearly continuous cover of *Bromus tectorum* in 2013.

Forty 7-m^2 permanent quadrats were established within invaded and non-invaded portions of three *Penstemon sudans* occurrences in 2015.

STUDY QUESTIONS

1. ***How does Susanville beardtongue density vary between invaded and non-invaded areas?***
2. ***Is early-season herbicide treatment effective in reducing cheatgrass density?***
3. ***Where cheatgrass density is reduced, is there an increase in Susanville beardtongue density?***

RESULTS

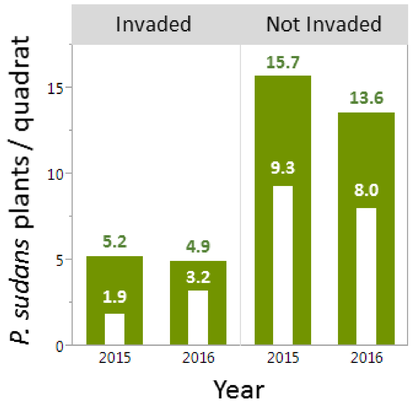


Fig. 2: Mean densities of all *P. sudans* plants (green bars) and flowering *P. sudans* plants (white bars) in 2015 and 2016, prior to the treatment of cheatgrass in invaded plots.

Pre-treatment monitoring indicated that total plant density (green bars) and flowering plant density (white bars) were significantly lower in invaded versus non-invaded plots in both 2015 and 2016 at $\alpha = 0.05$ (Fig. 2).

In May 2017, half of invaded plots were sprayed with fluazifop-p-butyl (Fusilade®), a selective, post-emergent herbicide that targets grasses. We attempted to follow the recommendation that herbicide application occur when *B. tectorum* plants had developed just 3-4 true leaves, but found significant variation in *B. tectorum* phenology both between and within occurrences.

Herbicide treatment resulted in a significant decrease in *B. tectorum* cover relative to invaded control plots (Fig. 3), however there was also a strong declining trend in *B. tectorum* from year to year in all invaded plots.

Changes in *P. sudans* cover between 2015 and 2018 were negatively correlated with changes in *B. tectorum* cover, suggesting that *P. sudans* responds positively to *B. tectorum* treatment.

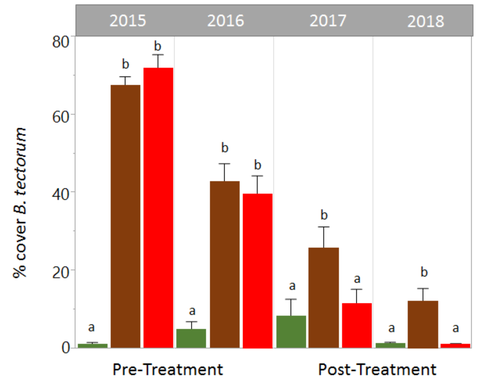


Fig. 3: Mean cover of *B. tectorum* in non-invaded control plots (green), invaded plots that were not sprayed (brown) and invaded plots that were sprayed (red). Error bars show standard error. Letters indicate significant differences between treatments within each year.

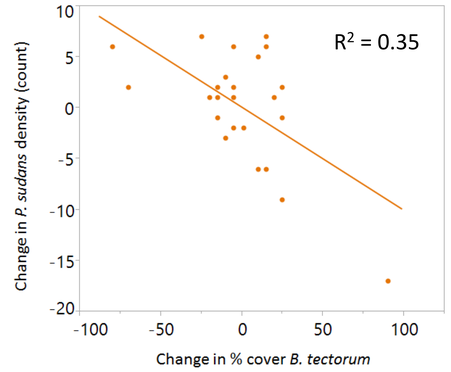
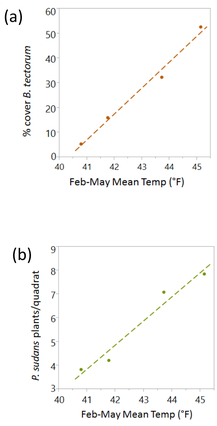


Fig. 4: Linear regression of changes in *P. sudans* cover between 2015 and 2018 plotted against changes in *B. tectorum* cover. Relationship is significant at $\alpha = 0.05$.

FUTURE WORK

High interannual variation across treatments leads us to ask how temperature and precipitation may also affect cover of *B. tectorum*.

Trends over four years of data collection show that winter precipitation and mean spring temperatures across the study area as modelled by PRISM are strongly associated with several *B. tectorum* and *P. sudans* variables (Fig. 5), however additional years of data collection are needed to determine the strength of these relationships.



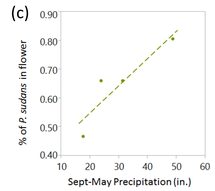


Fig. 5: Relationships between **(a)** mean cover of *B. tectorum,* **(b)** mean density of *P. sudans* and mean spring temperatures. **(c)** Relationship between percentage of *P. sudans* plants in flower and winter-spring precipitation. Regression lines are shown for each.

Establishing which environmental variables best predict *B. tectorum* cover would help land managers prioritize high *B. tectorum* years for herbicide treatment.

Herbicide reapplication is planned for Spring 2019.

THANKS TO

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