



Long-term Cheatgrass Reduction with Indaziflam in Sagebrush-Grassland Plant Communities in Sublette County, Wyoming

Jacob S. Courkamp, Paul J. Meiman

Management Implications:

- Indaziflam (Rejuvra[®], Bayer) is a pre-emergent herbicide that can manage annual grass seed banks and provide long-term reductions with minimal harm to established perennial vegetation.
- Indaziflam provided significant, long-term reductions in cheatgrass cover and density in invaded sagebrush-grasslands in western Wyoming without negative effects on native vegetation species richness.
- Observations from the site after an unplanned wildfire suggest that treatment three years earlier may have prevented the fire from burning significant areas of two large aerial treatment plots, likely by reducing the amount and continuity of fine fuel.
- These results suggest that indaziflam may help managers mitigate the impacts of invasion and proactively protect intact shrublands from cheatgrass-altered fire regimes.

A New Tool for Cheatgrass Management

Downy Brome (*Bromus tectorum* L.), commonly known as cheatgrass, is an invasive winter annual grass that is widespread in a variety of ecosystems in the western US. Cheatgrass invasion often dramatically increases wildfire frequency, and this can devastate semi-arid shrublands historically characterized by infrequent fire. The continuous bed of fine fuel left after cheatgrass completes its short life cycle in early summer increases the likelihood of ignition and the rate of wildfire spread in the communities it invades. Cheatgrass-altered fire regimes have been linked to declines in the extent of sagebrush-dominated plant communities in western North America.

The tools available to managers are often effective at reducing cheatgrass in the short-term, but long-term management success remains elusive in most circumstances. Recent research has highlighted the importance of managing the cheatgrass seed bank, demonstrating that successful control over a period of four or more years can potentially exhaust the soil seed bank, provide long-term reductions, and mitigate the impacts of altered fire regimes. This report describes research with indaziflam (Rejuvra[®], Bayer), a pre-emergent herbicide with the potential to provide sustained cheatgrass reductions over multiple years with a single application. Indaziflam can inhibit the germination of this devastating annual grass by remaining near the soil surface, with minimal harm to established plants with deeper roots.

Cheatgrass Reduction on the Bridger-Teton National Forest

We applied indaziflam at Boulder Lake in the Bridger-Teton National Forest near Pinedale, Wyoming. In September 2016, four randomized replications of five herbicide treatments (including a control) were established on a south facing slope just north of the lake. The herbicide treatments included indaziflam at three different rates (3.5, 5, and 7oz/ac) and imazapic (Plateau[®], BASF) at the standard rate (7oz/ac). All application rates mentioned herein refer to Rejuvra[®] and

Plateau[®] formulations. Imazapic is widely used for cheatgrass management, and in some cases can provide selective control for up to two years, but reapplication is typically required to sustain reductions beyond this time frame. In each of the three summers following application, percent canopy cover by species and cheatgrass density (stems/m²) were measured by randomly locating five extended-Daubenmire frames (0.5m²) in each plot.

We also established eight larger plots (approx. 5ac) at the Boulder Lake research site. Four of these were aerially treated with indaziflam at the 5oz/ac rate (helicopter with 5 gallons/ac spray volume), and four were left as untreated

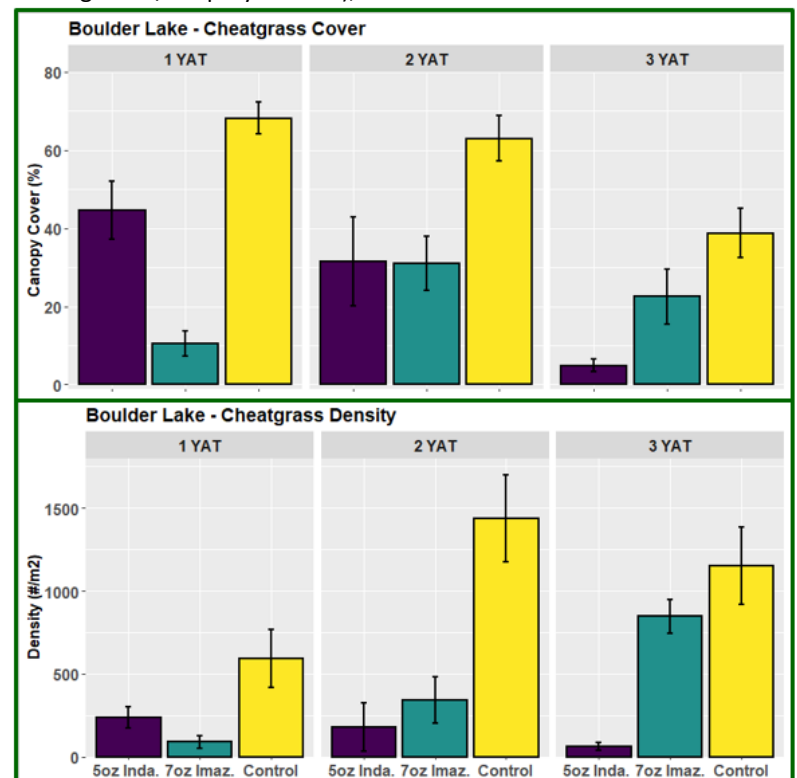


Figure 1. Data from small plots, all rates per acre. 3.5 and 7oz/ac indaziflam not shown. Inda. = Rejuvra[®], Imaz. = Plateau[®], YAT= years after treatment.

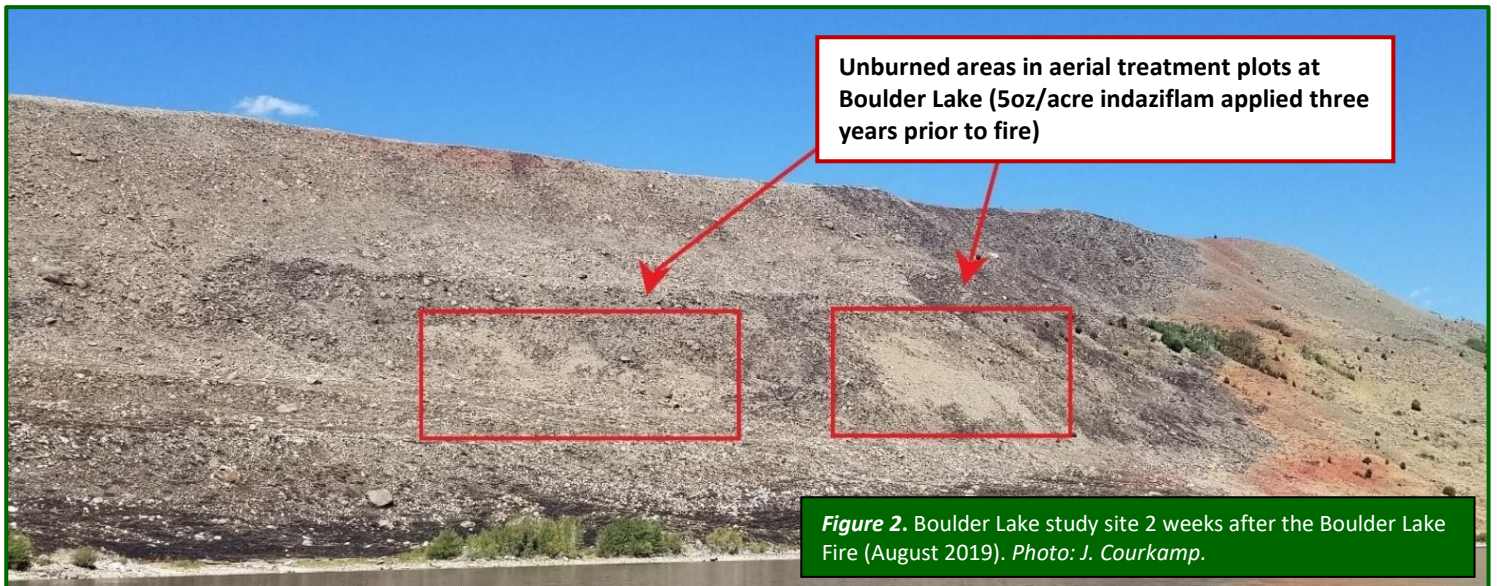


Figure 2. Boulder Lake study site 2 weeks after the Boulder Lake Fire (August 2019). Photo: J. Courkamp.

controls. In six of these plots (three treated, three untreated), Modified-Whittaker multiscale vegetation sampling was used to compare native vegetation species richness between treated and untreated plots.

Imazapic outperformed indaziflam in the small plot study one year after treatment, but cheatgrass increased in imazapic plots over the next two years while control improved in indaziflam plots over the same period. Three years after application, reductions in cover and density remain significant in plots treated with indaziflam at 5 and 7oz/ac, while control has declined in plots treated with indaziflam at 3.5oz/ac and the imazapic plots (Figure 1.). In addition, cheatgrass cover and density were significantly reduced in the large aerial treatment plots with no effect on native vegetation species richness three years after treatment (not shown).

Boulder Lake Fire: Anecdotal Results Suggest a Potential Path Forward for Invaded Landscapes

In August 2019, a human-ignited wildfire burned through the study area at Boulder Lake. All of the small plots were burned, but significant portions of two aerial treatment plots were left unburned within the boundary of the wildfire (Figure 2). While strong conclusions cannot be drawn from an unplanned wildfire, the fact that significant portions of treated areas remained unburned suggests that the reductions in cheatgrass as a result of indaziflam application likely influenced the behavior of the Boulder Lake Fire.

Photographs taken from the aerial plots at Boulder Lake approximately six weeks prior to the fire show the difference in the continuity and abundance of cheatgrass-associated fine fuels between treated and untreated plots (Figure 3).

Conclusions:

While indaziflam and imazapic provided comparable reductions in cheatgrass cover and density one year after treatment, control declined in imazapic plots and increased in indaziflam plots through time. Only indaziflam plots continued to show significant reductions three years after treatment. Indaziflam had no impact on native vegetation species richness in the aerial treatment plots at Boulder Lake and anecdotal observations from these plots following wildfire indicate that treatment may have altered wildfire behavior and allowed portions of the aerial treatment plots to remain as unburned islands completely surrounded by burned areas.

The selectivity of indaziflam may allow managers to proactively treat invaded areas that continue to support communities of perennial plants, and this may prove critical to mitigating the destructive impacts of cheatgrass. Our results suggest that indaziflam may be an important tool for managers tasked with confronting continuing invasion and the increased fire frequency it portends.



Figure 3. Close-ups of treated and untreated aerial plots at Boulder Lake approximately 6 weeks prior to the Boulder Lake Fire. Photos: J. Courkamp.

For Further Reading

*This brief represents PhD research pending defense and future publication. For more information see the sources below.

- Clark SL, (2020). Using herbicides to restore native species and improve habitat on rangelands and wildlands. *Outlooks on Pest Management*, 31(2): 57-60. doi: 10.1564/v31_apr_00
- Sebastian DJ, Sebastian JR, Nissen SJ, Beck KG, (2016). A potential new herbicide for invasive annual grass control on rangeland. *Rangeland Ecology and Management*, 69(3): 195-198. doi: 10.1016/j.rama.2015.11.001