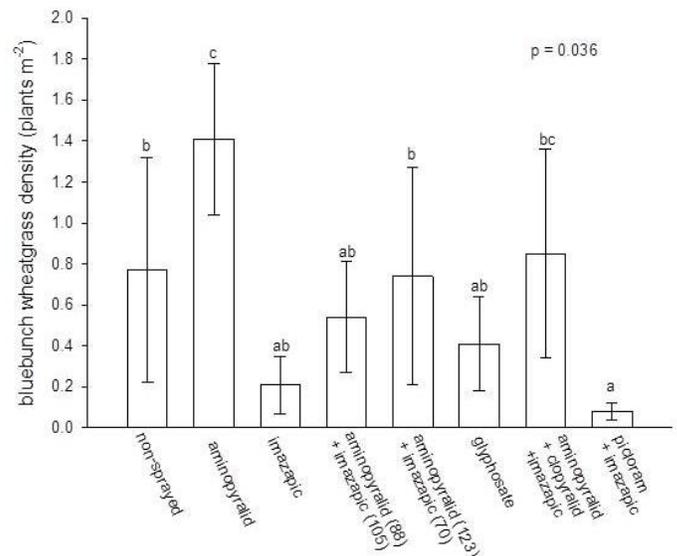


## Revegetation of rangeland infested by an invasive forb-annual grass complex

When land managers are faced with invasive forbs listed as noxious weeds, they have viable options for controlling them such as herbicide or biological control. While these tools can effectively kill weeds, they often do not result in a plant community that meets management objectives. Remnant desired vegetation is often too scarce to fill voids previously occupied by an invasive forb, and the invasive forb may be replaced by an unwelcome secondary invader like the annual grass cheatgrass. Integrating seeding of desired species with weed control may help to prevent secondary invasion and improve long-term restoration outcomes.

We conducted a study in which the goal was to restore desired grasses to rangeland dominated by spotted knapweed and cheatgrass through the integration of herbicides and revegetation. We expected that seeded species establishment would increase with control of spotted knapweed and cheatgrass. We also expected that increased establishment of seeded species would result in lower abundance of spotted knapweed and cheatgrass over time. We tested eight herbicide treatments and six seeding treatments at a site near Missoula, MT. Herbicide treatments were designed to provide control of spotted knapweed, cheatgrass, or both and applied August 2009. Five perennial grasses were seeded in monoculture in November 2009. Plots were sampled 1, 2, and 4 years following treatment application.

In year 1 and 2, herbicide treatments performed as expected; spotted knapweed cover was reduced to less than 1% in all treatments that included aminopyralid, clopyralid, or picloram. Cheatgrass cover was reduced to less than 0.1% by treatments that included imazapic. In spite of good weed control, very few seedlings of seeded species were found. However, by year 4 we found bluebunch wheatgrass and tall wheatgrass growing where it had been seeded. Controlling weedy species with herbicides led to an increase in bluebunch wheatgrass establishment (see figure, right) but had no effect on establishment of tall wheatgrass. We were surprised that bluebunch wheatgrass and tall wheatgrass performed so well 4 years after treatment in spite of finding very few seedlings 1 and 2 years after treatment.



Effect of herbicide on bluebunch wheatgrass density 4 years after treatment. See link to full article below for details.

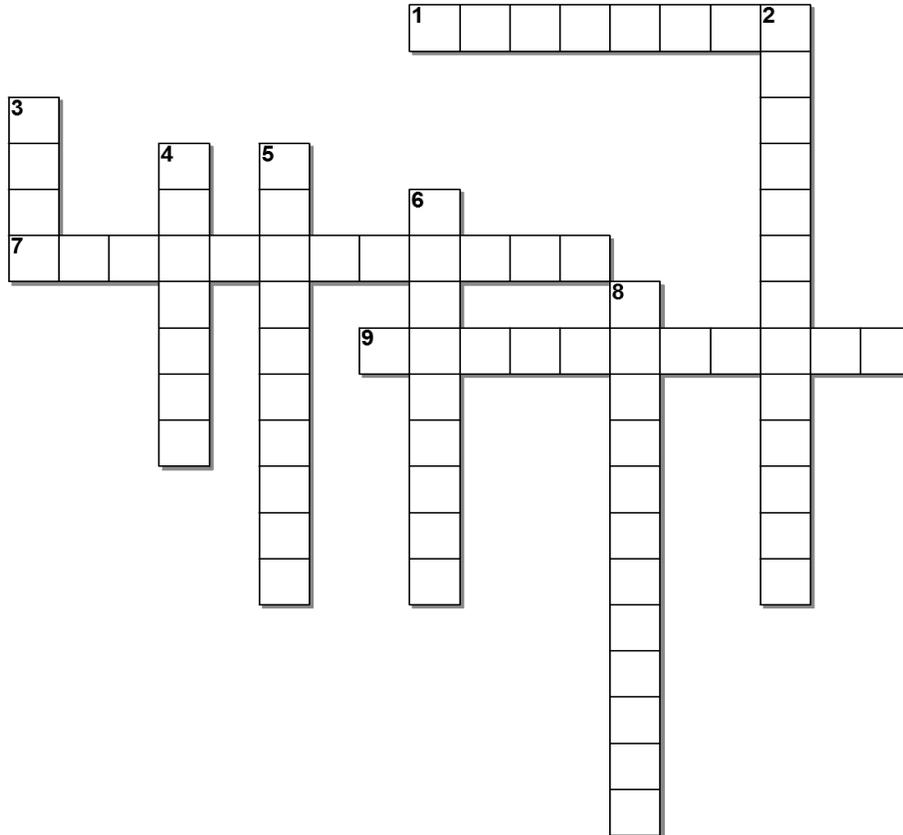
Establishment of seeded species resulted in lower weed abundance over time for spotted knapweed but not for cheatgrass. Spotted knapweed was nearly absent when bluebunch or tall wheatgrass was seeded in combination with certain herbicide treatments. Cheatgrass, on the other hand, did not seem to be affected by seeded grasses.

Although limited, this study still provides two valuable insights into revegetation of weed-infested rangeland. First, restoration of weed-infested rangeland is a slow process; it took 4 years before we saw the grasses we had seeded! Seeded species need time to establish and subsequently compete with weedy species. Second, good weed control does not always equate to improved establishment of seeded species. Seedling establishment is influenced by many factors, only one of which is competition with weedy species. Once established, however, seeded desired species can limit re-invasion. In our study, this was true for the large-statured exotic invasive forb spotted knapweed more so than the annual grass cheatgrass, whose abundance fluctuated greatly from year to year.

You can read about this study in more detail by clicking on the link below:

[http://www.msuextension.org/invasiveplantsMangold/documents/Publications\\_Mangold/Mangold%20et%20al\\_2015\\_Ecol%20Rest.pdf](http://www.msuextension.org/invasiveplantsMangold/documents/Publications_Mangold/Mangold%20et%20al_2015_Ecol%20Rest.pdf)

## Test your knowledge of revegetation of rangeland infested by invasive forb-annual grass complex



**Across:**

- 1 Location of study described in this month's Weed Post.
- 7 Patience is a virtue when applying this management technique to weed-infested rangeland.
- 9 It is generally assumed that \_\_\_\_\_ (two words) must occur in order to establish desirable plants during revegetation.

**Down:**

- 2 Watch out for this class of secondary invaders when managing invasive forbs.
- 3 Number of years it took before seeded grasses were evident at research site
- 4 One of two reasons why these results of this study are limited (two words).\*
- 5 Abundance of this plant is known to fluctuate greatly from year to year.
- 6 It ain't easy being green (and small); in addition to competition, these environmental conditions can limit seedling establishment.\*
- 8 Invasive forbs are often listed as these.

\*See journal article for answers to these questions.

Solutions are posted to the MSU Extension Invasive Rangeland Weed website:

<http://www.msuextension.org/invasiveplantsMangold/extensionsub.html>

