Evaluating control of late-season noxious grassland invasives with multiple approaches: wildfire, prescribed fire, native grass restoration, and organic herbicides

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In California grasslands, late-season invaders are some of our most noxious weeds
Phenological differences provide potential for control of late-season invasives
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Phenological differences provide potential for control of noxious weeds by:
- Herbicides
- Burning
- Suppression by native perennial grasses
- Grazing
Organic herbicides rely on contact-kill, most effective on small seedlings

- Early spring- early-season grasses large and less vulnerable vs. late-season are small and vulnerable.

Growing season - early season annual exotics

Germinating rains

Dry summer

Growing season - late-season noxious annual exotics
Organic herbicides rely on contact-kill, potential for targeting developing flowers

- Early spring- early-season grasses large and less vulnerable vs. late-season are small and vulnerable
- Late spring- early-season grasses senesced, can damage developing flowers & seeds of late-season grasses

Growing season- early season annual exotics

Growing season- late-season noxious annual exotics

Germinating rains

Dry summer
Glyphosate vs. D-Limonene (Avenger) vs. Capric & Caprilic Acid (Suppress)

Growing season - early season annual exotics

Germinating rains

Growing season - late-season noxious annual exotics

Dry summer
Any timing of glyphosate decreases cover of Medusahead and Goatgrass.

Early spring application of Capric acid has a moderate effect on noxious grasses.
No significant persistent effects of organic herbicides one year after treatment.
Early and mid-spring applications of glyphosate virtually eliminate wildflowers (organics have more muted effects)
Phenological differences provide potential for control of late-season invasives

Growing season - early season annual exotics

Growing season - late-season noxious annual exotics

Prescribed burns target time when flowering and seed production are vulnerable

Wildfires most often occur later when all annuals have senesced

Germinating rains

Dry summer
Fire mortality- seeds

- Vulnerable to fire: Up to 85% of seed production from the previous growing season is in the thatch layer (Young et al. 1981)

- Wildfire reduced overall germination 7-fold, and decreased germination of the dominant grasses 50-fold (Cox and Allen 2008).
Mendocino Complex Fire:
late July 2018

Prescribed fires: June 2018
Medusahead seed survival impacted similarly by prescribed and wildfires.

Goatgrass seed survival lower in wildfires.
For medusahead, both burns decrease seed survival and next year’s cover by 98%.

For goatgrass, despite high seed mortality, fire effects on first year’s cover is more muted.
Phenological differences to control late-season invasives?

Growing season - early season annual exotics

Growing season - late-season noxious annual exotics

Limited ability of early-season annuals to suppress late-season annuals because of different phenologies
Phenological differences to control late-season invasives?

Growing season- early season annual exotics

Growing season- late-season noxious annual exotics

Growing season- native perennial grasses

Native perennials can provide direct competition for late-season resources
Changes in cover of noxious weeds depends on who they are competing with

• Noxious weeds planted with

- Exotic annuals
- Native perennials

• Noxious weeds are initially higher in natives vs. annual exotic treatments
Native restoration can suppress noxious weeds over time

- Over time, noxious weeds in annual exotics are highly influenced by annual rainfall, vs. natives suppress noxious weeds.
Phenological differences provide opportunities for controlling noxious grasses

- Organic herbicide effects on noxious weeds are small and short-term. Their benefit is they have less negative effects on wildflowers
- Medusahead is virtually eliminated for at least the first year after prescribed and wild fires
- Goatgrass cover decreased by 39% in prescribed fires and 65-70% in wildfires
- Native perennial grasses, once established, provide long-term suppression of noxious weeds, even in highly-favorable years
- Is native grass restoration post-fire an effective long-term strategy for suppressing medusahead and goatgrass?