Restoring Native Plants to Crested Wheatgrass Stands in Eastern Oregon

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Crested Wheatgrass

- Introduced to North America in 1898
  - Used to:
    - Stabilize soils
    - Livestock forage
    - Prevent weed invasion
    - Reduce wildfire hazard
- Occupies more than 5 million hectares in western U.S.

(Pellant and Lysne 2005)
Crested Wheatgrass Legacy

- Dominates seed bank and limits growth of native species
- Native species recruitment unlikely
- To re-establish diversity:
  - Suppression of crested wheatgrass plants and propagules
  - Deliberate introduction of desired species

Benefits of Restoring Natives

• Improves resource capture and cycling
• Increases resilience and resistance to disturbance
• Improves wildlife habitat (esp. sagebrush obligate species)

Objective

• Test various strategies for restoring native plant species to crested wheatgrass-dominated rangeland
Hypotheses

• Suppression treatments would decrease crested wheatgrass density and cover
• Suppression treatment and revegetation would interact to increase native species density
Study Site

• 80 km south of Burns, OR
• Malheur National Wildlife Refuge
• Seeded to crested wheatgrass in 1981 following wildfire
Crested Wheatgrass Suppression Treatments

• Mechanical
  – One pass with disk (1M)
  – Two passes with disk (2M)

• Herbicide (glyphosate)
  – Low rate (LH)
    • 0.25X recommended rate
  – High rate (HH)
    • 1.0X recommended rate

• Undisturbed (UD)
Revegetation Treatments

• Seeded
• Non-seeded

• Truax™ Rough Rider no-till drill
• Cool season and fluffy seed boxes
• 31 Oct. – 1 Nov. 2005 (Trial 1)
• 30-31 Oct. 2006 (Trial 2)
Native Seed Mix

• 4 grasses
  – bluebunch wheatgrass \((L)\)
  – Sandberg’s bluegrass \((S)\)
  – Indian ricegrass \((L)\)
  – Squirreltail \((L)\)

• 3 forbs
  – western yarrow \((S)\)
  – Lewis flax \((L)\)
  – Munro globemallow \((L)\)

• 3 shrubs
  – Wyoming big sagebrush \((S)\)
  – four-wing saltbush \((L)\)
  – white-stemmed rabbitbrush \((S)\)
Experimental Design

- Randomized block, split-split-plot
- Whole-plot = suppression treatment (30m x 140m)
- Split-plot = seeding treatment (30m x 70m)
- Split-split-plot = year (2 trials)
- 5 replications
Sampling

• Density and canopy cover
  – Crested wheatgrass
  – Other perennial species
  – Cheatgrass

• Density
  – Seeded species

• 50, 0.25m² frames/plot

• Trial 1
  – 2006-2008

• Trial 2
  – 2007-2008
Data Analysis

• Mixed effect split-split plot analysis
  – Fixed effects = suppression treatment, seeding treatment, year
  – Random effects = block

• Means separated using Tukey’s Honestly Significant Difference (HSD)

(Ramsey and Schafer 2002)
Treatment x Year Effect on Crested Wheatgrass Density - Trial 1

- **HH** = high rate herbicide
- **2M** = mechanical, 2 passes
- **LH** = low rate herbicide
- **1M** = mechanical, 1 pass
- **UD** = undisturbed

HSDa = 1.1  
HSDb = 1.5  
$p < 0.01$
Treatment Effect on Crested Wheatgrass Density - Trial 2

HH = high rate herbicide
2M = mechanical, 2 passes
LH = low rate herbicide
1M = mechanical, 1 pass
UD = undisturbed

HSD = 1.7
p = 0.01
Treatment x Year Effect on Crested Wheatgrass Cover - Trial 1

- **HH** = high rate herbicide
- **2M** = mechanical, 2 passes
- **LH** = low rate herbicide
- **1M** = mechanical, 1 pass
- **UD** = undisturbed

HSDa = 2.1
HSDb = 2.8
p < 0.01
Treatment x Year Effect on Seeded Species Density – Trial 1

- **HH** = high rate herbicide
- **2M** = mechanical, 2 passes
- **LH** = low rate herbicide
- **1M** = mechanical, 1 pass
- **UD** = undisturbed

HSDa = 4.9
HSDb = 5.0
p < 0.01
Year Effect on Seeded Species Density – Trial 2

HSD = 1.7
p < 0.01
Conclusions—Eastern Oregon

• Suppression treatments not effective
• Mechanical suppression treatments increased crested wheatgrass
• Seeded species
  – High initial establishment in spite of poor suppression
  – Decreased over time
Implications

• Successive suppression treatments prior to seeding natives
• Subsequent management to favor persistence of native species
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Questions