Ecology & Management of Cheatgrass

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Land Reclamation Basics for Energy Development in Northeastern Wyoming
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Overview

- Exotic annuals in the West;
- Cheatgrass extent;
- Why worry?
- Cheatgrass MO;
- Wildfires;
- Impacts on soils;
- Can it happen here?
- Prevention & management.
California: complete conversion of native perennial bunchgrass communities to exotic annuals in the coast range, central valley, and foothills
Great Basin & Snake River Plain: Cheatgrass dominates over 1/3 of land area, including MOST sagebrush steppe grasslands, but medusa ahead is coming!
Southwestern Deserts: Red brome dominates many Sonoran, Mojave, and Great Basin deserts.
Wyoming: NEXT???

Why not?
In each case chronic disturbance disrupted nutrient cycles in winter-precip-dominated ecosystems:

- Undisturbed desert and shrub-steppe grasslands have very “tight” nutrient cycling: nutrients are taken up as soon as released by decomposition;
- 1000’s of years of conservative nutrient cycling caused accumulation of soil organic matter;
- Disturbance breaks nutrient cycles, releasing nutrients as stored SOM breaks down without uptake by diverse plant & microbial communities;
- Eurasian species adapted to “here today-gone tomorrow” nutrient regimes rapidly take advantage of available nutrients.
Cheatgrass MO in the GB

Sagebrush steppe
Pinyon-Juniper
Fire return interval

- Sage Steppe: 27-40 years;
- Pinyon-Juniper: ~ 100 years;
- Cheatgrass: 2-3 years;
  - Native grasses gone after 2-3 burn cycles;
- Utah: acres burned per year increased by factor of 6 in the last decade;
- Cost increased by factor of 7.
Distribution of Cheatgrass

http://plants.usda.gov

http://www.nps.gov
Impacts on Soils
- Thinner A horizons under cheatgrass
- Lower bulk density in cheatgrass A horizons
- Platy structure in cheatgrass A horizons
Cedar Creek
Cedar Knoll

Organic carbon concentration (g kg\(^{-1}\))

Depth (cm)

Percent difference: 0-5cm and 5-25cm depths

Native Cheatgrass
Nitrate-N as proportion of Total N

Soil Depth

<table>
<thead>
<tr>
<th>Soil Depth</th>
<th>Native</th>
<th>Cheatgrass</th>
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<tbody>
<tr>
<td>0-5 cm</td>
<td>a</td>
<td>b</td>
</tr>
<tr>
<td>5-20 cm</td>
<td>a</td>
<td>b</td>
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R = 0.84

Approx. Age of Cheatgrass Invasion (yrs)

A horizon - minimum Organic C (mg kg⁻¹, top 50 cm)
Mineral C:N after 12d incubation

Cedar Creek

Cedar Knoll

Depth (cm)

Native

Cheatgrass
Native shrub-steppe soil

Active SOM

Slow SOM

Passive SOM

Cheatgrass-dominated soil

Active SOM

Slow SOM

Passive SOM
More mineral N and sharper drops between surface and subsurface horizons suggest long-term mining of stored SOM under cheatgrass.

Large-scale environmental change in cycling of water, carbon, nitrogen, and other ecosystem components.

Loss of resiliency in a degradation spiral.
Management & Control

**Prevention**: Keeping cheatgrass out;

- Clean equipment, weed-free hay, socks, etc.;
- Vigilant monitoring, pulling, spot spraying;
- Manage for healthy perennial herbaceous plant communities:
  - Grazing: Monitor/manage for optimal utilization of key perennial grasses;
  - Fire: Use prescribed fire to thin sagebrush and stimulate grasses.
Are Wyoming Plant Communities Vulnerable?

- Wyoming big sage most vulnerable in other areas;
- Overstocked sagebrush;
- Bare and soil weakened perennial cover;
- Disturbance and seed introduction;
- Continued heavy grazing.
Management & Control

**Management:** Where cheatgrass is present but not dominant;

- Probably won’t eradicate it;
- Manage to strengthen perennial native grasses;
  - Thin sage brush without fire;
  - Careful grazing management;
  - Fire + herbicide depending on plant community and amount of cheatgrass present;
  - Minimize disturbance.
Management & Control

**Restoration**: Where cheatgrass dominates;

- Restoration of shrub-steppe and P-J is feasible:
  - Herbicide and well-timed seeding often successful, just as in mine and well-pad reclamation;
- Cheatgrass remains present: Careful management to maintain perennial grasses and proper shrub density is ongoing;
- “Augmented succession” may be necessary due to soil degradation in long-term cheatgrass;
- Crucial to break up landscape to reduce wildfire interval.
Cheatgrass remains present

- Ongoing management for healthy perennials;
- Fire breaks and green strips using fire resistant introduced species;
Degraded soil

- Augmented succession
  - Use competitive species to stabilize site, reduce fire frequency, and add SOM;
  - Increase diversity through interseeding native grasses, forbs, & shrubs;
  - Accepts that restoration may not be a one-step process.
Summary

- Exotic annual grasses dominate California, Great Basin, Snake River Plain, and Southwestern desert grasslands;
- Wyoming has millions of acres of the same plant communities being invaded in the GB & SRP: Wyoming big sagebrush steppe and pinyon-juniper;
- Utilize nutrients made available as chronic disturbance converts conservative nutrient cycles to “leaky” ones;
- In sage brush and P-J, fire suppression and grazing cause canopy to close until it will carry fire;
  - Cheatgrass goes from minor to major component of herbaceous cover;
  - Cheatgrass creates continuous fine fuel that causes repeated fires and loss of perennial vegetation;
Conversion to cheatgrass:
- Increases occurrence of large fires and cost of fighting fires;
- Destroys wildlife habitat and forage value;
- Degrades soils by mining organic matter stored during long-term perennial cover;

Prevention:
- Clean equipment, socks, hay, etc.;
- Vigilant monitoring, pulling, spot spraying;
- Manage for healthy herbaceous native perennial plants;

Management (cheatgrass present, not dominant):
- Strengthen herbaceous component without using fire;
- Fire + herbicide in some cases;
- Minimize disturbance.

Restoration:
- Often initially successful, but preventing large fires and disturbance is key to long-term stability;
- Where soils are degraded due to long-term cheatgrass dominance “augmented succession” approach may save money in the long run.