Factors Regulating Long-term, Large-Scale Grassland Community Assembly

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Two Studies

Office of Surface Mining (OSM)-funded study focused on constraining annual weeds, preventing crested wheatgrass invasion and increasing shrubs (i.e. winterfat, four-wing saltbrush, big sage, fringed sage) on surface-mined lands of the Great Plains. Shrubs are the most difficult plant group to establish on these lands.


Montana Department of Environmental Quality (DEQ)-funded study investigating factors regulating shrub abundances.

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Approach

Management data

Vegetation data

Statistical analysis

New knowledge
Sampling Designs

“Field” or area seeded and otherwise treated over a short period of time

OSM project

DEQ project

20 cm

51 cm

5 m, 46 m
Plant Cover

“Relative cover” $\text{Relative cover} = \frac{\text{Actual cover}}{\text{Maximal possible cover}}$
Effects of Grass Seed Rates on Plant Cover

Difference between 0.0 and low (>0.0 to 3.9 kg/ha)

Difference between low and medium (>3.9 to 7.8 kg/ha)

Difference between medium and high (>7.8 kg/ha)
## Effects of Grass Seed Rates on Plant Cover

<table>
<thead>
<tr>
<th>Grass seed rate</th>
<th>Seeded shrubs</th>
<th>Annual weeds</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.0 kg/ha</td>
<td>0.10 (0.02, 0.53)</td>
<td>2.8 (1.1, 6.7)</td>
</tr>
<tr>
<td>&lt;0.0 to 3.9 kg/ha</td>
<td>0.10 (0.03, 0.41)</td>
<td>1.5 (0.7, 3.3)</td>
</tr>
<tr>
<td>&gt;3.9 to 7.8 kg/ha</td>
<td>0.02 (0.007, 0.09)</td>
<td>1.1 (0.5, 2.4)</td>
</tr>
<tr>
<td>&gt;7.8 kg/ha</td>
<td>0.009 (0.002, 0.04)</td>
<td>1.1 (0.5, 2.4)</td>
</tr>
</tbody>
</table>
## Shrubs-DEQ Study

<table>
<thead>
<tr>
<th>Variable</th>
<th>Mean</th>
<th>Mean+SD</th>
</tr>
</thead>
<tbody>
<tr>
<td>Shrub (kg/ha)</td>
<td>1.0</td>
<td>2.4</td>
</tr>
<tr>
<td>Grass (kg/ha)</td>
<td>26</td>
<td>44</td>
</tr>
<tr>
<td>Rock cover (%)</td>
<td>9</td>
<td>30</td>
</tr>
<tr>
<td>Precip. (mm)</td>
<td>168</td>
<td>221</td>
</tr>
</tbody>
</table>

### Change in probability of sampling shrubs

- .15 - .10 - .05  .00  .05  .10

### Change in shrub cover (%)

-60 -40 -20  0  20  40  60  80
Why the Negative Precipitation Effect?
Niche partitioning promotes coexistence

Shrub, warm season grass or other slow growing species that is difficult to establish

Fast-growing seeded grass

Cheatgrass

High grass seed rate:

Low grass seed rate:

Time

Niche partitioning promotes coexistence
Crested Wheatgrass Time Trends

Not all fields had crested wheatgrass

Belle Ayr
Caballo
Cordero Rojo
Decker
Rawhide
Spring creek
Direct Haul Effect on Crested Wheatgrass

Corresponds to a 55% difference
Adaptive Management

Project evaluating aggressive grass seed rates well below rates commonly used (i.e. 0.2, 0.4, 1.0, 2.0 lb acre$^{-1}$)

Project spatially segregating difficult-to-establish shrubs from aggressive grasses
Final Thoughts

I believe this research has relevance in a variety of rangeland systems

If you see any potential for applying this research and have questions, please look me up today or feel free to contact me:

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