Does non-native white sweetclover impact Alaskan floodplain plant communities?

Blaine T. Spellman and Tricia L. Wurtz

Invasive Species Ecological Impacts

Research conducted outside Alaska
- Invasive plants displace native species and alter native plant communities and ecosystem processes (Levine et al. 2003)
- Invasive species can displace native seedlings and mature plants

Research within Alaska
- Prior to our study, no data existed on the ecological impacts of invasive plants within Alaska
- Research regarding invasive plant impacts to natural habitats was a stated need for land managers of Alaska (CNIPM 2005)
White Sweetclover (*Melilotus alba*)

- biennial legume
- grows 0.5 to 1.5 m in height
- common along roads in Alaska
- invasive along several river floodplains in Alaska

Sweetclover Distribution

Distribution of sweetclover along roadsides in Alaska.

Sweetclover along the Nenana River. mark locations of our floodplain study sites.
Early Stages of Glacial Floodplain Succession

Key Characteristics:
1) high disturbance
2) limited nutrients (i.e. Nitrogen)
3) sparsely vegetated
4) vegetation is shade intolerant

Teklanika River within Denali National Park and Preserve
Model of Plant Population Dynamics
(Hedysarum alpinum)

Overall Question and Hypothesis

Question:
• How does sweetclover affect the seedlings of native floodplain plants?

Hypothesis
• We predicted that sweetclover would reduce native seedling recruitment through competition
Experiments

1) Sweetclover removal experiment – determined the impact sweetclover has on native floodplain plant recruitment

2) Sweetclover shading experiment – determined if competition for light explained results observed from the removal experiment

3) Seedling competition experiment – determined competitive interactions between seedlings of sweetclover and two common floodplain legumes

Removal Methods

- Experiment conducted along the Nenana and Healy River floodplains during the summer of 2006 and 2007
- Each year and site had 12 unique patches of sweetclover (>10 m²); sweetclover cover in patches ranged between 30-90% cover

Distribution of sweetclover along the Nenana River. ● mark locations of our floodplain study sites.
Removal Methods

In September,
• Measured variables - % native seedling survival and # of native seedlings that survived
• In 2007, seedlings were identified to functional group

**Functional Groups** – Tree/Shrub, Forb, Legume, Graminoid

| control | sweetclover - | vegetation - |
Removal Experiment Results

Mean percent survivorship ($\pm$ SE) of native seedlings at a control and two treatments. Different letters indicate statistically significant differences $p>.05$. 

Removal Experiment Results

Mean count of native seedlings ($\pm$ SE) at a control and two treatments. Different letters indicate statistically significant differences $p>.05$. 

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Removal Experiment Results

### native seedling richness and abundance

<table>
<thead>
<tr>
<th>treatment</th>
<th>Tree/shrub</th>
<th>Forb</th>
<th>Legume</th>
<th>Graminoid</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>control</td>
<td>2</td>
<td>5</td>
<td>2</td>
<td>3</td>
<td>12</td>
</tr>
<tr>
<td>sweetclover -</td>
<td>2</td>
<td>7</td>
<td>3</td>
<td>4</td>
<td>16</td>
</tr>
<tr>
<td>vegetation -</td>
<td>3</td>
<td>6</td>
<td>3</td>
<td>2</td>
<td>14</td>
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</tbody>
</table>

Combined count from all plots in 2007

### abundance of native species

<table>
<thead>
<tr>
<th>treatment</th>
<th>Tree/shrub</th>
<th>Forb</th>
<th>Legume</th>
<th>Graminoid</th>
<th>Total</th>
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</thead>
<tbody>
<tr>
<td>control</td>
<td>6.5</td>
<td>7.8</td>
<td>1.6</td>
<td>8.1</td>
<td>18.1</td>
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<td>sweetclover -</td>
<td>6.3</td>
<td>10.3</td>
<td>2.8</td>
<td>16.1</td>
<td>35.5</td>
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<tr>
<td>vegetation -</td>
<td>2.6</td>
<td>15.6</td>
<td>1.6</td>
<td>2.5</td>
<td>22.3</td>
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</tbody>
</table>

Mean within control and removal plots in 2007

Removal Experiment Conclusions

1) Plots with sweetclover had significantly higher native seedling mortality and fewer native seedling recruits.

2) Plots with sweetclover had fewer native species and had fewer native seedlings within all functional groups.

Can these results be explained through shading by sweetclover?
Sweetclover Shading along the Healy River

Species used in Shading Experiment

- **Chamerion latifolium**
  - river beauty
  - *Salix alaxensis*
  - feltleaf willow

- **Hedysarum boreale**
  - northern sweetvetch
  - *Hedysarum alpinum*
  - eskimo potato

- **Alnus incana**
  - *Hedysarum mackenzii*
  - thinleaf alder
Shading Methods

Shading Results
Shading Results

Overwintering survival of *S. alaxensis*

<table>
<thead>
<tr>
<th>% seedling survivorship</th>
<th>control</th>
<th>medium-low</th>
<th>medium</th>
<th>medium-high</th>
<th>High</th>
</tr>
</thead>
<tbody>
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</tbody>
</table>

Shading Conclusions

1) Sweetclover shaded 1 to 94% of the available light along the Healy River floodplain.
2) Shading stressed and led to increased mortality of Alaskan floodplain species.
3) Depending on a species’ tolerance to shading, sweetclover may have major or minor impacts to Alaskan plant populations.
Overall Conclusions

- Sweetclover impacts Alaskan floodplain plant communities through altering native seedling recruitment.
- Competition for light can stress and lead to increased mortality of common Alaskan floodplain plant species.

Management Implications

endemic species

Both species were found along floodplain study sites and may warrant conservation efforts.
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Works Cited

