Treatments for preventing and controlling Scotch broom

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Acknowledgements

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- **Granting agencies**: USFS Special Technology Development Program & USDA NIFA
- **PNW Staff**: James Dollins, Dave Peter, and others
Scotch broom characteristics

- Native to Europe; introduced in 1850s; currently in 19 eastern and 8 western U.S. states.
- Copious seed producer (up to 17,000/year); seed bank viable for decades.
- Nitrogen fixer (15 lbs. N/acre/year); potential allelopathy.
Economic impacts

- High cost of controlling broom: $50-$300 per acre (Oneto et al. 2010).

- Oregon estimates $40 million spent annually for control expenses and lost timber revenues (Hulting et al. 2008).

High density stands can be difficult to control
Preventing Scotch broom during harvesting

- Wash equipment before operating
- Retain logging debris
- Limit soil disturbance
Matlock Long-Term Soil Productivity Study

Heavy debris

Light debris

2 weeks after treatment

3 years after treatment
Logging debris limited broom cover, resulting in better Douglas-fir survival

Harrington and Schoenholtz, *CJFR* 2010
Logging debris and Scotch broom:
Private landowner observes similar results

Heavy logging debris

Light logging debris

Photographs: Bruce Anderson
Aerial photograph of Matlock Study (2012)

Nine years after planting, Douglas-fir are sparse in plots with light debris and uniform in plots with heavy debris.
Dry Bed Creek Study initiated in late 2011

Study objective: identify combinations of logging debris and herbicides that inhibit Scotch broom and improve performance of planted Douglas-fir.

Pre-harvest density: 300 broom/acre
Scotch broom from soil-stored seed

Seed bank contained at least 600 viable seeds per acre
Harvesting at Dry Bed Creek, Nov.-Dec. 2011
Logging debris treatments

- Heavy debris: 8.9 tons/acre
- Light debris: 3.9 tons/acre
- Machine trails: 6.7 tons/acre
Logging debris inhibited Scotch broom regeneration

Dry Bed Creek Study, unpublished data
Logging debris reduced soil temperature

(5 cm depth)

• Up to 2.3°C cooler under heavy debris.

Dry Bed Creek Study, unpublished data
Temperature reductions from debris sufficient to slow broom germination
Soil disturbance in machine trails favored grasses, non-native forbs, and broom.

Dry Bed Creek Study, unpublished data
First-year Douglas-fir injury at Dry Bed Creek

<table>
<thead>
<tr>
<th>Variable</th>
<th>Heavy debris</th>
<th>Light debris</th>
<th>Machine trail</th>
</tr>
</thead>
<tbody>
<tr>
<td>Chlorosis</td>
<td>6.7 b</td>
<td>15.6 a</td>
<td>15.0 a</td>
</tr>
<tr>
<td>Aborted bud</td>
<td>6.5 a</td>
<td>7.5 a</td>
<td>8.8 a</td>
</tr>
<tr>
<td>Dieback</td>
<td>6.0 b</td>
<td>7.7 ab</td>
<td>10.8 a</td>
</tr>
<tr>
<td>Browse</td>
<td>3.9 a</td>
<td>5.0 a</td>
<td>7.2 a</td>
</tr>
</tbody>
</table>

---------- % of seedlings ----------

Dry Bed Creek Study, unpublished data
Controlling Scotch broom with herbicides

- **Spot treatments**: basal application of a 20% solution of triclopyr ester in oil.
- **Foliar treatments**: flowering is the best timing (more surface area for herbicide uptake).
Herbicide treatments at Dry Bed Creek

1. Forestry Garlon® XRT @ 40 oz/acre + SuperSpread® MSO @ 2.5% concentration
2. Milestone® @ 7 oz/acre + Syl-Tac® surfactant @ 0.25% concentration
3. Garlon® + Milestone®
4. Non-treated

Herbicide treatments applied on 8/13/12
Herbicide effects on Scotch broom regeneration

- Each treatment decreased 1\textsuperscript{st}-yr seedling density.
- Milestone\textsuperscript{®} decreased 2\textsuperscript{nd} -yr seedling density.

Dry Bed Creek Study, unpublished data
Lab studies of herbicide treatments for Scotch broom

Fixed soil weight, seed number

Herbicides applied via pipetor; watering rate controlled

Controlled-environment germinator
Sulfonylurea herbicides stunted broom seedling morphology

Harrington, *Weed Science* 2009
Sulfometuron effects during a simulated summer drought

- Switching H₂O from high → low greatly increased mortality from sulfometuron.
- Poor root development + drought = mortality.

Harrington, *Weed Science* 2009
Synthetic auxin herbicides killed up to 90% of Scotch broom seedlings

Harrington, *Weed Technology* 2014
Treatment effects on broom seedlings at 14 days

Non-treated check

Aminocyclopyrachlor

Aminopyralid

Clopyralid
Treatment effects on broom seedlings at 90 days

Non-treated check

Aminocyclopyrachlor

Aminopyralid

Clopyralid
# Cost comparisons among herbicides

<table>
<thead>
<tr>
<th>Herbicide</th>
<th>Herbicide rate</th>
<th>Herbicide cost</th>
<th>Broom seedling mortality</th>
<th>Cost per unit mortality</th>
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<tbody>
<tr>
<td></td>
<td>% max</td>
<td>$/acre</td>
<td>%</td>
<td>$ per %</td>
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<tr>
<td>Aminocyclopyrachlor</td>
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<td></td>
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<td>Aminopyralid</td>
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<td></td>
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<tr>
<td>Clopyralid</td>
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<td></td>
<td>100</td>
<td>27</td>
<td>69</td>
<td>0.39</td>
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</table>
Summary

Scotch broom prevention:
- Wash equipment before operating on a new site.
- Retain logging debris (8+ tons/acre) during harvesting.
- Limit soil disturbance via designated machine trails.

Scotch broom control:
- Site preparation with triclopyr, aminopyralid, clopyralid, or metsulfuron.
- Fall or spring release with sulfometuron or clopyralid.
- Basal spray of triclopyr ester in oil for spot treatments.