# Treatments for preventing and controlling Scotch broom

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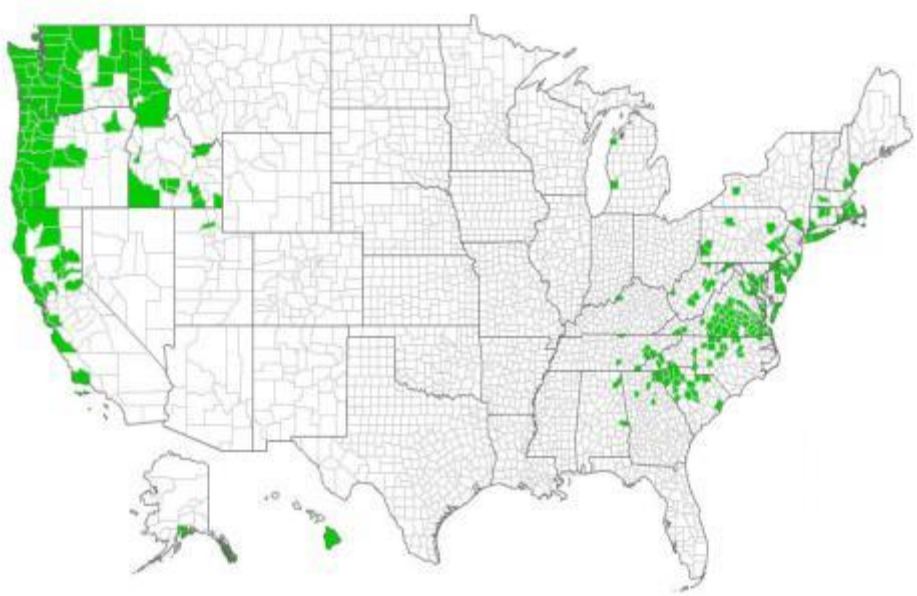
Four-year-old invasion

# Acknowledgements

Thanks for collaboration and support from:

- Forest Industry: Green Diamond, Port Blakely, & Weyerhaeuser
- Herbicide Companies: Dow AgroSciences, DuPont, & Wilbur-Ellis Company
- Universities: OSU, UW, VA Tech, & UMN
- Granting agencies: USFS Special Technology Development Program & USDA NIFA
- PNW Staff: James Dollins, Dave Peter, and others

# Scotch broom characteristics



Invasive Plant Atlas 2012

- 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

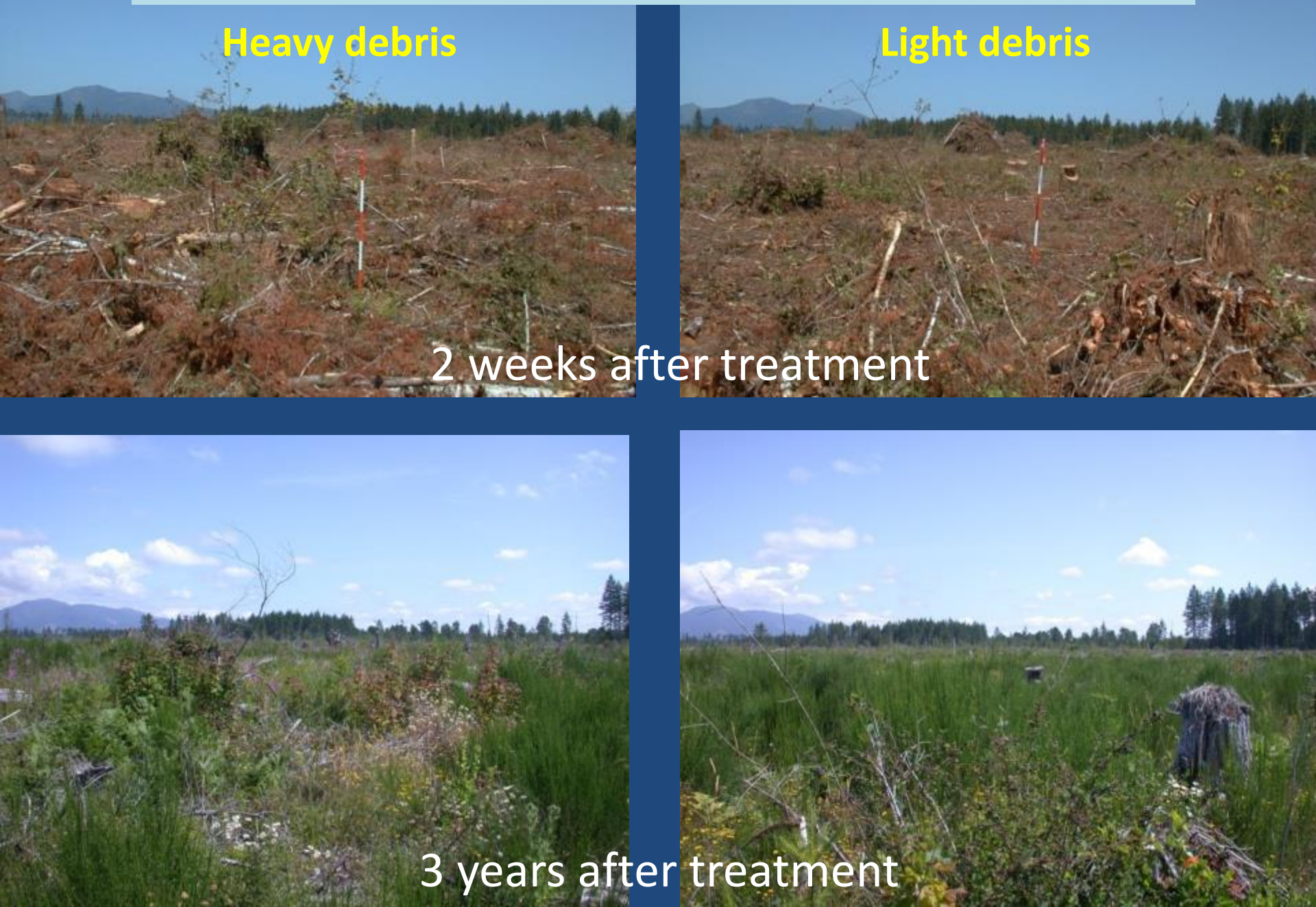
- High cost of controlling broom: $50-$300 per acre (Oneto et al. 2010).
- Oregon estimates $40 million spent annually for control expenses and lost timber revenues (Hulting et al. 2008).

High density stands can be difficult to control

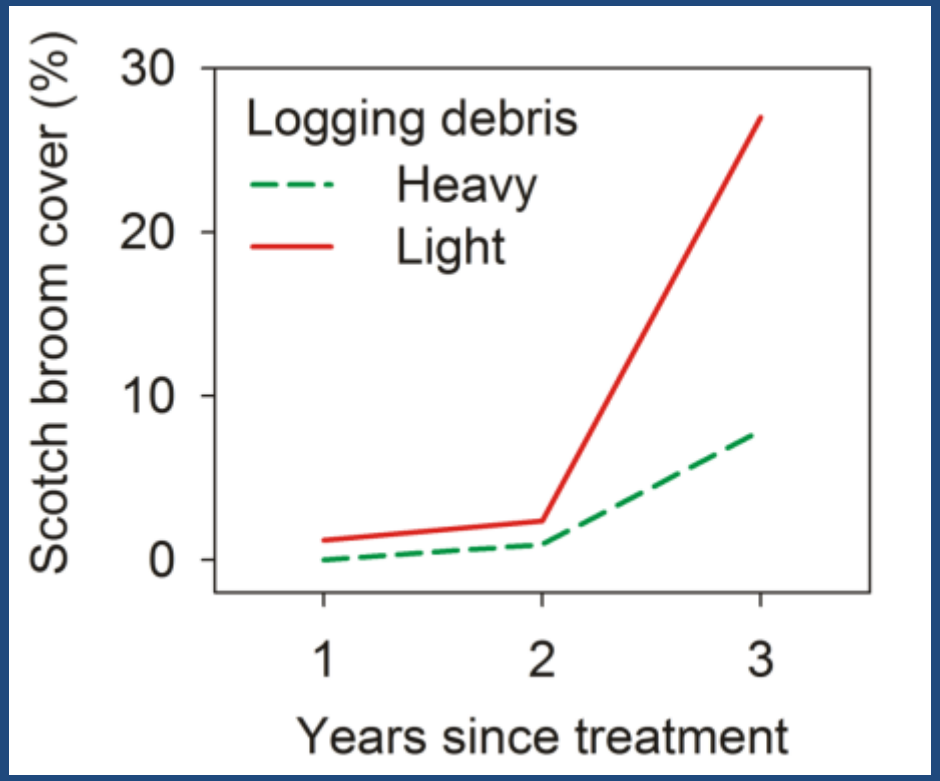
# Preventing Scotch broom during harvesting

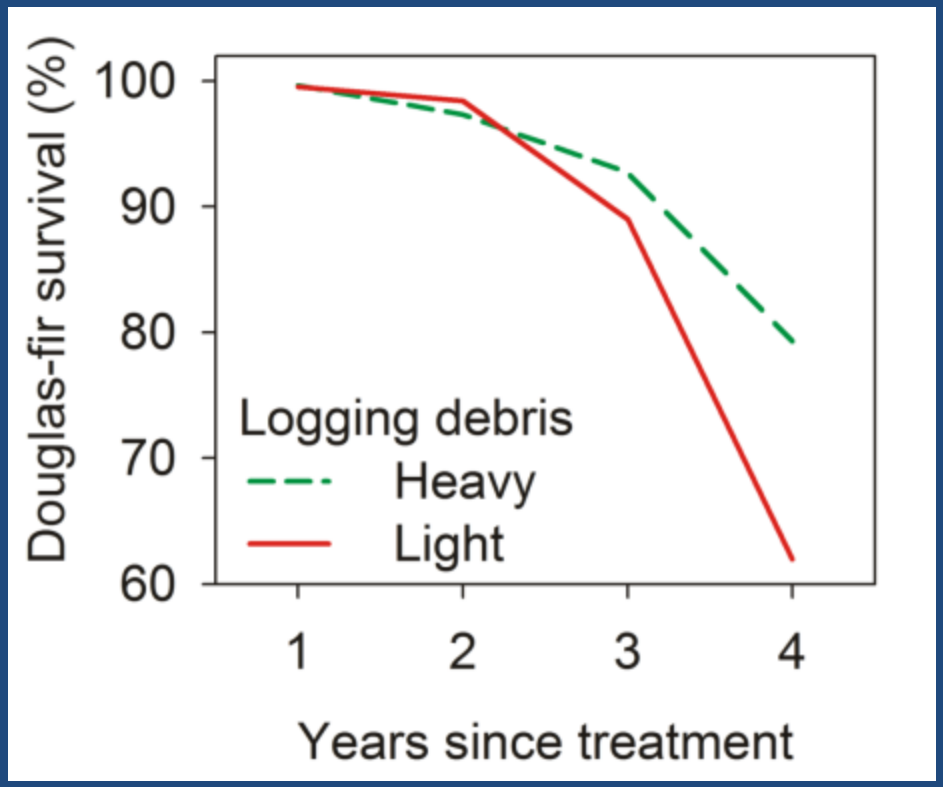
- Wash equipment before operating
- Retain logging debris
- Limit soil disturbance

# Matlock Long-Term Soil Productivity Study



# 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

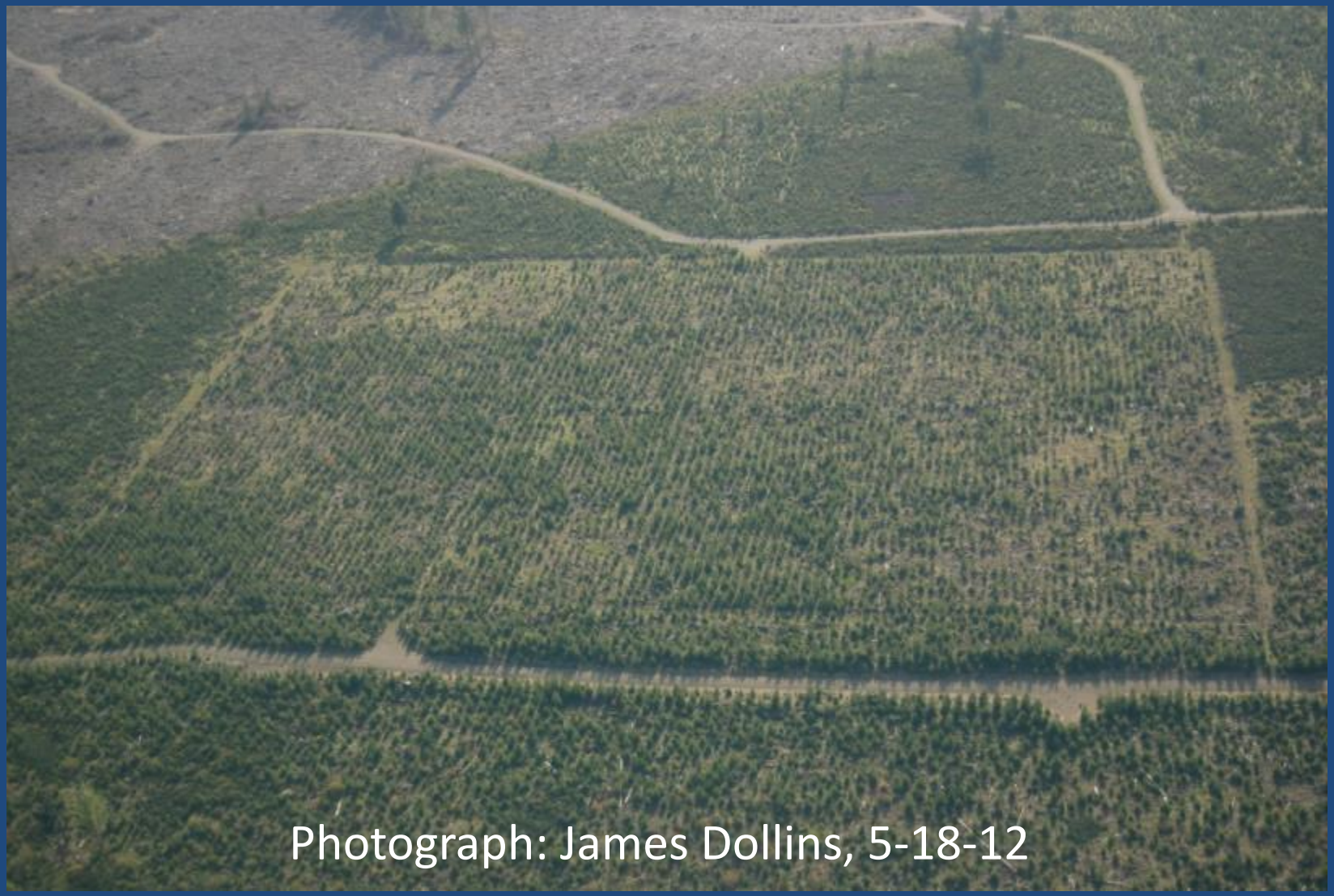
Heavy logging debris

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

Seed-bank soil sample

# Harvesting at Dry Bed Creek, Nov.-Dec. 2011

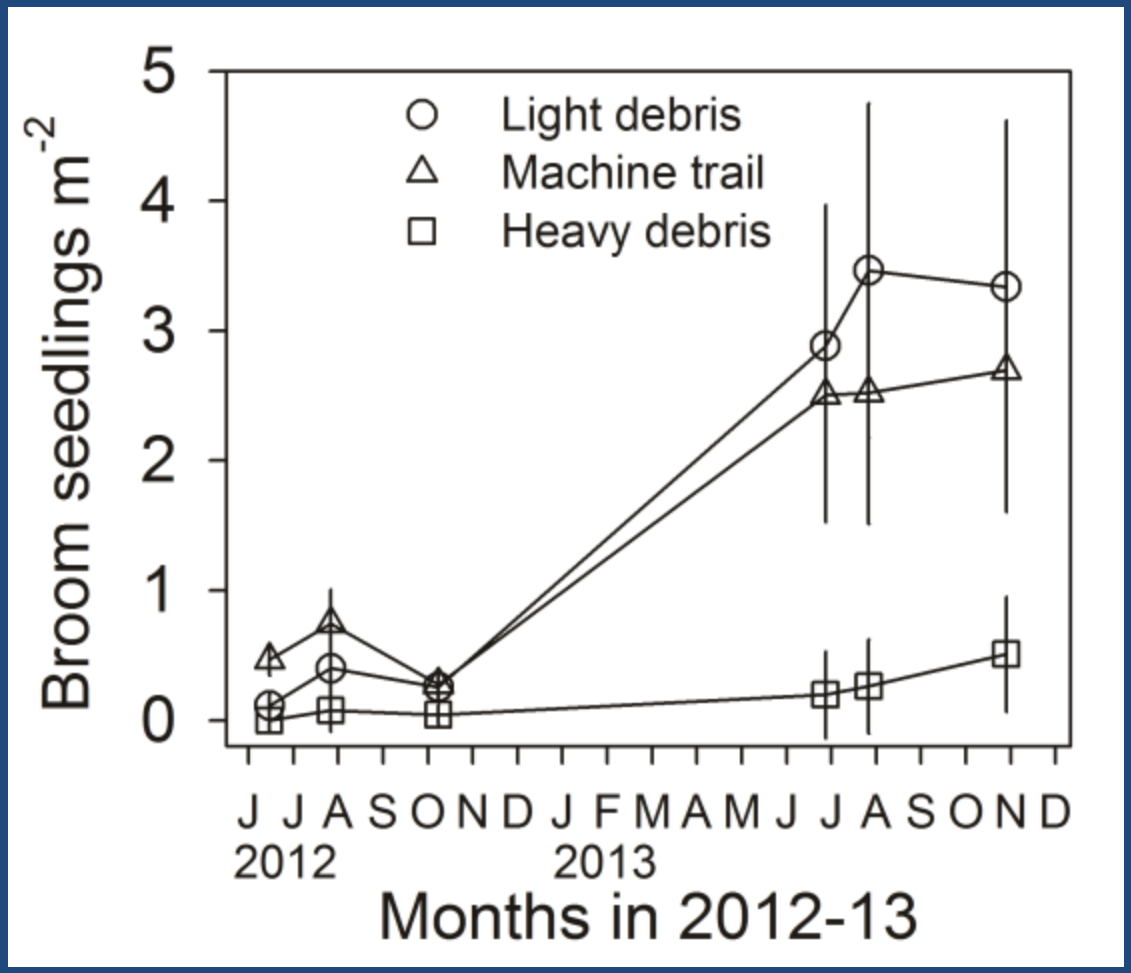
# Logging debris treatments

Heavy debris:
8.9 tons/acre

Light debris:
3.9 tons/acre

Machine trails:
6.7 tons/acre

# Logging debris inhibited Scotch broom regeneration

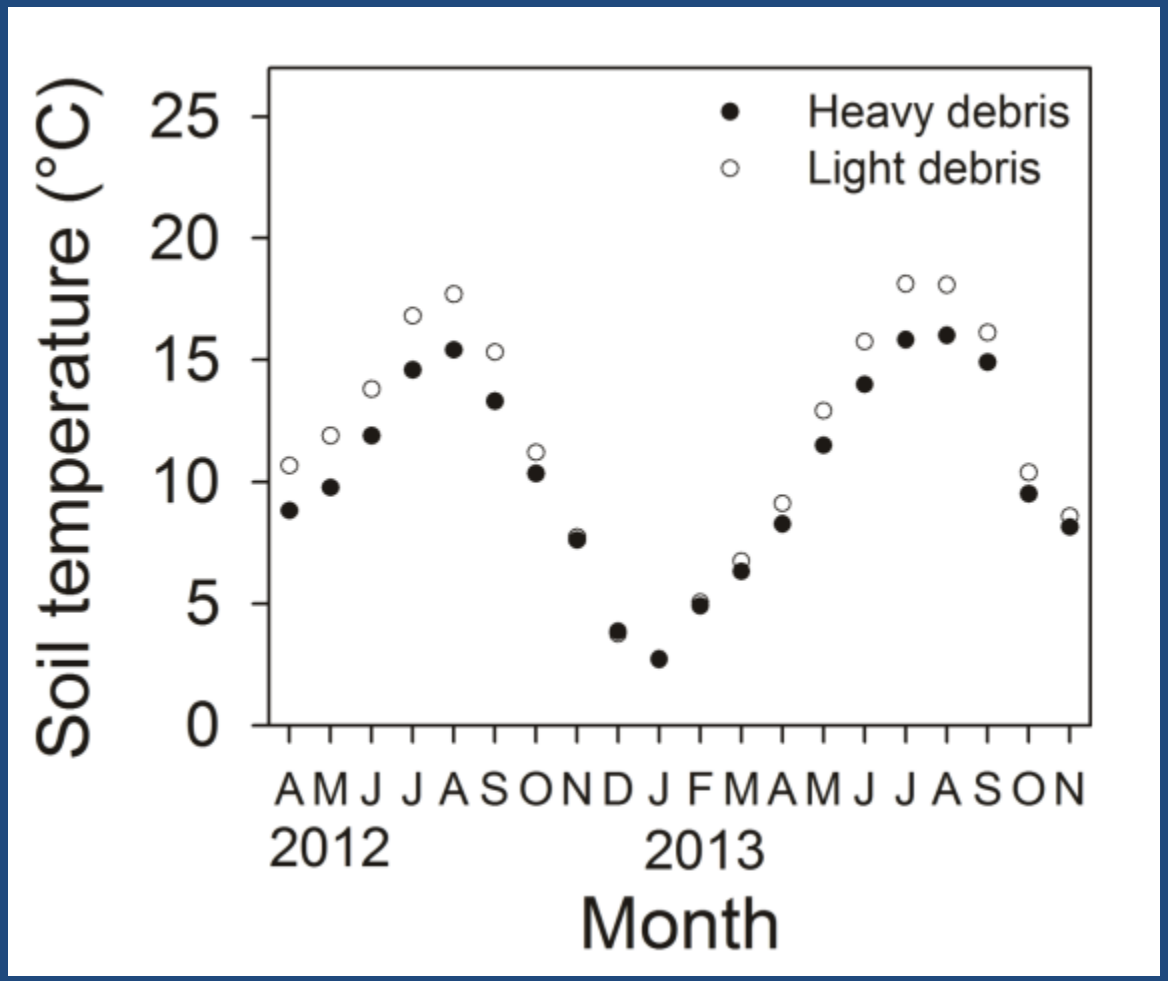



Dry Bed Creek Study, unpublished data

# Logging debris reduced soil temperature

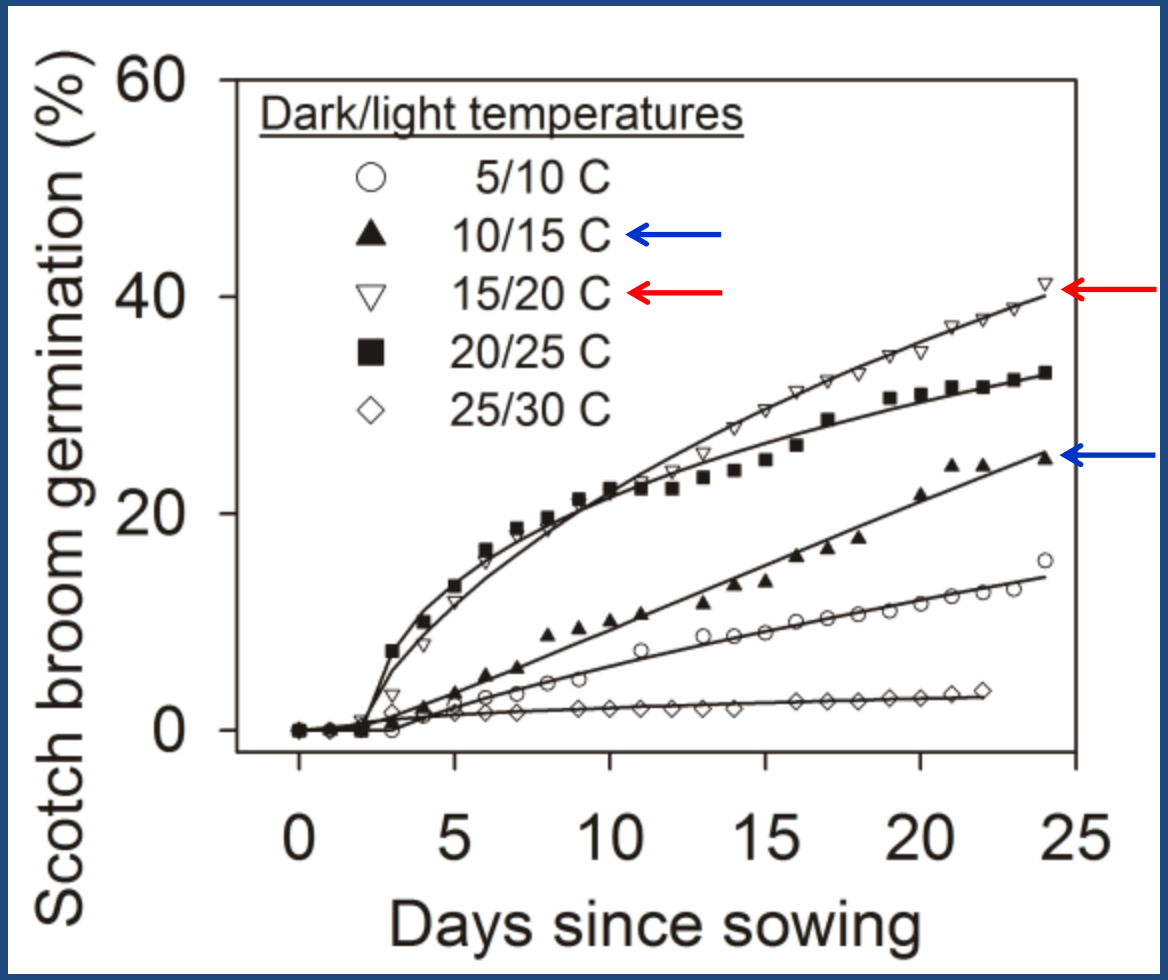
(5 cm depth)

- Up to 2.3°C cooler under heavy debris.



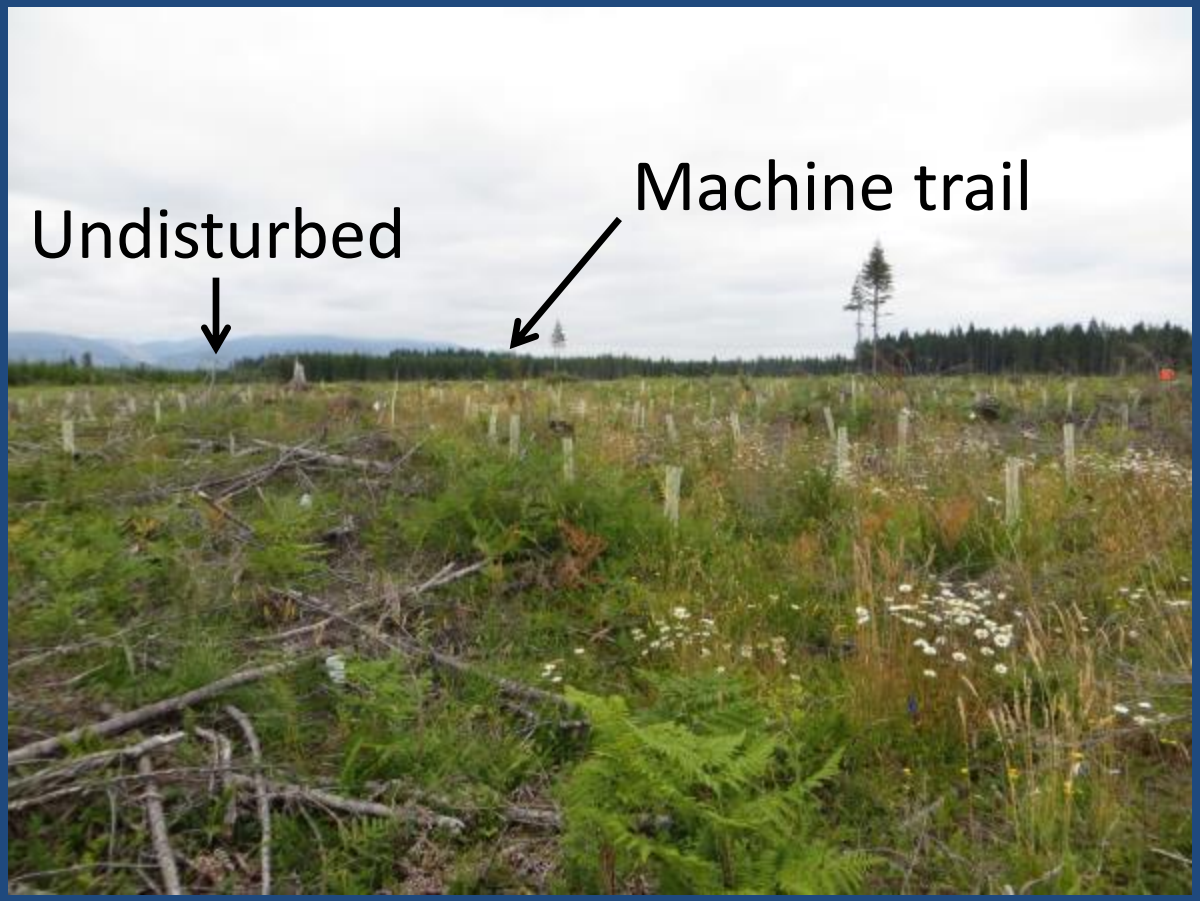

Dry Bed Creek Study, unpublished data

# Temperature reductions from debris sufficient to slow broom germination




Harrington, *Weed Science* 2009

# 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

| | Debris treatment | | | | |
|---|---|---|---|---|---|
| **Variable** | **Heavy debris** | | **Light debris** | | **Machine trail** |
| | ---------- % of seedlings ---------- | | | | |
| Chlorosis | 6.7 b | | 15.6 a | | 15.0 a |
| Aborted bud | 6.5 a | | 7.5 a | | 8.8 a |
| Dieback | 6.0 b | | 7.7 ab | | 10.8 a |
| Browse | 3.9 a | | 5.0 a | | 7.2 a |

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).

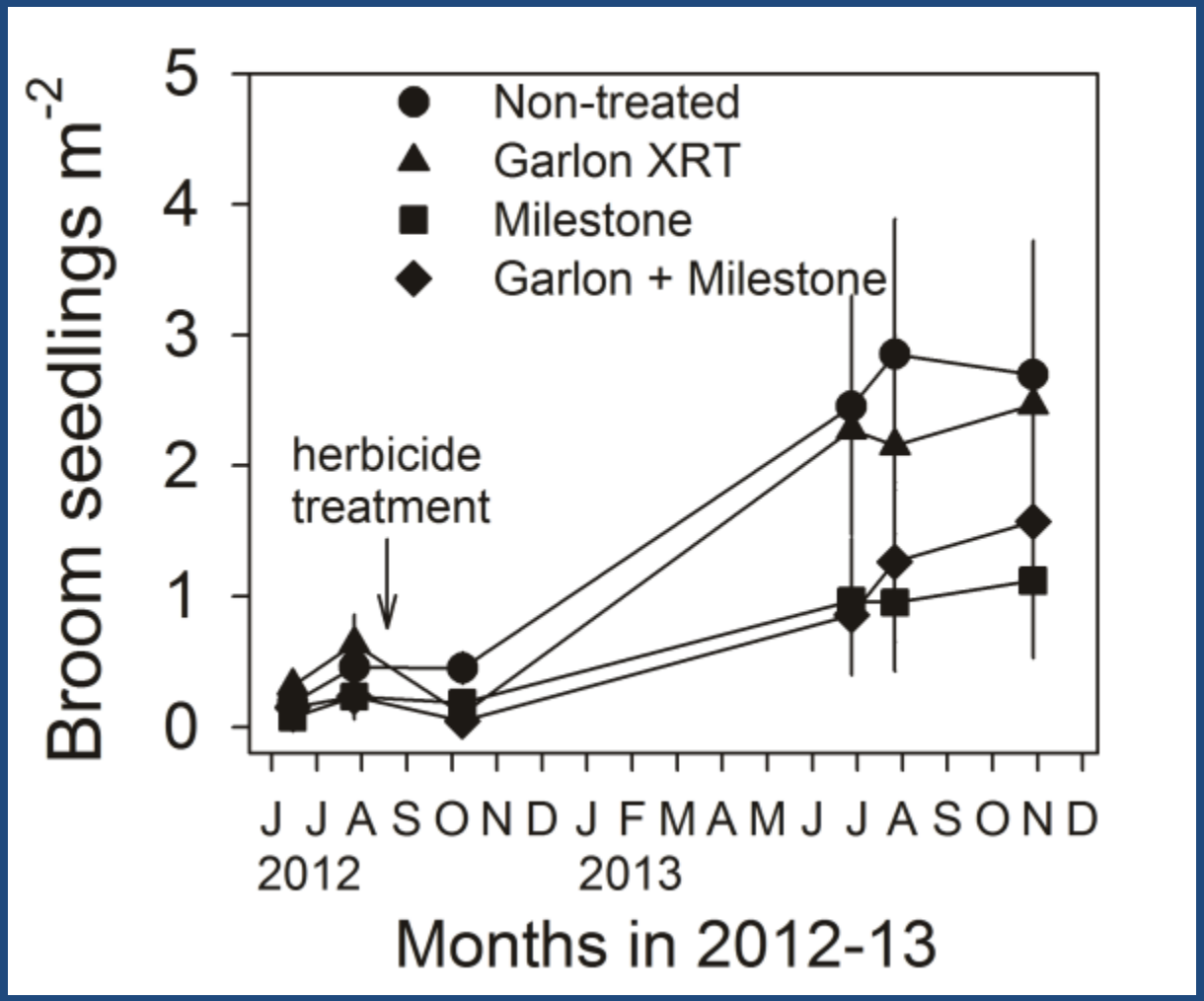
# Herbicide treatments at Dry Bed Creek

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 1st-yr seedling density.
- Milestone® decreased 2nd -yr seedling density.




Dry Bed Creek Study, unpublished data

# Lab studies of herbicide treatments for Scotch broom



# Sulfonylurea herbicides stunted broom seedling morphology

Non-treated seedlings @ 90 days

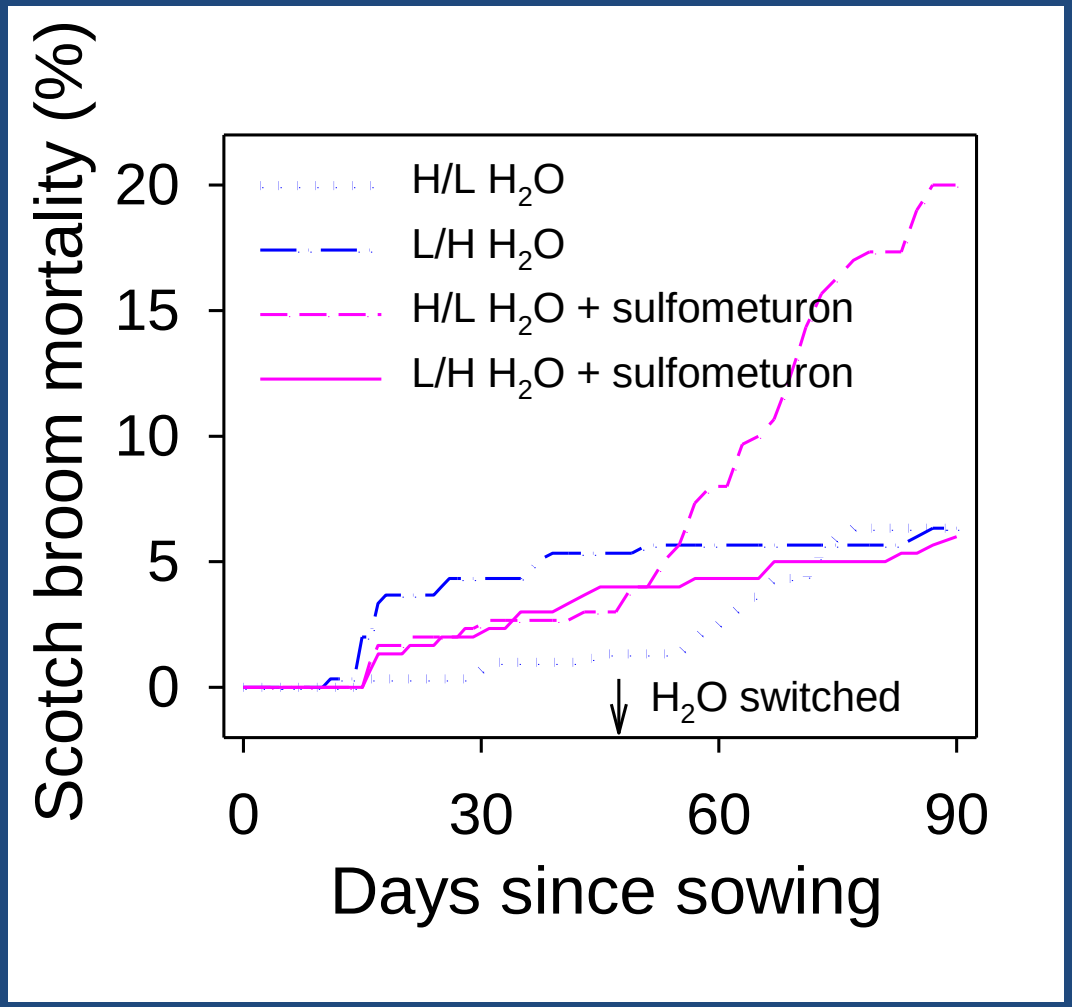
Sulfometuron-treated seedlings

Metsulfuron-treated seedlings

Harrington, *Weed Science* 2009

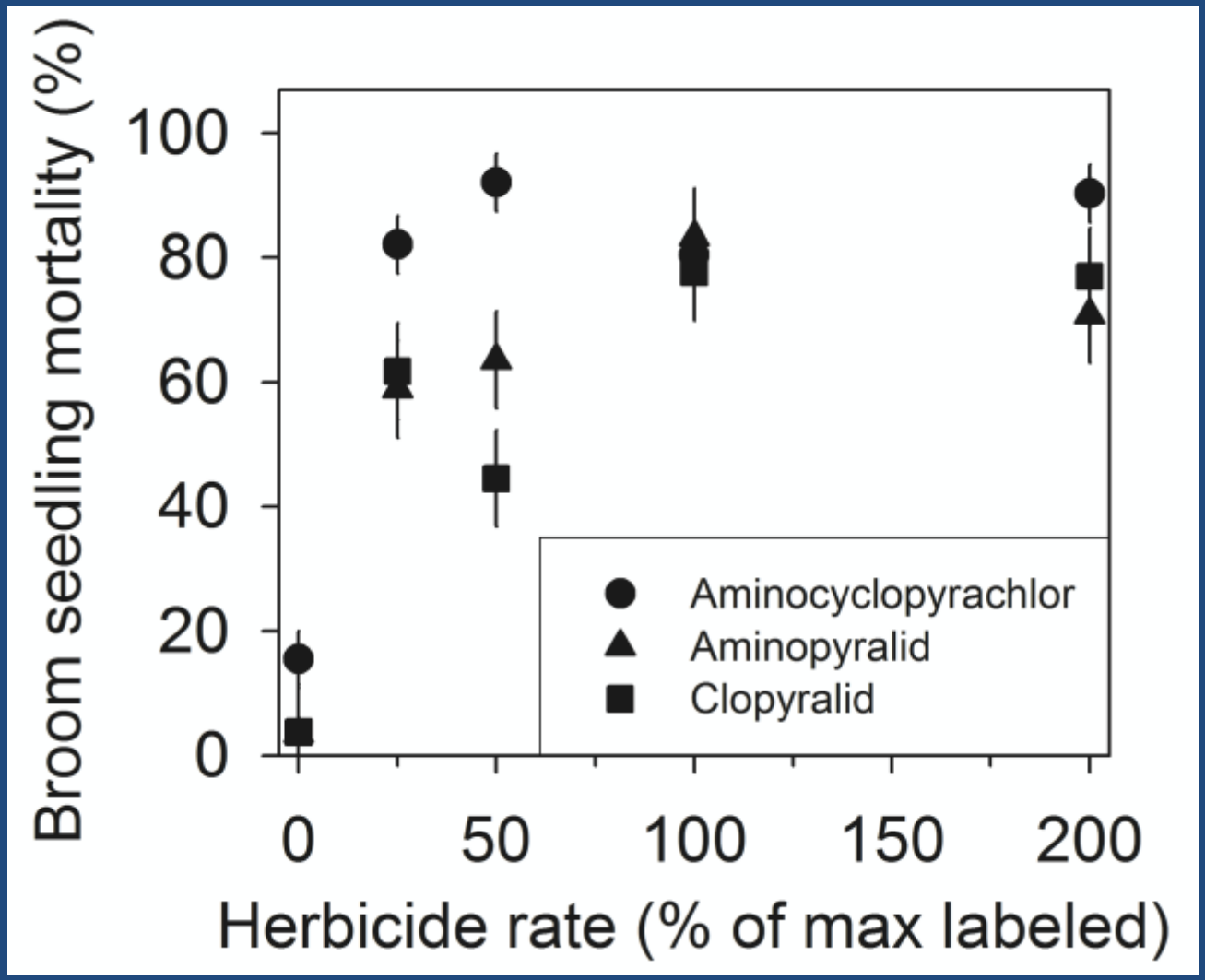
# Sulfometuron effects during a simulated summer drought

- Switching $H_2O$ 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

| Herbicide | Herbicide rate | Herbicide cost | Broom seedling mortality | Cost per unit mortality |
|---|---|---|---|---|
| | % max | $/acre | % | $ per % |
| | | | | |
| Aminocyclopyrachlor | 50 | 23 | 75 | 0.31 |
| | 100 | 47 | 89 | 0.52 |
| | | | | |
| Aminopyralid | 50 | 10 | 71 | 0.13 |
| | 100 | 19 | 87 | 0.22 |
| | | | | |
| Clopyralid | 50 | 13 | 59 | 0.22 |
| | 100 | 27 | 69 | 0.39 |

# 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.