Early vegetation control for the regeneration of a single-cohort, intimate mixture of white spruce and aspen on upland boreal sites

Presented by: Mike Hoepting
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Outline

- Research team and supporters
- Background and design
- Results
- Next Steps
- Benefits to our approach
Research Team (Whitecourt, Alberta):

- Doug Pitt, Dan MacIsaac, Mike Hoepting – CWFC-CFS
- Phil Comeau – University of Alberta
- Milo Mihajlovich – Incremental Forest Technologies

- Blue Ridge Lumber
- Millar Western Forest Products
- Canadian Forest Products
- Canadian Forest Service (CWFC; GLFC and NoFC)
- CEC - FRP (Grant Forest Products)
- Monsanto Canada
- Dow AgroSciences Canada
- Alberta Herbicide Task Force
- Alberta Forest Products Association (silv. Sub-committee)

- Mixedwood Management Association
- Ontario Ministry of Natural Resources and Forests (OMNRF)
- Forest Protection Limited (New Brunswick)

- University of Alberta
- NSERC
- WESBOGY
- Manitoba Conservation
- US Forest Service
Research Team (Timmins, Ontario):

- Doug Pitt, Mike Hoepting – CWFC-CFS
- Bill Parker, Scott McPherson, Dave Etheridge, Al Stinson – OMNRF

- Canadian Ecology Centre Forestry Research Partnership (Tembec, Grant Forest Products, CFS/CWFC, Ont. Min. Nat. Res.)
- Louisiana Pacific
- Ontario Living Legacy Trust
- Enhanced Forest Productivity Science Program (Forestry Futures Trust)
- Monsanto Canada
- Forest Protection Limited (New Brunswick)
- Dow AgroSciences Canada
- Millson Forestry Service
Research Team (Field Staff):

- Susan Humphries, U of A
- Lorna Pitt, ForesTech
- Nikki Wood, OMNRF
- and many students passing through…
Boreal Mixedwoods
Pressure for spruce, pressure for aspen, what to manage for?

Both?
Hypothesis...
Hypothesis...

Woody-only
Woody + herbaceous x 2
Woody + herbaceous x 4
Treatments

Radial Treatments (Sw planted at 5 m spacing):
1) Woody vegetation control only,
2) Complete vegetation control, 2 years; or
3) Complete vegetation control, 4 years.

Broadcast (whole-plot) Treatments (Sw planted at 2.5 m spacing):
1) No vegetation control;
2) Herbaceous vegetation control only;
3) Woody vegetation control only; or
4) Complete vegetation control.

“Four corners” approach; maintained for 10 yr
a) Radial treatment plot

Vegetation permanent assessment plot (four clusters of four 2.5 m x 2.5 m subplots)

White spruce planted at 5- or 2.5-m spacing

b) Broadcast treatment plot

Treatment plot (experimental unit)

Measurement plot (25 m x 25 m, containing 25 or 100 tagged, planted spruce)

2-m radial treatment; all deciduous tree and tall shrub vegetation removed (50% of treatment plot area)

Aspen ‘crop tree’ sampling zone (16 trees per plot).
Variable XYZ (example)

Growing season

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AB

\[ p = 0.65 \]

\[ \alpha = 0.05 \]

ON

\[ p = 0.65 \]

\[ \alpha = 0.05 \]

- Data presented in this format
- Least squares means, standard error, Tukey’s HSD

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Canada
Spruce Mortality (%)

- **AB**: $p = 0.65$; Mean = 18%
- **ON**: $p = 0.85$; Mean = 21%

- No treatments effect on planted spruce mortality.
- Mean mortality approx. 20%
Growing season

Spruce Health (excluding dead trees)

• Mean health code (lower = better)

Sw predation under full aspen cover

Open grown Sw more susceptible to frost events

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Canada
Frost Damage

- Significant frost events in 2007 and 2010.
- Much less damage to spruce with aspen cover.
- Less damage in 2010 when aspen larger.

2010 frost event in ON: 75% in open vs. 31% in radial.
Spruce Stem Volume Index (cm³/tree)

- Accelerating volume growth
- Growth maximized with no competition, although long-term effects from frost in ON
**Spruce Stem Volume Index** \((cm^3/\text{tree})\)

- **Exponential volume growth**
- Growth maximized with no competition, although long-term effects from frost in ON
  - Woody control increases growth, improved with herb control
  - In ON, herb-only has been effective
**Spruce Stem Volume Index (cm³/tree)**

- Exponential volume growth
- Growth maximized with no competition, although long-term effects from frost in ON
- Woody control increases growth, improved with herb control
- In ON, herb-only has been effective
- Radial treatments promising
**Spruce Height (cm)**

- **Growing season**: 1, 2, 3, 4, 5, 7, 10

**AB**
- $p < 0.01$
- Less woody comp = better height
- Less woody + herbaceous = best height

**ON**
- $p < 0.01$
- In ON, height less effected by competition
- Frost damage reduced heights in open grown Sw
**Spruce Dia. (mm) at 5 cm**

- **Diameter is main driver of volume**
- **Growth maximized with no competition**
- **In ON, either woody or herb. control effective; best when combined**

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*Canada*
Aspen Stem Volume Index (cm³/tree)

**AB**  
$p < 0.01$

- Radial treatments benefit aspen
- Larger diameter stems

- No height difference in AB or ON

- No treatment effect in ON, but more variability
Broadcast Treatments

Reference (broadcast) treatments as:

a) An untended mixedwood,

b) mixedwood with control of herbaceous vegetation,

c) spruce with control of herbaceous and woody vegetation, and

d) spruce with control of woody vegetation.
**Radial Treatments**

*Response-surface (radial) treatments* (note planted spruce tree in the center and surrounding aspen that will form the future mixedwood) with:

- **a)** *woody* vegetation controlled, and
- **b)** *both woody and herbaceous* vegetation controlled.
Next Steps: Aspen Thinning

Spacing of Aspen in radial treatments was planned for both sites at year 5

Thinning Delayed:
- AB: 2005 hail damage
- ON: variability in density

AB Thinning Aug 2012:
- 800, 1200, 2000 sph, and unthinned
- Radial plots only
- Most thinning by Foreestree Ltd., Whitecourt
Aspen Thinning
800 stems/ha
Aspen Thinning
1200 stems/ha
Aspen Thinning
2000 stems/ha

White Spruce and/or Aspen Volume

Aspen density (sph)

Years of Control
Aspen Thinning
5000+ stems/ha

White Spruce and/or Aspen Volume

Aspen density (sph)

400 800 1200 2000 5000+

Years of Control

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Potential Benefits (on some sites)

Can we grow Sw and aspen intermixed in single cohort stands? → Yes we can!

Benefits:
- Lower conifer establishment costs
Potential Benefits (on some sites)

Can we grow Sw and aspen intermixed in single cohort stands? → Yes we can!

Benefits:
- Lower conifer establishment costs
- More integrated use of veg. management tools

...chemical banding

...or spot spraying, through modified application technology
Potential Benefits (on some sites)

Can we grow Sw and aspen intermixed in single cohort stands?
→ Yes we can!

Benefits:
➢ Lower conifer establishment costs
  ➢ More integrated use of veg. management tools
  ➢ More complete and continuous site occupancy
Potential Benefits (on some sites)

Can we grow Sw and aspen intermixed in single cohort stands?
→ Yes we can!

Benefits:
➢ Lower conifer establishment costs
➢ More integrated use of veg. material
➢ More complete and continuous timber harvest
➢ Moderation of climatic extremes.

2010 frost event in ON:
75% in open vs. 31% in radial
Potential Benefits (on some sites)

Can we grow Sw and aspen intermixed in single cohort stands?
→ Yes we can!

Benefits:
- Lower conifer establishment costs
- More integrated use of veg. management tools
- More complete and continuous site occupancy
- Moderation of climatic extremes
- Satisfies needs for both products
- Ecological, social, and wildlife values associated with a mixedwood condition
More Information


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