The effects of precommercial thinning on the value chain of balsam fir – spruce stands in northwestern New Brunswick, Canada.

Doug Pitt, Len Lanteigne, and collaborators

CIF-IFC Electronic Lecture, September 30/09
Precommercial thinning (PCT)

- Stand- and forest-level benefits of PCT generally well understood...
- Lacking long-term data to calibrate expectations for the more than 2 M ha of young PCTd stands in the NE.
- Not a clear understanding of the effects of PCT on the value chain.
Balsam fir and red spruce dominated forest originating from clearcut harvest between 1946 and 1955

6 replicate blocks PCT’d between 1959 and 1961

Dr. Gordon Baskerville

47° 50’ Latitude

Boreal transition zone

Edmundston
Nominal spacings: 4’ (1.2-m); 6’ (1.8-m); 8’ (2.4-m); and unthinned.

Large treatment plots (> 1 ha).
Green River 2004

Quadratic mean DBH (cm)

Technical rotation age

Unthinned (vs. thinned, $p < 0.01$)
4' Spacing (vs. 6' & 8', $p < 0.01$)
6' Spacing (vs. 8', $p = 0.01$)
8' Spacing

Years since thinning


Today – a new chapter in the Green River Legacy

✓ ave. 56 years post harvest, 48 years post thin.  
✓ past opportunity for CT.  
✓ 100% stocking  
✓ > 76 K sph  
✓ 32 cm tall
Full remeasurement – 48 years post PCT

✓ Doug Pitt, Mike Hoepting, CWFC SSM
✓ Len Lanteigne, Jamie Farrel, CWFC Fredericton
✓ Several dedicated seasonal field staff.
Preliminary results: PCT effectively channeled growing resources onto fewer, larger stems, increasing yield and reducing technical rotation age.
Unthinned

- Balsam fir
- Spruce

13% < 9 cm
280 sph (18%) > 24 cm DBH
4’ spacing

Balsam fir

Spruce

294 sph (21%) > 24 cm DBH

5% < 9 cm
6’ Spacing

- Balsam fir
- Spruce

430 sph (35%)
> 24 cm DBH
(50% gain over 4’ spacing!)

1% < 9 cm
8’ Spacing

- Balsam fir
- Spruce

490 sph (47%) > 24 cm DBH

2% < 9 cm

Extreme upstream gains: an estimated 28% increase in stumpage value, or $1520 per ha using today’s NB rates!
Harvest half; leave half...

Clearcut harvest 3 blocks
Harvest half; leave half...

- Long-term succession on 3 blocks
Harvest productivity

✓ Improved DSS, productivity function models, stand attribute/product relationships, and log merchandizing optimization models…

- Jean Plamondon, FERIC
- Gaetan Pelletier, JD Irving
- Luc Ouellet, Acadian Timber
Preliminary Results: PCT had large effects on harvesting and wood handling efficiency…

- 26-43% gain in productivity
- 25-44% gain in loading rate
- 19-28% reduction in direct costs; $2 to $4/m³, or $700 to $1500 per ha
**Decay**

- What is the impact?
- How can we mitigate damage and losses?

Gary Warren, Patricia Baines  CWFC
Preliminary results: PCT appears to increase the incidence of root and butt decay...

Incidence and severity appear to increase with:
- Stand age
- Stand age at the time of thinning
- Thinning intensity
- Tree size
Solid wood product quality and value

 ✓ Stem form; lumber grade recovery; mechanical properties (MOE/MOR); downgrading defects; technical properties of fibre-based products…

➢ Isabelle Duchesne, Francis Tanguay, and Ghislain Veilleux Forintek

➢ Alain Ouellette, JD Irving
Preliminary Results: PCT had minimal effect on lumber recovery and quality...

4% increase in Premium; No. 2+, no effect

10% increase in 2x6, 2x8

Wood density, no effect

ave. = 310 kg/m³

-3% stiffness (MOE); -9% strength (MOR)

Spacings tested are reasonable to maintain good end-product quality in balsam fir...
Pulp product quality and value

✓ Stem microfibril angle; density distribution; early/latewood dist. & proportion; juvenile/ maturewood dist. & proportion, etc…

Fibre Quality dictates pulp quality/end use
Inherent wood property

Paul Bicho, Dongbo Yan, Elmer Portillo, Bernard Yuen, Surjit Johal, and Josiane Blanchett, Paprican
Preliminary Results: PCT had minimal effect on pulping quality; \( \leq \) variability between sites...

- 5% decrease in density and cell wall thickness
- 6% increase in time to Kraft pulp
- TMP, no effect on SRE
- Handsheet properties, no adverse effects...
- No reasons NOT to use wood from PCT’d stands!
Scaling up to the forest level...

✅ Relationships between important fibre quality / value characteristics and inventory parameters...
Supports an enhanced automated inventory product:
- Colour Infrared Imagery
- Tree Crown Delineation
- Stem Counting
- Automated Species Classification
- Automated Polygon Delineation
- Smoothed Polygons
- IT attributes:
  - Species comp.
  - Dia. dist.
  - BA
  - Volume
  - Ht dist.
  - Wood quality
  - Product value

49 Pw 21 Sw 9 Bf 8 Sb 7 Bd 3 Pr 3 Ce
31m
42% Crown Closure
238 Stems
Applanix DSS301 DFC imagery + LiDar
The Green River Legacy continues…

Unthinned

PCT 8’ x 8’
A new chapter in a 50-year legacy!

- Canadian Wood Fibre Centre, FERIC, Forintek, and Paprican / FPInnovations
- Canadian Ecology Centre - Forestry Research Partnership (Tembec, CFS, OMNR)
- Acadian Timber
- JD Irving Limited
- New Brunswick Department of Natural Resources and Energy

Special thanks to our dedicated support staff!
Stems/ha (x 1000) (> 1.3 m height)

- Unthinned (vs. thinned, \( p < 0.01 \)), 1550 sph
- 4' Spacing (vs. 6' & 8', \( p = 0.02 \), 1390 sph
- 6' Spacing (vs. 8', \( p = 0.05 \)), 1215 sph
- 8' Spacing, 1050 sph

Relative density index for balsam fir (Penner et al. 2006).

- Understocked: < 40
- Max. growth: 40-55
- Imminent competition-related mortality: > 55

Years since thinning
Gross Total Stem-wood Production (m³/ha)

- Unthinned
- 4'
- 6'
- 8'

- Cumulative mortality
- Live trees

- \( p(\text{total}) = 0.25 \)
- \( p(\text{mort.}) < 0.01 \)
Gross Merch. Vol. (m³/ha) (top dia. ≥ 8 cm)

- Unthinned (vs. thinned, $p < 0.01$)
- 4' Spacing (vs. 6' & 8', $p = 0.02$)
- 6' Spacing (vs. 8', $p = 0.92$)
- 8' Spacing

Increase by +20% or +8%
2008, 48 years post PCT – Stand-level attributes

Gross Merch. Vol. (m³/ha/yr) (top dia. ≥ 8 cm)

Years since thinning

Unthinned
4’ Spacing
6’ Spacing
8’ Spacing

~46/55
Gross Merch. Vol. (m³/ha) (top dia. ≥ 15 cm)

- Unthinned (vs. thinned, p < 0.01)
- 4' Spacing (vs. 6' & 8', p < 0.01)
- 6' Spacing (vs. 8', p = 0.36)
- 8' Spacing

Years since thinning

- +44%
- +36%
- +11%
2008, 48 years post PCT – Tree-level attributes

Quadratic mean DBH (cm)

Years since thinning

- Unthinned (vs. thinned, $p < 0.01$)
- 4’ Spacing (vs. 6’ & 8’, $p < 0.01$)
- 6’ Spacing (vs. 8’, $p = 0.02$)
- 8’ Spacing
Gross Merch. Vol. (dm³/tree) (top dia. ≥ 8 cm)

Unthinned (vs. thinned, \( p < 0.01 \))
4’ Spacing (vs. 6’ & 8’, \( p < 0.01 \))
6’ Spacing (vs. 8’, \( p = 0.04 \))
8’ Spacing

+56%
+31%
+6%