NATURAL RESOURCES CANADA - INVENTIVE BY NATURE

Effects on the Forest Value Chain 50 years after Precommercial Thinning in Northwestern New Brunswick

Michael Hoepting and Doug Pitt

CFS-CWFC, Sault Ste Marie, ON

michael.hoepting@canada.ca

Silviculture Symposium, Thunder Bay, ON

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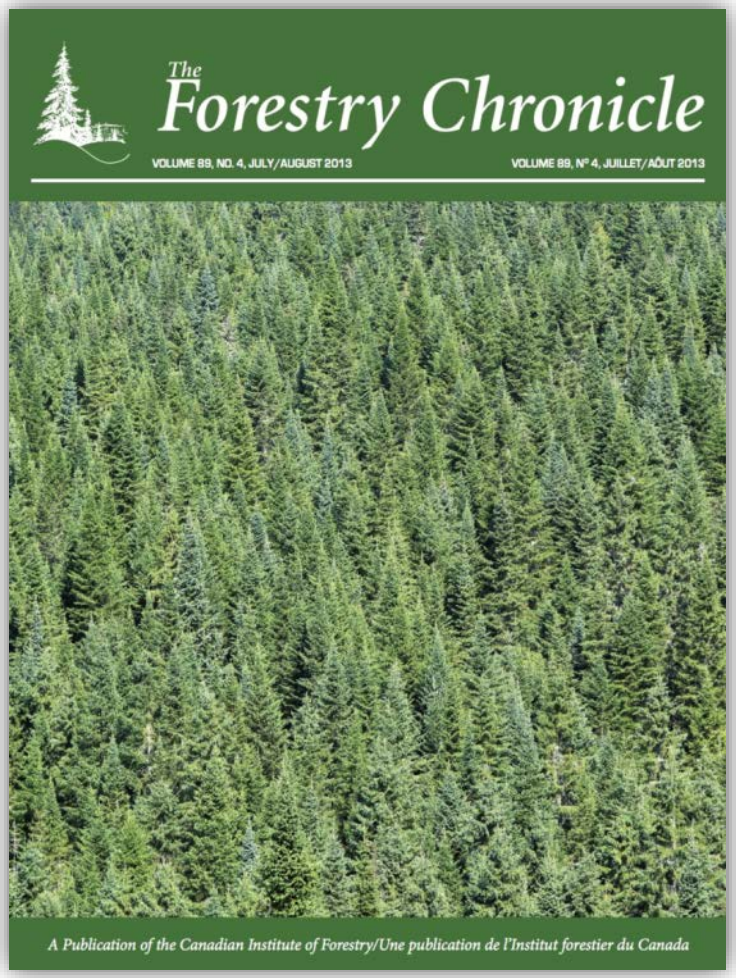
Outline:

1. Intro to Green River Trial
2. Impact of PCT on:
   a) *Growth and yield*
   b) *Disease and decay*
   c) *Operations*
   d) *Wood quality and value*
   e) *Pulp quality and value*
   f) *Economics of PCT*
3. Summary



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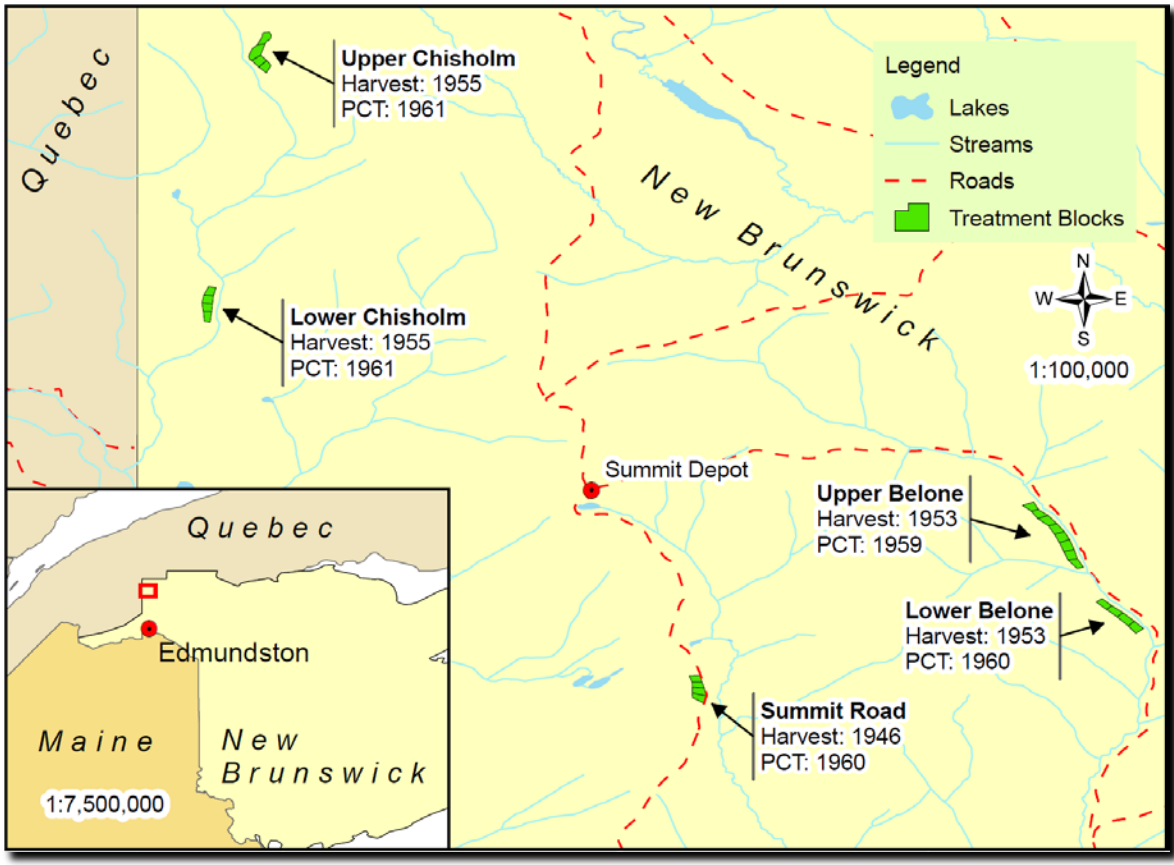
1: Intro to the Green River PCT Trail:

- Dr. Gordon Baskerville

- Balsam fir and red spruce dominated forest originating from clearcut harvest between 1946 and 1955; brush control and PCT.

1: Intro to the Green River PCT Trail:

- 0, 4, 6, and 8-ft PCT spacing treatments
- 6 replicate blocks
- 1 ha treatment plots containing two 0.08 ha PSPs
- Gaspé section of Boreal Forest Region (Rowe 1972)
- 47.8° N; similar to Chapleau (47.8°), Thunder Bay (48.4°)
- > 1250 GDDs



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2: Impact of PCT:

- 2004 (43-45 yr after PCT)
  - Doug Pitt and Len Lanteigne (CFS)
  - Pitt & Lanteigne (2008) CJFR 38:592-610
  - Cole, Newmaster, Lanteigne, & Pitt (2008) iForest 1: 145-156

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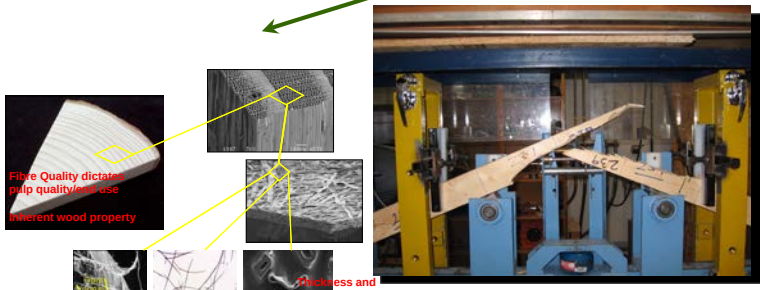
2: Impact of PCT:

- 2008 (47-49 yr after PCT)



- Quantify: production, harvest efficiencies, disease and decay, and solid wood & pulp recovery/quality/value

$$PNW = \frac{\sum_{t=0}^{r} R_t(1+i)^{r-t} - \sum_{t=0}^{r} C_t(1+i)^{r-t}}{(1+i)^r}$$

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2: Impact of PCT:

Len Lanteigne & Doug Pitt

Jamie Farrell

Mike Hoepting

Jean Plamondon

Isabelle Duchesne

Francis Tanguay

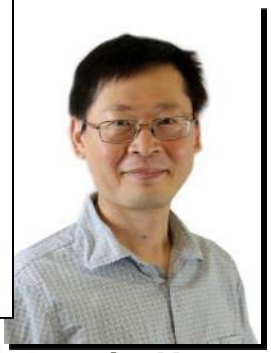
Gary Warren

Patricia Baines

Paul Bicho

Elmer Portillo

Bernard Yuen



Dongbo Yan

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2: Impact of PCT:

- Supporters and Collaborators:
  - Canadian Forest Service - Canadian Wood Fibre Centre
  - FPInnovations
  - Canadian Ecology Centre - Forestry Research Partnership (Tembec, CFS, OMNR)
  - JD Irving Limited
  - Acadian Timber
  - Twin Rivers Paper Company
  - New Brunswick Department of Natural Resources

- Special thanks to the numerous dedicated support staff!

2a: Growth and Yield:

Harvest: 1953
PCT: 1959
Tot Age: ~63 yr

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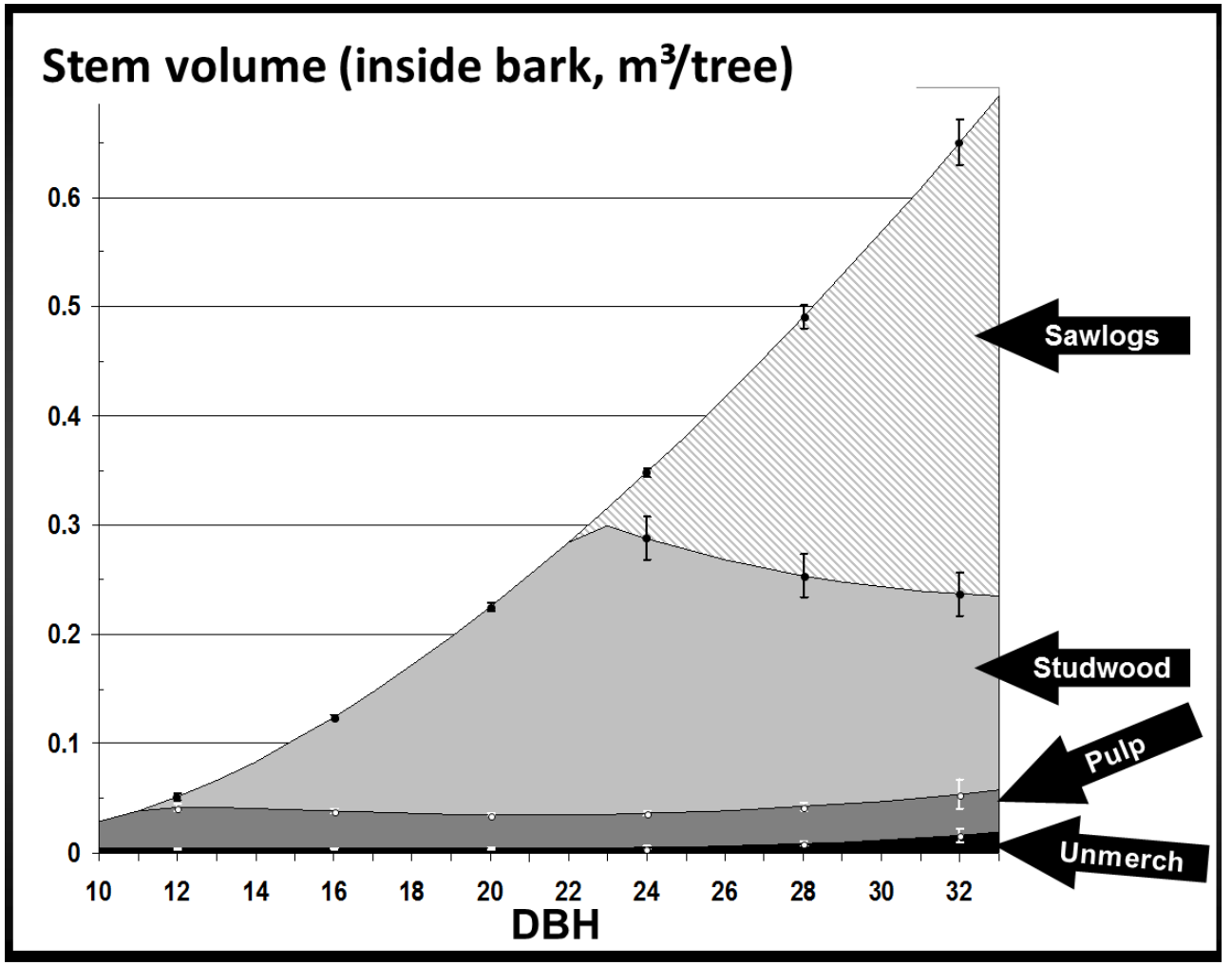
2a: Growth and Yield:

- Sawlogs > 8ft; top > 10 cm (*aka 'random length')*
- Studwood = 8ft sawlogs; top > 10 cm)
- Pulp = top > 8 cm
- Unmerchantable: tops,rot, forks, etc…

- *No diff. in taper between spacings*



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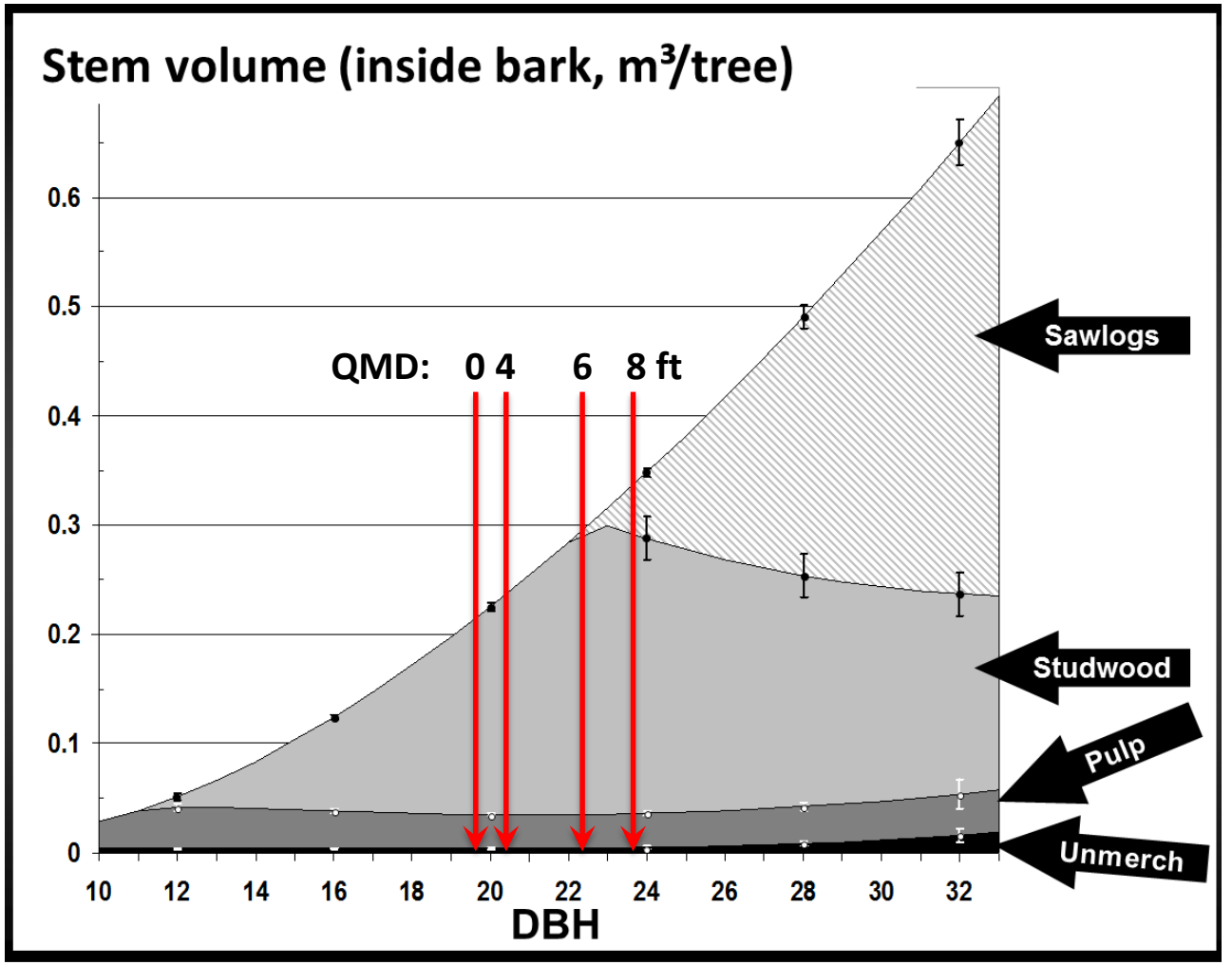
2a: Growth and Yield:

- 0 < 4',6',8' (<0.01)
- 4' < 6' & 8' (<0.01)
- 6' < 8' (0.01)



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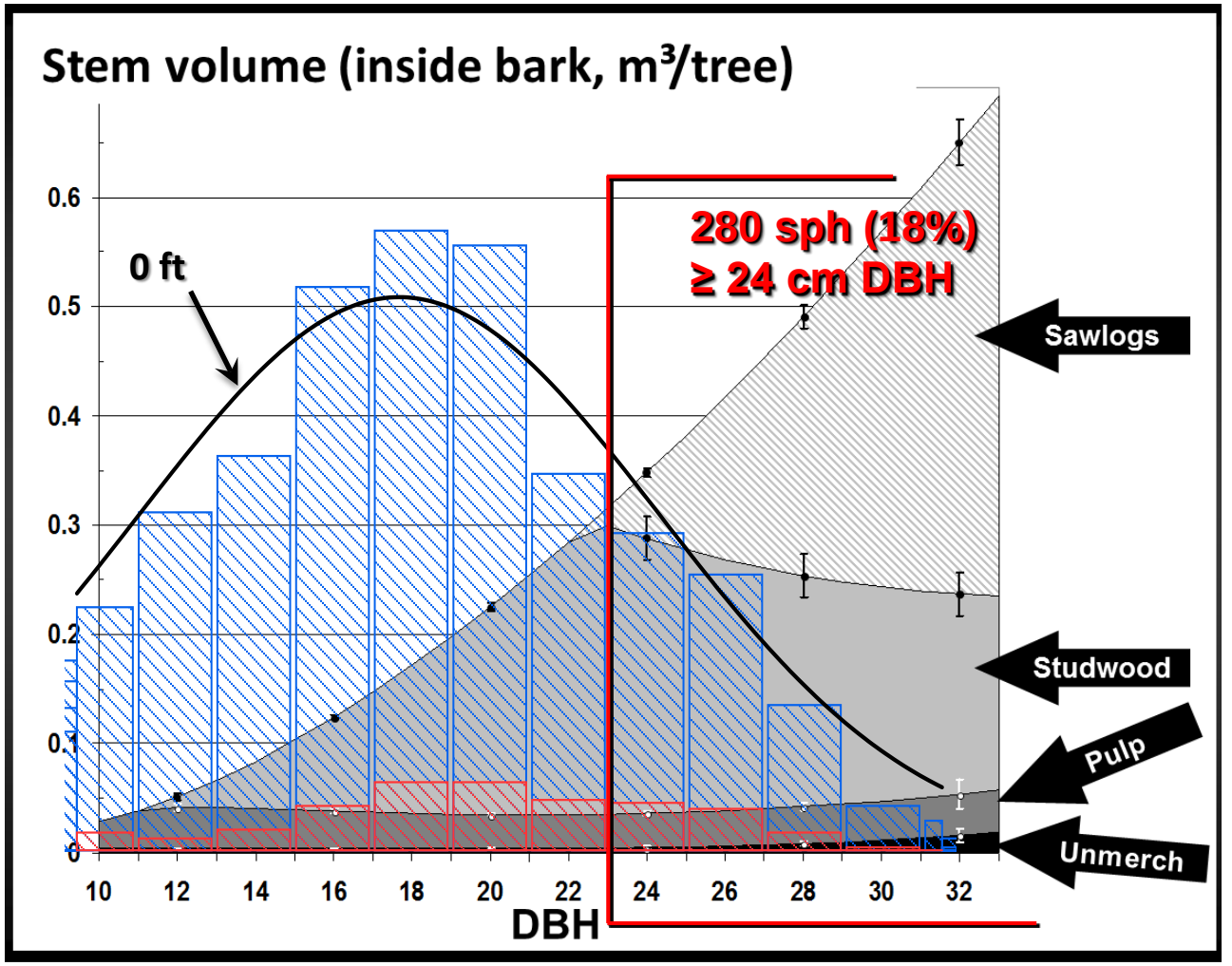
2a: Growth and Yield:

Unthinned:

- 1340 sph
- 13% < 9 cm
- 18% ≥ 24 cm



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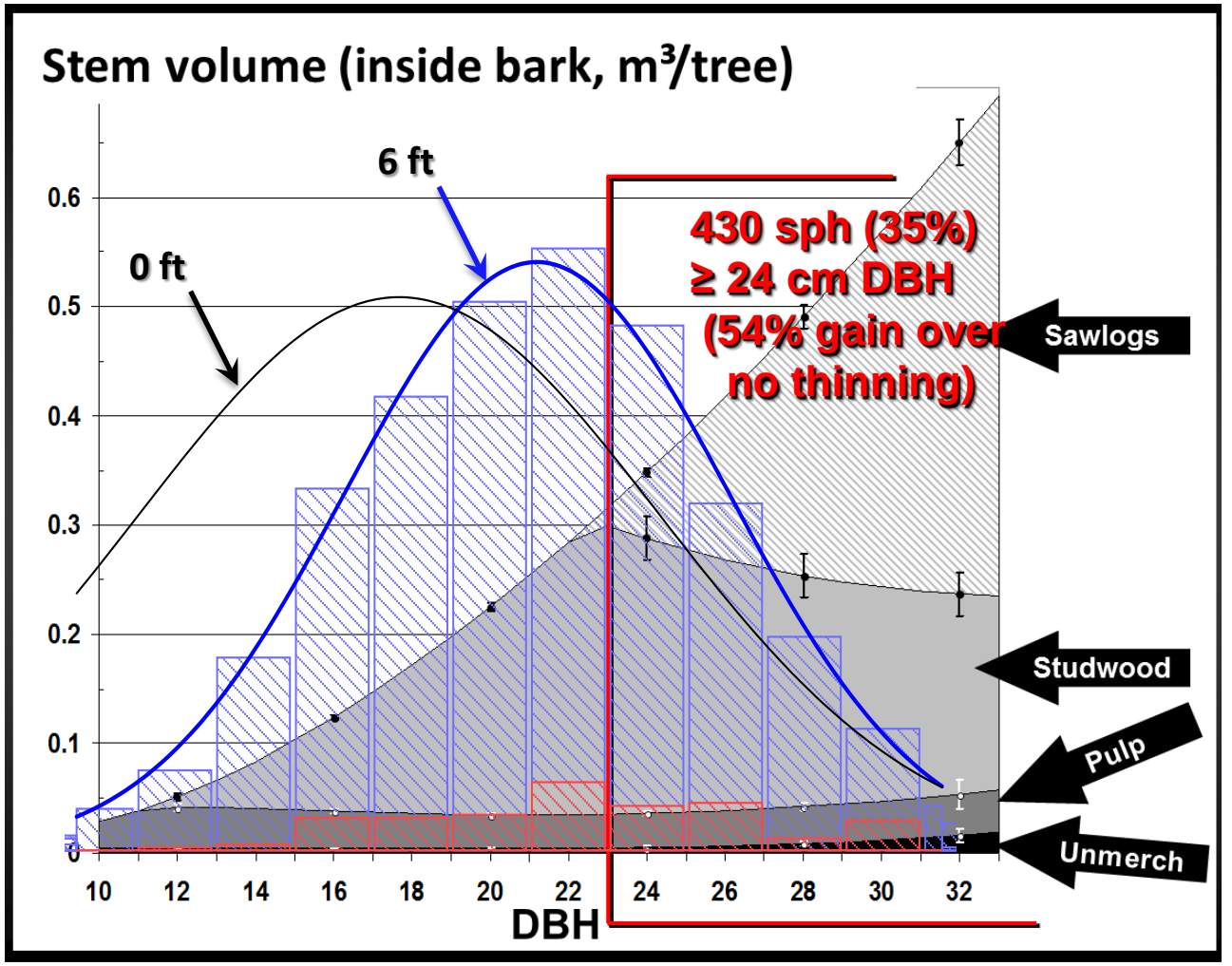
2a: Growth and Yield:

Unthinned:

- 1340 sph
- 13% < 9 cm
- 18% ≥ 24 cm

6 ft Spacing:

- 1200 sph
- 1% < 9 cm
- 35% ≥ 24 cm
- *Nearly all stems merchantable*



2a: Growth and Yield:

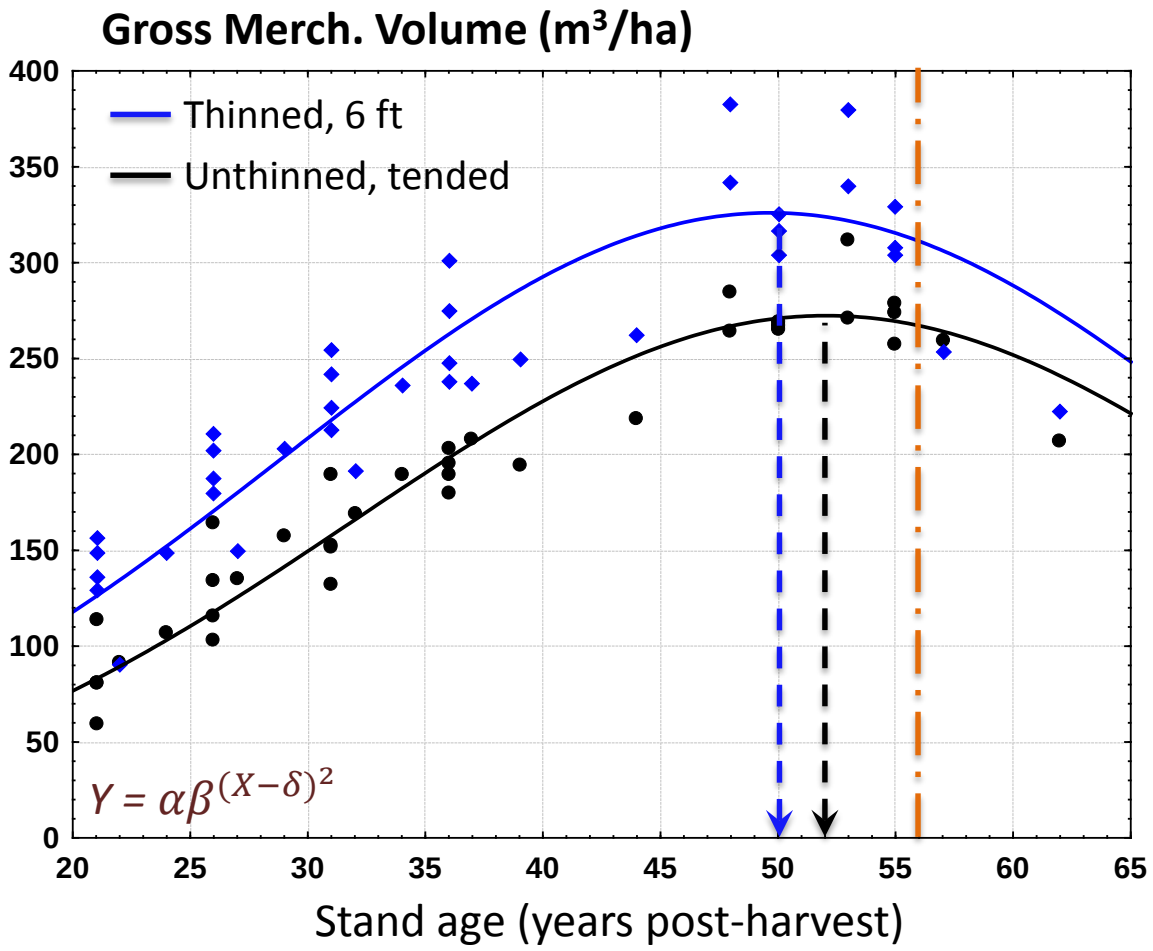
Average harvest age was 56 years

Thinned:

- *max 326 m^3/ha at 50 years*

Unthinned:

- *max 272 m^3/ha at 52 years*



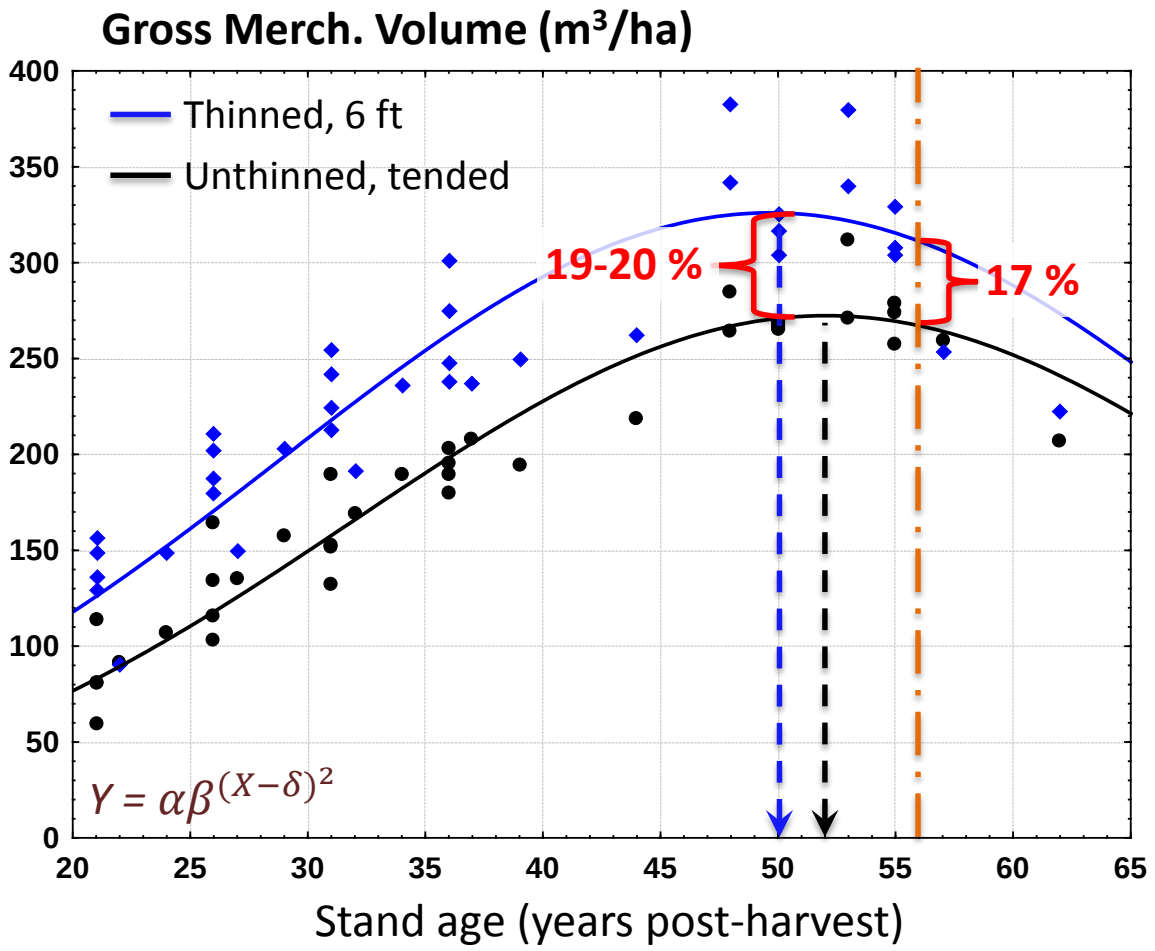
2a: Growth and Yield:

Differences:

- *At peaks, 19-20% gain*
- *At Harvest age, gain was 17%*
- *Max, 64 m^3 (28%) at 40 years*

Benefit declines with age

PCT = higher yield

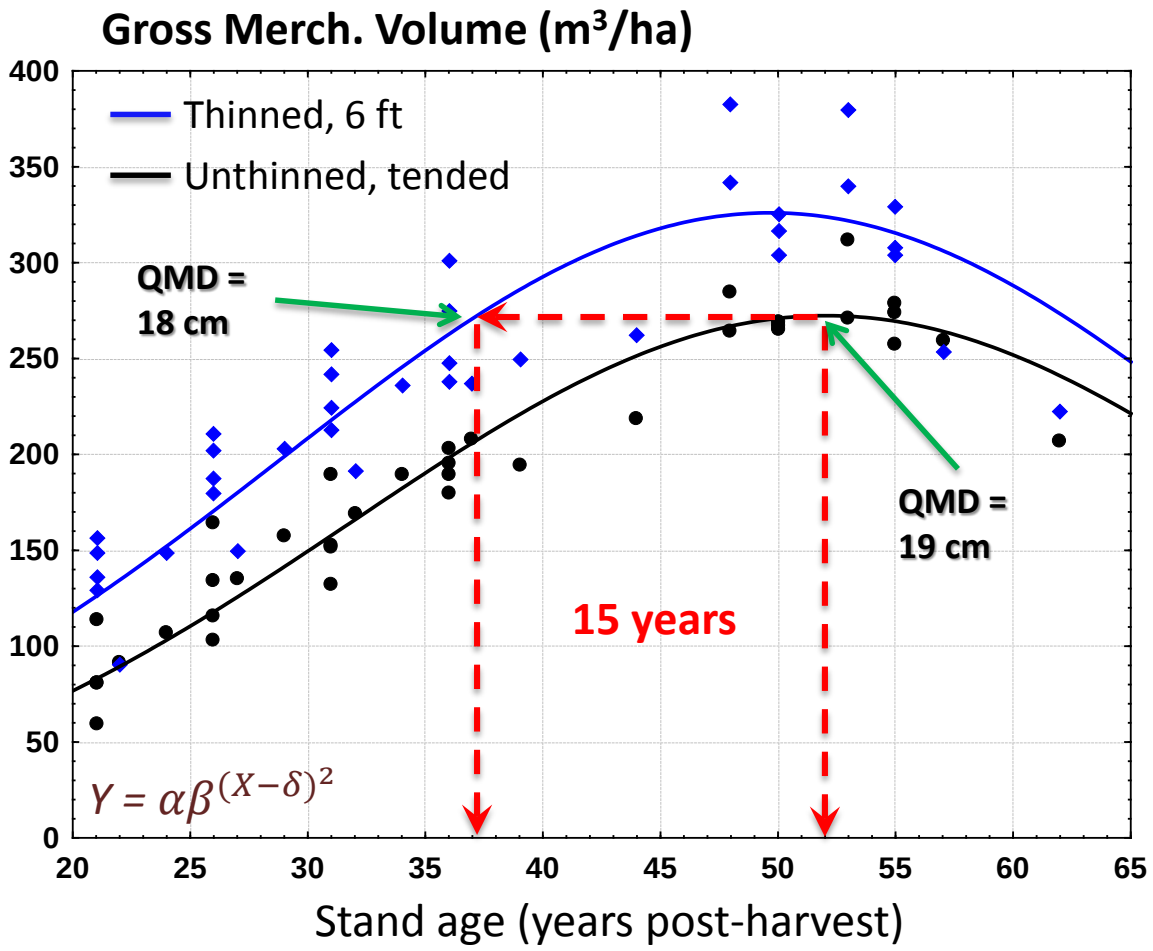


2a: Growth and Yield:

Differences:

- *Vol available sooner*
- *E.g. 6ft produces same vol as unthinned peak 15 years earlier*

Vol available earlier = more management flexibility



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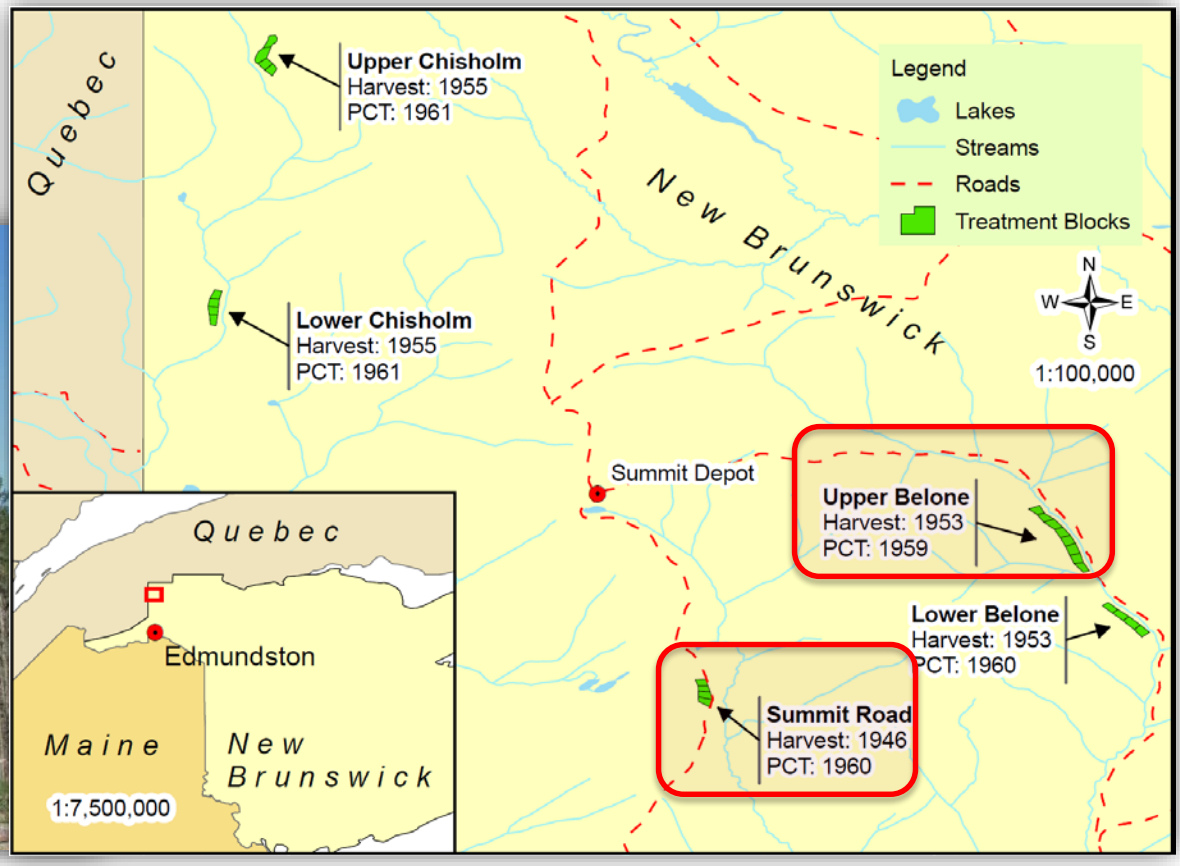
Harvest

- Harvest Fall 2008, 3 of 6 replicate blocks
- JDI → Upper Belone
- Acadian Timber → Summit Rd



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2b: Disease and Decay *(Gary Warren – CFS ret.)*

PCT does appear to increase the incidence of root and butt decay…

Mitigation:

- **Stand age at the time of thinning.**
- **Thinning intensity (~6').**
- **Stand age at time of harvest.**
- **Pay attention to "Best-Before" date**

2c: Operations (Jean Plamondon – FPInnovations)

PCT had large effects on harvesting and wood handling efficiency…

30-35% gain in harvesting productivity

17-46% gain in loading rate

16-39% gain in forwarding productivity

- ***28% reduction in direct costs***
- ***$3.48/m³, or more than $1000/ha!***

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2d: Wood Quality and Value (Isabelle Duchesne – FPI, now CFS)

PCT had minor effects on lumber recovery and quality…

3X more fbm/tree in 2x6

68% more Premium fbm/tree
47% more No.2+ fbm/tree

Wood density, no effect

-5% stiffness (MOE);
-9% strength (MOR)

- ***Recovery greater for large dimensions and higher visual grades***
- ***6' spacing, as tested, is reasonable to maintain product quality in balsam fir…***

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2d: Wood Quality and Value *(Isabelle Duchesne – FPI, now CFS)*

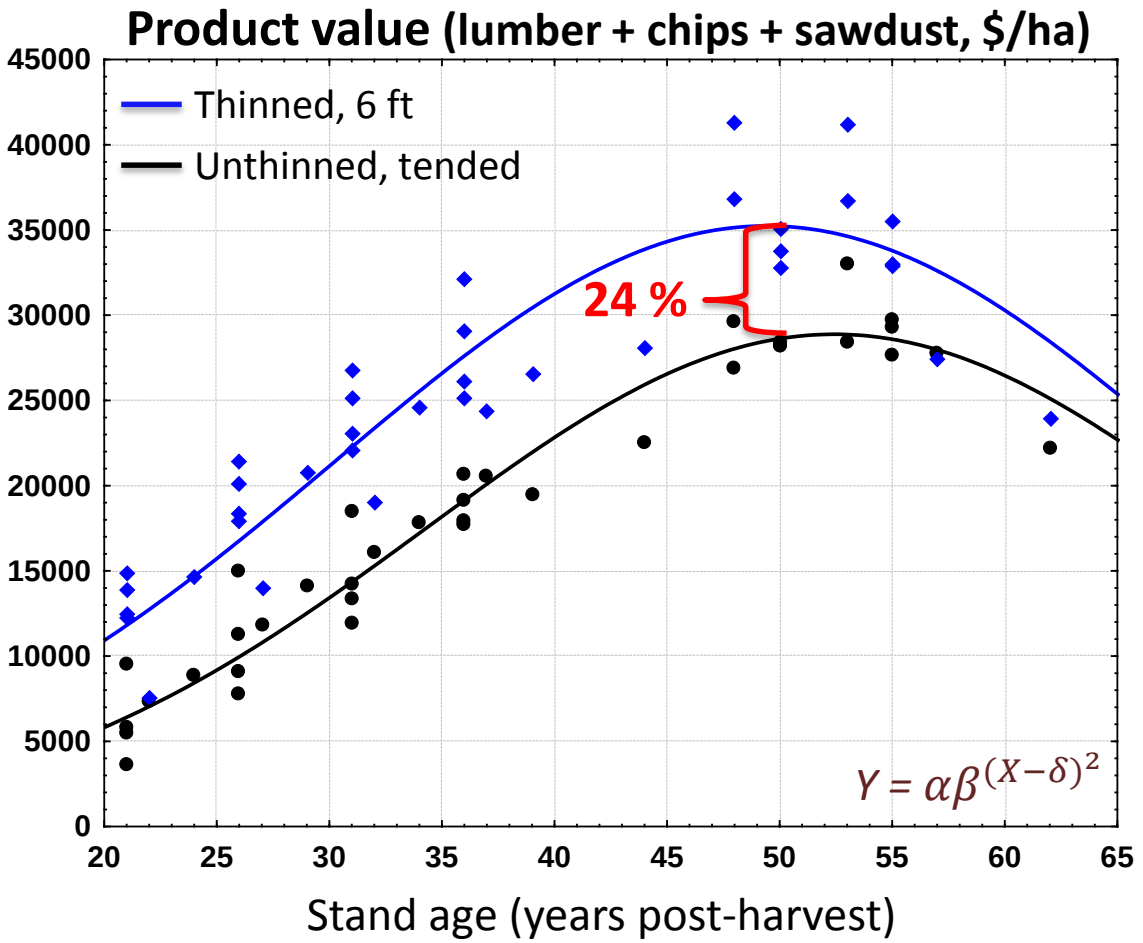
higher recovery of large dimension lumber

+

higher recovery of No.2+ grades

=

more product value in thinned stands



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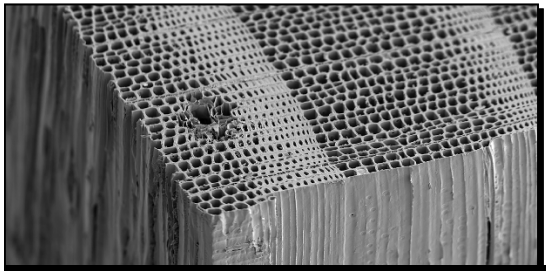
2e: Pulp Quality and Value (Paul Bicho – FPI, now Canfor Pulp)

PCT had minor effects on pulping and quality; ≤ variability between sites…

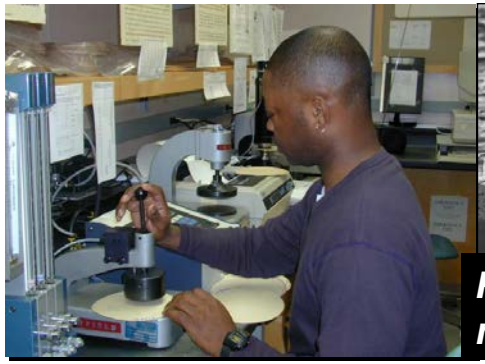


1-4% decrease in slabwood chip density

1.8% decrease Kraft pulp productivity

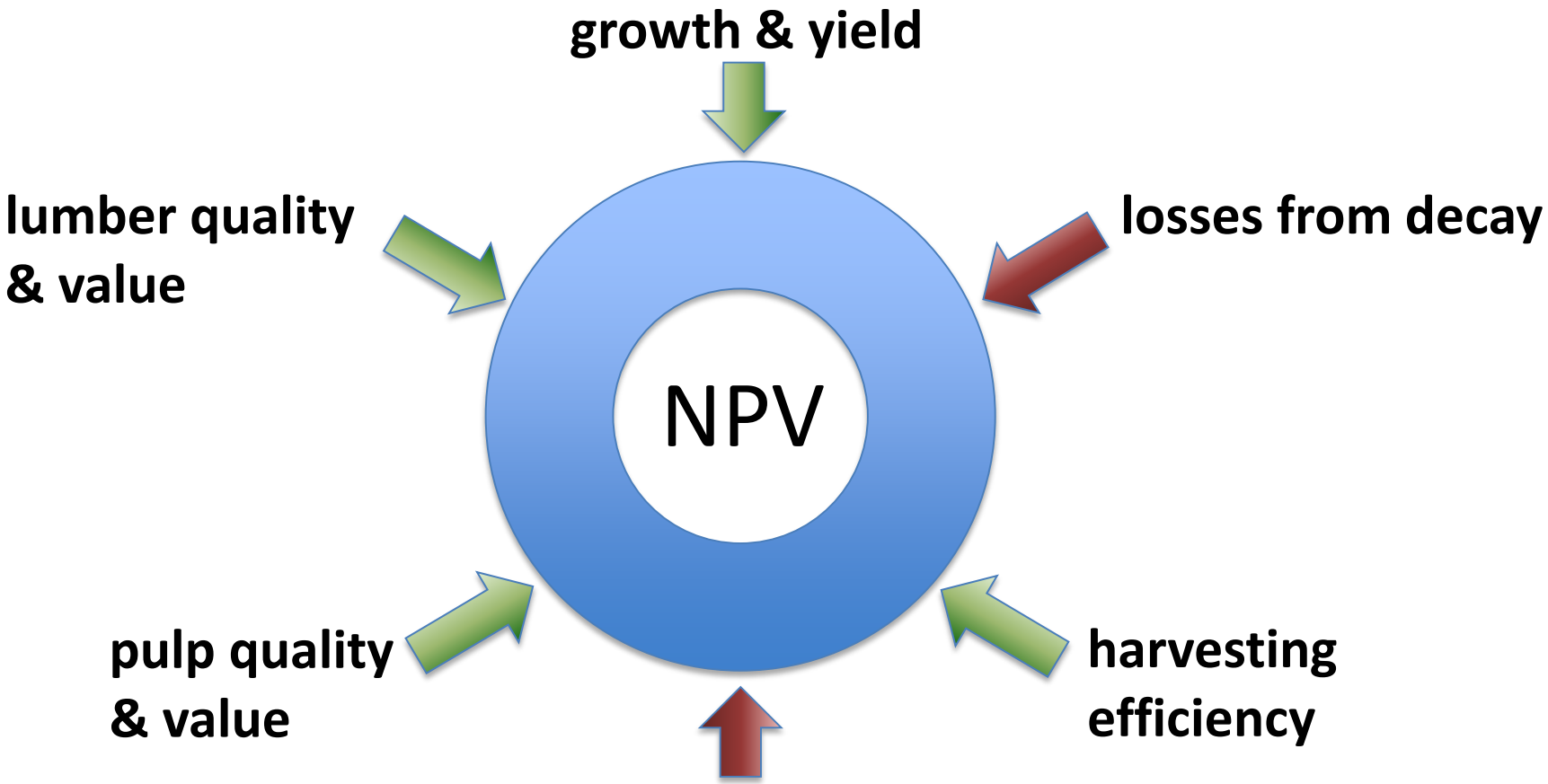
4% reduction in SRE of TMP

- ***Chips from 6' spacing offered greatest value extraction (highest chip mass, uniformity, and slab:top ratio)***



Handsheet properties, no adverse effects…

2f: Economics of PCT



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2f: Economics of PCT

INSTRUCTIONS: All user-inputs (below) are outlined in yellow. Hover on any of the parameter descriptions for a pop-up explanation of the values and potential inputs. The model will immediately update all economic calculations and display them on the "Out graphs" and "Out stats" pages. The yield curves that drive the analyses are graphed below - the Green River experimental plot averages are shown with solid lines (Pitt et al. 2013b); the New Brunswick Growth & Yield plot averages for northwestern NB are shown in dashed lines (see sheet "A1" for our adaptation procedure). Note that the X-axes on the yield curve references the number of years post harvest - for the Green River data, it is necessary to make this distinction because trees originated as advanced regeneration prior to overstory removal in these stands and are, on average, 8-10 years older than the X-axes ages indicate. This regeneration scenario is fairly typical of shade-tolerant species such as balsam fir and red spruce.

Input values -on the forest side:

		@ time (year)			
Vegetation management costs ($/ha):	120	4			
PCT costs ($/ha):	650	8			
discount rate i (%):	4				
Average haul distance to mill (km):	100				
Haul costs ($/m³):	$10.24		NB 10yr ave*	ON 10yr ave*	ME 2010*
Posted Sawlog stumpage rate ($/m³):	$20.59		$20.59	$9.23	$18.90
Posted Pulpwood stumpage rate ($/m³):	$11.83		$11.83	$8.92	$8.50
Posted Hardwood stumpage rate ($/m³):	$6.45		$6.45	$3.66	$9.45
Posted random-length log stumpage rate ($/m³):	$20.59		same	same	$19.95
Operational overheads ($/m³):	$5.00				
Assumed conifer stocking, untended (%):	60				
Assumed lag (years) for no tending:	10				
Change in expected yield (+10% to -30%):	0	%			
Sector benefits ($/m³):	$0.00				

Input values -on the mill side:

Mill costs and product values fluctuate daily and have a huge impact on the value chain. Below, the user can adjust both production costs and product values to suit particular

COSTS

Lumber conversion (see A8-10 for details):	0	%
NBSK		
Chip costs ($/OD t):	$140	
Chip delivery (10% of chip costs) ($/OD t):	$14	
All other production costs ($/t NBSK):	$265	
Total cost ($/t NBSK):	$660	*
NBHK		
Chip costs ($/OD t):	$140	
Chip delivery (10% of chip costs) ($/OD t):	$14	
All other production costs ($/t NBHK):	$265	
Total cost ($/t NBHK):	$586	

PRODUCT VALUES

Lumber (Indec 2007) Chips ($140/OD t) Sawdust ($40/OD t)	0	%
NBSK ($/t NBSK):	$780	
NBHK ($/t NBHK):	$700	

* based on wood from unthinned stands (see A17 for details)

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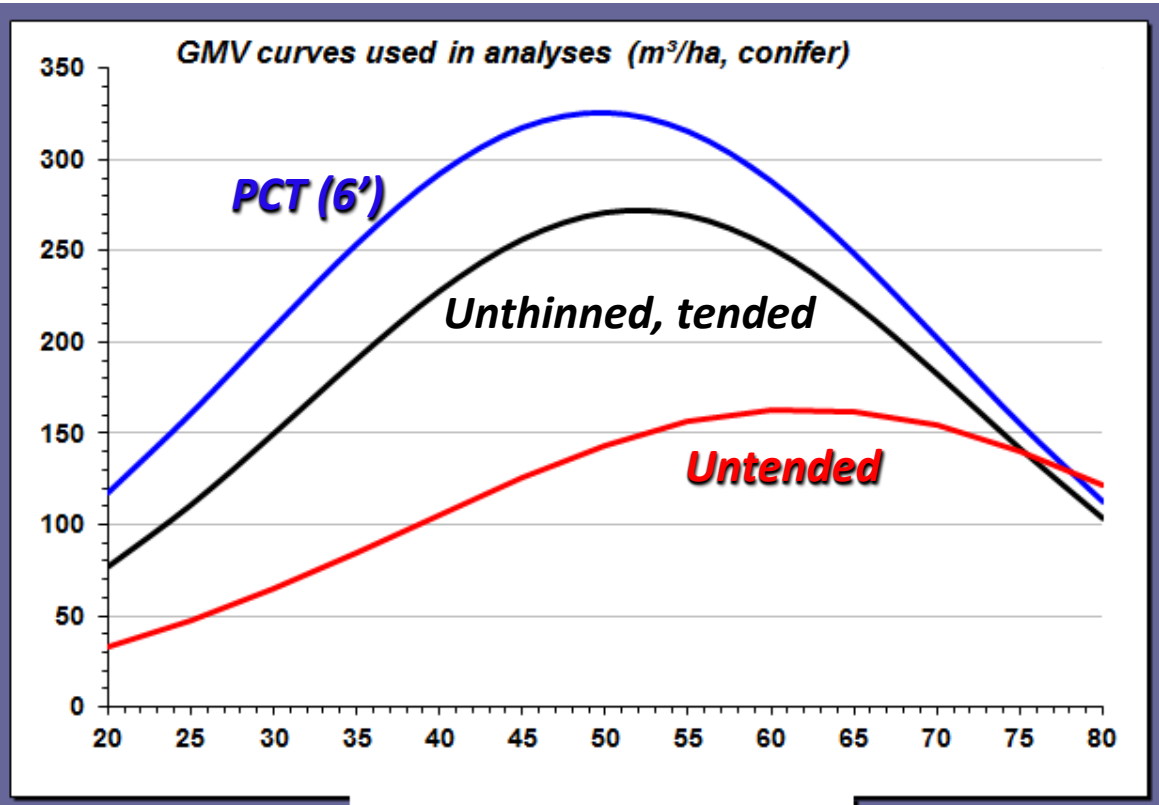
2f: Economics of PCT



Legend

- Green River brushed unthinned
- Green River, PCT'd to 6'spacing
- Green River, untended (estimated)
- NB G&Y brushed unthinned
- NB G&Y PCT'd
- NB G&Y, untended (estimated).

	Age of Maximum Sawlog MAI (years since harvest)	Maximum Sawlog MAI (m³/ha/yr)
Green River		
PCT'd	45	5.9
brushed, unthinned	50	4.3
untended	55	2.3
NB G&Y		
PCT'd	45	4.3
brushed, unthinned	50	2.7
untended	55	1.4

CoverPage | Index | Assumptions | **Inputs** | Out graphs | Out stats | Unthinned | 6' Spacing | Untended | Unthinned (NB) | 6' Spacing (NB) | Untended

Untended = est. of 60% conifer, 40% hdwd; all hdwd goes to pulp

2f: Value Chain Economics

Two Perspectives:

1. **Landowner** = $\int \begin{matrix} Standing\ Value \\ Establishment\ Costs \end{matrix}$

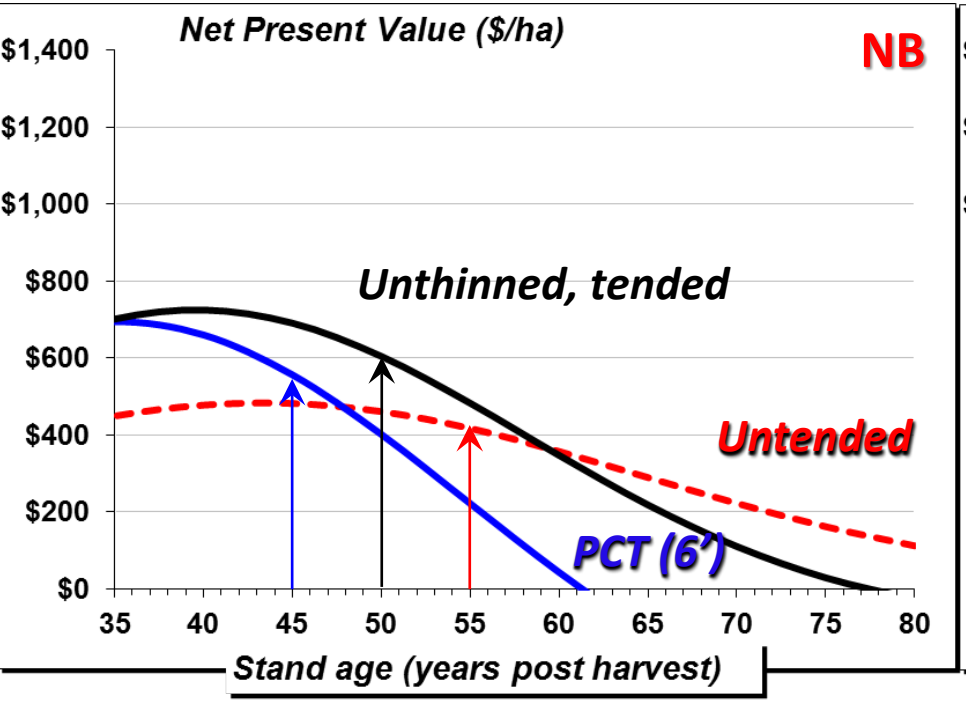
2. **Integrated Producer** = $\int \begin{matrix} Product\ Value\ (solid\ wood, pulp) \\ Operations\ Costs\ (harvest, transport, \\ lumber\ conversion) \\ Establishment\ Costs\ (tending, PCT) \end{matrix}$

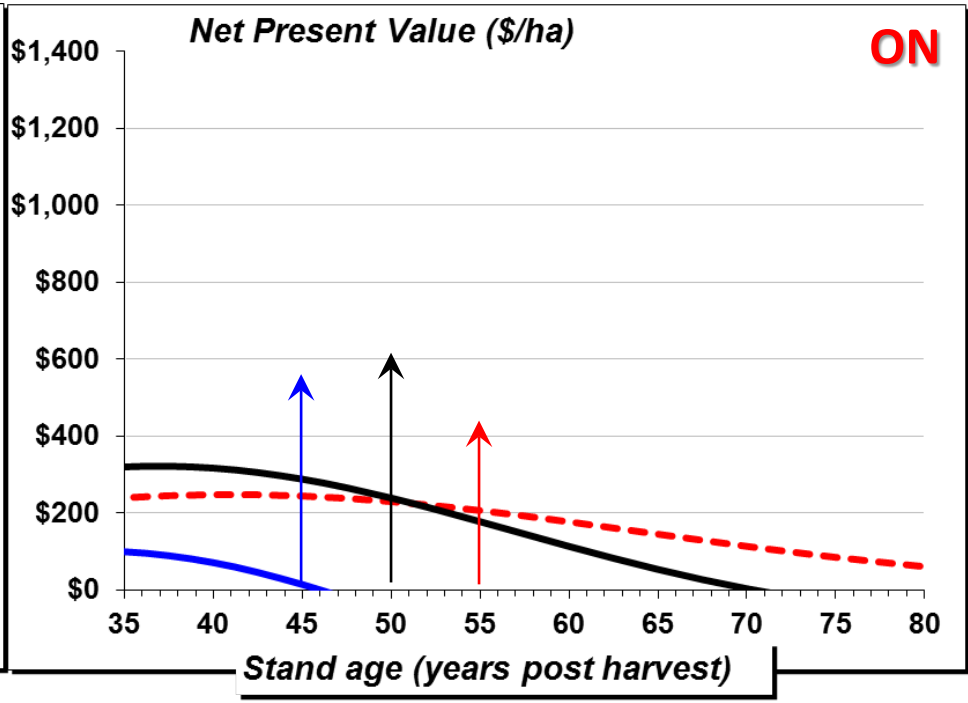
Discount rate applied to convert values and costs into *present value.*

2f: Economics of PCT

1. Landowner

Max Sawlog MAI





Sawlogs	= $20.59/m³
Pulp	= $11.83/m³
hw pulp	= $6.45/m³

i	= 4%
PCT	=$650/ha
VM	= $120/ha

Sawlogs	= $9.23/m³
Pulp	= $8.92/m³
hw pulp	= $3.66/m³

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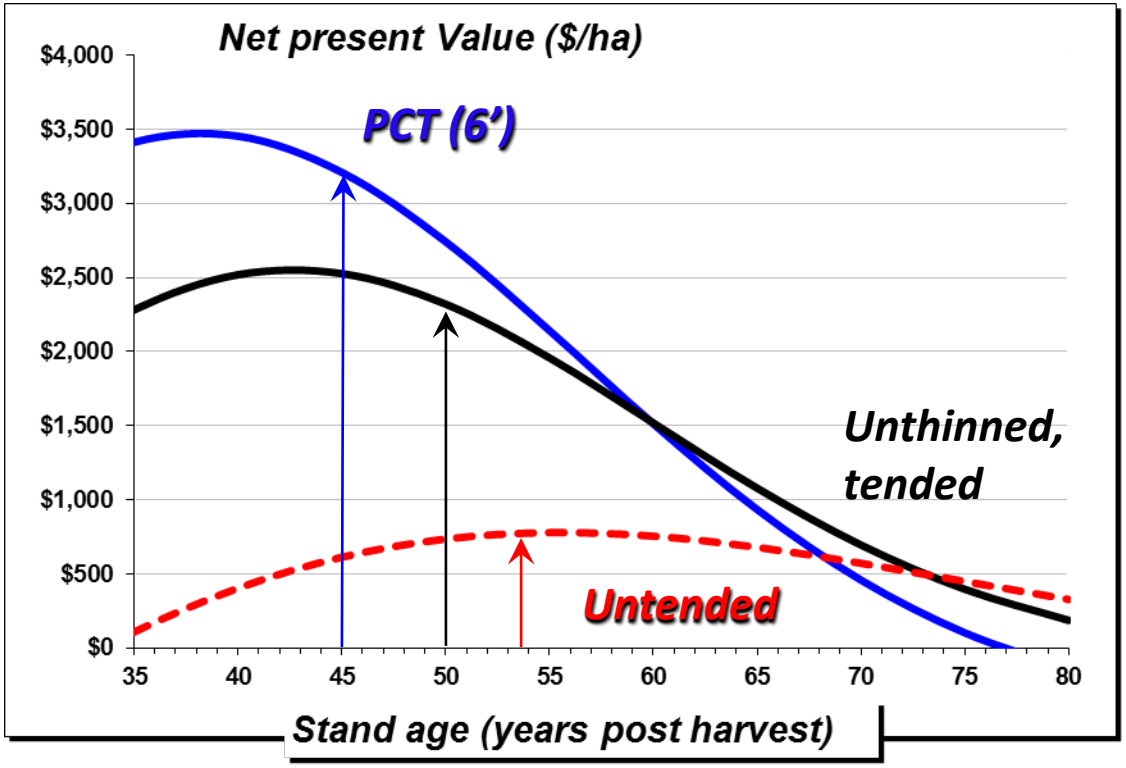
2f: Economics of PCT

2. Integrated Producer

- ↑ product revenues
- ↓ costs/unit

- At max sawlog MAI, PCT 38% > Unthinned, and 4x > Untended

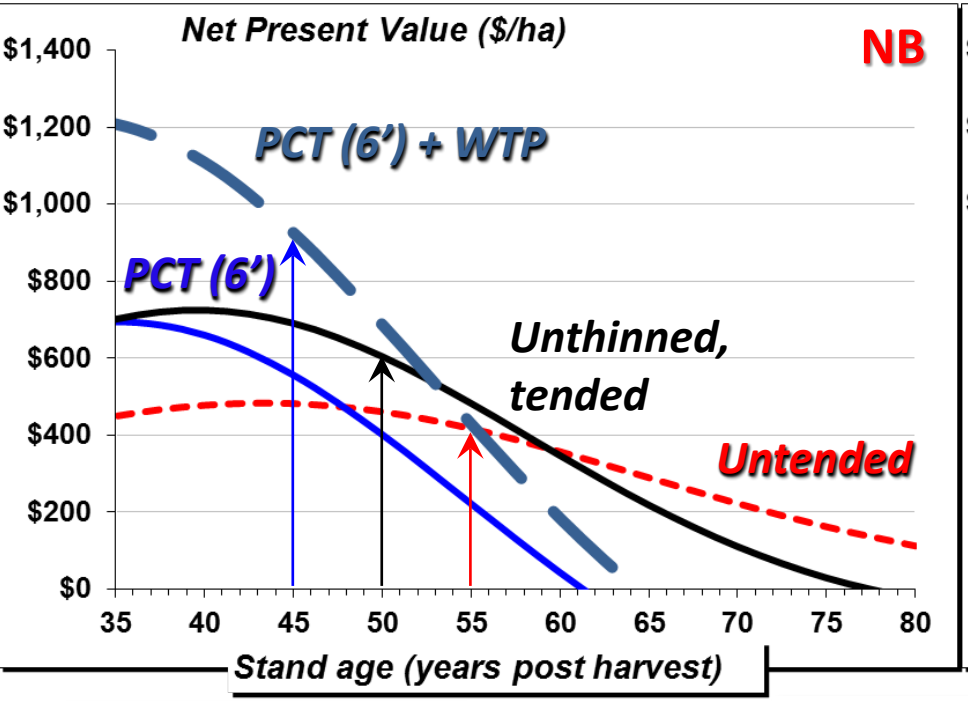
- Revenues available for stumpage, risk, profit.

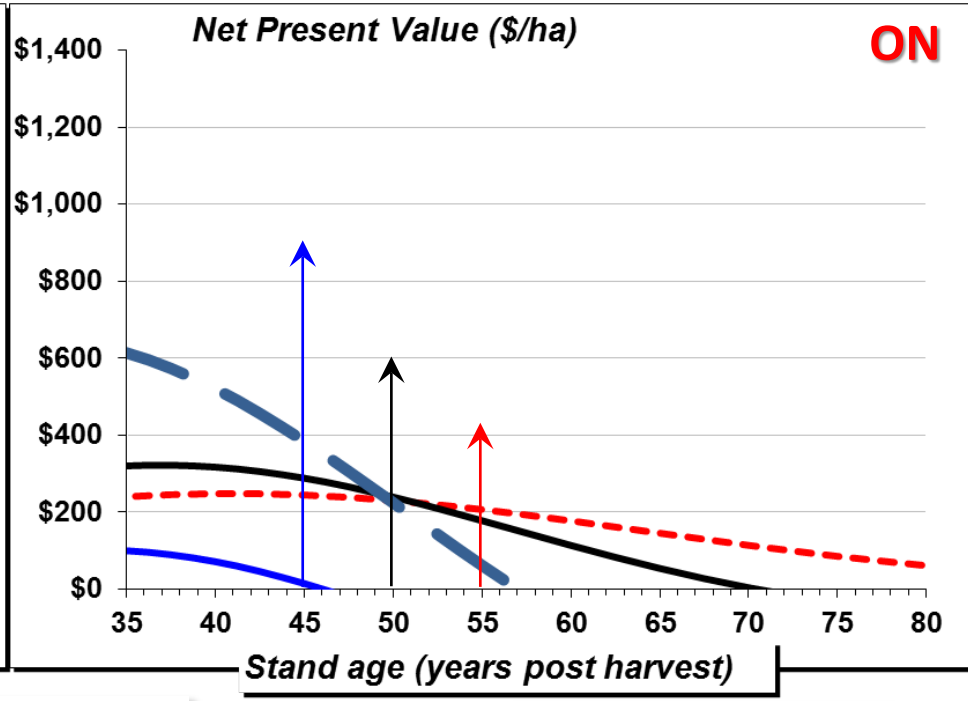


i	= 4%
PCT	=$650/ha
VM	= $120/ha

2f: Economics of PCT

1. Landowner (*revisited*): WTP = 'willingness to pay'; harvesting & milling efficiencies passed on to landowner





Sawlogs	*= $20.59/m³*
Pulp	*= $11.83/m³*
hw pulp	*= $6.45/m³*

i	*= 4%*
PCT	*=$650/ha*
VM	*= $120/ha*

Sawlogs	*= $9.23/m³*
Pulp	*= $8.92/m³*
hw pulp	*= $3.66/m³*

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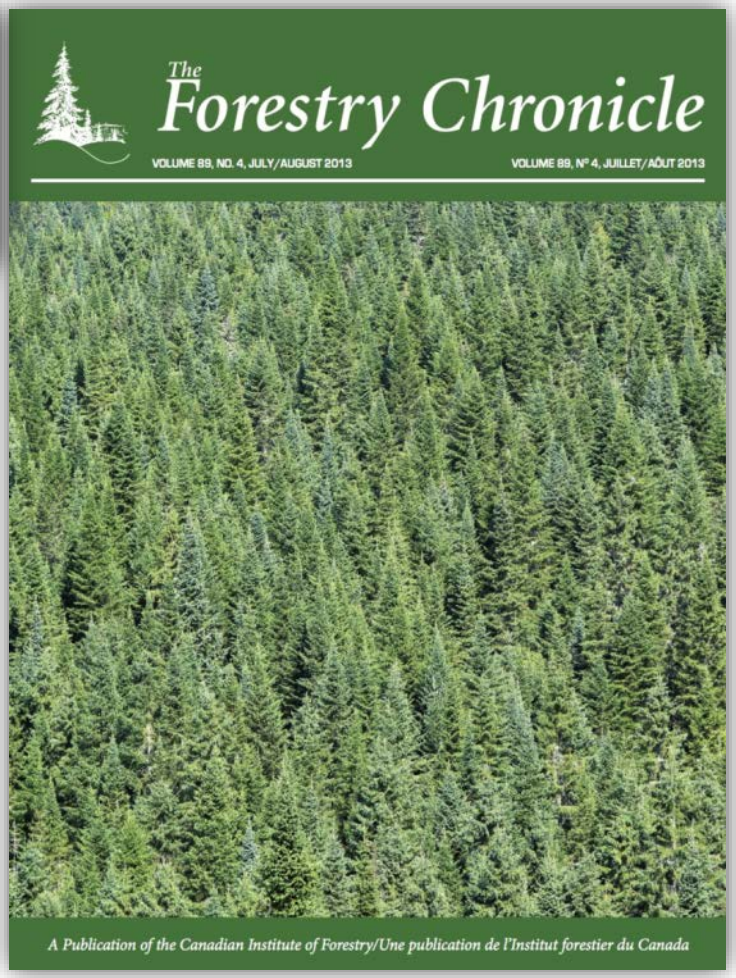
2f: Economics of PCT

Effects of precommercial thinning on the forest value chain in northwestern New Brunswick: Part 6 – Estimating the economic benefits

by Doug Pitt[1,*] Len Lanteigne[2], Michael K. Hoepting[1], Jean Plamondon[3], Isabelle Duchesne[4], Paul Bicho[5] and Gary Warren[6]



Sensitivity Analyses:

- *Discount rate*
- *Site productivity*
- *Silviculture costs*
- *Timber royalties*

The model can be shared. Try it out!

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3: Summary

michael.hoepting@canada.ca

Impact of PCT on:

a) *Growth and yield:* ↑ ***larger trees, more sawlog volume***

b) *Operations:* ↑ ***more efficient harvesting***

c) *Disease and decay:* ↓ ***small increase in losses to decay***

d) *Wood quality and value:* ↑ ***lumber value up, quality stable***

e) *Pulp quality and value:* ↔ ***quality stable, minimal effect on processing***

f) *Value chain economics:* ↔ ***depends on perspective!***

1. *Landowner:* ↓ ***tending > PCT > untended***
2. *Integrated Producer:* ↑ ***PCT > tending > untended***

1b. Landower + WTP: ↑ ***PCT+WTP > tending > PCT***

Ontario Species

Black Spruce (44 yr old plantations thinned at 23 yr to 0, 20, 35 BA reductions)

- Yield of No2. & Better: n.s. diff in stand-level yields
- Yield of MSR: T35 < T0 & T20; therefore don't thin to T35
- Lumber Bending (MOE)
  - Lower than mature natural stands
  - Higher than Sb plantations
  - Higher than natural 50-60 Pj

White Spruce (60 yr old 1.8, 2.7, 3.6 m spacing)

- Yield of No.2 & Better: 1.8 > 2.7 > 3.6
- MSR Yield: 3.6 < 2.7
- Product Value (lumber, chips, sawdust): 2.7 > 1.8 > 3.6

Ontario Species

Jack Pine (1966 PCT to 4, 5, and 7ft in 1941 fire origin stand)

- Yield of No.2 & Better: increases with spacing, but higher levels of downgrades due to knots; lumber from 7ft meeting visual grades but not strength properties
- MOE & MOR: reduction with thinning intensity