Tools for noncommercial silvicultural treatment selection and rate adjustments based on operating conditions

Denis Cormier

NERCOFE Workshop, University of Maine

March 10, 2015

FPInnovations

Agenda

1. Overview of silvicultural operation trials
   - Effects of site conditions on productivity and treatment quality
2. Tools
   - Operating costs
   - Site dispersion
   - Prescription

Overview of silvicultural operation trials

Productivity and Quality

- Site preparation
- Planting (Full / Fill)
- Precommercial thinning and manual brushing

Costs

- Machine
- Labour

Overview of silvicultural operation trials

Site Preparation – Productivity

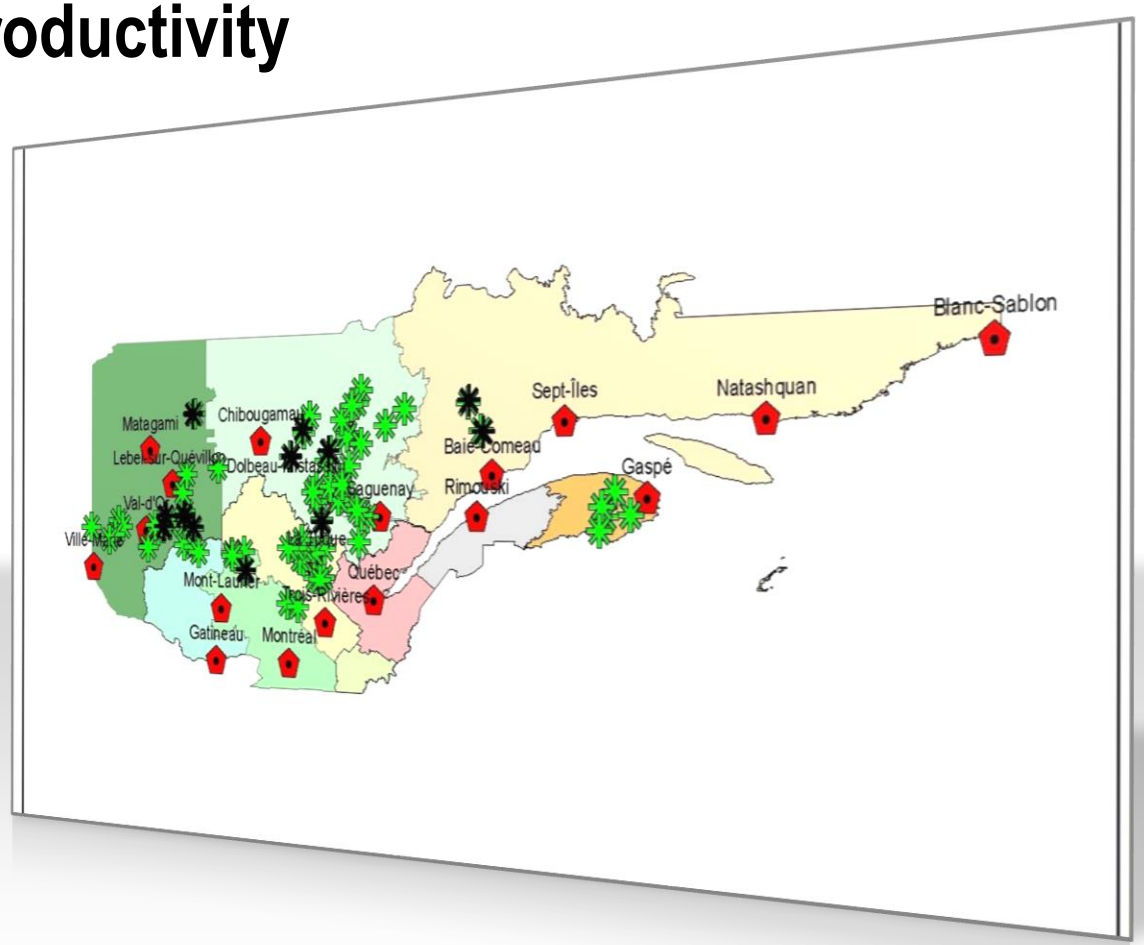
- GPS tracking of 2 full seasons;
- Geofor analysis of machine productivity;
- Scope:

  26 141 ha analysed;

  4 365 blocks;

  10 regions

  73 machines

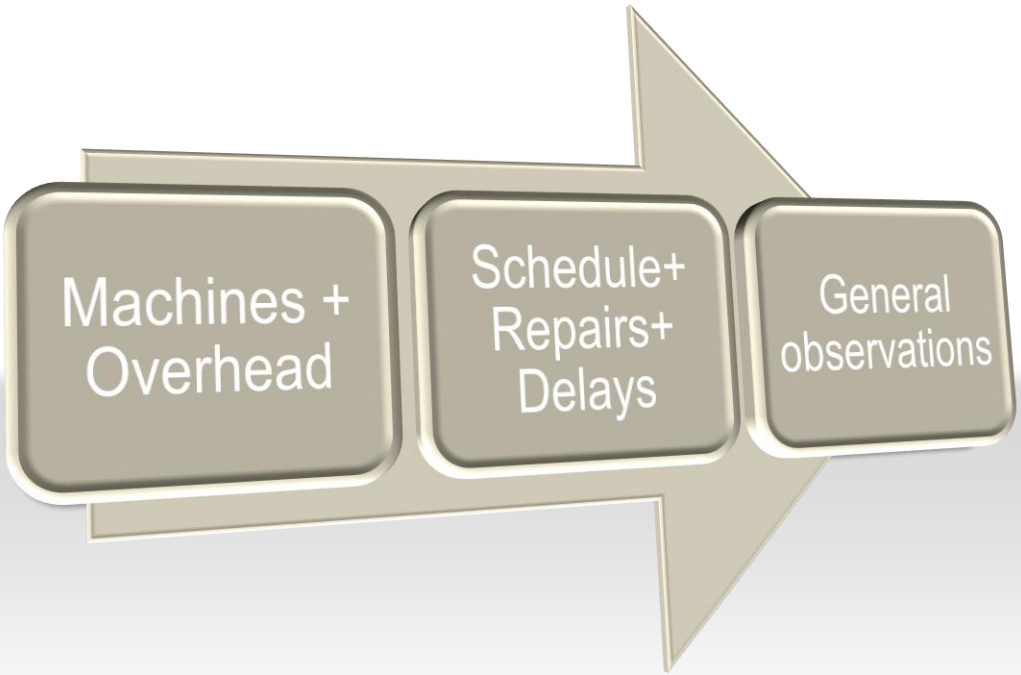


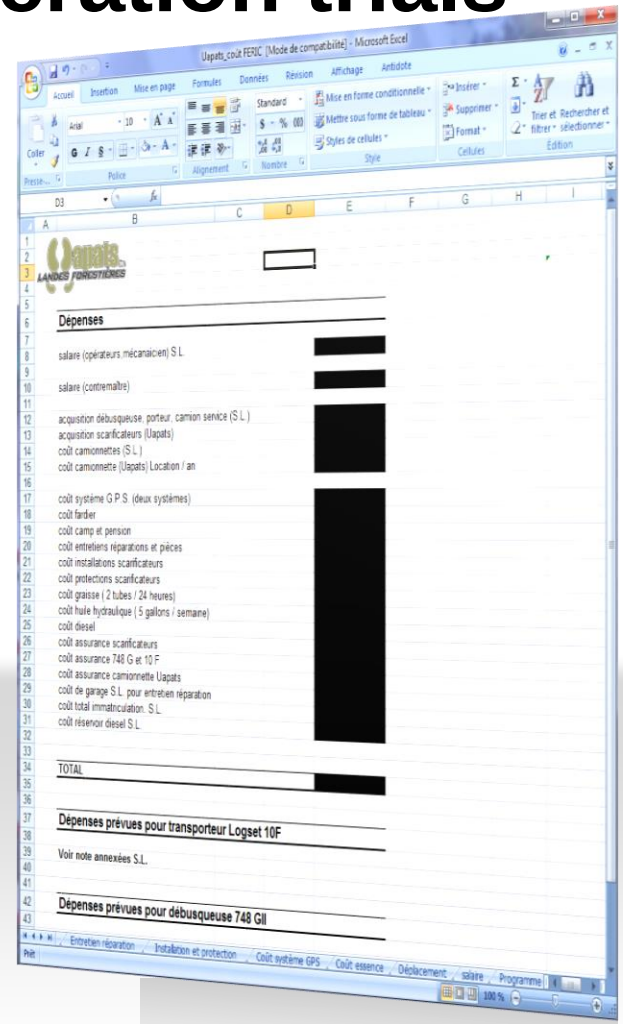
FPInnovations

Overview of silvicultural operation trials

Site Preparation – Costs

- Logbook



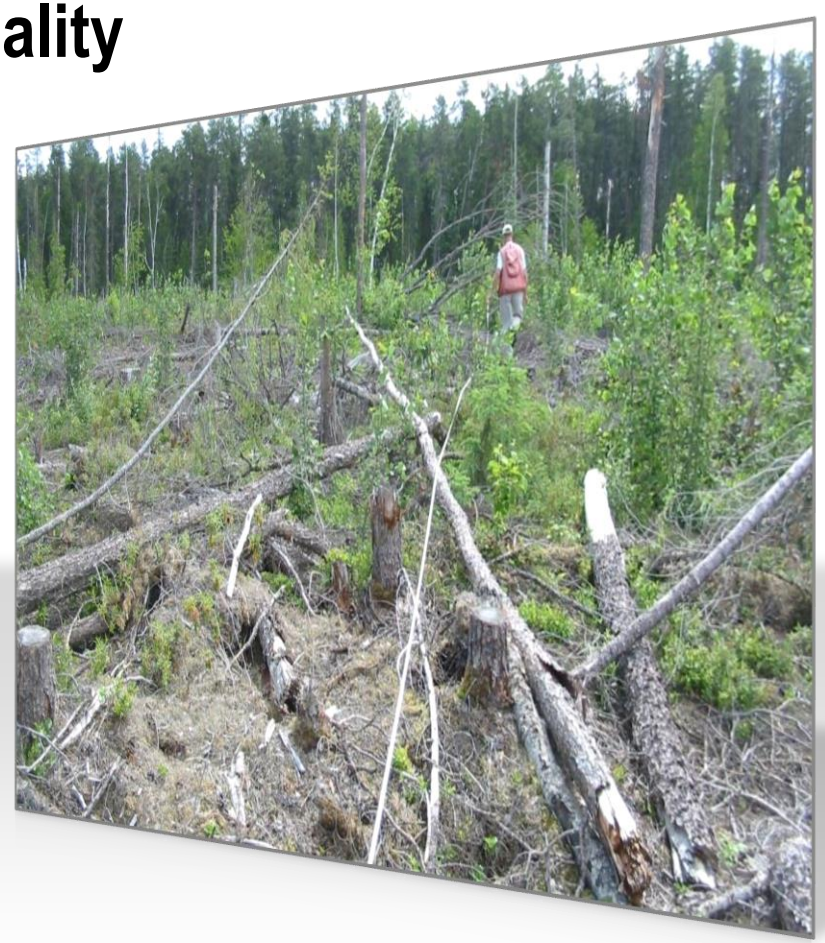


FPInnovations

Overview of silvicultural operation trials

Site Preparation – Treatment quality

- 139 blocks;
- Short-wood and Full-tree
- Wide spectrum of conditions;
- Parameters :
  - Position (trail/strip)
  - Debris et duff
  - Vegetation, residual trees and stumps
  - Stoniness and soil type
  - Slope and drainage

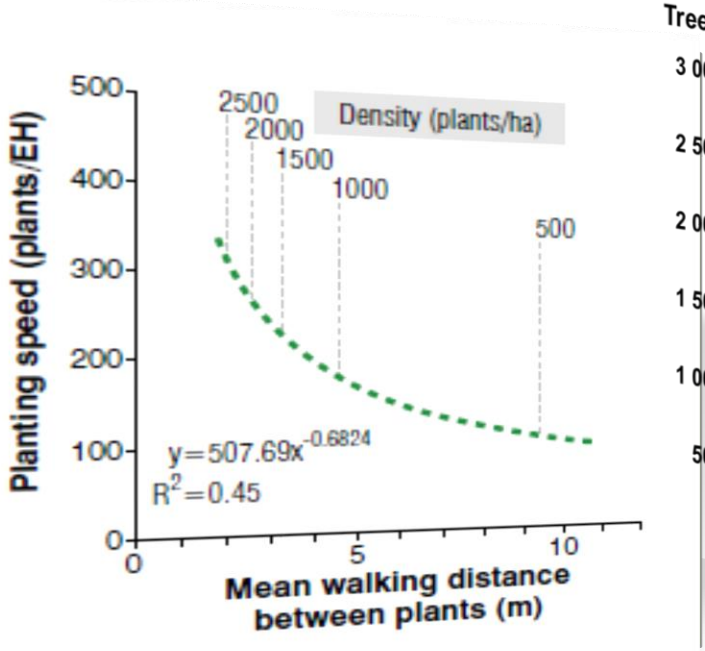


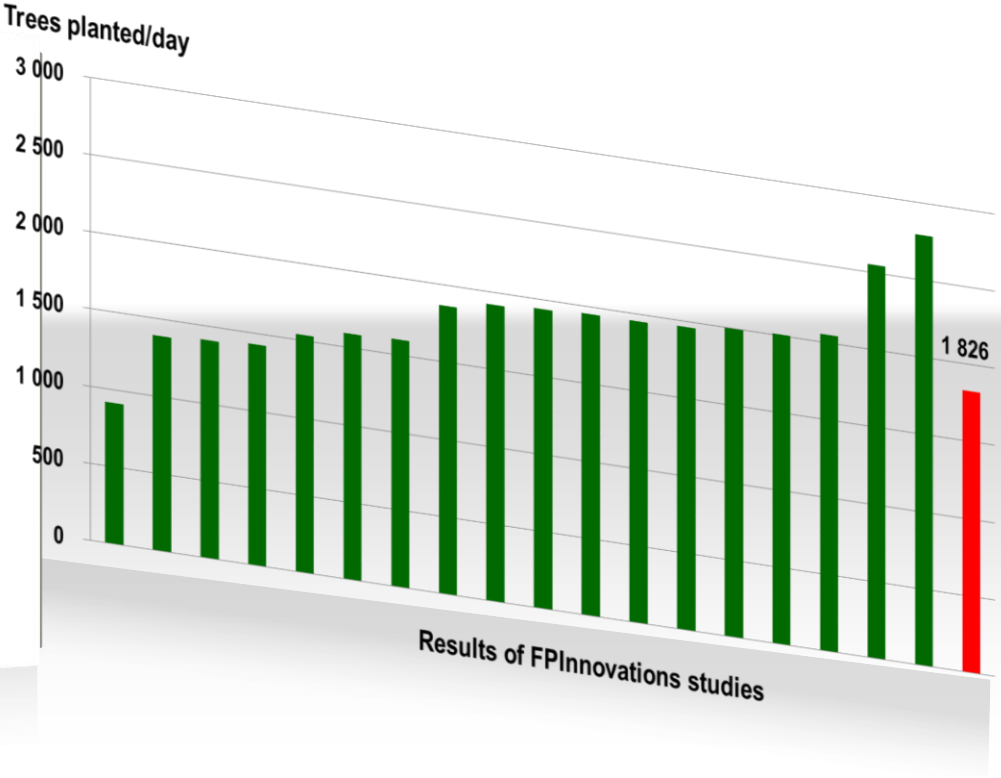
FPInnovations

Overview of silvicultural operation trials

Planting - Productivity

- 10 planting projects
- 353 speed tests on 46 planters
- 28 detailed timing on 28 planters



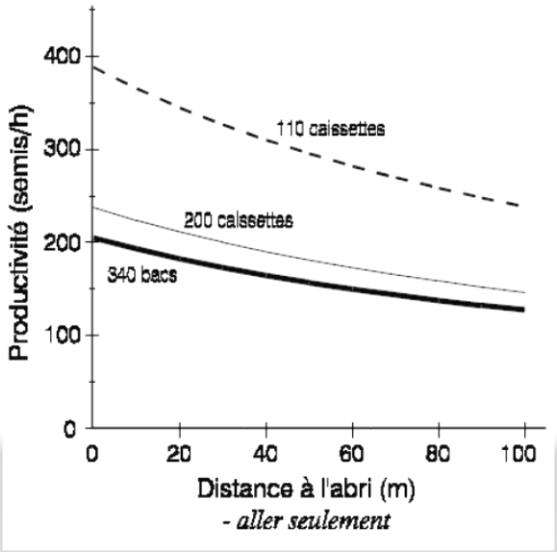


FPInnovations

Overview of silvicultural operation trials

Effects of seedling size

- 110 vs 200 vs 340 cc
- Containers
- Plantation tools
- Logistics



FPInnovations

Overview of silvicultural operation trials

Precommercial thinning (PCT)

- 203 PCT softwood
- 18 PCT hardwood
- 68 Spacing

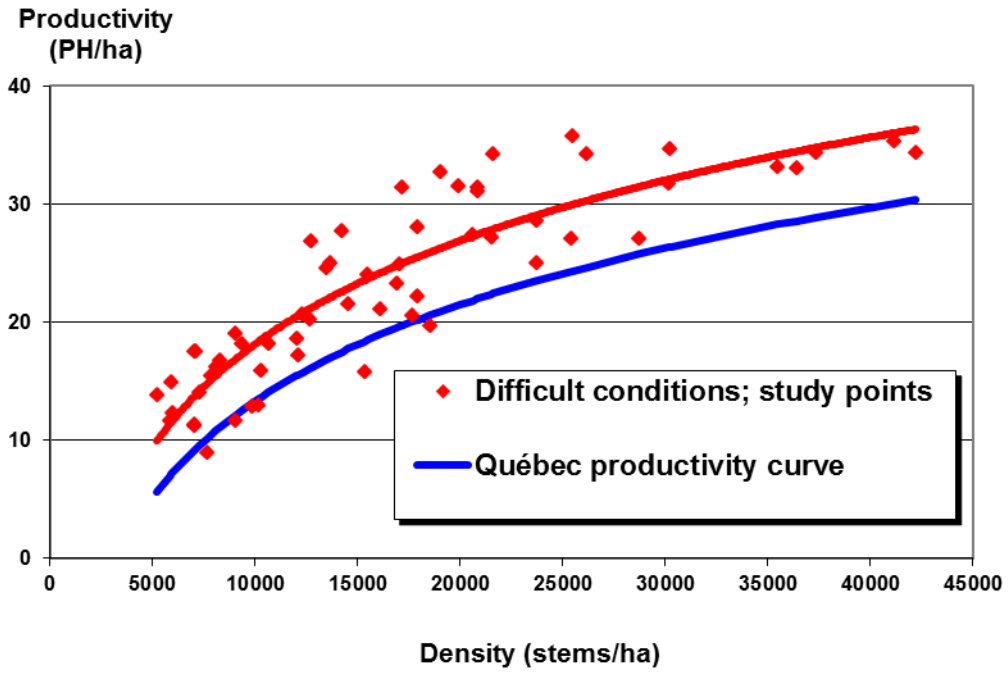
Spacing: PCT variations for lower stand densities

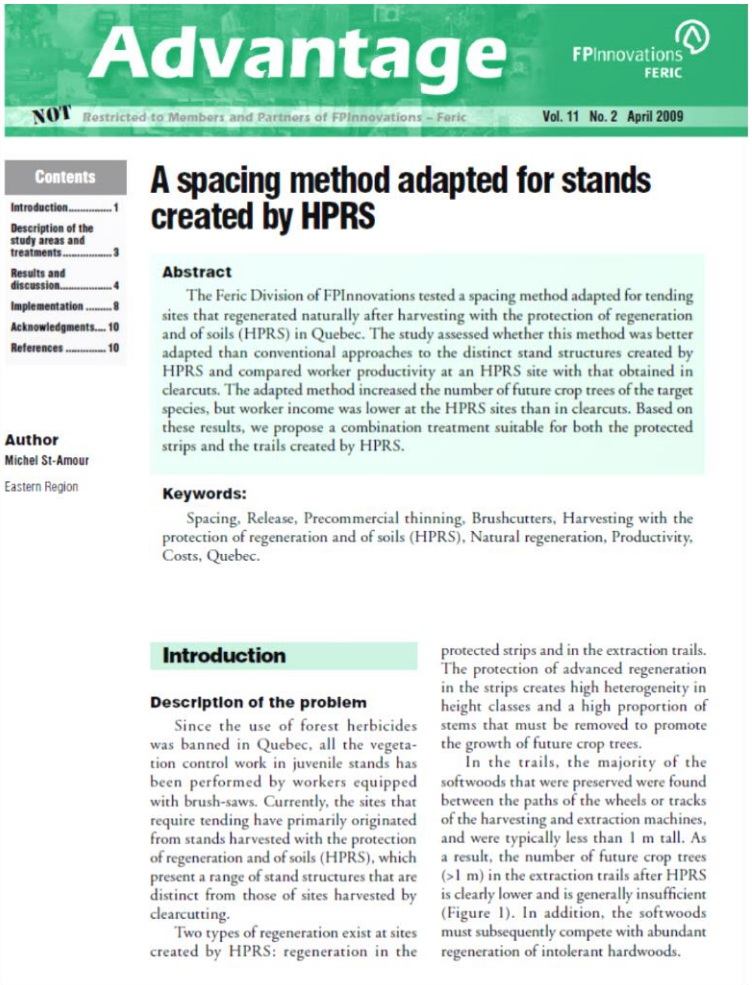
FPInnovations

Overview of silvicultural operation trials

Precommercial thinning - productivity

- Difficulty factors:
  - Tree height, obstacles, slope, type of harvest





Advantage
FPInnovations FERIC
NOT Restricted to Members and Partners of FPInnovations – Feric
Vol. 11 No. 2 April 2009

Contents

A spacing method adapted for stands created by HPRS

Author
Michel St-Amour
Eastern Region

Abstract

The Feric Division of FPInnovations tested a spacing method adapted for tending sites that regenerated naturally after harvesting with the protection of regeneration and of soils (HPRS) in Quebec. The study assessed whether this method was better adapted than conventional approaches to the distinct stand structures created by HPRS and compared worker productivity at an HPRS site with that obtained in clearcuts. The adapted method increased the number of future crop trees of the target species, but worker income was lower at the HPRS sites than in clearcuts. Based on these results, we propose a combination treatment suitable for both the protected strips and the trails created by HPRS.

Keywords:

Spacing, Release, Precommercial thinning, Brushcutters, Harvesting with the protection of regeneration and of soils (HPRS), Natural regeneration, Productivity, Costs, Quebec.

Introduction

Description of the problem

Since the use of forest herbicides was banned in Quebec, all the vegetation control work in juvenile stands has been performed by workers equipped with brush-saws. Currently, the sites that require tending have primarily originated from stands harvested with the protection of regeneration and of soils (HPRS), which present a range of stand structures that are distinct from those of sites harvested by clearcutting.

Two types of regeneration exist at sites created by HPRS: regeneration in the protected strips and in the extraction trails. The protection of advanced regeneration in the strips creates high heterogeneity in height classes and a high proportion of stems that must be removed to promote the growth of future crop trees.

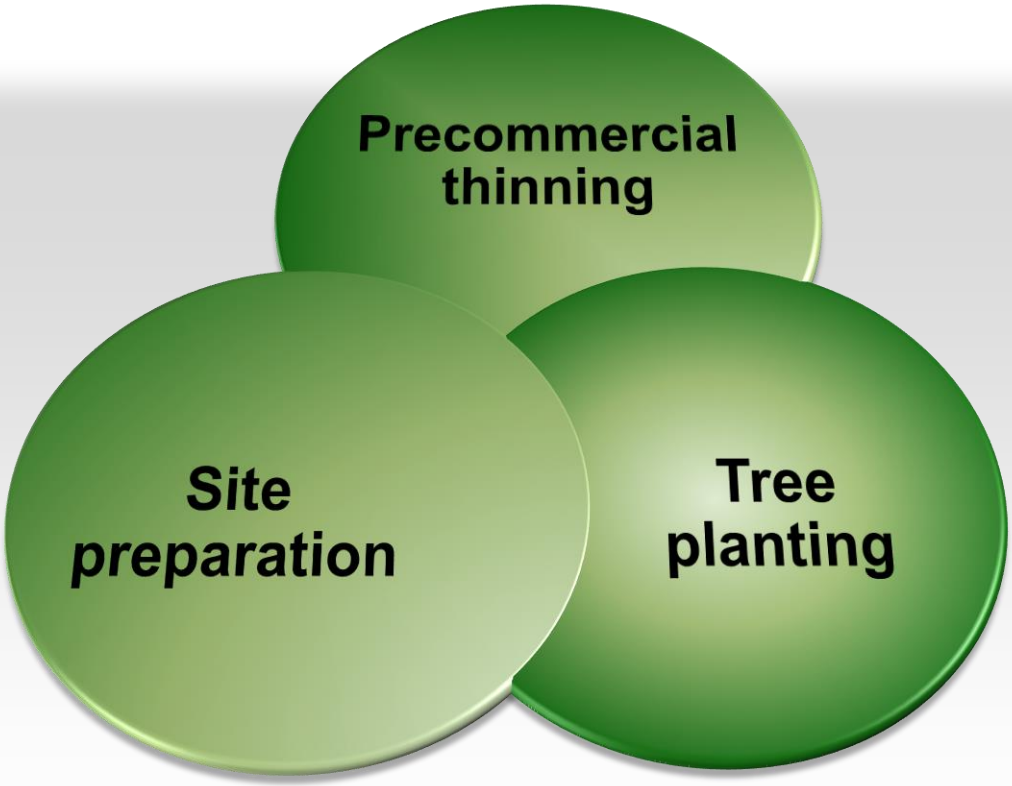
In the trails, the majority of the softwoods that were preserved were found between the paths of the wheels or tracks of the harvesting and extraction machines, and were typically less than 1 m tall. As a result, the number of future crop trees (>1 m) in the extraction trails after HPRS is clearly lower and is generally insufficient (Figure 1). In addition, the softwoods must subsequently compete with abundant regeneration of intolerant hardwoods.

FPInnovations

Tools

FPInnovations

Costing models for three silviculture treatments



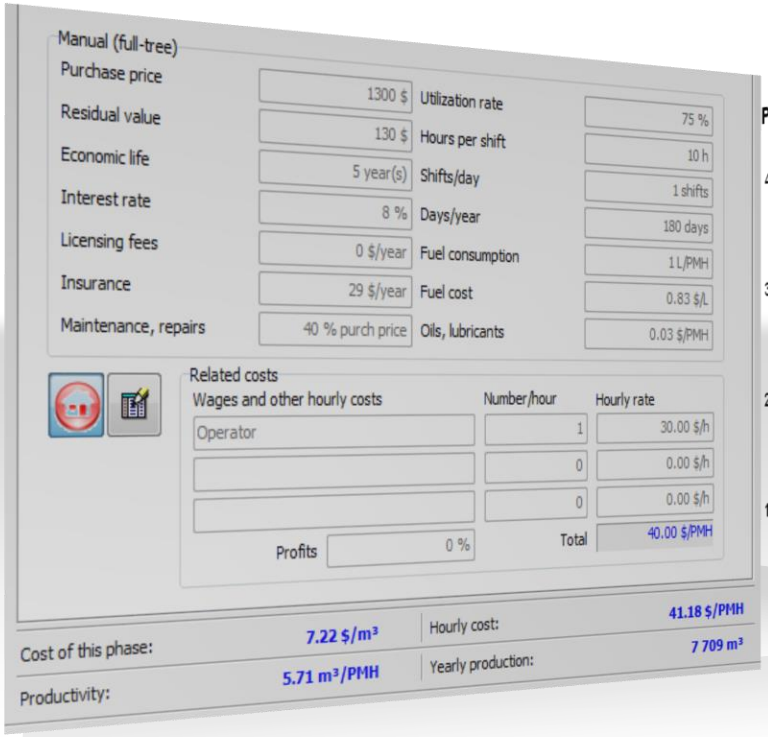
Warning: Numbers used today are for the sole purpose of explaining the dynamics of the model and should not be considered as factual

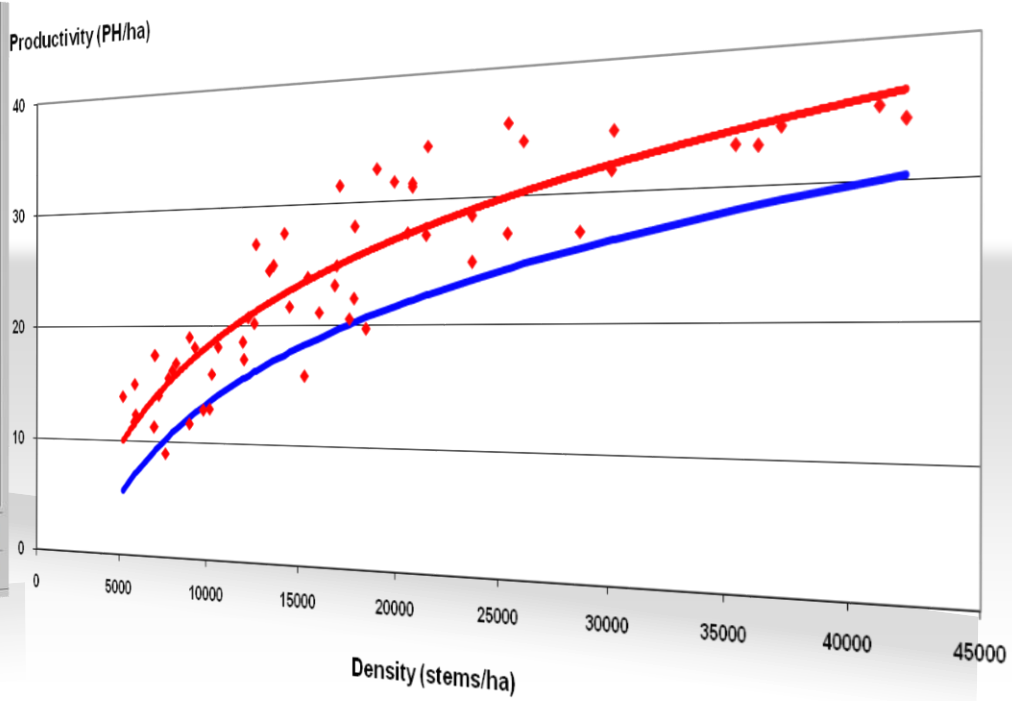
FPInnovations

Model Establishment

Cost and productivity spreadsheet

- Customizable – Framework + Updates





FPInnovations

General structure of costing models

Precommercial thinning	Tree planting	Site preparation
▪ **Thinner costs** – Direct labor – Transportation – Equipment ▪ **Field supervision costs** – Direct labor – Transportation ▪ **Overhead costs**	▪ **Tree planter costs** – Direct labor – Transportation – Equipment ▪ **Field supervision costs** – Direct labor – Transportation ▪ **Overhead costs**	▪ **Operator costs** – Direct labor – Transportation ▪ **Machine costs** – Ownership costs – Operating (fuel & repair) ▪ **Field supervision costs** ▪ **Floating costs** ▪ **Overhead costs**

FPInnovations

General structure of costing model

Spreadsheet modules

- Summary tabs (1 for each treatment)
- Detailed calculator tabs (1 for each treatment)
- Supervisor to worker ratio
- General inputs
- Equipment inputs

FPInnovations

Costing model

Summary report

Thinner costs		% of total cost
Total expected revenue ($/week)	830.77 $	
Days/week	5.0	
Weeks/year	20	
Scheduled hours/day (SH)	9	
Productive time (%)	75%	
Labor & benefits ($/day)	183.05 $	56%
Thinner transport ($/day)	26.52 $	8%
Thinning equipment costs ($/day)	27.17 $	8%
Brush saw operating costs ($/day)	9.78 $	3%
Safety equipment ($/day)	5.98 $	2%
Total thinner costs ($/day)	**252.51 $**	**77%**

Supervision costs		
Labor & benefits ($/day)	32.74 $	10%
Transport ($/day)	10.69 $	3%
Safety equipment ($/day)	0.46 $	0%
Total supervision costs ($/day)	**43.88 $**	**13%**

Total thinner and supervision ($/day)	**296.39 $**	**91%**

Overhead, risk and profit costs		
Operational overhead	9.74 $	*3%*
Cash flow charges	0.99 $	*0%*
Contractor risk & profit	18.94 $	*6%*
Total overhead and profit costs ($/day)	**29.67 $**	**9%**

Total costs ($/day)	**326.06 $**
Total costs ($/PH)	**48.37 $**
Total costs ($/ha)	**842.73 $**

FPInnovations

Costing model

Detailed costing (worker)

- Direct labor, equipment and transportation costs calculated separately

Thinner costs			
Direct labor costs			
Total expected revenue ($/week)		830,77 $	
Revenue from labor ($/week)		769,23 $	
Vacation Pay ($/week)	5%	38,46 $	
Statutory Holidays ($/week)	3%	23,08 $	
Total revenue ($/week)		**830,77 $**	
Days/week		5,0	
Weeks/year		20	
Days/year		100	
Scheduled hours/day (SH)		9	
Scheduled hours/week (SH)		45	
Productive time (%)		75%	
Adjusted utilization-site dispersion (%)		75%	
Productive hours/day (PH)		6,7	
Productive hours/week (PH)		33,7	
sub-total ($/day)		**166,15 $**	
% of total cost			**51%**
Benefits			
Employment Insurance	2,49%	4,14 $	
Canada Pension Plan	4,95%	8,22 $	
Workplace Health and Safety	2,73%	4,54 $	
sub-total ($/day)		**16,90 $**	
% of total cost			**5%**

Transportation costs	***Cost/unit***			
Transportation to work site (km/day)		102		
Transportation rate($/km)	0,52 $			
No. of passengers		2		
sub-total ($/day)			**26,52 $**	
% of total cost				**8%**

FPInnovations

Costing model

Detailed costing (equip.)

- Detailed calculation of tools and safety equipement

Thinning equipment costs	Cost/unit	# used	
Brush saw	1 350.00 $	1	1 350.00 $
Brush saw blade	23.00 $	10	230.00 $
Gear grease	9.43 $	3	28.29 $
Round files	5.99 $	20	119.80 $
Flat files	5.50 $	10	55.00 $
File guide	11.57 $	1	11.57 $
Repair parts	610.20 $		610.20 $
total			*2 404.86 $*
HST	13%		*313 $*
sub-total ($/day)			**27.17 $**
% of total cost			**8%**

Safety equipment costs	Cost/unit	# used	
Boots (steel toe)	135.00 $	1	135.00 $
Hardhat (Helmet set)	44.00 $	1	44.00 $
Ear protection	50.00 $	1	50.00 $
Pressure bandages	3.45 $	1	3.45 $
Ancil packs and pouch	9.00 $	2	18.00 $
Gloves (leather)	15.75 $	8	126.00 $
Rain suit	152.95 $	1	152.95 $
Other		0	0.00 $
Other		0	0.00 $
total			*529.40 $*
HST	13%		*68.82 $*
sub-total ($/day)			**5.98 $**
% of total cost			**2%**

Brush saw operating costs	Cost/unit	# used	
No. of cycles/day		6,7	
Fuel consumption (l/cycle)		0,93	
Fuel consumption (l/day)		6,27	
Fuel cost ($/l)	1,40 $		8,78 $
Mix oil-1:50 ratio to gaz (l/cycle)		0,019	
Mix oil ($/l)	8,00 $		
Mix oil ($/day)			1,00 $
sub-total ($/day)			**9,78 $**
% of total cost			**3%**

FPInnovations

Costing model

Detailed costing (machine)

- Detailed fixed and variable costs of machines for site preparation treatments

Machine costs		
Site preparation fixed costs		
Prime mover		
Purchase price ($)		280 000 $
Residual value ($)		56 000 $
Estimated machine life		7
Scheduled hours for other work (hours/yr)		600
Total scheduled hours/year		2 040
Scarifier		
Purchase price ($)		220 000 $
Residual value ($)		44 000 $
Estimated machine life		7
Total scheduled hours/year		1 440
Annual capital cost		
Interest rate		8%
Yearly total		95 829 $
Cost per PMH		73,53 $
Cost per SMH		55,59 $
sub-total ($/day)		**667,04 $**

Site preparation operating costs		
Annual repair cost - prime mover		28 235 $
Annual repair cost - implement		23 571 $
Fuel consumption (l/PMH)	24	
Fuel cost ($/l)	0,84 $	
Oil & lubricants ($/PMH)	1,01 $	
Annual fuel, oil and lubricants		23 044 $
Annual operating cost		
Yearly total		74 851 $
Cost per PMH		64,97 $
Cost per SMH		51,98 $
sub-total ($/day)		**623,76 $**
Floating costs		
Annual floating costs ($/year)		7 167,06 $
sub-total ($/day)		**59,73 $**

FPInnovations

Costing model

Detailed costing (supervision)

- Supervision costs based on supervision ratio exercise
- Each level of supervision considered separately
- Includes salary, transport and safety equipment
- Monitoring equipement includes in overhead

Supervision costs			
Number of thinners per crew		41	
Thinner to supervisor ratio		7.5	
Direct labor costs			
Days/week		5	
Weeks/year		22	
Days/year		110	
Scheduled hours/day (SH)		10	
No. of direct foremen		2.71	
Pay rate ($/week)		757.44 $	
Salaries ($/year)		45 144 $	
No. of contractor supervisors		1.76	
Pay rate ($/week)		946.19 $	
Salaries ($/year)		36 598 $	
No. of licensee supervisors		0.97	
Pay rate ($/week)		1 467.67 $	
Salaries ($/year)		31 187 $	
Total salaries ($/year)		**112 929 $**	
Vacation Pay	4.00%	4 517 $	
Statutory Holidays	3.00%	3 523 $	
Total labor costs ($/year)		**120 969 $**	
sub-total ($/day)		**29.72 $**	
% of total cost			**9%**
Benefits			
Employment Insurance	2.49%	0.74 $	
Canada Pension Plan	4.95%	1.47 $	
Workplace Health and Safety	2.73%	0.81 $	
sub-total ($/day)		**3.02 $**	
% of total cost			**1%**

Transportation costs			
Distance to work site (km/day)		140	
Transportation rate ($/km)	0.52 $		
No. of direct foremen		2.71	
Transportation costs ($/year)		21 694 $	
No. of contractor supervisors		1.76	
Transportation costs ($/year)		14 079 $	
No. of licensee supervisors		0.97	
Transportation costs ($/year)		7 735 $	
Total transportation costs ($/year)		**43 507 $**	
sub-total ($/day)		**10.69 $**	
% of total cost			**3%**

Safety equipment costs	*Cost/unit*	*# used*	
Boots (steel toe)	135.00 $	5.43	733.48 $
Hardhat	14.95 $	5.43	81.23 $
Rain suit	152.95 $	5.43	831.00 $
Other			0.00 $
total			*1 646 $*
HST	13%		*214 $*
sub-total ($/day)			**0.46 $**
% of total cost			**0%**

Costing model

Challenges – Overhead costs

1. Equipment floating (disp)
2. Transport to site (disp)
3. Supervision / Support (ratio)
4. Road repair / maintenance
5. Block layout and surveys
6. Planning
7. Risk and profits
8. Others

FPInnovations

Costing model

Detailed costing (overhead)

- Overhead based on size of operation
- Includes:
  - Field operation
  - Administration
  - Risk and profits
- Items already covered by other agreements should be excluded

Overhead costs	
Precommercial thinning operational overhead costs	
Size of operation	
Average density (stems/ha)	25000
Productivity (PH/ha)	17.4
Productive hours/week (PH)	33.7
Productivity (ha/week)	1.93
No. of thinners	41
Days/week	5
No. of weeks/year	20
Area to treat (ha)	1575
Total worker days	4071
Field operations costs	$/year
Flagging	906 $
GPS equipment	4 939 $
Communications equipment	1 294 $
Emergency response equipment	428 $
Fire fighting equipment	831 $
First aid training	815 $
Other	
Other	
Other	
Other	
sub-total	***9 212 $***
Administration costs	$/year
Manager ($/year)	15 993 $
Payroll ($/year)	4 270 $
Office space rental ($/year)	4 478 $
Office equipment ($/year)	1 357 $
Transportation ($/year)	4 347 $
Other	
Other	
sub-total	***30 445 $***
Total operational overhead costs ($/year)	**39 657 $**
Total operational overhead costs ($/day)	**9.74 $**
Contractor cash flow charges	
Monthly cash flow advance ($)	-120 659 $
Duration (months)	5
Interest rate (%)	**8.0%**
Total cash flow charges ($/year)	**4 022 $**
Total cash flow charges ($/day)	**0.99 $**
Contractor risk & profit	
Rate of risk and profit	**7.5%**
Total risk and profit cost ($/day)	$18.94

Costing model

Supervision ratio

- For each level of supervision for planting and precommercial thinning
- Separate value for Licencees and Marketing Boards

Precommercial thinning - Thinner to supervisor ratio calculation																		
PCT supervision scenarios	Com1	Com1	Com1	Com1	Com1	Com1	Com1	Com1	Com2	Com2	Com3	Com4	Com5	Com5	Com5	Com5	Com6	Combined scenarios
% of total	19%	17%	27%	10%	9%	4%	8%	6%	75%	25%	100%	100%	37%	15%	33%	15%	100%	100%
no. of thinners	68	43	50	20	24	30	12	15	29	12	67	45	16	9	20	15	15	40.71
No. of direct foreman	4.5	3	3	2	2	2	1	1	4	1	3	3	1	1	2	1	1	2.71
No. of contractor supervisors	1	1	1	1	1	1	1	1	2	1	5	3	1	0	2	1	1	
% dedicated to operation	100%	50%	50%	100%	100%	100%	100%	100%	20%	30%	100%	100%	100%	0%	25%	30%	25%	
	1	0.5	0.5	1	1	1	1	1	0.4	0.3	5	3	1	0	0.5	0.3	0.25	1.76
No. of Licensee/MB supervisors	2	1	2	1	1	1	1	1	1	1	4	3	1	1	1	1	1	
% dedicated to operation	31%	17%	31%	14%	17%	17%	14%	14%	27%	30%	100%	45%	25%	15%	20%	15%	30%	
	0.62	0.17	0.62	0.14	0.17	0.17	0.14	0.14	0.27	0.3	4	0.45	0.25	0.15	0.2	0.15	0.3	0.97
Total supervisors	6.12	3.67	4.12	3.14	3.17	3.17	2.14	2.14	4.67	1.6	12	6.45	2.25	1.15	2.7	1.45	1.55	5.43
Ratio applicable per scenario	11.11	11.72	12.14	6.37	7.57	9.46	5.61	7.01	6.21	7.50	5.58	6.98	7.11	7.83	7.41	10.34	9.68	
Thinner to supervisor ratio applicable to combined scenarios																		7.49

Planting - Planter to supervisor ratio calculation														
Planting supervision scenario	Com1	Com1	Com1	Com2	Com3	Com3	Com3	Com3	Com4	Com5	Com5	Com5	Com6	Combined scenarios
% of total	55%	26%	19%	100%	25%	25%	25%	25%	100%	36%	36%	27%	100%	100%
no. of planters	34	16	12	25	37	37	38	38	20	16	16	12	15	29.65
No. of direct support staff	0	0	0	1	3	3	3	3	1	0.5	0.5	0.25	1	1.66
No. of direct foreman	2	1	1	2	3	3	3	3	2	1	1	1	1	2.25
No. of contractor supervisors	1	1	1	2	1	1	1	1	1	1	1	1	1	
% dedicated to operation	50%	50%	100%	50%	40%	40%	40%	40%	100%	40%	40%	20%	30%	
	0.5	0.5	1	1	0.4	0.4	0.4	0.4	1	0.4	0.4	0.2	0.3	0.53
No. of Licensee/MB supervisors	1	1	1	1	1	1	1	1	1	1	1	1	1	
% dedicated to operation	14%	17%	14%	38%	100%	100%	100%	100%	45%	25%	25%	20%	20%	
	0.14	0.17	0.14	0.38	1.00	1.00	1.00	1.00	0.45	0.25	0.25	0.20	0.20	0.61
Total supervisors	2.64	1.67	2.14	4.38	7.40	7.40	7.40	7.40	4.45	2.15	2.15	1.65	2.50	5.05
Ratio applicable per scenario	12.88	9.58	5.61	5.71	5.00	5.00	5.14	5.14	4.49	7.44	7.44	7.27	6.00	
Planter to supervisor ratio applicable to combined scenarios														5.88

FPInnovations

Costing model

Inputs - General

- Default values
  - Salary
  - Transport allowance
  - Site dispersion inputs
  - Fuel
  - Office space

Social Costs & Benefits	*Thinner*	*Planter*	*Supervisor*
Vacation Pay	5,00%	4,00%	4,00%
Statutory Holidays	3,00%	3,00%	3,00%
Employment Insurance	2,49%	2,49%	2,49%
Canada Pension Plan	4,95%	4,95%	4,95%
Workplace Health and Safety	2,73%	2,73%	2,73%
Workplace Health and Safety	2,73%	2,73%	2,73%
Transportation allowance	*Thinner*	*Planter*	*Supervisor*
($/km)	0,52 $	0,52 $	0,52 $
Pay rates - Supervision staff	*$/week*	*$/hour*	*$/day*
Support staff - planting	600,00 $	12,00 $	
Direct foremen	757,44 $	15,15 $	
Contractor supervisors	946,19 $	18,92 $	
Licensee/MB supervisors	1 467,67 $	29,35 $	
Contractor manager	892,86 $	22,32 $	178,57 $
Payroll personnel	715,21 $	17,88 $	143,04 $
Site dispersion	*Thinning*	*Planting*	*Site prep*
Utilization adjustment for workers and operato	0,1%	0,4%	4,4%
Transportation to work site (km/day)	*Thinners*	*Planters*	*Operators*
Thinners/Planters/Operators	102	97	90
Supervisors	140	109	128
Office space rental ($/month)	150 $		
Office equipment ($/year)	1 000 $		
Diesel rack rate ($/l)	0,84		
Premium gasoline ($/l)	1,40 $		

FPInnovations

Costing model

Inputs - Equipment

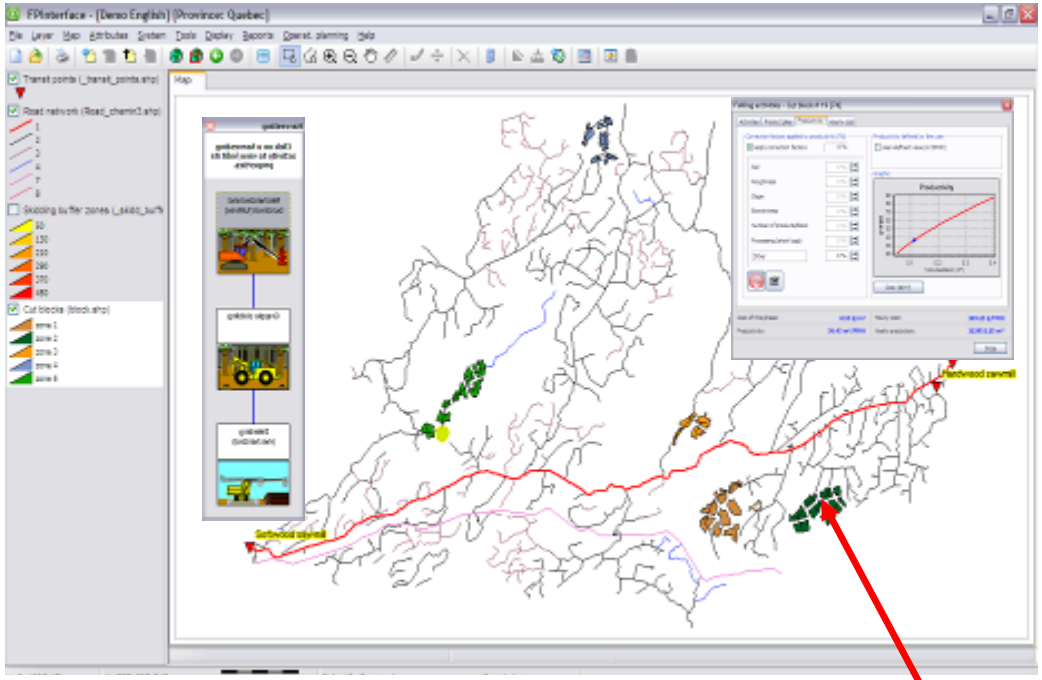
- Default values with references

Thinning equipment	Cost/unit	Spec Item	Hyperlink	Address	Website	Last update
Brush saw	1 050,00 $	Stihl FS 450 K	Trimmers, Brushcutters and Clearing Saws, Specifications and Pricing at Yard Gear Sales & Service Inc	Yard Gear Sales & Service Inc. 9 Tim	http://www.yardgear.ca/	
Brush saw	1 350,00 $	Stihl FS 550 K	Trimmers, Brushcutters and Clearing Saws, Specifications and Pricing at Yard Gear Sales & Service Inc	Yard Gear Sales & Service Inc. 9 Tim	http://www.yardgear.ca/	
Brush saw blade	23,00 $					
Gear grease	9,43 $					Yard gear courriel
Round files	5,99 $	Chainsaw File	Mastercraft Chainsaw File | Canadian Tire	Candian Tire Web site	http://www.canadiantire.ca	
Flat files	5,50 $	Oregon flat file	Chainsaw Accessories | Canadian Tire	Candian Tire Web site	http://www.canadiantire.ca	
File guide	11,57 $	Stihl	Featured Accessories, Specifications and Pricing at Yard Gear Sales & Service Inc.	Yard Gear Sales & Service Inc. 9 Timothy Dr., Hanwell, New Brunswick, E3C 2B8	http://www.yardgear.ca/	
Mix oil (litre)	8,00 $	2-Cycle Engine Oil		Canadian Tire		Yard gear courriel
Sprout-less Applicator	650,00 $					SPROUT LESS courriel
Gaskets for Sprout-less appl.	3,00 $					SPROUT LESS courriel
Swedish brush axe	49,95 $	Swedish Bush Axe 3022	E-mail	BAP Equipment Ltd. 203 Waggoners Lane Fredericton,N.B. Canada E3B 2L4 Phone: 1-800-561-3600 Fax: 1-	http://www.bapequipment.com/index.html	
Planting equipment						
Planting tube	265,00 $	model 55, 55/53mm	http://www.bapequipment.com/TreePlanting.pdf	BAP Equipment Ltd. 203 Waggoners Lane Fredericton,N.B. Canada E3B	http://www.bapequipment.com/	

Spatial model

FPInterface™

- **Works directly with forest GIS maps and databases (shape files)**
- **Built-in FPInnovations knowledge for productivity and cost predictions**
- **Simulates forest operations and predicts:**
  - Harvesting costs
  - Transport costs
  - Road costs
  - Silviculture costs
  - Biomass supply and costs



Costs - Selected items

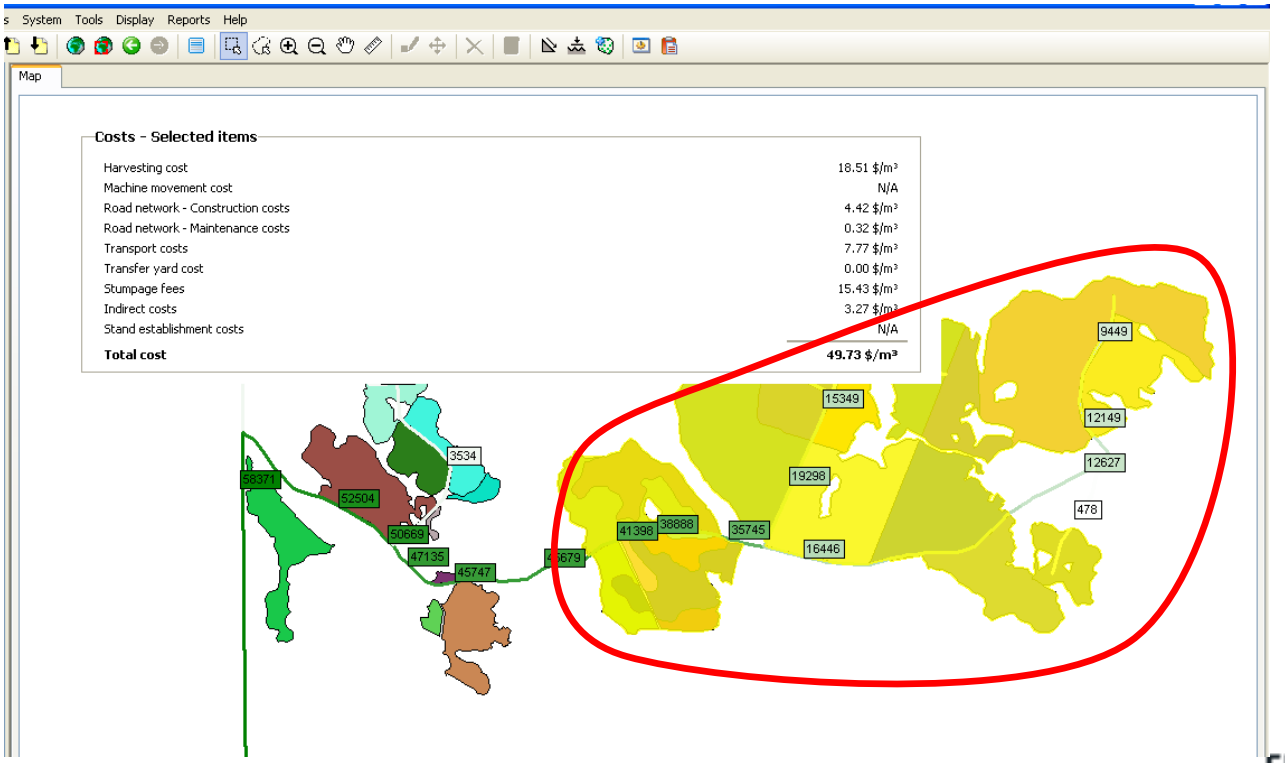
Harvesting cost	18.22 $/m³
Machine movement cost	N/A
Road network - Construction costs	3.80 $/m³
Road network - Maintenance costs	0.32 $/m³
Transport costs	7.46 $/m³
Transfer yard cost	0.00 $/m³
Stumpage fees	17.80 $/m³
Indirect costs	3.27 $/m³
Stand establishment costs	N/A
Total cost	**50.88 $/m³**

FPInnovations

Spatial model - level of simulation

FPInterface™

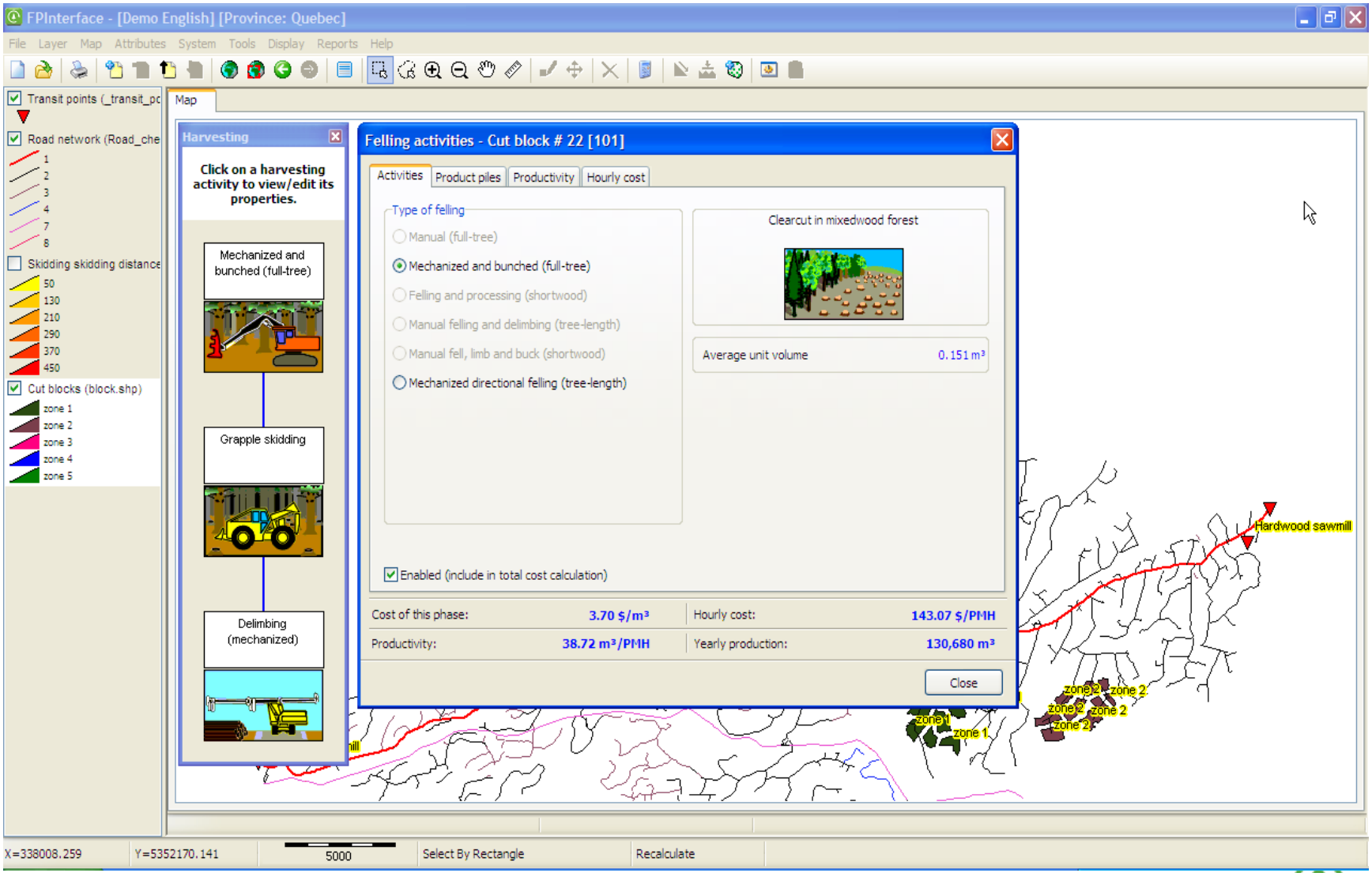
- Ability to generate a cost by block or by aggregated blocks (road, zone, region, attributes)
- Analysis for each product (multiple destinations possible)



FPInnovations

Harvesting simulation

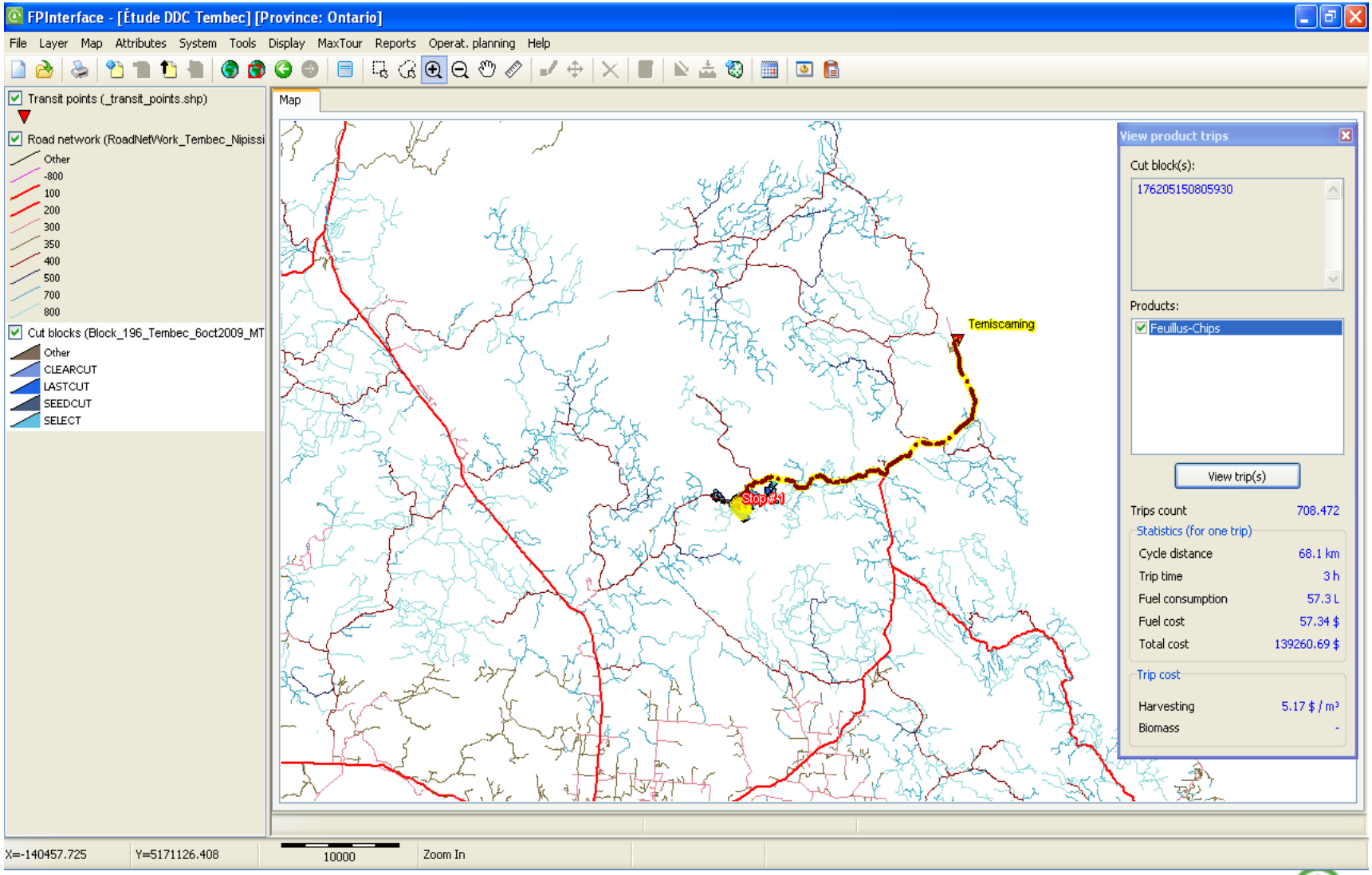
FPInterface™



FPInnovations

Transportation simulation

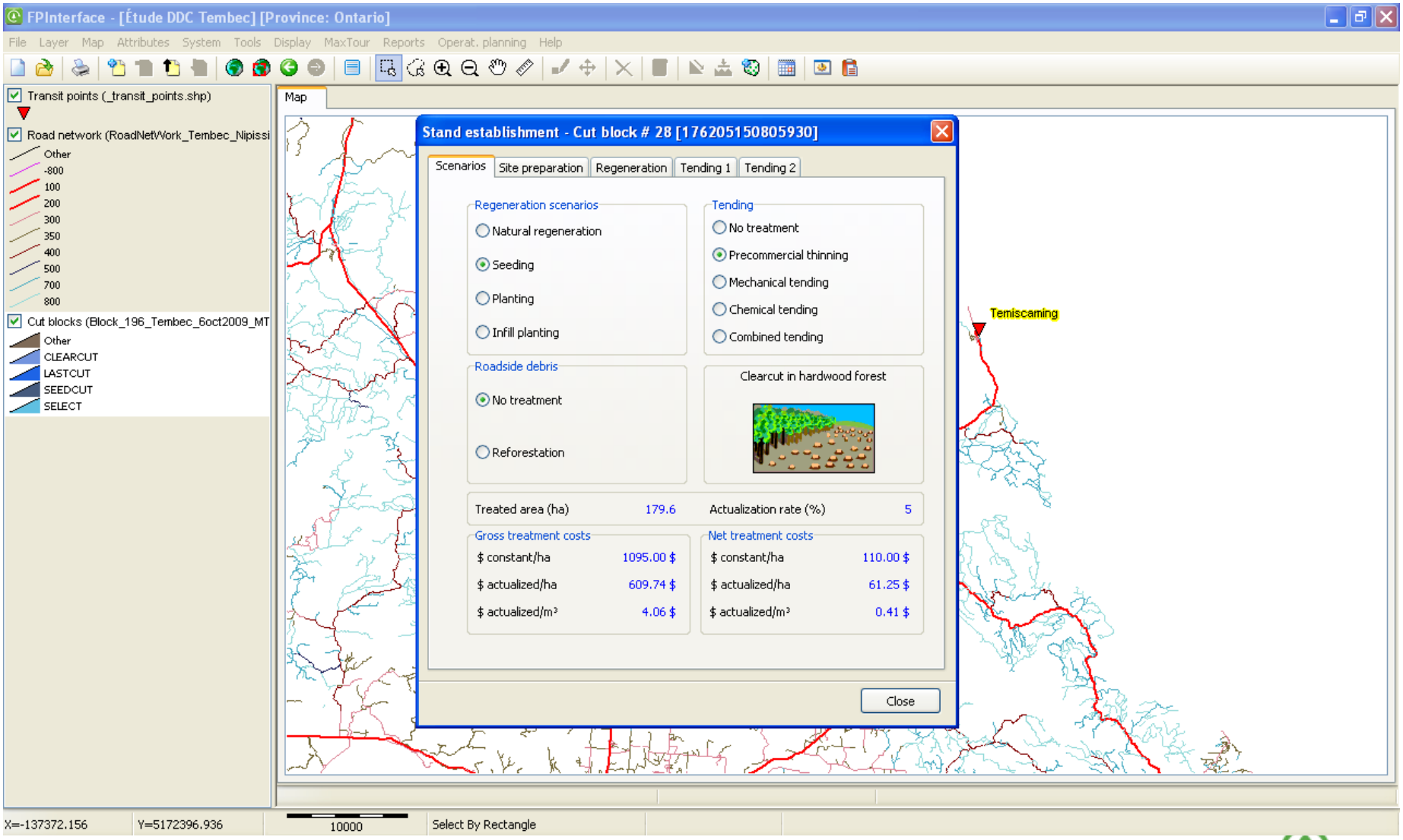
FPInterface™



FPInnovations

Silviculture simulation

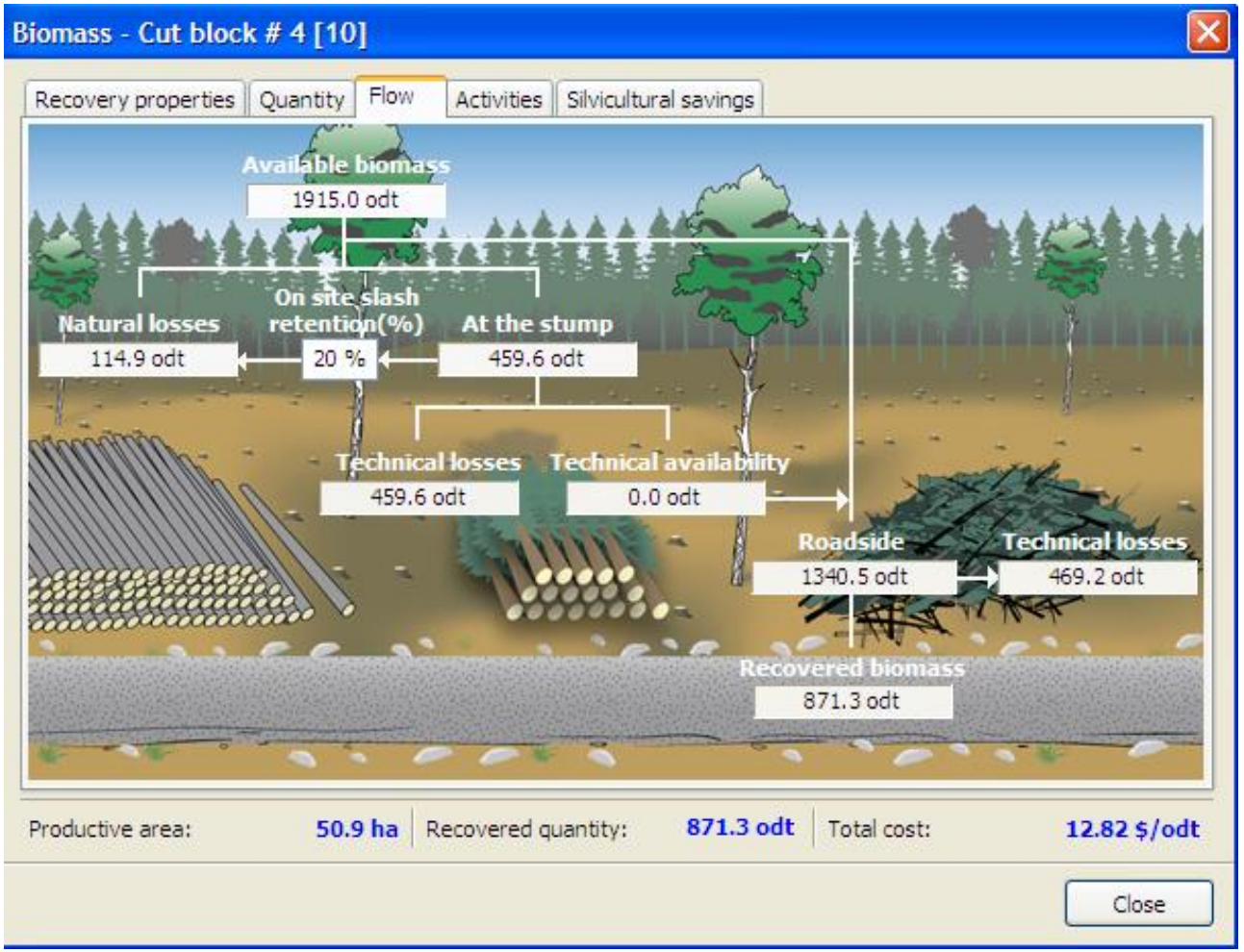
FPInterface™



FPInnovations

Biomass simulation

FPInterface™

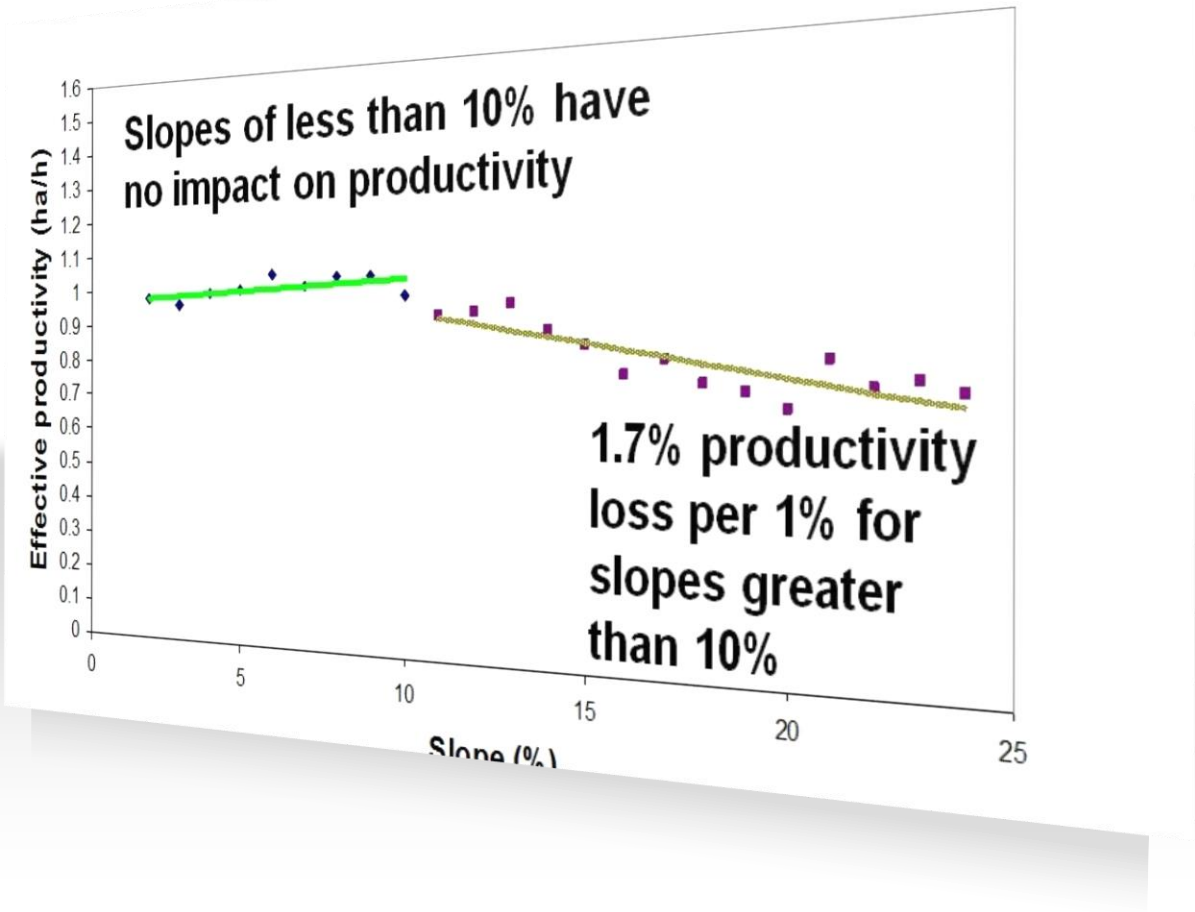


FPInnovations

Tool – assistance in fair rate adjustments

Parameters affecting productivity

- Terrain
  - *Slope*;
  - *Debris (FT vs CTL)*;
  - Drainage;
  - Stocking of natural regeneration;
  - Rockiness;
  - Ground roughness.
- Human factors
  - Operator experience;
  - Payment method.
- Prescription
  - *Treatment selection*
  - *Treatment intensity*



FPInnovations

Tool – assistance in fair rate adjustments

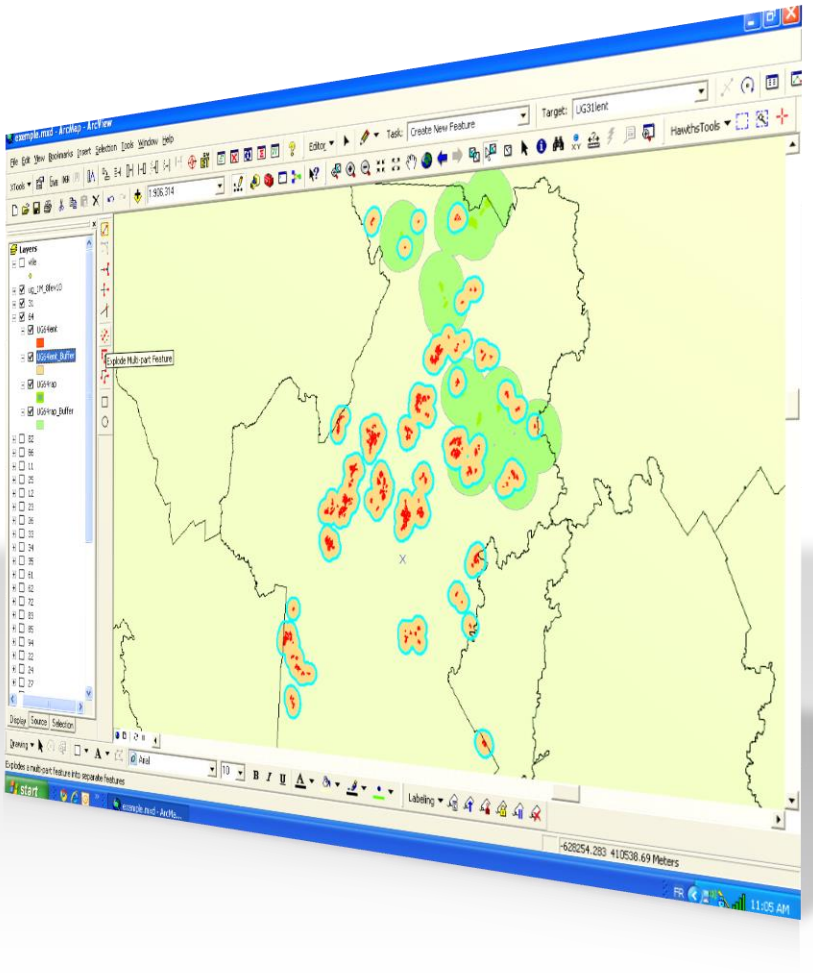
- Implementation
  - Objective : Fairness
  - Neutral effect of the adjustment
    - (rate based on average productivity)

Slope	$/ha
Actual (assumption)	200
0-10	194
12	202
15	213
20	236
25	264
Weighted average	200

Tool - Site dispersion

Cost of missed opportunities

- Moving between blocks and sectors
  - Lower productivity for moves between blocks;
  - Floating costs for moves between sectors;
  - Lower utilization rate when waiting for float and floating time.
- Useful for regional disparities



FPInnovations

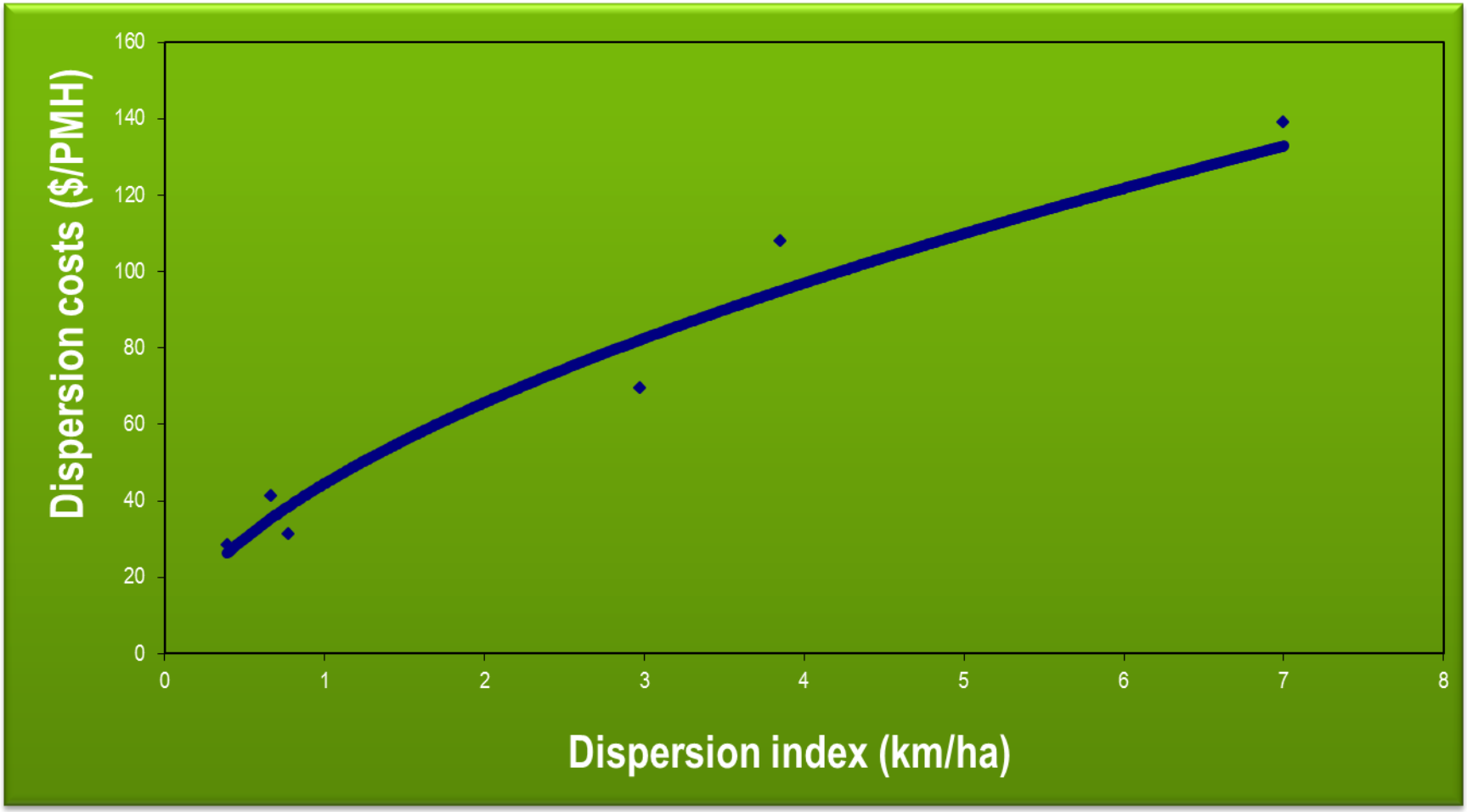
Tool - Site dispersion

	Regions					
	Lac St-Jean	Abitibi	North Shore	Laurentians	Mauricie	Gaspésie
Dispersion index (km/ha)	**0.77**	**0.39**	**0.66**	**3.85**	**2.98**	**7.00**
Lost time (Travel between sites and floating) (%)	11	10	16	29	23	32
Opportunity costs ($/PMH)	23	20	37	79	53	90
Floating costs ($/PMH)	8	8	4	29	16	49
Dispersion costs ($/PMH)	**31**	**28**	**41**	**108**	**69**	**139**

FPInnovations

Tool - Site dispersion

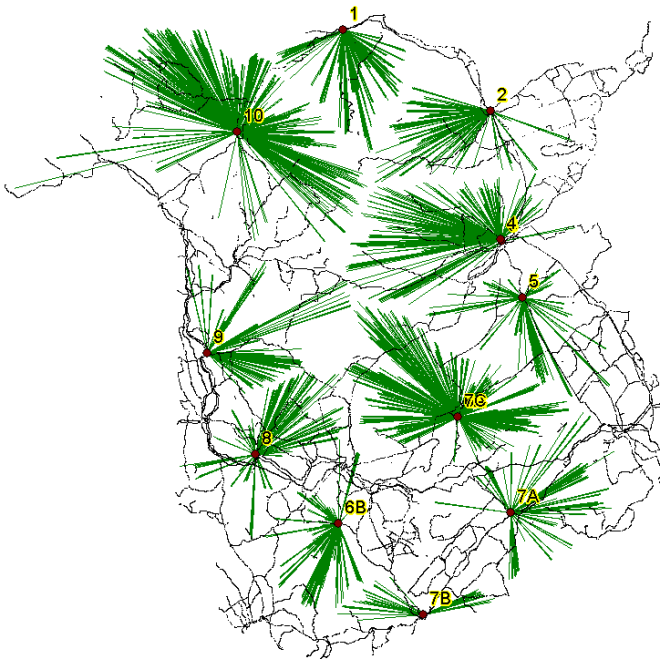
Effect of site dispersion on hourly costs

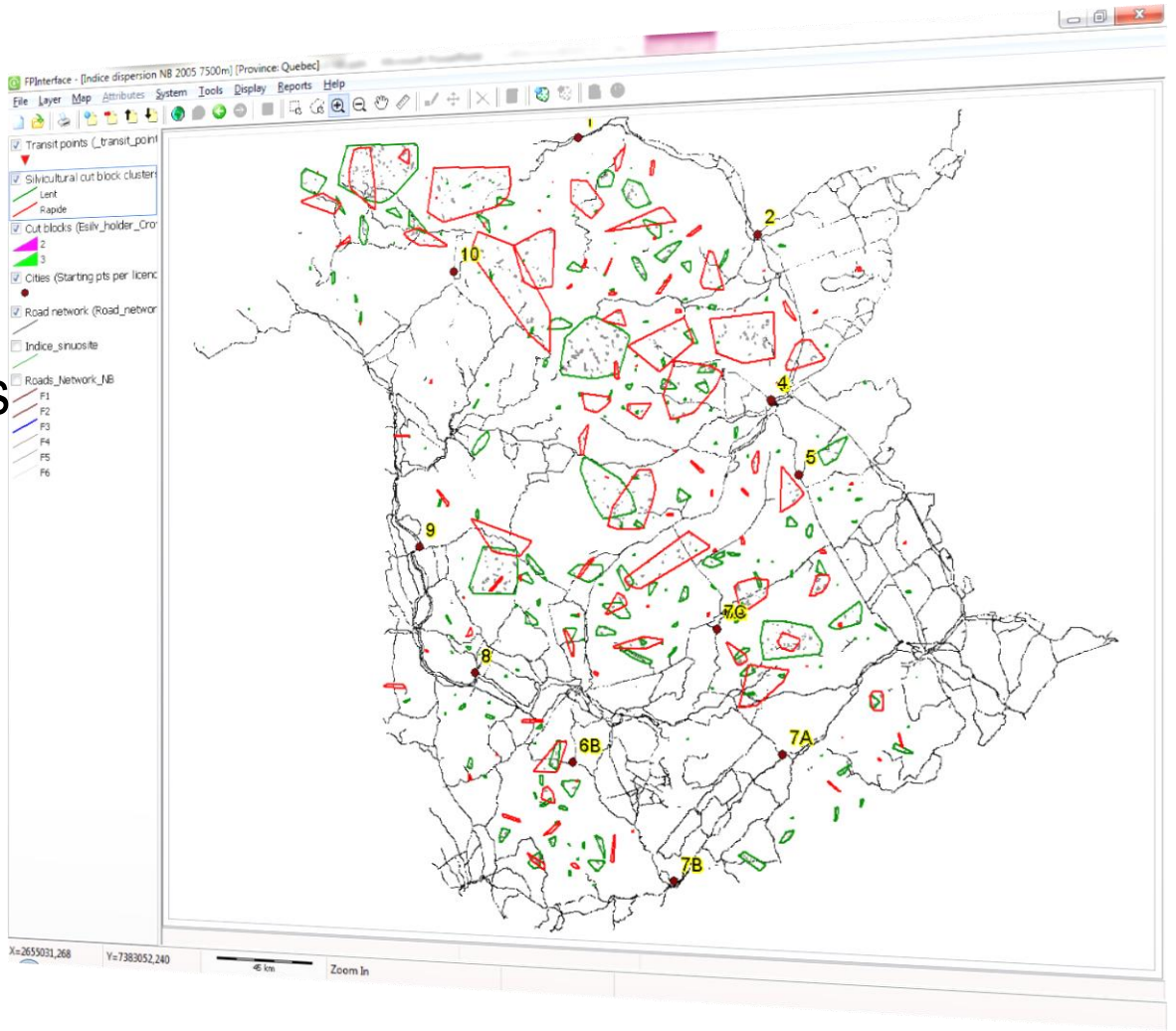


FPInnovations

Tool – Site dispersion

- Information needed
  - Blocks shapefile
  - Road network
- Specific analysis for public and private lands

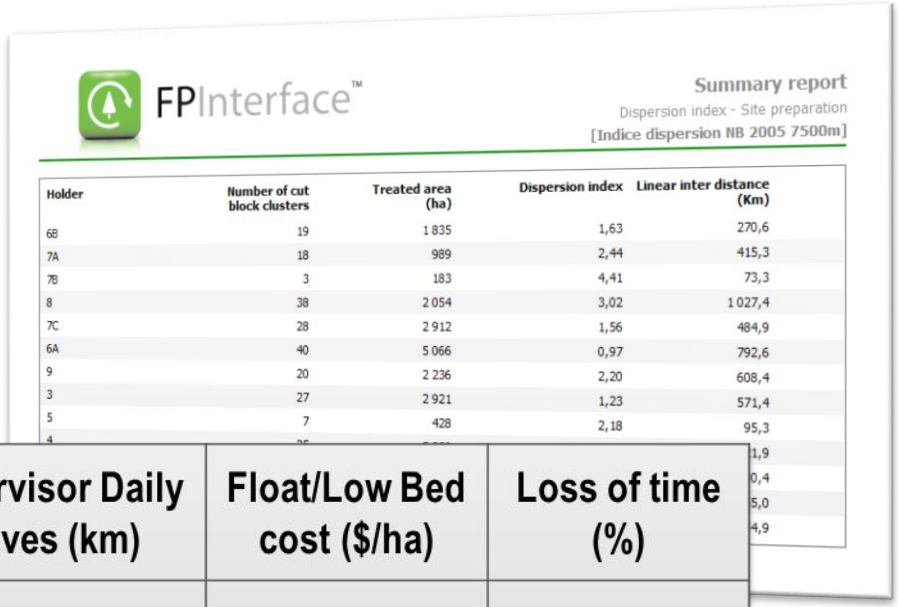




FPInnovations

Dispersion index in FPInterface

- Calculations automated in FPInterface
- Report includes average daily moves, float costs and time loss


FPInterface™

Summary report

Dispersion index - Site preparation

[Indice dispersion NB 2005 7500m]

Holder	Number of cut block clusters	Treated area (ha)	Dispersion index	Linear inter distance (Km)
6B	19	1 835	1,63	270,6
7A	18	989	2,44	415,3
7B	3	183	4,41	73,3
8	38	2 054	3,02	1 027,4
7C	28	2 912	1,56	484,9
6A	40	5 066	0,97	792,6
9	20	2 236	2,20	608,4
3	27	2 921	1,23	571,4
5	7	428	2,18	95,3
4				1,9
				0,4
				5,0
				4,9

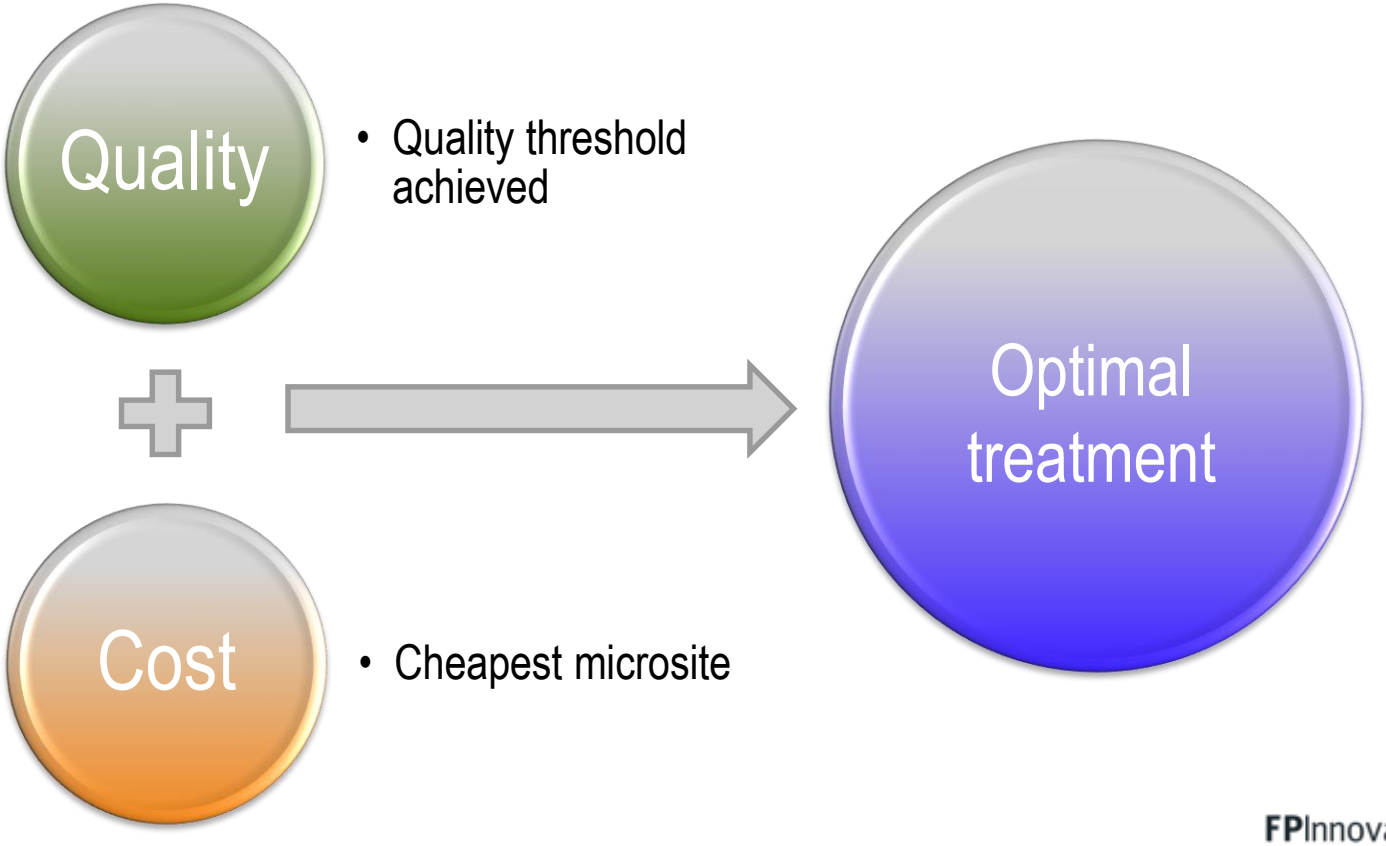
Treatment	Worker Daily Moves (km)	Supervisor Daily Moves (km)	Float/Low Bed cost ($/ha)	Loss of time (%)
Site preparation				
Licensees	117	201	11	5.1
Marketing Boards	126	129	57	13.9
Precommercial thinning				
Licensees	135	166	-	0.2
Marketing Boards	110	113	-	0.9
Planting				
Licensees	118	136	-	0.7
Marketing Boards	126	129	-	2.3

FPInnovations

Regional Prescription Tool for Site Preparation

Initial trial in the Quebec North Shore Area

- Minimize cost per microsite given a minimum quality level
- Quality and costs = f(terrain conditions)



FPInnovations

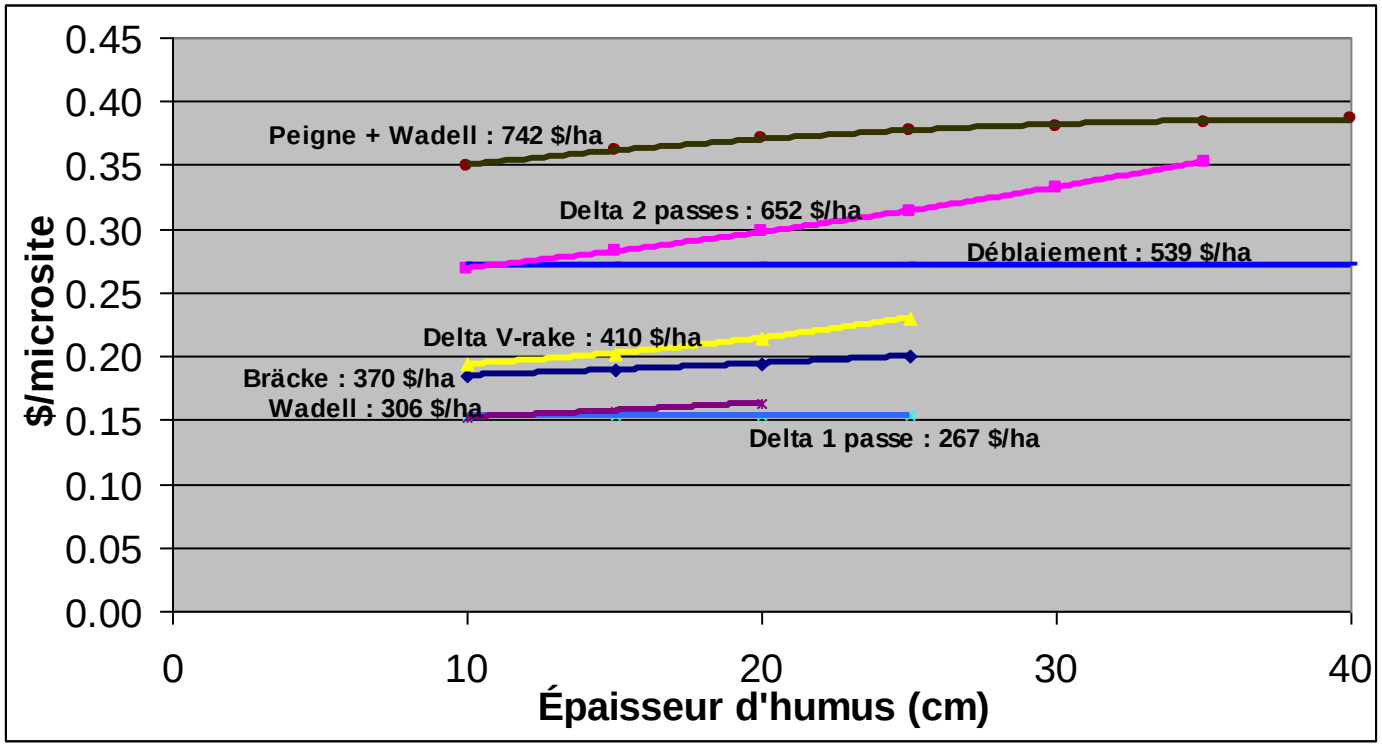
Regional Prescription Tool for Site Preparation

- Methods compared based on a gradient treatment intensity
  - Cones vs. discs
  - New disc trenching technology (Bräcke T26)
  - Added partial rake
  - Intensification (double)
  - Windrowing
  - Blading

Regional Prescription Tool for Site Preparation

Prescription based on cost per microsite

- Medium slash loading



FPInnovations

Implementation / Thresholds

- Scattered debris (0-15 pieces / 20m)
  - Adequate disc trenching
  - Advantage of longer teeth on the Delta in deeper duff (>20 cm)

Implementation / Thresholds

- Medium slash loading (16-35 pieces / 20m)
  - Disc trenching adequate for shallower duff (< 25 cm)
  - Double pass treatment adequate for up to 35 cm
  - Blading / windrowing for deeper duff

Implementation / Thresholds

- Heavy debris (>36 pieces / 20m)
  - Disc trenching for up to 15 cm of duff (Delta inadequate)
  - Parting rake up to 20 cm, Double disking up to 25 cm
  - Blading / windrowing with deeper duff

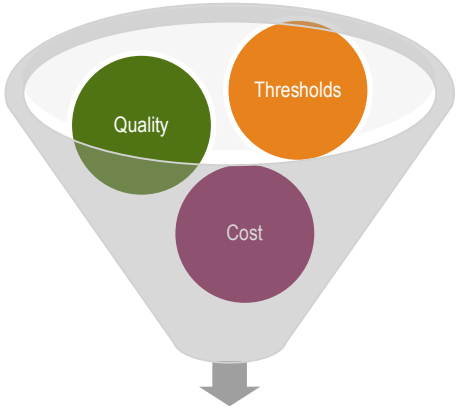
Regional Prescription Tool for Site Preparation

Implementation / Thresholds

FPInnovations

Regional Prescription Tool for Site Preparation

Implementation in other regions



Treatment selection

- Identify treatment thresholds
- Integrate quality and costs parameters in a decisional process
- Facilitate treatment selection

FPInnovations

Regional Prescription Tool for Site Preparation

Implementation in other regions

- Limiting operating conditions and machine selection specific for each region
- Parameters affecting treatment quality are:
    1. Specific to the treatment
    2. Predictable (models)
    3. Not necessarily the same affecting productivity

Regional Prescription Tool for Site Preparation

Decision grid

- **Process**:
  - Trials to evaluate various treatments in typical conditions
  - Build productivity and quality models
  - Include costing model
  - User inputs of specific terrain conditions

- Predicted adequate microsites for each treatment
- Cost per microsite
- Optimal treatment selection

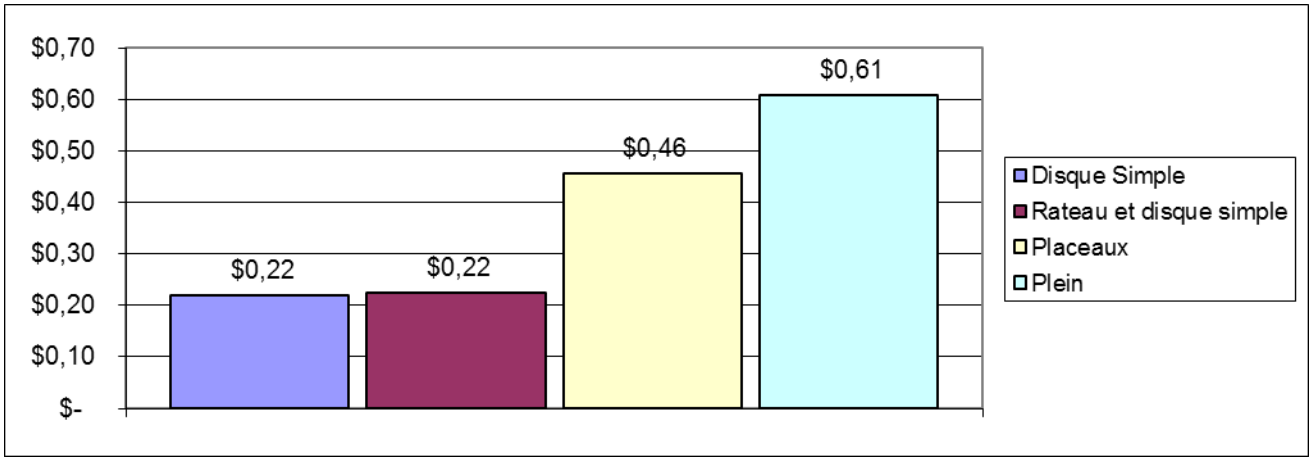
Regional Prescription Tool for Site Preparation

Decision grid

Conditions de terrain	
Humus	10
Débris	22
% Sol 30cm+	61

Traitement	Coût direct d'opération ($/HMP)	Productivité observée (ha/HMP)	Coût/ha	% microsite adéquat	Nombre de microsites adéquats	Coût par microsite
Disque Simple	$ 203.52	0.71	$ 285.84	52.2	1305	$ 0.22
Rateau et disque simple	$ 208.17	0.53	$ 392.77	70.2	1755	$ 0.22
Placeaux	$ 193.64	0.32	$ 612.80	53.8	1346	$ 0.46
Plein	$ 193.64	0.25	$ 774.58	51.0	1276	$ 0.61

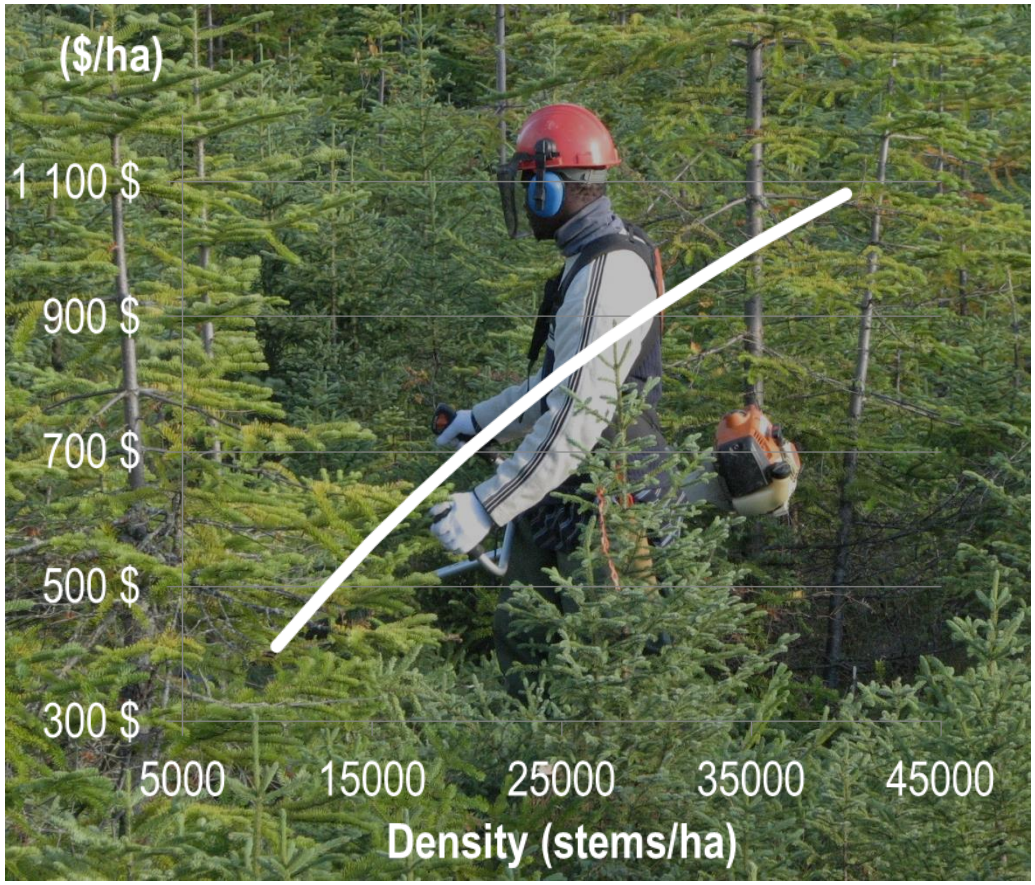
Plein — Le pourcentage de sol 30cm+ n'a plus d'influence sur la qualité du traitement au-delà de 50%



- **Annual results should be used to adjust thresholds**

FPInnovations

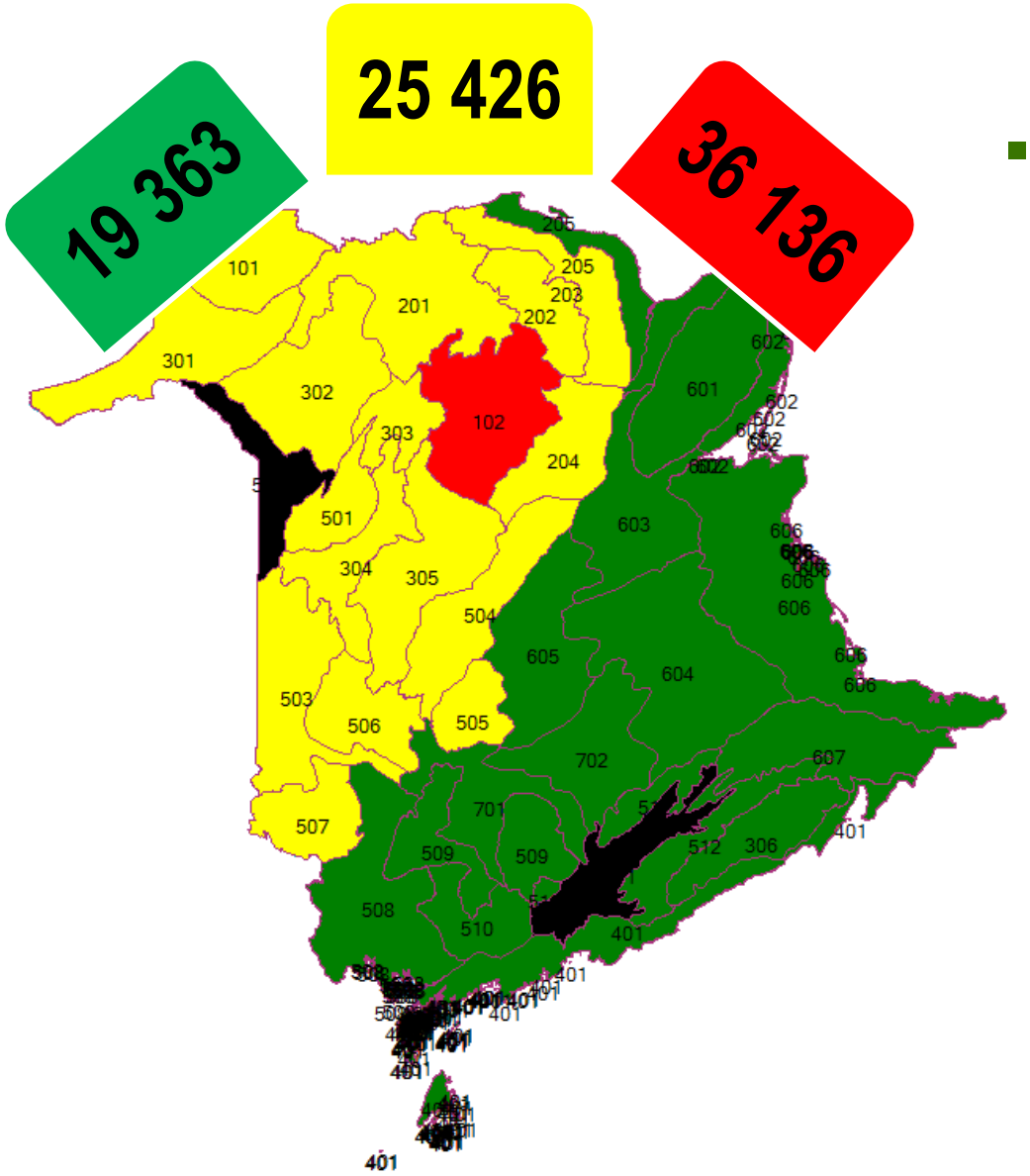
Tool - Density zones for PCT



- Productivity (payment) based on stand density
- High sampling cost when applied at the site level

FPInnovations

Tool - Density zones for PCT



- Density zones based on ecodistricts
  - 22 287 density plots
  - 3 zones
  - Significantly different (Dunn's test)

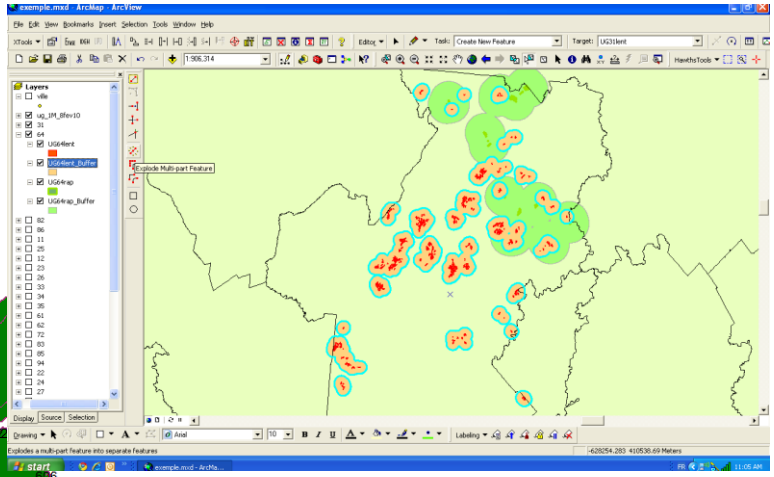
FPInnovations

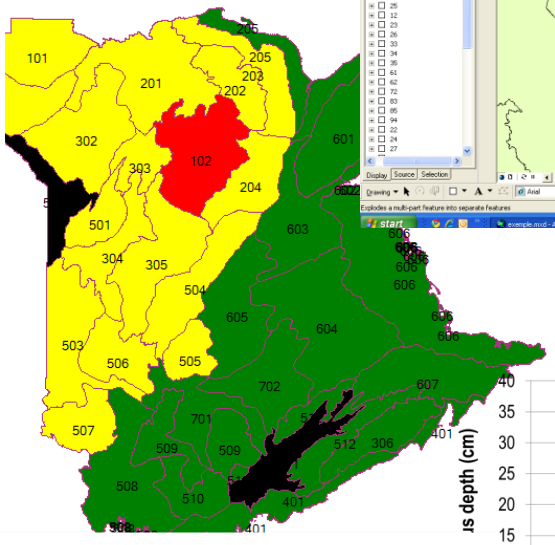
Conclusions

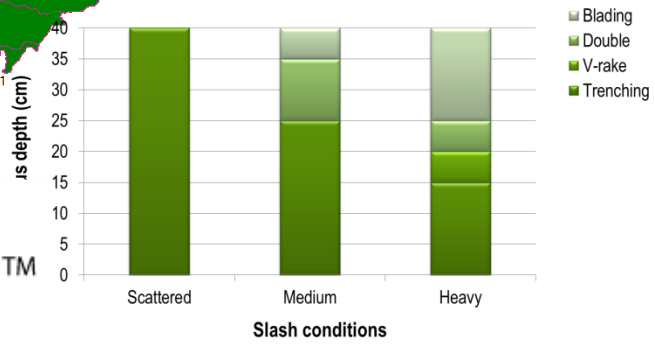
Using research results to develop tools to help members

Precommercial thinning cost summary

Thinner costs		% of total cost
Total expected revenue ($/week)	830,77 $	
Days/week	5,0	
Weeks/year	20	
Scheduled hours/day (SH)	9	
Productive time (%)	75%	
Adjusted utilization-site dispersion (%)		
Labor & benefits ($/day)	**183,05 $**	**55%**
Transportation to work site (km/day)	102	
No. of passengers	2	
Thinner transport ($/day)	**26,52 $**	**8%**
Thinning equipment costs ($/day)	**27,17 $**	**8%**
Brush saw operating costs ($/day)	**9,79 $**	**3%**
Safety equipment ($/day)	**4,77 $**	**1%**
Total thinner costs ($/day)	**251,31 $**	**75%**
Supervision costs		
Labor & benefits ($/day)	36,37 $	11%
Transport ($/day)	10,46 $	3%
Safety equipment ($/day)	0,45 $	0%
Total supervision costs ($/day)	**47,28 $**	**14%**
Total thinner and supervision ($/day)	**298,59 $**	**89%**
Overhead, risk and profit costs		
Operational overhead	12,44 $	*4%*
Cash flow charges	1,00 $	*0%*
Contractor risk & profit	22,39 $	*7%*
Total overhead and profit costs ($/day)	**35,83 $**	**11%**
Total costs ($/day)	**334,42 $**	
Total costs ($/PH)	**49,54 $**	
Total costs ($/I		







FPInterface™

FPInnovations

Thank you!

Contact

FPInnovations
Denis Cormier
Program Leader Silviculture and Bioenergy

570 St-Jean
Pointe-Claire, QC
H9R 3J9

Phone: 514-782-4539
Email: denis.cormier@fpinnovations.ca

www.fpinnovations.ca

FPInnovations