Jim Stewart

The Great Alberta Tour

August 28-31, 2001

Foothills Model Forest
attn: Ms Fan Hannington
Box 6330, Hinton
Alberta, T7V 1X6

Compiled by:
Jim Stewart
Stan Lux
Thomas Braun

THE HISTORIC ALBERTA
LODGEPOLE PINE TRIALS TOUR
AUGUST 28-31, 2001

Date/Time	Location	Agenda
Tuesday 28th	Depart Edmonton for Nojack and ETC Hinton	• Lodgepole Pine PCT in 22 year old regenerated stand, MacKay. Est. 1954 • Whitecourt EFM/intensive silviculture tour (TBD)
	7:30 pm ETC Hinton	▪ Dinner ▪ Overview and update: Foothills G&Y Association trials and program status. WR Dempster ▪ G&Y Association Meeting
Wed. 29th	8 am Depart to Field	• The Gregg PCT Trials: 1963 (CFS) • Accelerated Development of doghair pine through fertilization 1997 (Weldwood) • Late stage fertilization for growth and yield 1997 (Weldwood) • Fertilization/Thinning of Semimature Pl 1984 (CFS) • Factorial thinning/ fertilization (Weldwood) • Foothills G&Y Trials 2001 (Sundance) • Drive to RMH and Dinner
	Evening RMH	• Free Time
Thurs. 30th	8 am Depart for Clearwater and Kananaskis	• Fertilization after Thinning 70 yr old Pl at Clearwater, est. 1968 (CFS) • Early Pl development after mechanical thinning, est. 1977 (CFS) • Juvenile spacing of 25 yr old Pl, est. 1976 (CFS)
	Meeting & Overnight Canmore	• **Research and monitoring needs in lodgepole pine management. Overview and Discussion: WR Dempster**
Fri. 31st	Kananaskis	• Development of a 77 yr old Pl stand following heavy thinning, est. 1941 (CFS) • Classic European trials late 40s (CFS) • Crossley's "economic possibilities" CT trial, 1950 (CFS) • Wrapup and Depart for Home
Participants: DM, ADM, Directors: SRD Foothills Model Forest Steering and Technical Committees, Foothills G&Y Association		
Tour Objectives: 1. Experience, learn from the historic trials 2. Discuss the possibilities 3. Identify gaps in knowledge 4. Consider further actions		

Information on Bus: The Bus will start in Edmonton at 7:30 am Aug. 27th and will end at Edmonton Friday Aug. 31st.

Growth and Yield Field Tour August 28-31

Name	Company	Phone	Cell	Bus	Hinton	RMH	Canmore	
Ken Armason	(with Bob Fesseden)			1	1	1	1	
Greg Branton	Alberta Newsprint Company				1	1	1	
Jim McCammon	Alberta Newsprint Company				1	1	1	
Barry White	Alberta Research Council	780-632-8296		1	1	1	1	
Daryl D'Amico	Blue Ridge Lumber	780-648-6340			1			Meeting Aug 28 only
Murray Summers	Blue Ridge Lumber	780-648-6325			1			Meeting Aug 28 only
Jim Stewart	Canadian Forest Service	780-435-7224		1	Sharing room with Travis Jones			
Travis Jones	Canadian Forest Service	780-435-7362		1	Sharing room with Jim Stewart			
Lorne Greenhorn	Canfor			1	1	1	1	
Pat Ewan	Canfor			1	1	1	1	
Bob Newstead	CFS			1	1	1	1	
Dick Dempster	Dempster Consulting	604-886-0461	604-454-7090	1	1	1	1	
Bob Udell	Foothills Model Forest	780-865-8181		1		1	1	
Mark Storie	Foothills Model Forest	780-865-8332		1		1	1	
Dave Morgan	Gov of AB Forest Management	780-422-5295		1	1	1	1	
Greg Greidanus	Gov of AB Forest Management	780-422-5772		1	1	1	1	
Brent Schleppe	LFS	780-865-8396		1		1	1	
Jonathan Russell	Millar Western	780-486-8200		1	1	1	1	
Ray Hiltz	Millar Western			1	1	1	1	Meeting bus at Nojack
Tim McCready	Millar Western			1	1	1	1	Meeting bus at Nojack
Darrell Panas	Spray Lake Sawmills	403-932-2234		1	1	1	1	Drop off inCochrane
Gord Lehn	Spray Lake Sawmills	403-932-2234	403-861-7019	1	1	1	1	Drop off inCochrane
John Huey	Sundance Forest Industries	780-723-3977-245	780-712-0472	1	1	1	1	Joining evening of 28th
Bob Fesseden	Sustainable Resource Deputy Minister	780-415-9663		1	1	1	1	
Patrick Guidera	Sustainable Resource Parkland/Bow/Prairie	403-845-8250		1	1		1	
Hugh Lougheed	Weldwood of Canada	780-865-8191		1		1	1	
Thomas Braun	Weldwood of Canada	780-817-7708		1		1	1	
Greg Behuniak	Weyerhaeuser	780-539-8207		1	1	1	1	
Wally Rude	Weyerhaeuser	780-727-4065	780-621-6530	1	1	1	1	
Bus Driver (Rick McKinnon)		699-4869			1	1	1	No lunches required
Howard Gray		780-422-9320	780-940-4357	1	1	1	1	uncertain where he will be catching the bus
Stan Lux		780-435-8954		1	1	1	1	
				27	25	27	28	

Accommodations for the Growth and Yield Field Tour
August 28-31, 2001

Town	Hotel Name	Phone	Date	# of Rooms	Mtg room	Rate
Hinton	Ramada Inn	865-2575	28-Aug	26	214 ETC	$ 99.00
Rocky Mountain House	Walking Eagle Motor Inn	403-845-2804	29-Aug	29	NO	$65-67.00
Canmore	Radisson Hotel	403-609-5438	30-Aug	28	YES	$ 149.00

Actions required

(A) signage for trials - main roadside sign
- plot corner/centre markers
- interval interp. sign(s)
- trail marking (+ brushing)

- Pat G. has money for signs + can have them made up; if we provide content
- John Huey has FRIP money for signs
- others could contribute - perhaps thru FGYA

(B) remeasurement - partner w/ FGYA as a sponsor to contribute $, mgt participation (decision-making)
- set up schedule; w/ estimates of labour req'd + costs
- get mgt buy-in (report to minister) connection to research Program

(C) Re-analysis of all trials using common protocols for calculations + presentation (vs's SI problems)
- global synthesis (vs site-by-site basis)
- check out taper eqn's
- write inf. report
- write journal paper on pine stand dev't + silv.

(D) Integration of plot + physiol. ~~SDs~~ work into models
- TASS - Goudie
- 4C - Sadeck, Lindner, Price
- Ecoleap - Raulier, Bernier

(E) Develop Alberta-based SDMD's

(F) Check age of ~~the~~ Yang TxF trial

WESTLOCK
BARRHEAD
MORINVILLE
ST. ALBERT
EDMONTON
SPRUCE GROVE
STONY PLAIN
DEVON
CALMAR
LEDUC
WARBURG
BRETON
RIMBEY
LACOMBE
BLACKFALDS
RED DEER
PENHOLD
INNISFAIL
BOWDEN
OLDS
SUNDRE
DIDSBURY
CARSTAIRS
CREMONA
TORRINGTON
BEISEKER
IRRICANA
AIRDRIE
CROSSFIELD
CALGARY
OKOTOKS
COCHRANE
CHESTERMERE
BLACK DIAMOND
TURNER VALLEY
MAYERTHORPE
WHITECOURT
EVANSBURG
ENTWISTLE
EDSON
HINTON
ROCKY MOUNTAIN HOUSE
CLEARWATER
CANYON
FOREST RESERVE
FOREST RESERVE
ROCKY MOUNTAINS
PARK
NATIONAL PARK
BANFF
CANMORE
GOLDEN
KOOTENAY NATIONAL PARK
YOHO NATIONAL PARK
JASPER NATIONAL PARK
ROCKY

Lunches

August 28
Please provide your own bag lunch

August 29
Whitespot care of Ramada Inn
Fresh Whole Fruit
2 Roast Beef Sandwiches
Pastry
Pop
$10.00 per person

August 30
Walking Eagle Motor Inn
Turkey Sandwich
Green Salad w/ dressing
Assorted muffin
Fresh Whole Fruit
Pop
$9.95 per person

August 31
Radisson Hotel Canmore
Fresh Whole Fruit
Submarine Sandwich with
Black Forest Ham and Cheddar Cheese
Soft Drink or Fruit Juice
Chocolate Brownie
Fruit Yogurt
$11.95 Per Person

Great Alberta Tour – Day 1

August 28, 2001 Nojack, Whitecourt, Hinton

Time	Agenda Item	Location	WHO
0900	**Tour Overview for the day**	**Nojack Hotel Parking lot**	**TBRA**
0915	Leave for MacKay		
0930	**Lodgepole Pine PCT in 22 year old regenerated stand Est. 1954**	**MacKay**	**SLUX**
1100	Leave MacKay – Headed for Whitecourt		
1300	**Whitecourt EFM/intensive silviculture tour (TBD)**	**TBA**	**TBA**
1630	Leave Whitecourt – Headed for Hinton		
1930	**Dinner and Foothills G&Y association meeting**	**ETC**	**DDEM**

Canadian Forest Service
Silviculture and Growth & Yield Research Studies

PROJECT A34 - Lodgepole pine pre-commercial thinning, MacKay, Alberta . Established 1954.

Site Description

Soil: Brunisolic Grey Luvisol
Stand Origin: originated after a 1932 wildfire following logging in 1930
Present Stand Age: 69 Years
Ecosite: LF D1 Pine/Ledum/ Corncan

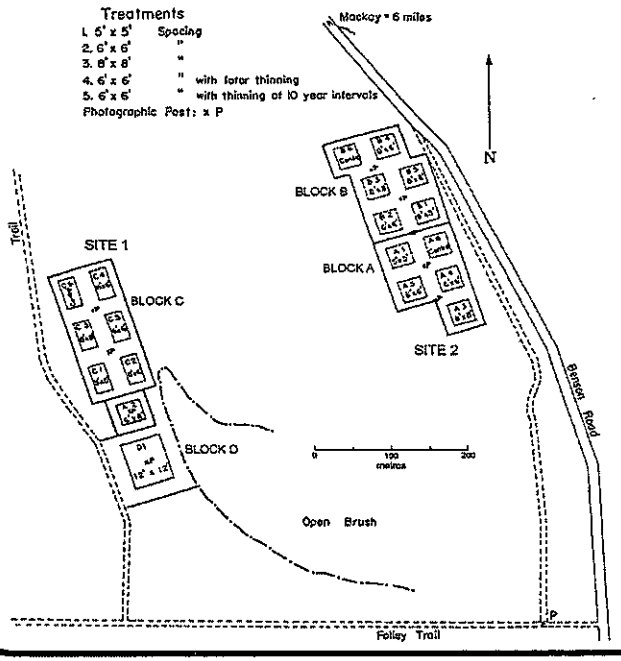
Technical Description

Thinned in 1954 at a stand age of 22 years
Treatments:
1) 1.5 m (5ft.) spacing
2) 1.83 m (6 ft) spacing
3) 1.83 m spacing re-thinned at age 42 (1974) to 70% BA
4) 2.44 (8 ft) spacing
5) Control - no thinning

Objective

To determine if precommercial thinning of Lodgepole pine can improve merchantable volume and quality at a younger age and in turn shorten rotation and increase AAC.
Established cooperatively by Canadian Forest Service and Alberta Forest Service.

Site Layout



Results To Date

Results to Age 64 (1996)
42 years post-treatment

Treat.	T.Vol.	Merch. Volume	
		10cmT	*15cmT*
Control	225	107	46
1.5	253	179	114
1.8	222	175	126
1.8+R	238	207	165
2.4	217	184	146

Interpretations/Reference

Report 1981 NOR-X-237
W.D. Johnstone

- Latest data supplied by SILFOR Consulting and Weldwood of Canada LTD. in 1996 using FRIP dollars.

Foothills Growth and Yield Association

Meeting Agenda

7:30 p.m., August 28th 2001

Room 214, Environmental Training Centre, Hinton

Part 1 (members and other tour participants)

1. Introduction
2. Highlights of annual report and workplan
3. Project synopsis and update
4. Research and monitoring needs being addressed by the Association

Part 2 (members only)

- ***Project 1. Program Development and Management***

1. Revised annual work plan
2. Payment of annual fees
3. Staff and contractor update
4. Long term plans: extended FRIAA proposal and 5-year business plan

- ***Project 2. Lodgepole Pine Regeneration***

1. Vegetation control: herbicide use
2. Establishment delays
3. Audit protocols
4. Extension: comparison of pre-harvest and post-harvest site indices

- ***Project 3. Nutrition and Density Management ("Fire-origin Lodgepole Pine Project")***

1. Time schedule for scope assessment
2. Arrangements for scope assessment input by members ("situational review")

- ***Other business***

Great Alberta Tour – Day 2

August 29, 2001 — Hinton & Rocky Mtn House

Time	Agenda Item	Location	WHO
0800	**Overview of the day's logistics** • Maps, cell phones, packages	**Hinton ETC**	**TBRA**
0815	Leave for Gregg PCT Low site		
0900	**The Gregg PCT Trials: 1963 (CFS)**	"G" Rd Km 38	**SLUX**
1000	Leave for ASD site 11 & 12		
1010	**Accelerating the development of repressed pine through nitrogen fertilization 1997**	"G" Rd Km 38	**TBRA & JSTE**
1110	Leave for FML site 10		
1125	**Fertilization of late rotation lodgepole pine**	"G" Rd Km 38	**TBRA**
1200	Lunch		
1230	Leave for Yang's Trial		
1300	**Fertilization/Thinning of Semi-mature Pl 1984 (CFS)**	**"PR" Rd Km 45**	**SLUX & JSTE**
1345	Leave for factorial thinning and fertilization (2000)		
1430	**Factorial thinning and fertilization (2000)**	**"L" RD Km 60**	**TBRA**
1515	Leave for Sundance FGYA Regen Trial		
1615	**Foothills growth and yield association Regen Trial**	**Sundance FMA**	**KMAC**
1700	Leave for Rocky Mountain House		
	Dinner and Free time		

Canadian Forest Service
Silviculture and Growth & Yield Research Studies

PROJECT A100 - 7 year old fire origin stand of Lodgepole Pine - spacing trials, Gregg River. Established 1963/64. Low site.

Site Description

Soil: eluviated eutric brunisol developed on glaciofluvial terrace gravels - shallow organic - rapidly drained
Ecosite: UF d1 - Pine/Ledum

Stand Origin: following 1956 wildfire
Present Stand Age: 45 yrs.

Technical Description

Plots: varied with density to achieve 100 pine trees per plot. In 1996, 2 control plots were established. There is only one replicate of each treatment.
Treatments:

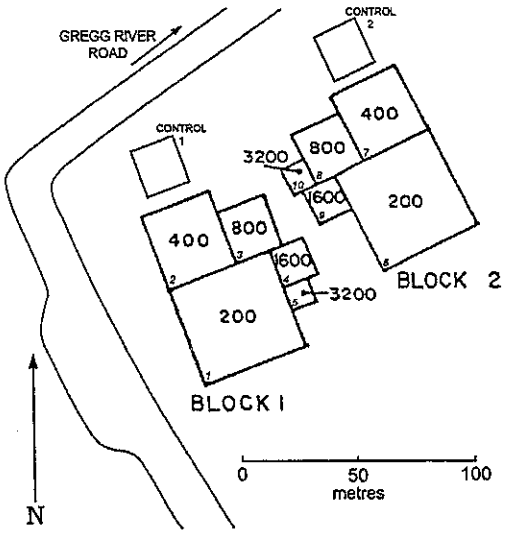
1) Control
2) 7907 (3200/ac) (1.1x1.1m)
3) 3954 (1600/ac) (1.6x1.6m)
4) 1977 (800/ac) (2.3x2.3m)
5) 988 (400/ac) (3.2x3.2m)
6) 494 (200/ac) (4.5x4.5m)

-treatment completed by hand

Objectives

Density affects lodgepole pine tree growth and stand development. This study evaluates spacing effects on early stand growth on poor, medium and high sites and develops size-density and yield relationships as a basis for density management guidelines

Site Layout



Results To Date

Remeasured at 5 year intervals. Table based on 33 years growth since treatment and a merchantable volume of 15/10.

TpH63	TPH96	T.Vol.	M. Vol	DBH
	24608	61.5	0. 0	3.3
7907	6837	125.7	7.0	7.4
3954	3399	110.0	28.3	9.5
1977	1630	82.1	44.1	11.8
988	889	59.9	42.7	13.6
494	450	42.2	34.9	15.7

Interpretations/References

Report 1981 NOR-X-236
WD Johnstone
Report 1991 NOR-X-322
RC Yang

Weldwood remeasured the trial in 1996 using FRIP dollars. The Forestry Corp was responsible for the data collection and the analysis. Geographic Dynamic Corp conducted the ecological classification.

Program: Enhanced Forest Management
Project: Accelerated stand development of dense, fire-origin lodgepole pine through fertilization
Established: Fall 1997, Gregg Burn (1956), 42 year old, fire origin stand
Location: McLeod 04, Turn off "G" road at 35km. GBSD SITE 10

Site Description: Plot GBSD 10B

Mean DBH:	5.10 cm
Mean HT:	7.04 m
Mean SI age:	40.5 years
Mean SI DBH:	8.9 cm
Mean SI HT:	9.65 m
Live Density:	25200 tph
Mean HT/DBH:	1.44 m/cm
Mean live BA:	11.4 m^2
Ecosite:	UF d1
Soil:	SiL

Technical Description

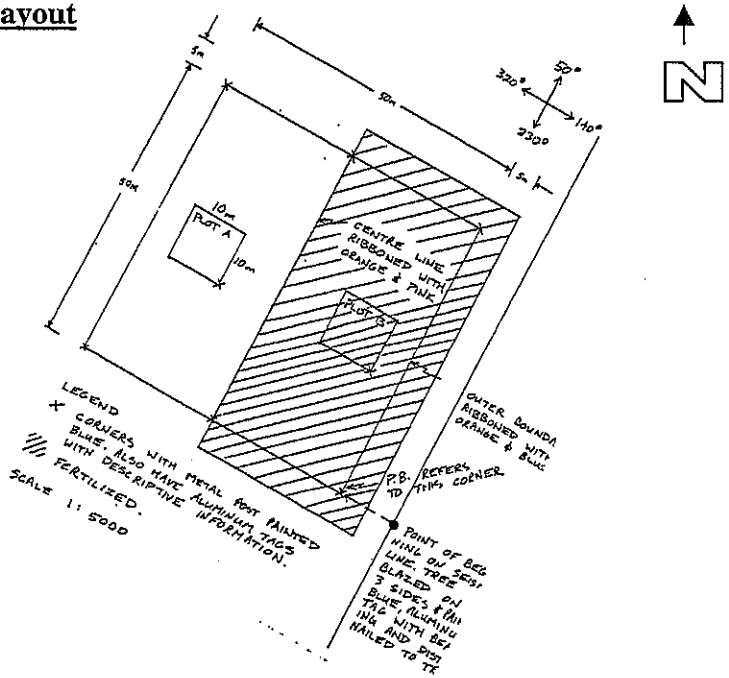
Side "B" was fertilized by hand in May 1997 at a stand age of 42 years. Used planting bags with 5m strung swaths to control distribution. Paired plot design, 50m x 50m split down the middle (A&B) with a 10mx10m mensuration plot within each side.

Fertilizer composition:
Ammonium Nitrate 30-0-0-0-28
Application rate: 891 kg/ha based on 400kg/ha of Nitrogen.

Objectives

1. To determine how site attributes influence stand development and stand differentiation and how their interaction impacts stand structure and growth and yield.
2. To test fertilization application as a means of accelerating stand development, stand differentiation and natural thinning and thus, substituting for, or replacing the need for precommercial thinning.

Site Layout



Results – 3 years since treatment

Needle dry weight – prolonged positive effect on needle weight 3 years after fertilization (1- 25% over control)

Nutrient concentration – N concentration still substantially higher than control, effectiveness of N addition has reduced with time

Height growth response – 3-year height growth was 8-53 cm (14-150%) over the control

Radial growth response – 3-year radial growth was 3-26 mm (6-76%) over the control

Interpretations/References

This is funded by FRIP under Weldwood's EFM program. SILFOR consulting coordinate the project; data collection was provided by Deci-con and Geographic Dynamics Corp.

Program: Enhanced Forest Management
Project: Fertilization of mid- to late-rotation Lodgepole Pine
Established: 1998 October Burn, 100 year old, fire origin stand
Location: McLeod 05, Turn off "G" road at 35km. FML Site 10 Research Trial

Site Description (1998)

Mean DBH:	19.5 cm
Mean HT:	20.37 m
Mean age:	97 years
Live Density:	1371 tph
HT/DBH:	1.04 m/cm
BA:	43.00 m^2
Total Vol:	367.73 m^3/ha
Merch Vol:	341.14 m^3/ha (10/8)
Ecosite:	UF e1.3

Technical Description

Randomized complete block design:
4 treatments * 3 replications

Treatement	Rate* (kg/ha)	Plots
Control	None	3, 7, 10
Blend	1212	4, 8, 12
200N + B	445	2, 5, 9
200N	435	1, 6, 11

* Rates based on 200 kg/ha of N

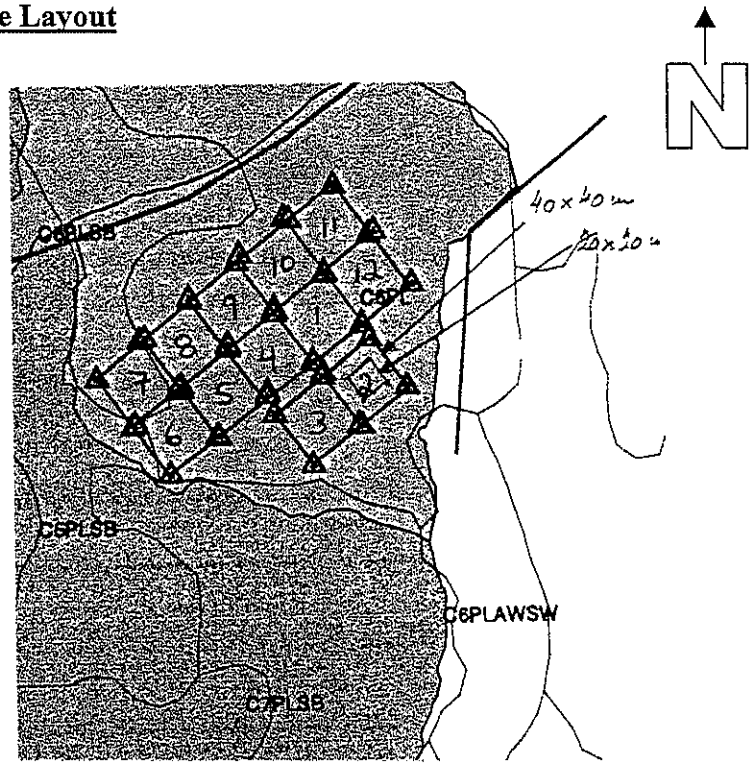
Fertilizer Composition:
Blend: 16.5-19.1-9.9-3.1Mg-6.2S-0.25B
Nitrogen + Boron: 45-0-0-0.3B
Nitrogen: 46-0-0

Hand fertilization using planting bags and stringing 5m swaths to control distribution.

Objectives

The overall objective is to develop Fertilization and Fertilization + Stand density management strategies that result in productivity gains across ecosystems that are dominant in the Foothills of Alberta. Specific objectives are to evaluate the effects of different fertilizer treatments on tree growth and stand development of mid- to late-rotation lodgepole pine and to test foliage responses in miniplot fertilization as a diagnostic tool.

Site Layout



Foliage Analysis 1997

Stand nutrient status

	Baseline	Deficiency*
N	1.05 %	severely deficient
P	0.14 %	slight deficiency
B	6.4 ppm	possible deficiency
Mg	0.082 %	Slight to moderate deficiency
SO_4	126 ppm	Not deficient

*Based on Ballard and Carter

Relative needle weight response from 1997 miniplots

Fertilizer	Needle WT (%)
Blend	128.9
Nitrogen	116.8
Control	100

References

This trial was funded by FRIP under Weldwood's EFM program. SILFOR consulting coordinated the project and was responsible for data collection and analysis. Foliage samples were collected and analyzed by Mackenzie Reforestation and Pacific Soil Analysis. Fertilization was conducted by Olson Ventures.

Report – SILFOR 1999. Fertilization of mid to late rotation lodgepole pine in the foothills of Alberta. Trial #1, Research Experimental, Establishment Deport.

Canadian Forest Service
Silviculture and Growth & Yield Research Studies

PROJECT NOR-0405 Thinning and fertilization of 40-year-old semi-mature lodgepole pine. Established 1984-85.

Site Description

Soils: Orthic Gray luvisol of Mercoal series developed on medium-textured Cordilleran till, well-drained. Slope ranged from level to undulating (4-11%).
Ecosite: Lf d1.1 Pl/Sb/Labrador tea/Feather moss.
Stand origin: from 1944 burn.
Current stand age: 57 years.

Treatments

Eight fertilization and thinning treatments

Treatment	Thinning	kg/ha N
1. T0F0	No	0
2. T0F1	No	180
3. T0F2	No	360
4. T0F3	No	540
5. T1F0	Yes	0
6. T1F1	Yes	180
7. T1F2	Yes	360
8. T1F3	Yes	540

Objectives

The study was to quantify the interactive response to thinning and N fertilizer in a mid-rotation Pl stand; to assess fertilization and thinning effects on stand growth and mortality; and to determine the optimum fertilizer regime on the Mercoal soils.

Technical Description

Pre-thin density was 5270 TPH, thinning reduced the stand by 60% to 2130 TPH (38% reduction in BA). The trial is a randomized complete block design with factorial arrangement of treatments, 9 replicates= 72 plots.

Interpretation

Ten years after treatment, fertilized and unthinned plots had 80 m^3/ha more than fertilized and thinned plots. In contrast, thinning removed small trees and average tree size was larger (31% by DBH and 36% by Volume)

Results To Date

Plots were remeasured in 1989, 1994 and 1999. Following results are from 1994.

Treat.	T. vol	M. vol	DBH
1	266	116	11.2
2	273	110	11.5
3	294	158	12.3
4	311	103	10.8
5	208	124	14.5
6	213	133	15.2
7	214	135	15
8	209	138	14.9

Interpretations/References

Yang, Richard C. 1998. Foliage and stand growth responses of semi-mature lodgepole pine to thinning and fertilization. Can J For Res 28: 1794-1804.

Program: Enhanced Forest Management
Project: Factorial Thinning and Fertilization Trial
Established: Thinned and Fertilized in April 2000
Location: McLeod 18, Turn off "L" road at ~ 66km and follow Petro-Can Rd

Site Description (1999 Pre Thin)

Mean DBH (cm)	11.1
Top HT (m)	16.8
BH age	70
Live Density (SPH)	3369
HT/DBH	1.51
BA (m^2/ha)	38
TVOL (m^3/ha)	246.8
MVOL 10/8 (m^3/ha)	181.3
Spacing Factor (%)	10.3
Ecosite	UF e1.3

Technical Description

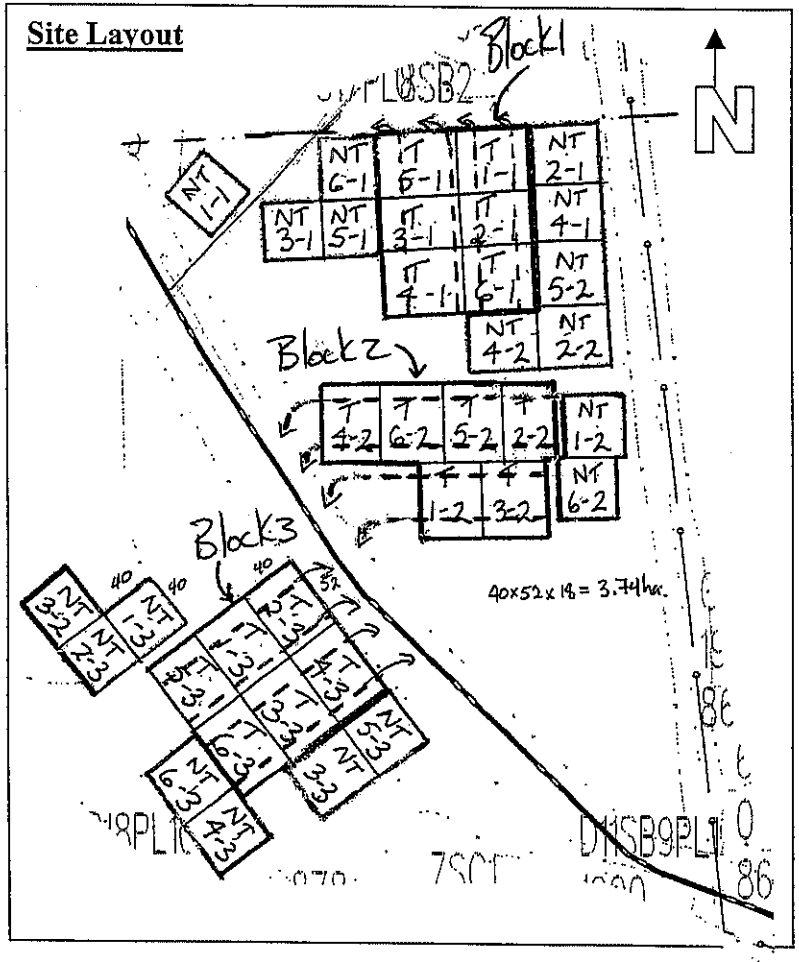
Fertilizer Treatments	Thin (T) Plots	No Thin (NT) Plots
Control	6-1,2,3	6-1,2,3
200N-urea+B	1-1,2,3	1-1,2,3
400N-urea+B	2-1,2,3	2-1,2,3
200N-urea+blend	3-1,2,3	3-1,2,3
400N-urea+blend	4-1,2,3	4-1,2,3
400N-NO_3+B	5-1,2,3	5-1,2,3

Fertilizer Composition:
200N+Boron= 43.8-0-0-0-0.6B
400N+Boron= 44.9-0-0-0-0.3B
200N urea+Bld=16.8-18.7-9.3-6.6-2.8-0.2B
400N urea+Bld=24.5-13.8-6.8-4.9-2-0.1B
400N-NO_3+B= 33.8-0-0-0-0.2B
Thinning Prescription:
50% of the BA = 14.5% SF = 90m^3/ha

Objectives

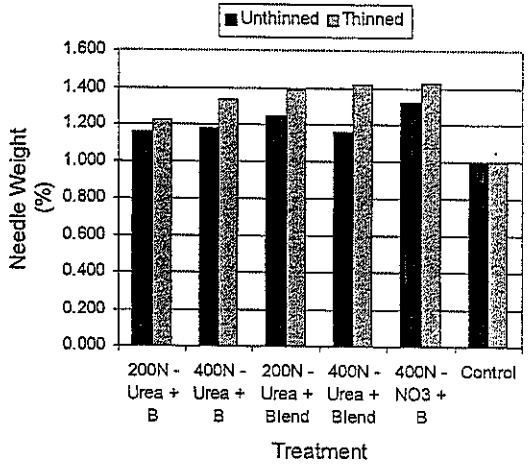
The objective is to quantify yield gains from commercial thinning, in combination with fertilization of lodgepole pine in the Foothills of Alberta. The results will be used to develop yield curves for different fertilization treatments – provide the foundation for a forest level deployment of an operational fertilization program.

Site Layout



Preliminary Data

2000 Foliage analysis showed:



- thinning in combination with fertilization significantly and positively affected needle weight
- no differences in needle weight response between 200 kg N/ha and 400 N kg/ha
- ammonium nitrate produced the highest needle weight responses and foliage concentration of nitrogen

References

This trial was funded by FRIP under Weldwood's EFM program. SILFOR consulting coordinated the project and was responsible for data collection and analysis.

Foothills Growth and Yield Association Sundance Forest Industries Ltd.

Sundance FGYA Research Installation
4444 Stems/ Ha

ACCESS NOTES

- 3.1 kilometers from junction of Windy Creek Road and Elk River Road to Tie point on cutblock corner and edge of road.
- Orange plot center to tie point is 176 meters at 50 degrees.

SITE DESCRIPTION

Block: 9-3083

Location: 45-17-30-W5M
Block Area: 34 hectares
Elevation: 1390m
Stand Type:

Ecosite Category: 3
Billberry/cranberry/sarsaparilla/rhodendron (mesic/medium)
Natural Sub-region: Upper Foothills
Ecosite: E1
Soil Moisture Regime: 5
Soil Nutrient Regime: C

ACTIVITIES

Opening Date: July 22, 2000
Skid Clearance Date: August 21, 2000
Road and piling reclaimation date: October 27, 2000
Site Preparation date: October 18, 2000
Pile Burning completion date: February 15, 2001
Harvest Method: Feller buncher / delimbed at roadside.
Site Preparation Method: Drag scarification (JD 740A grapple/winch skidder pulling two sets of barrels and chains).
Planting Date: July 1, 2001

HARVEST VOLUMES

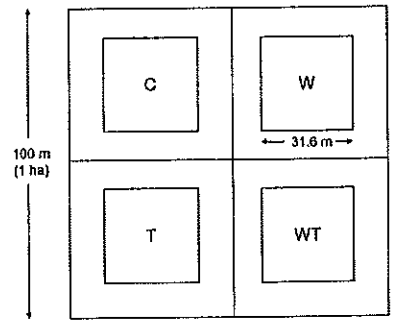
Volumes (m^3)										
Pl		Sw		Pulp		Posts		Aw		Block
Total	Vol/ha	Total	Vol/ha	Total	Vol/ha	Total	Vol/ha	Total	Vol/ha	Total Vol/ha
10,933	322	-	-	497	15	72	2	-	-	338

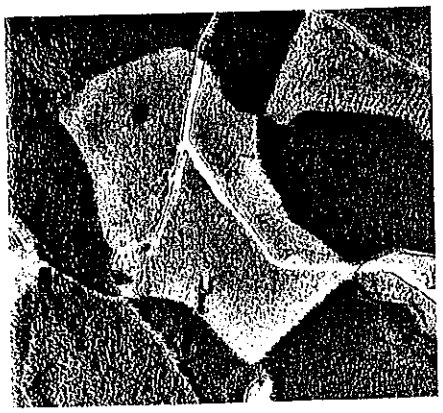
INSTALLATION ORIENTATION

Installation is orientated due North-South. The four treatment plots within are located as follows:

- NE Plot - Weeded
- SE Plot - Thinned/ Weeded
- SW Plot - Thinned
- NW Plot - Control

Figure 1. Installation Diagram





Lodgepole Pine Regeneration Project

Objectives

The general purpose of the Project is to forecast and monitor the effects of site, vegetative competition, and initial density management on the early crop performance and subsequent stand growth and yield of lodgepole pine.

The Project is designed to answer the following questions:

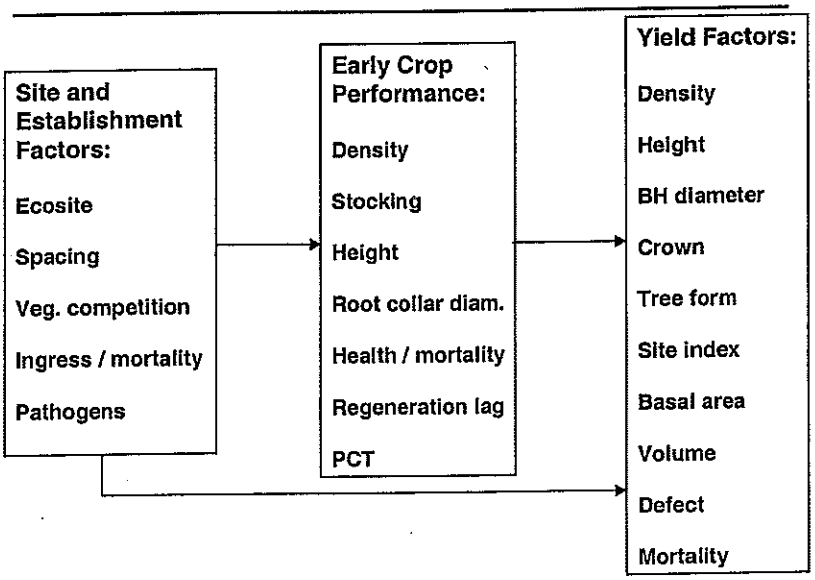
- What are the relationships between early stand conditions (stocking, height growth, density, competition) and subsequent growth and yield?
- How does stand growth and yield respond to control of competing vegetation and to different levels of planting and early density management?
- How do these responses and relationships vary across sites of primary interest?

The experimental objectives are:

1. Estimate the effects of site and establishment factors on early crop performance.
2. Estimate the effects of site and establishment factors on subsequent stand growth and yield.
3. Estimate the effects of early crop performance and density regulation on subsequent stand growth and yield.

The effects to be estimated and monitored are summarized in Figure 1.

Figure 1. Effects to Be Estimated



Experimental Treatments

Ecosite

Table 1 shows the 5 ecosite categories that will be recognized in the experimental design, and references the associated field guides and natural sub-regions.

Table 1. Ecosite Categories

Ecosite (and Edatope)	*WC*	*SW*	*NSR*
1. Bearberry / lichen / h.w. rye (submesic / subxeric, medium – low)	b, c	b	any
2. Labrador tea – mesic (mesic – poor)	d	c	UF LF
3. Billberry / cranberry / sarsaparilla / rhododendron (mesic / medium)	e	d	SA/UF LF
4. Honeysuckle / fern (subhygric – rich)	f	e	UF LF
5. Labrador tea – hygric (hygric – poor)	h	f	any

WC = west-central guide
SW = southwestern guide
NSR = natural sub-region

Management Treatments

Controlled management treatments will involve initial spacing of planting stock (6 levels including no planting), and 4 vegetation management treatments (see Table 2).

Table 2. Management Treatments

Treatment	*N*	*Explanation*
Spacing	6	control (no planting); plant: 816, 1111, 1600, 2500, 4444 per ha
Vegetation management	4	none, weed, pre-commercially thin, weed and PCT

Statistical Design

The trial is a three-level split-plot design. The basic balanced design consists of 90 field installations (5 ecosites x 6 spacings x 3 replications), with each installation split into 4 plots (vegetation management treatments). Additional replication may be added. An additional 12 installations (6 spacings x 2 replications) has so far been added in the modal category 3 ecosite, to produce a total of 102 installations. The three levels are described below for the basic balanced design.

Level A:
Installations within each of the 5 ecosites are blocked into 3 geographic "groups", to produce a total of 15 groups. Note that these groups are *blocks* in the statistical sense, but not cut-blocks. Rather, they are geographic groups of cut-blocks having the same ecosite and similar climatic, edaphic, and site preparation characteristics. The intent is to reduce the confounding influence of uncontrolled site and management variables on spacing effects and interactions. These uncontrolled variables will also be measured at each installation and may be included in the analysis of variance (see below) as co-variates.

Level B:
6 installations (one for each spacing treatment) in each of the 15 "groups".

Level C:
Each installation is split into 4 vegetation management treatment plots.

Each installation is actually a "split-plot", and will be split two ways (weeding / no weeding and eventually thinning / no thinning) to produce 4 sub-plots (i.e. the Level C "treatment plots").

Table 3 shows the design in terms of analysis of variance and degrees of freedom.

Table 3
Analysis of Variance

Analysis of Variance		Degrees of Freedom
Level A	Ecosite	4
	Error	10
Level B	Spacing	5
	Spacing * ecosite	20
	Error	50
Level C	Vegetation management	3
	Vegetation management * spacing	15
	Vegetation management * ecosite	12
	Vegetation management * spacing * ecosite	60
	Error	180
Total		359

Great Alberta Tour – Day 3

August 30, 2001 — Clearwater & Kananaskis

Time	Agenda Item	Location	WHO
0800	**Overview of the day's logistics** • Maps, cell phones, packages	**Rocky Mtn House**	**TBRA**
0815	Leave for Swan Lake		
0915	**Swan Lake**		**SLUX & JSTE**
1000	Leave for Clearwater		
1045	**Clearwater**		**SLUX & JSTE**
1130	Lunch		
1200	Leave for Teepee Pole		
1230	**Teepee Pole Creek**		**SLUX & JSTE**
1330	Leave for Canmore		
1530	**Canmore**		
1600	**Research and Monitoring Needs in Lodgepole Pine Management: Overview and Discussion**	**Canmore**	**DDEM**
1900	Dinner, Team Building		

Canadian Forest Service
Silviculture and Growth & Yield Research Studies

Early development of Lodgepole Pine after three different mechanical thinning treatments at Swan Lake. Established 1977.

Site Description

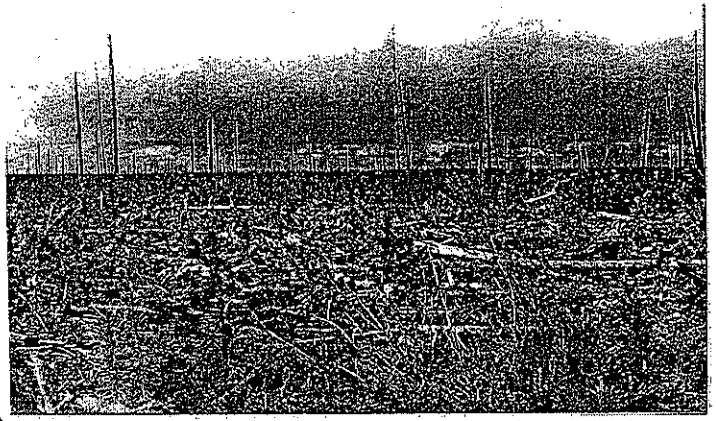
Stand Origin: fire killed and salvage logged in 1967.
Soils: fresh to moist with silty clay loam soils, undulating topography.
Present Stand Age: 34 yrs.
Stand density in 1977: 30 to 40 thousand stems per ha.
Site: above average productivity for Pl.

Technical Description

Scarification equipment used: Rome disks, shark-finned barrels and anchor chains.
These implements were dragged by a D8 CAT in one or two directions.
Trial design: 15 sample plots, 12 thinned and 3 controls were established in 1977.

Objective

To find cheap and effective ways to reduce density and accelerate individual tree growth for increased timber production.
Established cooperatively by Canadian Forest Service and Alberta Forest Service.



Interpretations/References

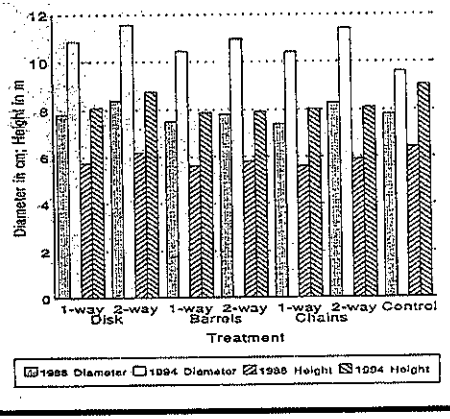
I. Bella. 1994. Unpublished report.
Bella. 1990. Technical Note:Thinning Lodgepole pine by Brute Force: Three Implements. For. Chron. Dec. 1990

Results To Date

Stand conditions in 1994

Treatment	Stems/ha	DBH	HT
Disk 1 W	5969	7.3	7
Disk 2 W	6199	7.6	7.8
Barrels - 1 W	10371	6.5	6.8
Barrels - 2 W	7092	7	7
Chain - 1 W	7946	6.6	7.2
Chain - 2 W	7778	7.3	7.3
Control	21111	5.4	7.1

Mean diameter and height of the 1000 largest trees/ha in 1988 and 1994.



Canadian Forest Service
Silviculture and Growth & Yield Research Studies

PROJECT - Fertilizing after thinning 70-year-old Lodgepole pine at Clearwater. Established 1968.

Site Description

Elevation: 1280 m
Soil: Podolized Gray Luvisols developed on level-to-undulating coarse outwash material with alluvial veneer.
Ecosite: LF c1
Pine/Vac-Shepcan/Corncan
Stand origin: 1898 from wildfire.

Technical Description

Pre-thin density was 2500 TPH. Thinning treatment reduced the stand to 850 TPH. The trial is a completely randomized design, with an incomplete factorial treatment structure, 3 replicates = 42 plots.

Treatments:
N:112, S:0, P 0
N:112, S:28, P 168
N:673, S:0, P:0
N:673, S:0, P:168
N:673, S:28, P:168

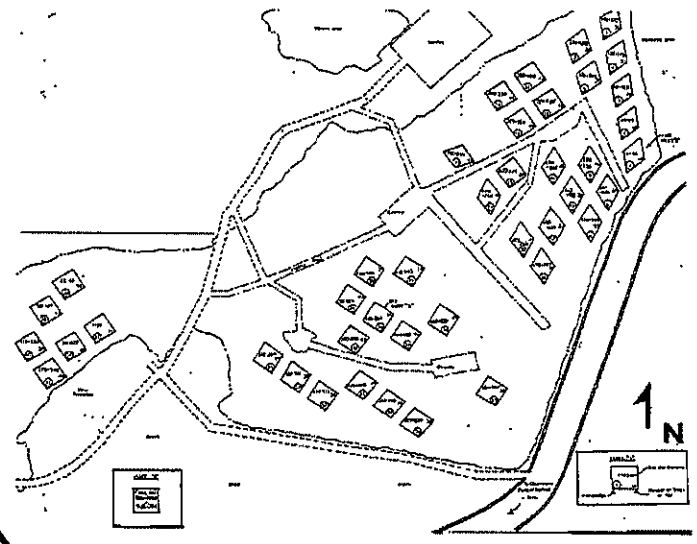
Fertilizer: Urea(45-0-0), conc. superphosphate(0-45-0), ammonium phosphate(11-48-0) and ammonium phosphate sulphate(16-20-0-14)

Objective

To redistribute growth on fewer selected trees and to eliminate mortality. Fertilization after thinning ensures that only future crop trees benefit from the added nutrients. The combined treatment effect may significantly improve merchantable yield.

Established cooperatively by the Canadian Forest Service and Alberta Forest Service

Site Layout



Results and Interpretations to Date

Treat.	T. Vol (1996)	1975-96 Incr (%)	M. Vol (1996)	Pine Mortality 1975-96
control	158.5	29.4	131.5	23%
673N	171.3	16.6	144.1	27%
112N	122.2	-5.7	100.7	37%
673N+PS	136.4	6.3	115.4	37%
112N+PS	110.3	-10.1	89.7	48%

Reference

Bi-monthly research notes:34 pages 22-23. 1978. I. Bella
Weldwood remeasured plots in 1996 using FRIP dollars. The Forestry Corp was responsible for the data collection and analysis. Geographic Dynamics Corp conducted the ecological classification. SILFOR calculated and interpreted the results.

Canadian Forest Service
Silviculture and Growth & Yield Research Studies

PROJECT NOR008 - Teepee Pole Creek juvenile spacing of 25 year-old Lodgepole pine. Established 1967. Flat site.

Site Description

Soil: Site 1. good site on level, well drained Brunisolic Gray Luvisol

Ecosite: UF e1 Pine/Alder/Corncan

Stand Origin: 1942 wildfire

Present stand age: 59 years

Technical Description

Spaced by hand in 1967 at a stand age of 25 years.

2 control plots were established at each site in 1992.

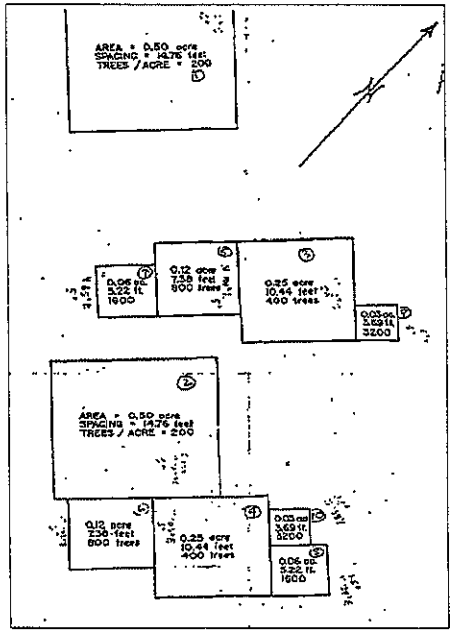
Treatments:

494/ha (200/ac) (4.5x4.5m)
988/ha (400/ac) (3.2x3.2m)
1977/ha (800/ac) (2.3x2.3m)
3954/ha (1600/ac) (1.6x1.6m)
7907/ha (3200/ac) (1.1x1.1m)
Control (unthinned)

Objective

Excessive stand density reduces stand and tree growth in Lodgepole Pine. This study evaluates crop tree and stand growth and yield based on early stand spacing on three sites and 5 treatment densities.

Site Layout -flat site



Results to Date

Measurements from 1996, merchantable volume of 15/10

Treat.	T. vol	M. vol	DBH
494	69	62	16.1
988	131	115	16.2
1977	260	219	15.5
3954	303	215	13.3
7907	371	257	12.9
Control	320	206	12.1

Interpretations/References

Information Report 1981 Nor-X-244
W.D. Johnstone
Forest Management Note 1986
R. Yang

Weldwood remeasured trial in 1996 using FRIP dollars The Forestry Corp was responsible for the data collection and analysis. Geographic Dynamics Corp conducted the ecological classification.

Canadian Forest Service
Silviculture and Growth & Yield Research Studies

PROJECT NOR008 - Teepee Pole Creek Juvenile Spacing of 25 year-old Lodgepole pine. Established 1967. South site.

Site Description

Soil: Site 3. southerly aspect with well drained Brunisolic Gray Luvisol developed in Cordilleran till over sandstone of the Paskapoo formation. Towards the western edge of this location there were drier soils, with truncated development due to shallow depth to bedrock.

Stand Origin: 1942 wildfire

Present stand age: 59 years

Technical Description

Spaced by hand in 1967 at a stand age of 25 years.

2 control plots were established at each site in 1992.

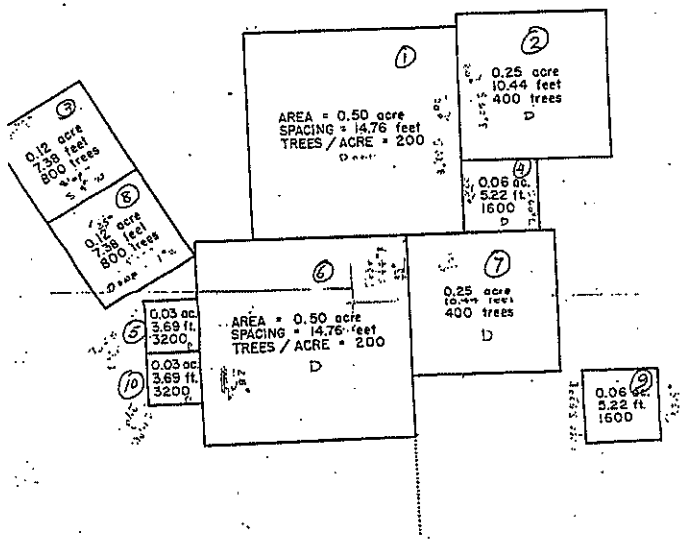
Treatments:

494/ha (200/ac) (4.5x4.5m)
988/ha (400/ac) (3.2x3.2m)
1977/ha (800/ac) (2.3x2.3m)
3954/ha (1600/ac) (1.6x1.6m)
7907/ha (3200/ac) (1.1x1.1m)
Control (unthinned)

Objective

Excessive stand density reduces stand and tree growth in Lodgepole Pine. This study evaluates crop tree and stand growth and yield based on early stand spacing on three sites and 5 treatment densities.

Site Layout - south site



Results To Date

Measurements from 1996, merchantable volume of 15/10

Treat.	T. vol	M. vol	DBH
494	73	65	19.1
988	173	160	15.2
1977	161	124	14.1
3954	318	259	14.7
7907	230	109	10.5
Control	312	244	13.7

Interpretations/Reference

Information Report 1981 Nor-X-244
W.D. Johnstone
Forest Management Note 1986
R. Yang

Weldwood remeasured trial in 1996 using FRIP dollars. The Forestry Corp was responsible for the data collection and analysis. Geographic Dynamics Corp conducted the ecological classification.

Great Alberta Tour – Day 4

August 31, 2001 Kananaskis

Time	Agenda Item	Location	WHO
0800	**Overview of the day's logistics** • Maps, cell phones, packages	**Canmore**	**TBRA**
0815	Leave for K57		
0845	**K57 - Development of a 77 year old Pl stand following heavy thinning, est. 1941 (CFS)**		**SLUX & JSTE**
0945	Leave for K03		
1015	**K03 - Classic European trials late 40s (CFS)**		**SLUX & JSTE**
1045	Leave for K58		
1115	**K58 - Crossley's "economic possibilities" CT trial, 1950 (CFS)**		**SLUX & JSTE**
1200	Lunch		
1230	Wrapup and Depart for Edmonton		

Canadian Forest Service
Silviculture and Growth & Yield Research Studies

PROJECT K57 - The development of a 77 year old Lodgepole pine stand following a heavy thinning. Established 1941.

Site Description

Stand origin: 1864 wildfire
Present stand age: 137 years
Soil: degraded brown wooded soil developed on fine textured deltaic and alluvial fan deposits with a moderately high lime content.

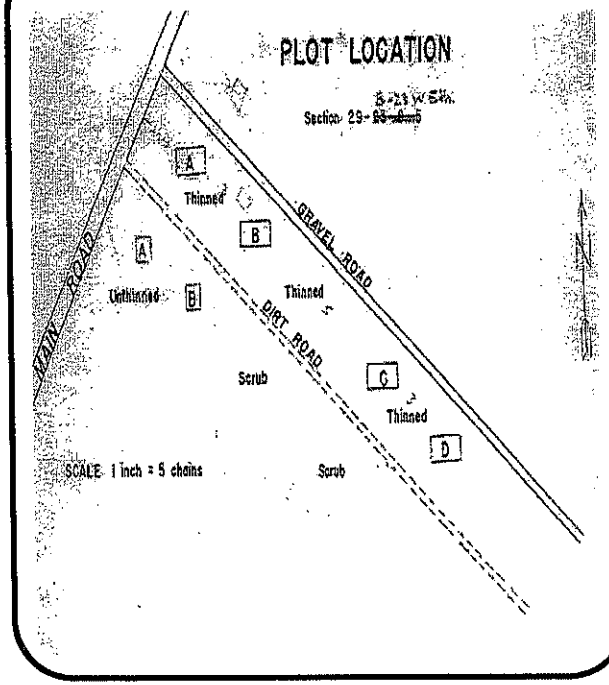
Technical Description

Treatment: a combination of heavy thinning from above and below with ca. 70% of the total volume removed. In 1949, the treated and untreated areas of the stand were sampled by 1/5th and 1/10th acre plots.
Before thinning: 7250 TPH, mean DBH of 9 cm.
Following thinning: mean DBH of 10.7 cm.
Volume removed by thinning 187 m3/ha.

Objective

To commercially thin a mature and overstocked lodgepole pine stand for fuel wood with the intention of producing poles and sawlogs after a second thinning.

Site Layout



Results to Date

	Unthinned	Thinned
Trees/ha 41	6079	1554
Standing Vol. 41	235	79
Trees/ha Pl 99	1471	1192
Trees/ha Sw 99	605	145
Standing Vol. Pl 99	292	330
Standing Vol. Sw 99	70	31
Cum. Vol. Pl+Sw 99	362	547
Cum. MAI Pl+Sw 99	2.68	4.05
Merch. Vol. Pl 99	237	277
Merch. Vol. Sw 99	53	25

References

Silvicultural leaflet No 47. J. Quaite. 1950.
Internal report no. A25. 1969. WD Johnstone.

Weldwood remeasured the plots in 1999 using FRIP dollars. SILFOR Consulting was responsible for data collection, analysis and interpretation of the results.

Canadian Forest Service
Silviculture and Growth & Yield Research Studies

PROJECT K3 - A Variety of Thinnings in Kananaskis Based on European Practices. Established in 1938-39.

Site Description

Stand origin: 1864 wildfire
Present stand age: 137 years
Soil: degraded brown wooded soil developed on fine textured deltaic and alluvial fan deposits with a moderately high lime content.

Technical Description

A variety of thinning techniques were used: French (from above), German (from below), and Crop Tree Release.

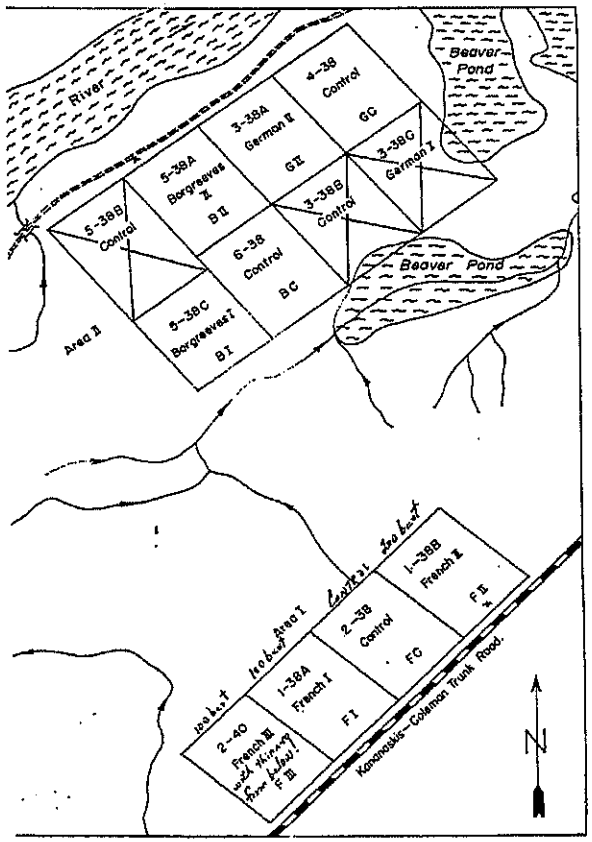
Sample plots were 1-acre, with a 1-chain surround. Diameter and height were measured at 5-year intervals.

Many plots along Kananaskis River were flooded, with consequent high mortality. Other stand intrusions have reduced the research value of these studies.

Objective

To commercially thin a mature and overstocked lodgepole pine stand for fuel wood with the intention of producing poles and sawlogs after a second thinning.

Site Layout



Results and Interpretations to Date

Most crop trees have achieved sawlog or pole size. Many incidental white spruce in the original plots are now of merchantable size. Note that painted markings on crop trees are still visible.

Reference

Lodgepole Pine in Alberta.
Smithers. 1961.
Dept. of Forestry
Bulletin No. 127

Canadian Forest Service
Silviculture and Growth & Yield Research Studies

PROJECT K58 - Economic possibilities of commercial thinning in an 88-year-old Lodgepole Pine stand in Alberta. Established 1950.

Site Description

Stand Origin: originated from a wildfire 88 years before treatment - 1862
Elevation: 1500 m in a subalpine forest region
Area thinned: 2.04 ha
Present Stand Age: 139 yrs.

Objective

The thinning objective was to produce poles of an average diameter of 25.4 cm. The proposed plan was to leave 679 TPH at an average spacing of 3.8 m (12.5 ft). The operation removed 45% of the basal area and left trees with an average diameter of 18 cm.

Technical Description

Commercial thinning was done using Hecks' method of free thinning in a modified form. Under this system only the perfect or alpha stems are left as crop trees, as evenly spaced over the thinned area as possible. Hecks suggests gradual release every 5 years, but in this study release occurred by one drastic thinning.

Results To 1999

Variable	Pre-treat		Post-treat		Present	
Species	PL	SW	PL	SW	PL	SW
TPH	1565	245	922	218	662	175
BA	29.4	1.2	17.5	1.1	34	3.1
T. Vol	249	5.5	148	5.3	341	21
M. Vol	210	3.0	126	3.0	324	19
Mean DBH			15.5	0.0	25.6	21
PAI - total	2.8	0.06			4.0	0.3
PAI - merch	2.4	0.03			4.1	0.4

Interpretations/Reference

Unpublished report 1952 by DI Crossley and RS Jewesson Canadian Forest Service.

Present data provided by SILFOR and Weldwood of Canada in 1999 using FRIP dollars.