

FGROW Fall Field Tour (Hinton, AB) – October 12th, 2022

Research and Operational Density Management Trials

Host: West Fraser Mills, Hinton Woodlands

Lunch: provided

Transportation: carpool (tour ends at last stop)

Contact: Brian Roth (780) 709-1393

AGENDA

9:00 AM	<p><i>Meet in parking lot at lower entrance to Hinton Training Center 1176 Switzer Dr, Hinton, AB – coffee and doughnuts</i></p> <p>53.399560, -117.582047</p>
9:30 AM	<p>Depart Hinton for first stop</p>
10:00 AM	<p>Stop 1. Canadian Forest Service, Gregg Burn 1963 and 1984 Spacing Experiments – Jim Stewart (CWFC)</p> <ul style="list-style-type: none">• The 1963 experiment examines spacing effects on stand development, to develop size–density and yield relationships for density management guidelines, and to recommend suitable spacings for juvenile stands (age 7 yrs).• The 1984 experiment was a follow-up to the 1963 experiment and evaluates differences in stand development by thinning at a later stand age (age 28 yrs). <p>53.234563, -117.368655</p>
12:00 PM	<p><i>Depart for Lunch at Gregg Cabin Recreation Area - boxed lunches from the Old Grind Coffee Shop: Turkey and Swiss sandwich + chocolate chip cookie and beverages</i></p> <p>53.242625, -117.391408</p>
1:00 PM	<p><i>Depart Gregg Cabin for second stop</i></p>
2:00 PM	<p>Stop 2. WF Hinton Operational Density Management Studies – Apsana Kafle and Francis Scaria (University of Alberta MSc. Students).</p> <ul style="list-style-type: none">• Preliminary results from older Pre-commercial Thinning and Commercial Thinning investigations. <p>53.399521, -117.071410</p>
3:30 PM	<p><i>End of tour</i></p>

FGROW 2022 Fall Field Tour – Gregg Burn Trials

Stop Objectives

Gregg 63 High site: demonstrate topographic differences in disturbance by wind and MPB

Gregg 63/84 Medium site: demonstrate effect of timing of PCT on tree growth and form, and differences in MPB attack and mortality

Gregg Burn Seedling Spacing Experiment, Project A-100 (1963)

Establishment and Objectives

The first Gregg Burn spacing experiment was established in 1963 to examine spacing effects on stand development, to develop size–density and yield relationships for density management guidelines, and to recommend suitable spacings for juvenile stands. These sites are located in the Upper Foothills section (B.19c) of the Boreal Forest Region.

Experimental Design and Treatments

The Gregg Burn 1963 experiment comprised three different sites, classified by productivity (high, medium, and low). Each site was set up as a semirandomized complete-block design with two replicate blocks of treatment plots. Each plot contained 100 uniformly spaced trees, and plot area varied with spacing. The treatments were carried out by setting up a grid of string at the prescribed spacing and tagging the best seedling within 46 cm of each string intersection. All other seedlings were removed by hand. Plots were established at spacings of 1.1, 1.6, 2.3, 3.2, and 4.5 m, corresponding to approximate stand densities of 8000, 4000, 2000, 1000, and 500 stems per hectare. Measurements were taken in 1966 and every 5 years thereafter. Control plots were established in unthinned portions of the stands adjacent to the treated plots for each block of the high and low productivity sites in 1996 and the medium productivity sites in 2004. Unthinned pseudo-control plots were established in adjacent unthinned parts of the stand in 2004.

Gregg Burn Juvenile Spacing Experiment, Project NOR-402 (1984)

Establishment and Objectives

The second Gregg Burn spacing experiment was established in 1984 as a follow-up to the 1963 experiment to evaluate differences in stand development by thinning at a later stand age (28 vs. 7 years). The medium productivity plots were established immediately adjacent to the 1963 medium productivity plots. The high and low productivity plots were established a few kilometers southwest.

Experimental Design and Treatments

As for the 1963 installation, the 1984 installation consisted of three different sites, classified by productivity (high, medium, and low); with two replicate blocks of treatments at each site. Based on early results of the 1963 experiment, the two extreme spacing

treatments from 1963 were dropped and one intermediate spacing treatment added. The 1984 treatments were 1000, 2000, 3000 (1.83-m) and 4000 stems per hectare. Unthinned pseudo-control plots were established in adjacent unthinned parts of the stand in 2004.

Site Descriptions

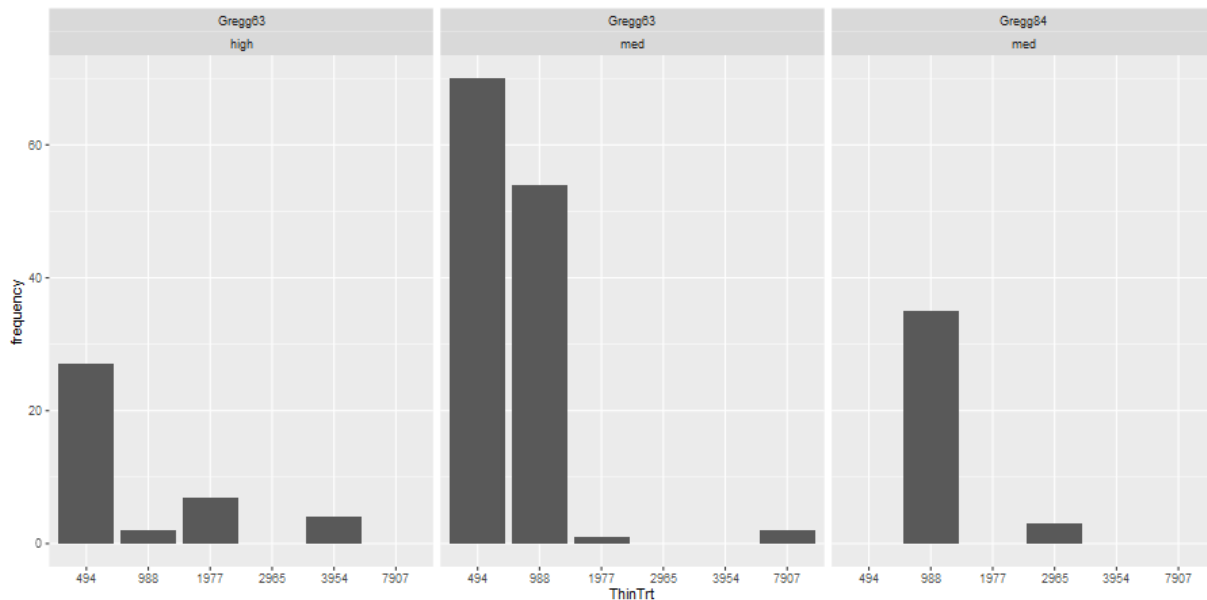
Gregg 1963 High

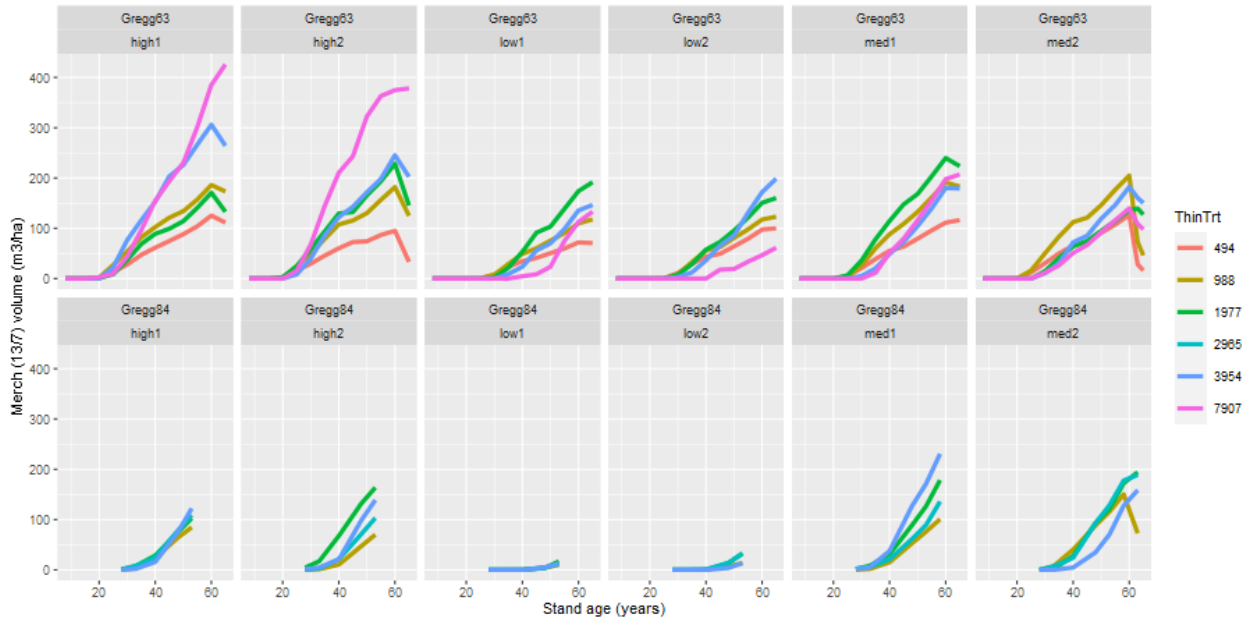
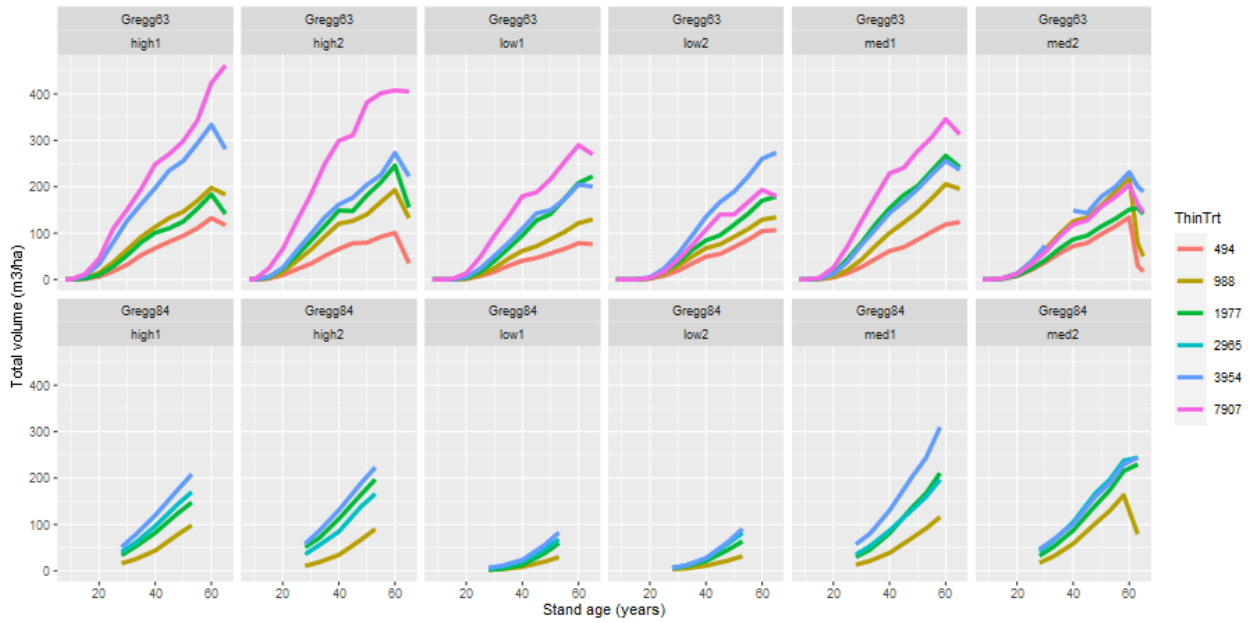
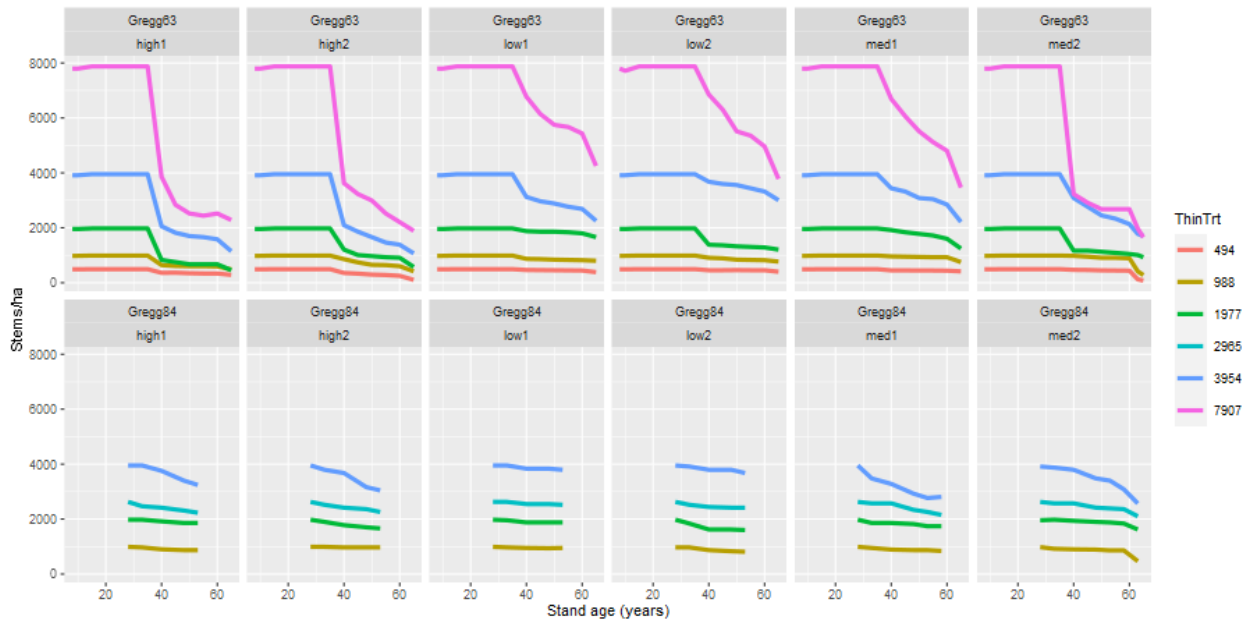
The Gregg 1963 High sites are in the Upper Foothills subregion on different slopes: block 3 on a southwest aspect midslope and block 4 on a northeast aspect hilltop. Grades vary from 0% to 25%. Soils are sandy loam Eluviated Eutric Brunisols. The SMR is mesic to subhygric, and SNR medium-poor to medium-rich, with a lodgepole pine/green alder/feather moss plant community.

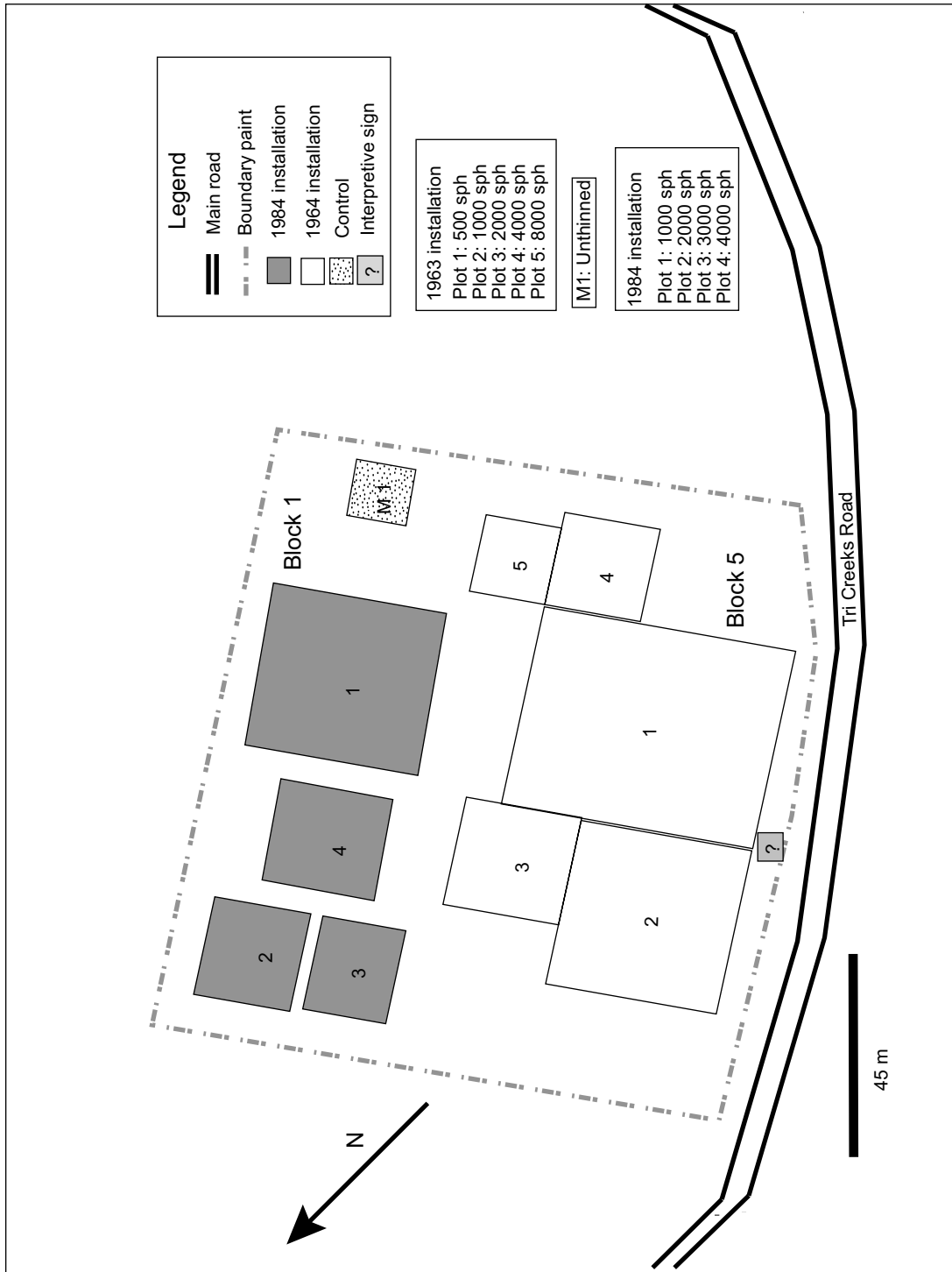
Gregg 1963/84 Medium

The Gregg Medium sites are in the Upper Foothills subregion on south to southwest aspect slopes, with grades from 5% to 25%. Soils are moderately well-drained Brunisolic Gray Luvisols developed on sandy loam to clay loam textured cordilleran till with fluvioeolian veneer. The SMR is mesic, and the SNR is poor, with a lodgepole pine/Labrador tea/feather moss plant community.

Mountain Pine Beetle attacks 2017-2020

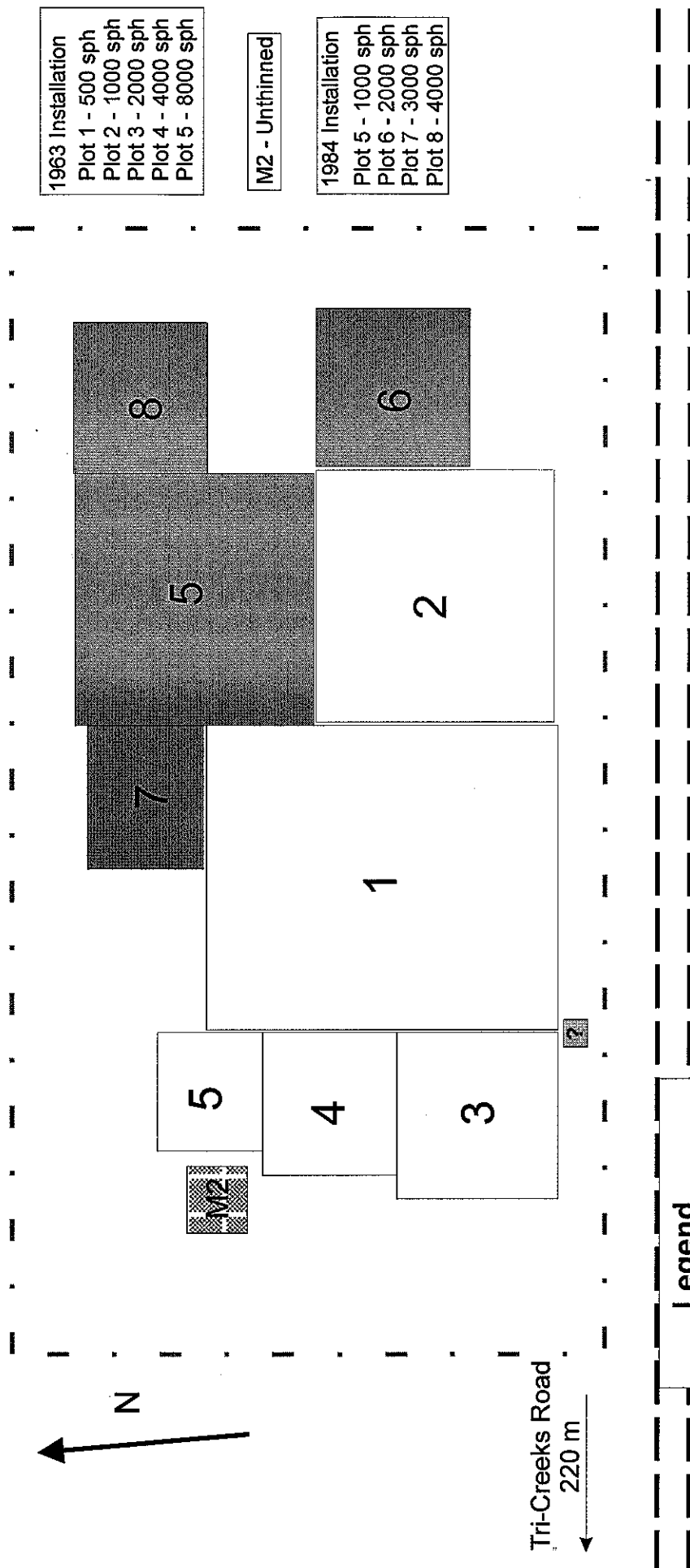






Gregg Burn 1963 and 1984 spacing experiments— medium productivity site, replicate 1. Note: sph = stems per hectare.

Gregg Spacing 1963 and 1984 Experiments- Medium Site 2nd Rep



1963 Installation
 Plot 1 - 500 sph
 Plot 2 - 1000 sph
 Plot 3 - 2000 sph
 Plot 4 - 4000 sph
 Plot 5 - 8000 sph

M2 - Unthinned

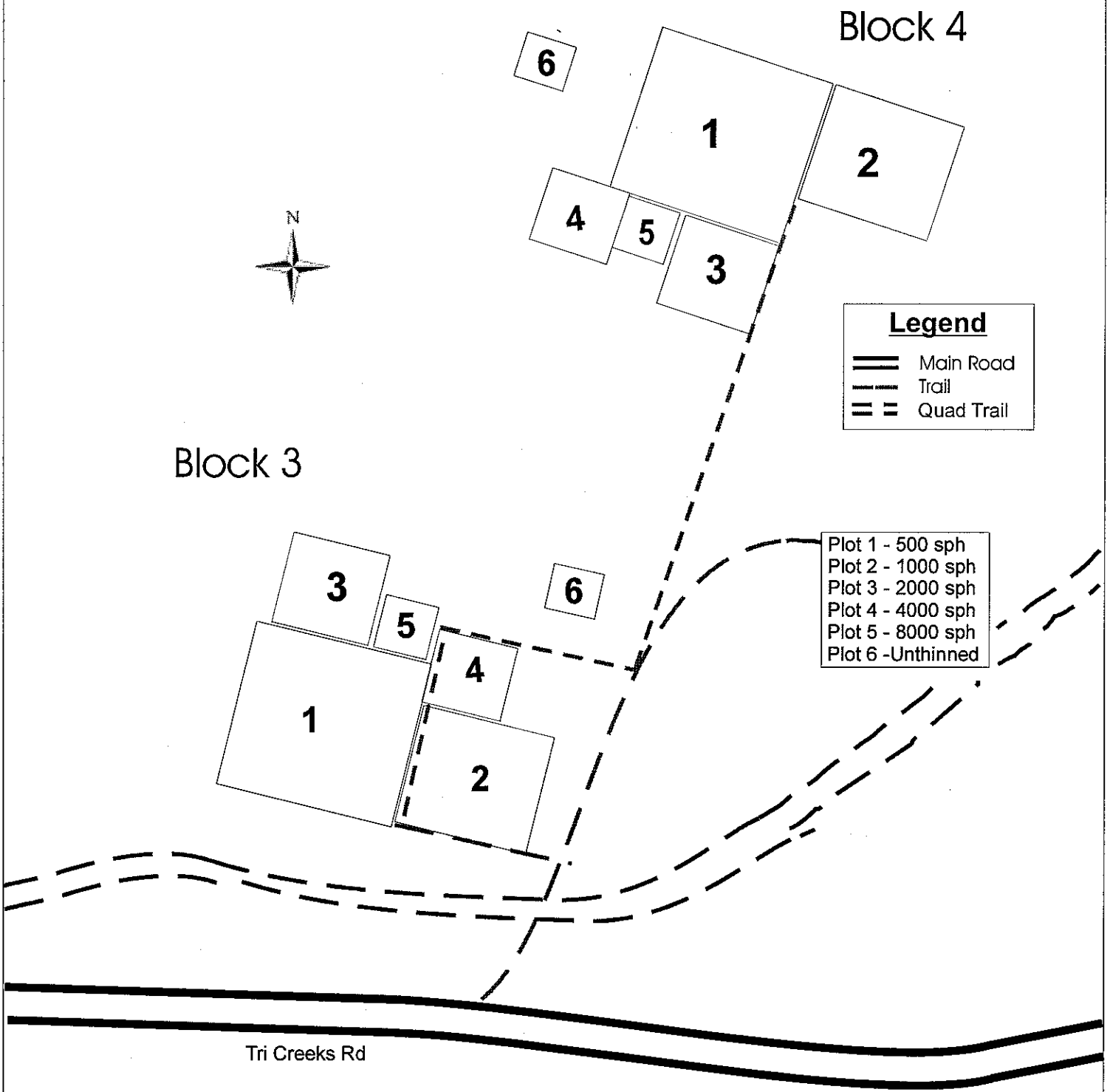
1984 Installation
 Plot 5 - 1000 sph
 Plot 6 - 2000 sph
 Plot 7 - 3000 sph
 Plot 8 - 4000 sph

Legend

- Quad Trail
- - - - - Boundary Paint
- 1984 Installation
- 1963 Installation
- ▨ Control
- Ⓜ Interpretive Sign

Prepared by:
 Richard Nobile
 Canadian Forest Service
 Date: November 2005

Gregg Burn 1963 Spacing Experiment - High Productivity Site



Legend

- == Main Road
- - - Trail
- - - Quad Trail

Plot 1 - 500 sph
Plot 2 - 1000 sph
Plot 3 - 2000 sph
Plot 4 - 4000 sph
Plot 5 - 8000 sph
Plot 6 - Unthinned

Tri Creeks Rd

45 meters

Prepared by:
Richard Noble
Canadian Forest Service
Date: December 2005

Late Rotation Commercial Thinning and Fertilization in Lodgepole Pine: An assessment on growth and mortality

Background

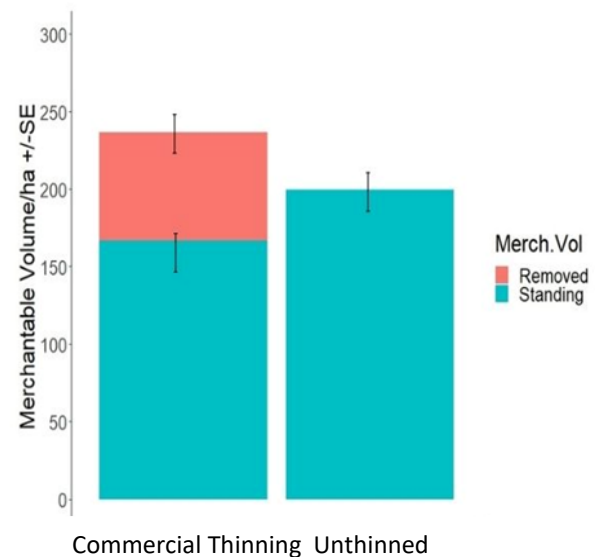
A factorial trial of thinning and six fertilization treatment (200 kg/ha N+blend, 200 kg/ha N+Boron, 400 kg/ha N+blend, 400 kg/ha N+ Boron, 400 kg/ha Ammonium nitrate +Boron and Control) was established in a 68-year-old-fire origin lodge pole pine stand in 2000. Thinning was a 50% BA area removal with merchantable volume removal of 70 m³/ha. The site is located in the upper foothills of natural sub-regions of Alberta within the eco-site “e”. The study below uses 20 years measurement data to answer the following questions.

- What is the stand level and individual tree level growth effect of thinning and fertilization on late rotation lodgepole pine?
- Does thinning and fertilization influence mortality, if so how?

Results

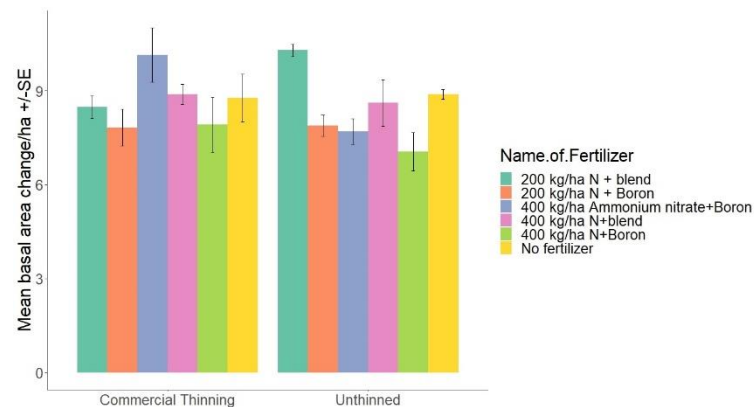
Merchantable Volume:

- The standing merchantable volume at age 88, 20 years after thinning was higher in unthinned stands than in thinned stands.
- However, cumulative merchantable volume (standing merchantable volume+ volume removed at thinning) is higher in thinned stands at all levels of fertilization.
- The total volume growth since thinning in unthinned stand was greater by 8.6 m³/ha than thinned stand, but was not significantly different.
- In addition, average DBH is greater in thinned stands (18.2 cm) than in unthinned stands (16.4) cm.



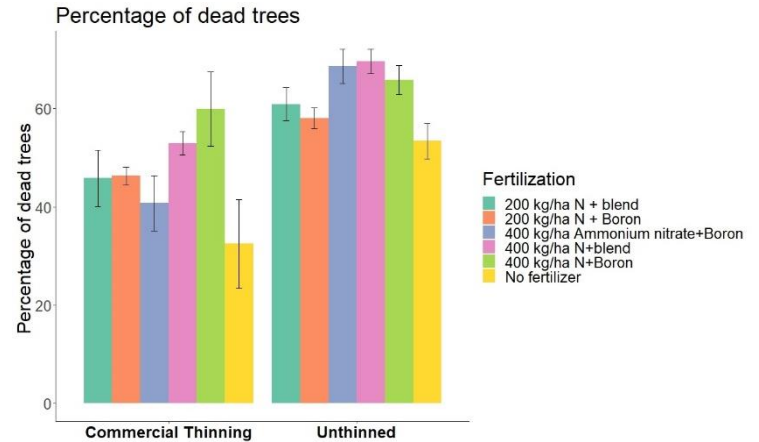
Basal Area Growth

- The mean basal area growth since thinning was similar ($P > 0.05$) between thinned and unthinned stands. Thinning with highest fertilization level had the greatest basal area growth of (11.14 ± 1.49) m²/ha.
- The balance between individual tree growth and mortality could be a reason for the insignificant difference.

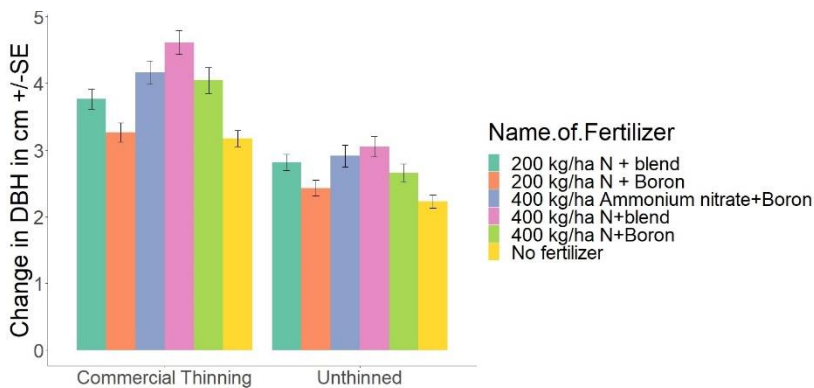


Mortality

- There are more dead trees (N= 1456) in unthinned stands than in the thinned stands (N= 546).
- Mortality increased with increasing fertilization level.
- For both levels of thinning, fertilization increased mortality for the smallest dbh classes (<10 cm).
- Merchantable tree mortality was higher in unthinned stands than thinned.



Individual Tree Growth



- DBH growth after twenty years was significantly greater in thinned stands than unthinned stands. The mean growth difference was by 1.2 cm.
- Average DBH growth increased with amount of fertilizer application, 400 kg/ha N > 200 kg/ha N > Control
- Within the fertilization levels, DBH growth was greatest in 400 kg/ha N+ blend.
- Growth varied by the diameter class and is skewed towards the largest trees.

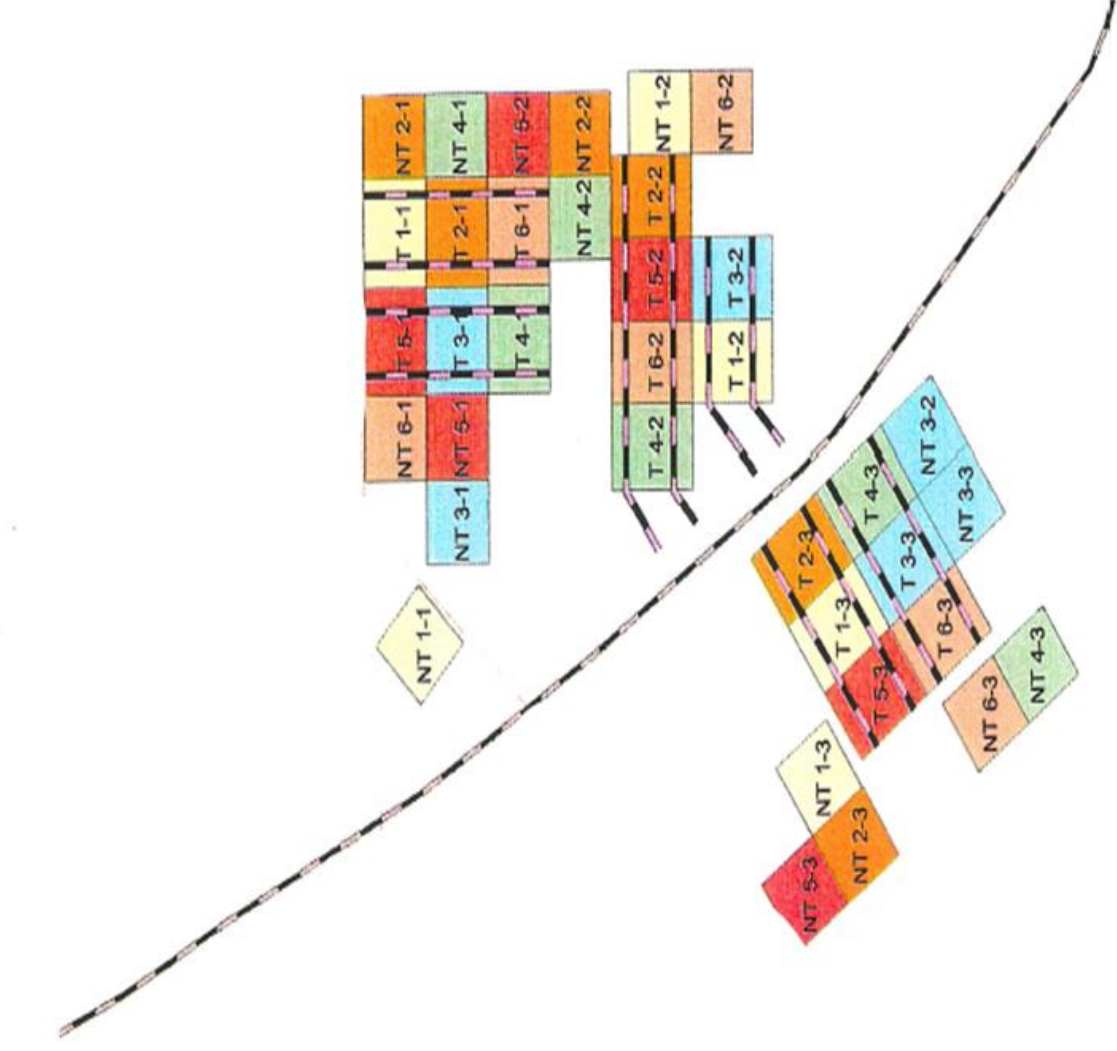
Key Take Away

- Commercial thinning results in greater cumulative volume due to increase in tree growth and capture of natural drain.
- Fertilization increases individual tree growth along with increased mortality. The effect is 400 > 200 > Control.
- Commercial Thinning and fertilization favors the individual level tree growth such as dbh, individual tree volume, and individual basal area. The growth rate increases with increasing level of fertilizers in most cases.







Next Steps

- Can we predict individual tree growth and mortality based on initial condition (dbh, crown, fertilizer level)?
- What is the temporal growth response of trees to thinning and fertilization?

Commercial Thinning and Fertilization Research Trial- Stand #5, McLeod 18



Fertilization

	200- N + Boron
	400- N + Boron
	200 N + blend
	400 N + blend
	400 NH ₄ NO ₃ + Boron
	No Fertilizer

Thinning

T	: Thinned
NT	: Non Thinned

Block and Plot

Plot-Block
e.g. NT 1-3 ; Non Thinned Plot 1 Block 3

Treatment Plots:

52m×40m in thinned block
40m×40m in unthinned block
Measurement Plots: 400m²

A Retrospective Study on Past Lodgepole Pine Precommercial Thinning Operations in Western Alberta

Background:

Operational precommercial thinning post harvest stands established during 1961-64 near Hinton, Alberta. The stands are categorized in to PCT (Pre commercial thinning) stands and un-thinned reference stands (10 stands).

PCT stands are further categorized in to two groups based on their age at thinning

- PCT -OLD: Thinned at 23-25 years - 10 stands
- PCT -YOUNG: Thinned at 17-19 years -10 stands

Research questions:

- 🌿 How does individual tree level and stand level growth responds to thinning?
- 🌿 Is the incidence of Western gall rust (WGR) affected by timing of thinning?

Preliminary results

A. Stand level -Summary table

Treatment	Density(stems/ha)	Basal area (m ² /ha)	Mer.Basal area(m ² /ha)	QMD(cm)	Total vol(m ³ /ha)	Mer.Vol(m ³ /ha)
PCT-OLD	1411	31.3	27.6	16.8	258.8	123.6
PCT-YOUNG	1405	31.8	27.7	16.8	257.5	124.4
REF	2063	31.2	22.4	13.9	232.7	89.5

- 🌿 All the treatments have comparable values of total tree volume, basal area however PCT stands have higher merchantable basal area (dbh \geq 13.5cm) and merchantable volume (15 cm min stump DOB).
- 🌿 The QMD values are higher in PCT stands.

B. Diameter Distribution

- 🌿 Number of merchantable trees (dbh \geq 13.5cm) is comparable in PCT and REF stands.
- 🌿 PCT stands have greater number of trees in larger diameter classes(dbh \geq 20cm).
- 🌿 More small trees in REF stands
- 🌿 No substantial differences between PCT treatments

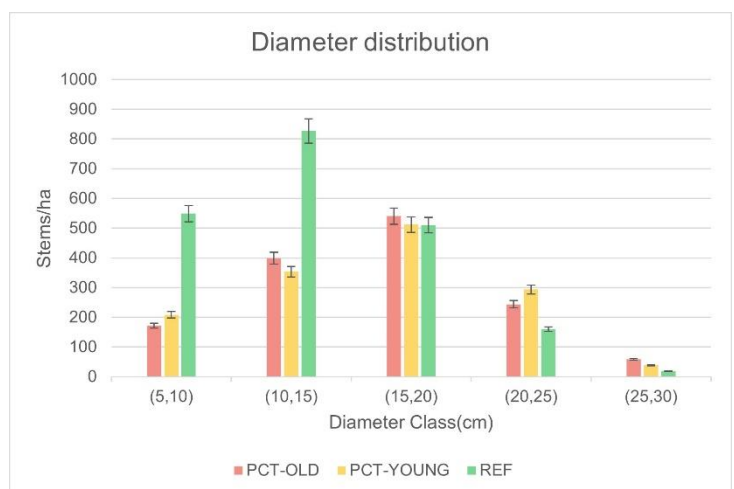


Fig 1. Diameter Distribution in different treatments

C. Western Gall Rust

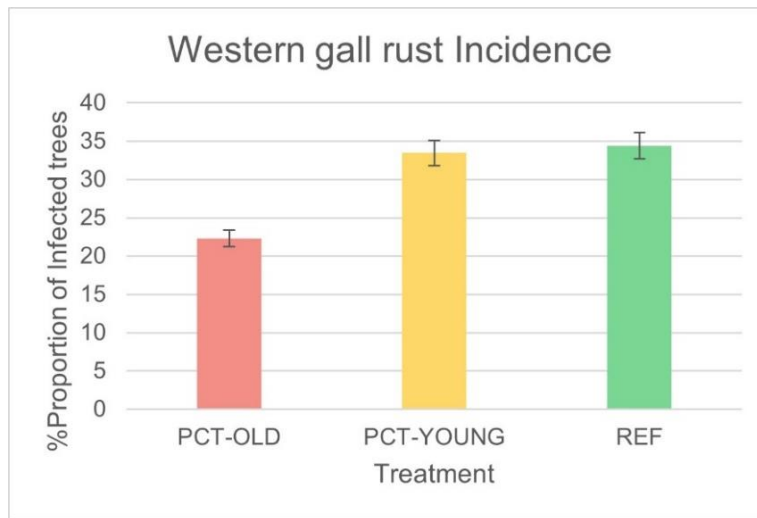


Fig 2. Western Gall Rust Infestation proportion in different treatments

- 🌿 PCT-Old stands have lower proportion of trees with stem galls.
- 🌿 Not much difference between PCT -Young stands and reference stands.

Key Take away

- 🌿 Even though stand level metrics like total basal area or total tree volume are comparable between PCT stands and un-thinned reference stands, PCT stands have greater merchantable volume and bigger trees. There is little difference between timing of thinning.
- 🌿 Delayed thinning results in reduced WGR infection, hence it should be considered in areas with higher WGR occurrence.

Next Steps

- 🌿 Tree cores collected will be used to evaluate the temporal response of individual trees to thinning and determine how long the growth rates are elevated.
- 🌿 Another step will be modeling to see when these stands reach varying merchantable status.