
White Pine Shelterwood
Creating & Managing Light Levels for
White Pine Regeneration

# History
# FFT Project 844-1-R36

- Sites that do not contain enough volume to carry out two removal cuts as was originally prescribed (200 hectares).
- Hardwood and balsam fir poles and smalls were not harvested at the time of the regeneration cut (1996-1998).
- With only one removal cut left, no FRT funds will be generated to carry out required tending & stand improvement

# History
# FFT Project 844-1-R36

- These sites did not have adequate light conditions to bring the white pine regeneration to the required 6 meters to carry out final removal

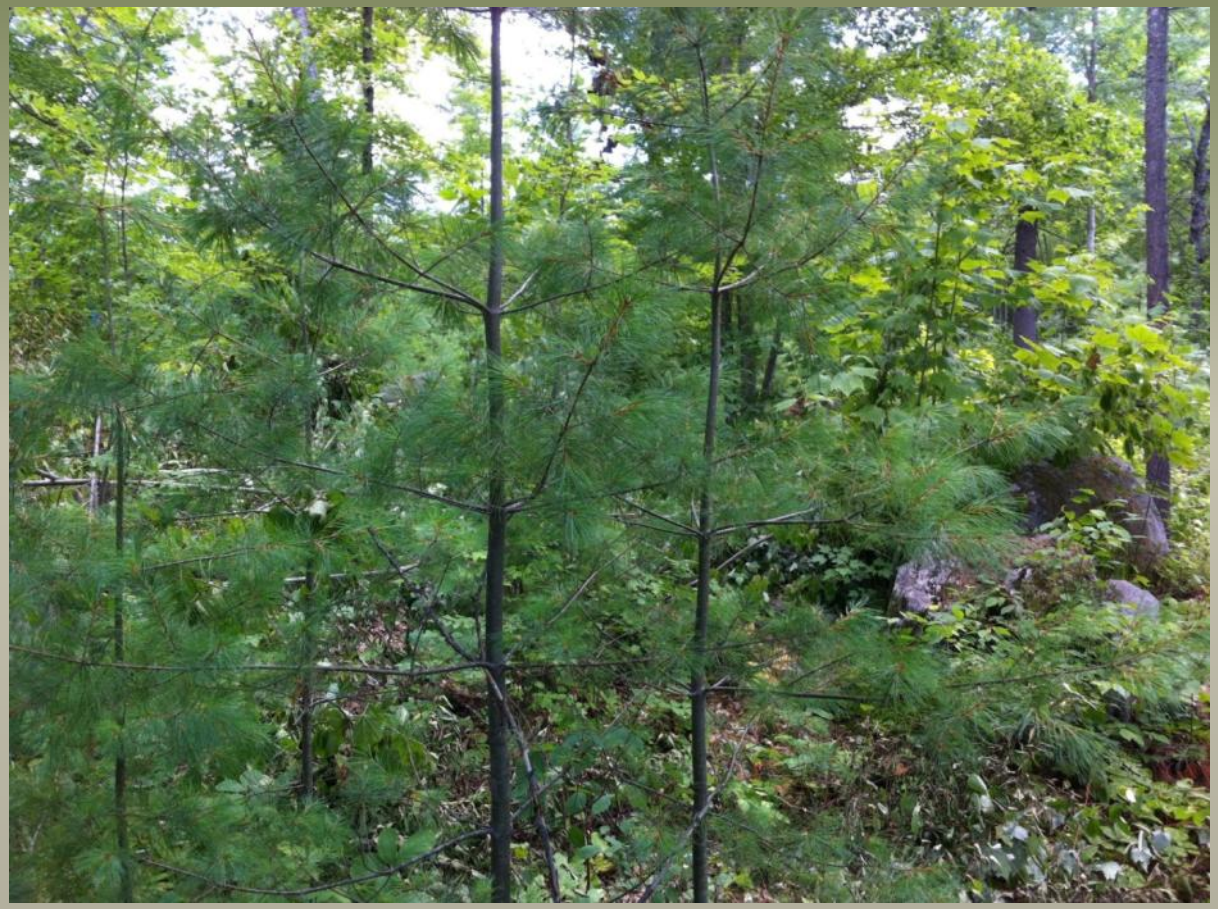
- Investments in renewal treatments have been made.

# Objective
# FFT Project 844-1-R36

- To provide optimal light conditions for white pine regeneration by removing mid-canopy and competition.

# Objective
# FFT Project 844-1-R36

- To ensure these light conditions remain until white pine regeneration is 6 meters tall and a final removal can be carried out.



# Block(s) Description

- Uniform Shelterwood Seed cut 1996-1998
- Mechanically site preparation 1998-2000
- Tree plant (white pine) 1999-2001
- Chemical tending (Air Blast Spray) 2002-2004
- Scattered blowdown 2006
- Enhanced Tending 2013

# Understory Description

## Target Regeneration Description

- White Pine Height 1-3 meters Stocking .35
- Red Oak Height 1-4 meters Stocking .15
- White Spruce, Hemlock, Yellow Birch scattered throughout


Target
Regeneration

# Understory Description

## Competition - Understory Description

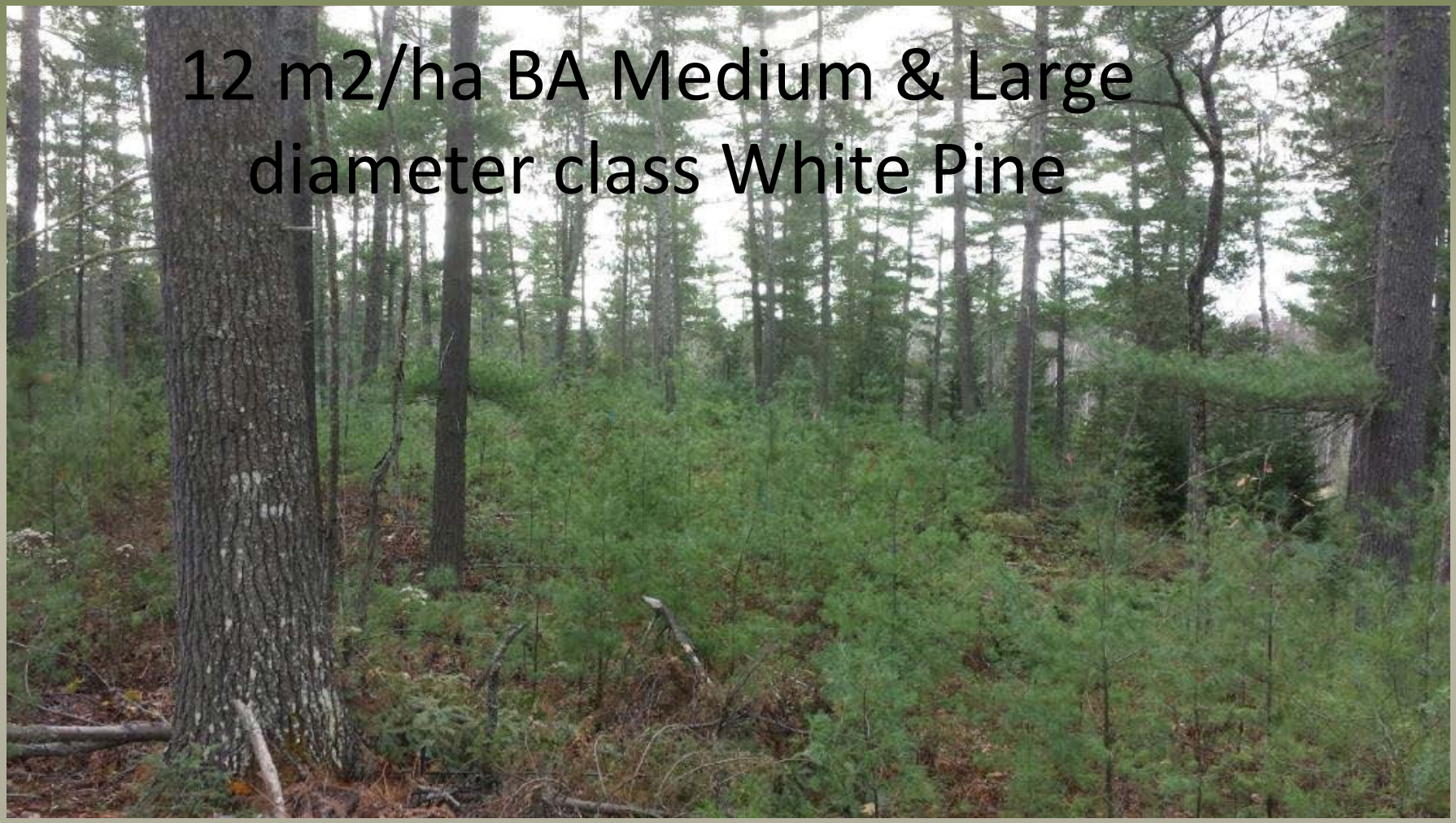
- Red Maple/Sugar Maple/Balsam Fir/Beech Height 3-5 meters Stocking .6

## Competition – Mid-Canopy Description

- Red Maple/Sugar Maple/Balsam Fir/Beech
- Height 6-10 meters
- Basal Area 8 m2/ha

# Competition

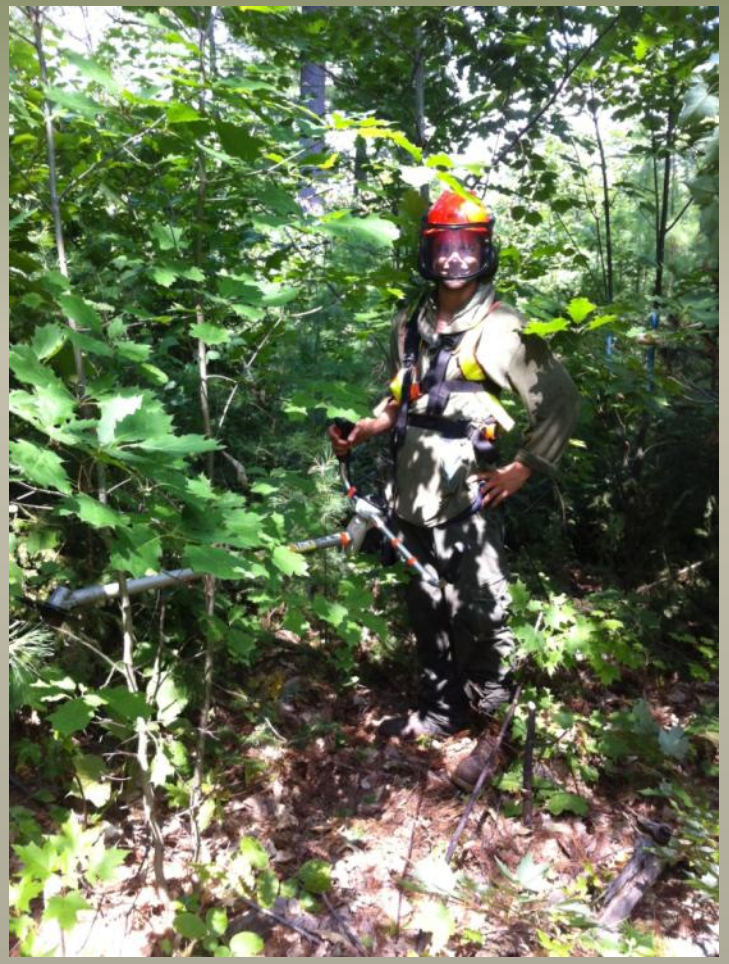
# Overstory Description



# Project Details
# FFT Project 844-1-R36

**Enhanced tending occurred in two phases.**

- Tended with brushaws during July-August 2013.



# Project Details
# FFT Project 844-1-R36

- Competition was removed in a 2 meter radius around all target regeneration
- Cut stump heights are 50 cm in height to promote poor re-sprouting

# Project Details
# FFT Project 844-1-R36

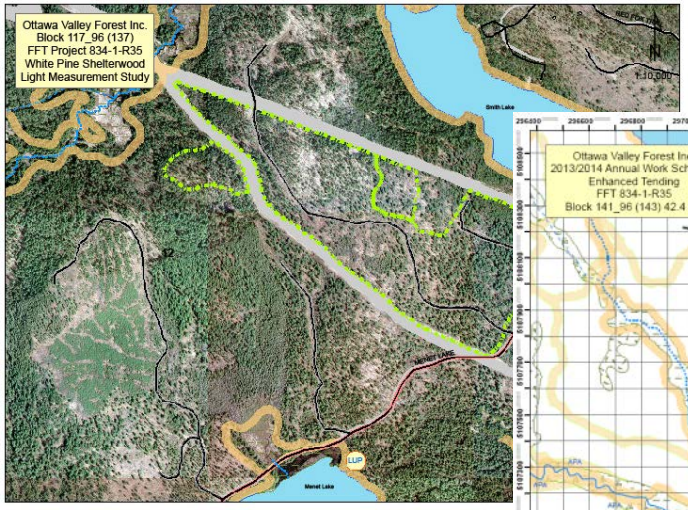
- Stand improvement was carried out in the fall with chainsaws.

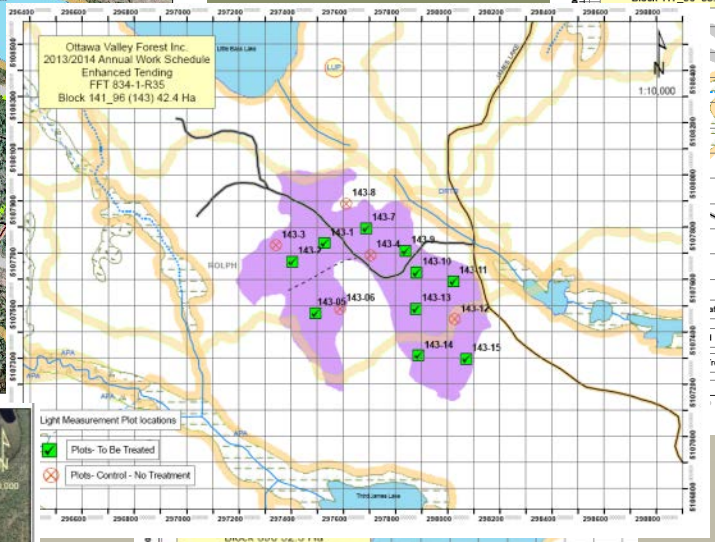
# Project Details
# FFT Project 844-1-R36

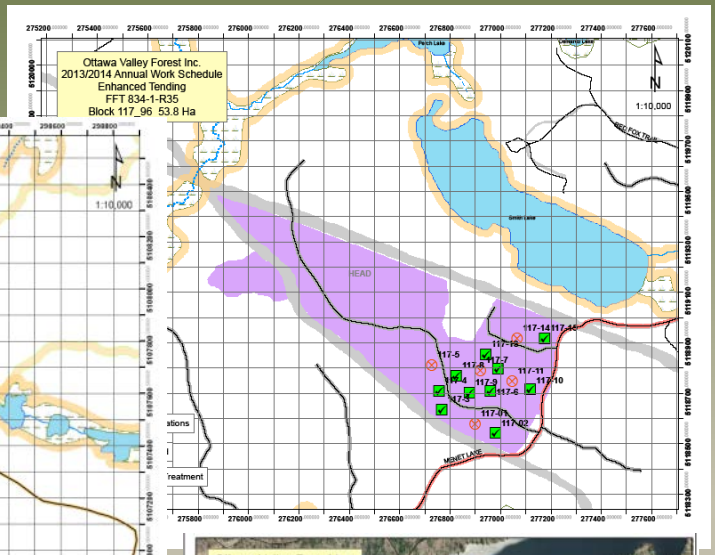
- Removed mid-canopy trees up to 20 cm dbh. Negotiations required due to merchantable pieces being harvested.

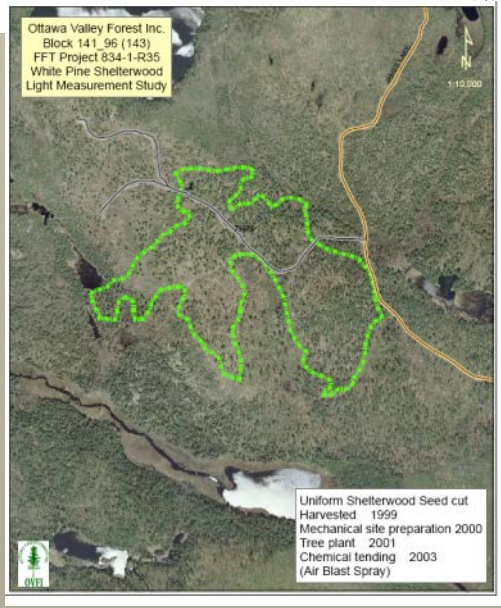
# Location Location Location

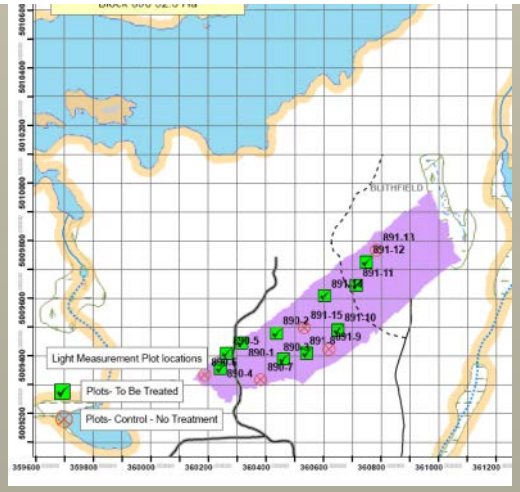
# Plot Locations

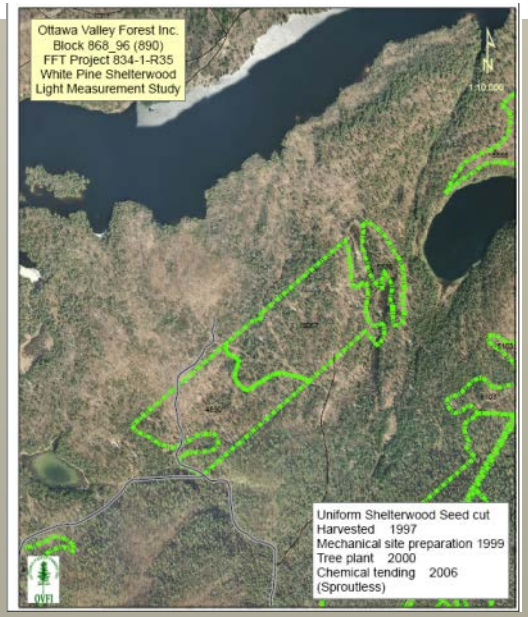


# Plot Description

- Fifteen plots were established (14 meter radius) in each block

- 5 plots were control plots and did not receive treatment.

# Plot Description

- All trees 10 cm DBH and greater were measured by species.
- Plot centers and boundaries were identified and gps'd.

# Plot Description

- photos  (digital hemispherical)will be taken pre and post mid-canopy removal treatment.

# Plot Description

- FTG Surveys were carried out at every plot (SOI-Stars)

# To Do List

- Canopy photos were analyzed over the winter 2013/2014.
- All tallied information was compiled and summarized over the winter of 2013/2014.
- A report was prepared with all the information mentioned above.
- Monitoring of regeneration and their response to the treatment will continue annually.

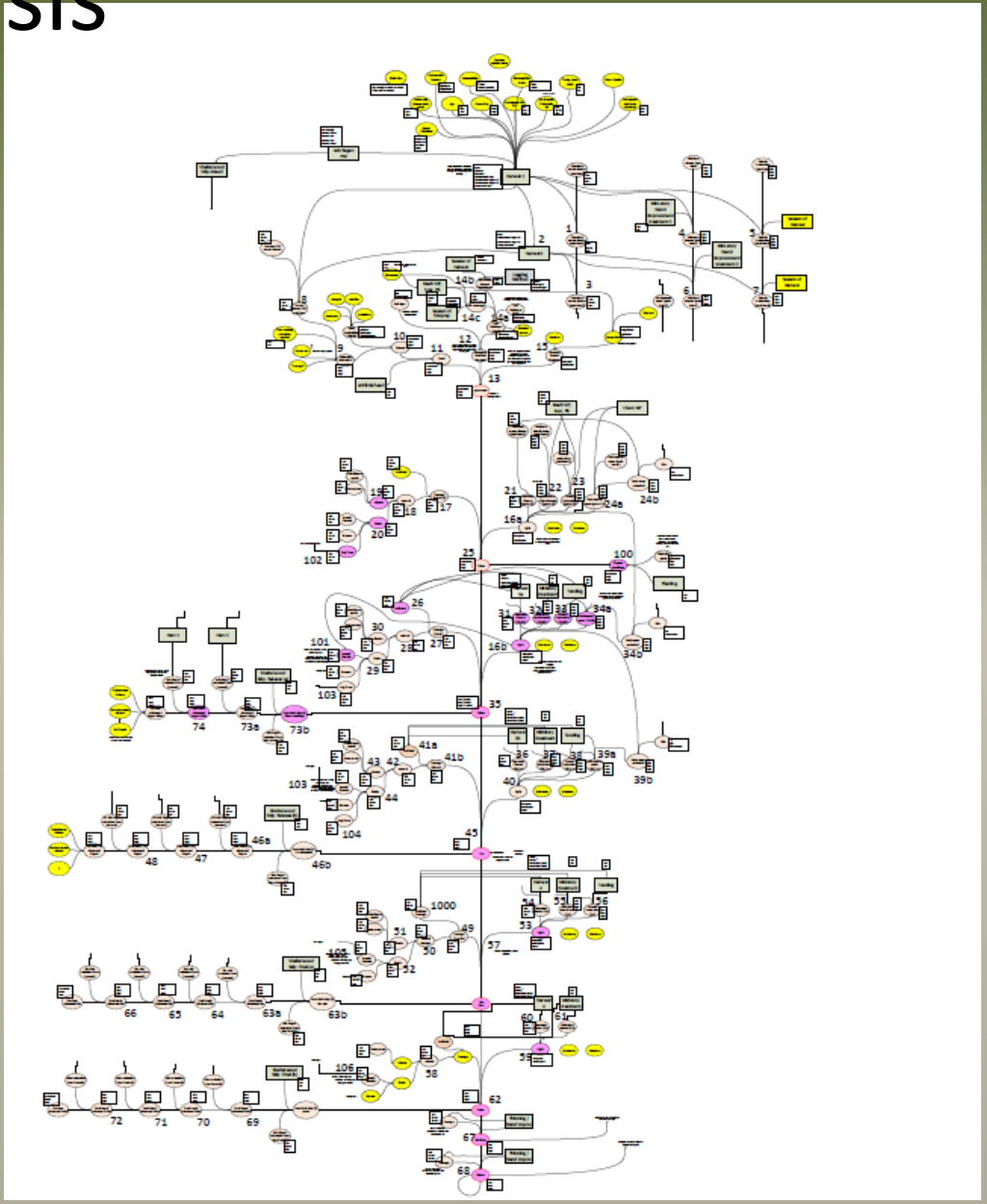
# The Results

- Light levels prior to treatment = 1-15%
- Light levels post treatment = 7- 45%
- Reduced density of midstory up to 46%
- Increased gap light index up to 60%.

Technical Report TR-002 (William C. Parker, Andree E. Morneault & Liz Cobb)

# Knowledge Synthesis

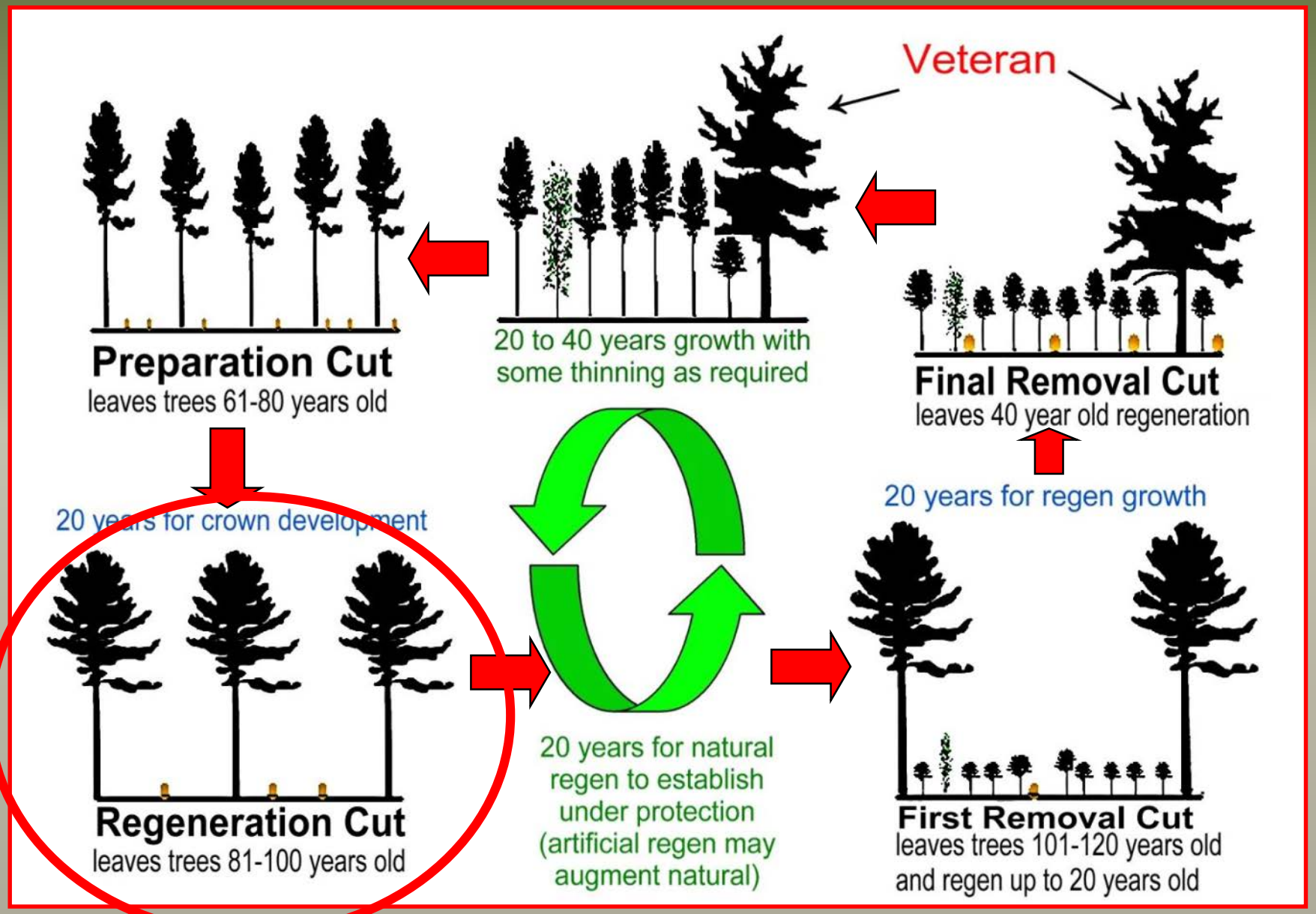
- Uses experience and knowledge with Bayesian Belief Networks (BBN) to aid in determining successful approaches to white pine management.
- BBN portrays the variables within specific goals and treatment paths (e.g. a future forest stand)
- Variables include: physical site conditions, competing vegetation, and management interventions
- BBN developed for white pine for the silvicultural guide and is included in the background and rationale document.



# White Pine Management

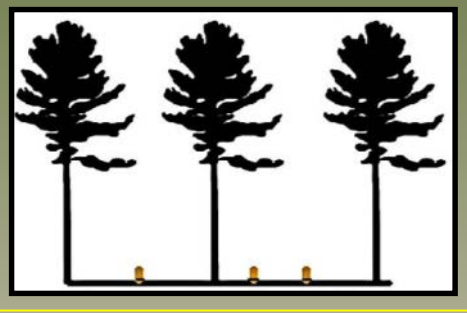
The goal is to create optimal light conditions for the establishment and continued growth of white regeneration until final removal.

# Review: Uniform Shelterwood Management



# 3-Cut Shelterwood – Natural Regeneration - Best Results when:

Site: low competition, low potential for competition; high stocking, almost pure Pwr pre-harvest



## Regeneration Cut

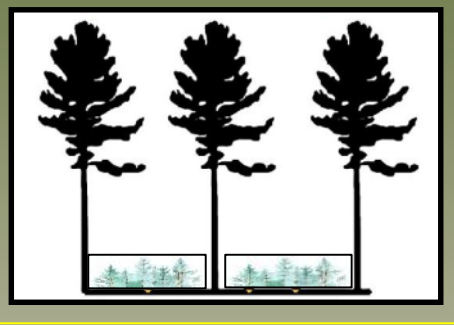
Retain:

- ✓ ≈18 $m^2$/ha, 50-60% CC
- ✓ 45-53% sunlight
- ✓ thin from below
- ✓ 100-120 stems per ha
- ✓ ½ to 1/3 crown spacing

## Establish Abundant Regen

- ✓ high % of soil disturbance
- ✓ excellent competition control
- ✓ bumper seed year

= early site capture by excessive amounts of regen



## Removal/Release Cut

- ✓ Careful logging
- ✓ Retain:
- ✓ ≈12 $m^2$/ha, 40% CC

= lower weevil and blister rust

## Regeneration grows

- ✓ monitor
- ✓ tend, if required

## Final Removal Cut

- ✓ Careful logging
- ✓ Retain residual trees according to guidelines

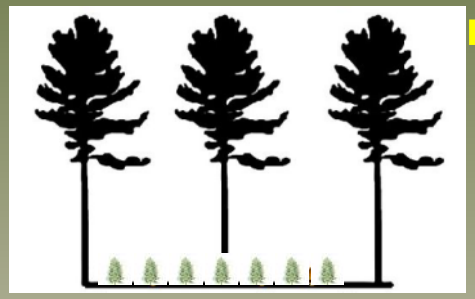
# 2-Cut Shelterwood – Planted Regeneration - Best Results when:

Site: High stocking, mixed stand, cannot retain 18 m2/ha, 60% CC dom/co-dom, evenly distributed Pwr+companion species, thin from below

## Regeneration Cut

Retain:

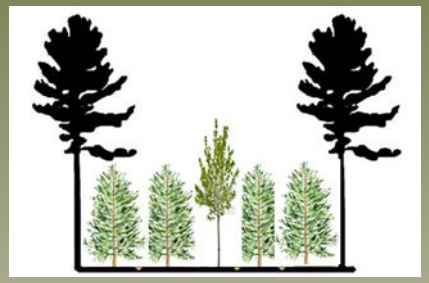
- ✓ ≥12 $m^2$/ha, 40-50% CC
- ✓ 53-61% Sunlight
- ✓ 55-80 stems per ha
- ✓ thin from below
- ✓ ½ to 2/3 crown spacing



## Plant

- ✓ Plant ≥1200 trees/ha
- ✓ excellent competition control

= early site capture by pine regeneration

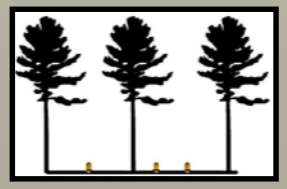


## Regeneration grows

- ✓ monitor
- ✓ tend

## Final Removal Cut

- ✓ Careful logging
- ✓ Retain residual trees according to guidelines



3-Cut Shelterwood

# Partial shade and white pine growth

- Light levels of
  - ≤25% of full sunlight - poor survival and growth
  - ≈30% - competitive height growth
  - 40% to 50% - maximum height growth
  - >50% - maximum volume growth
- Thin from below
- Stay over 30% light overstory+midstory+understory
- Aim for >45% light to maximize height growth
- More would be better – how much more before weevil problems get bad?

(Logan 1966, Messier *et al.* 1999, Boucher *et al.* 2007, Fahey and Lorimer 2013, Parker 2014)

Overstory

Midstory

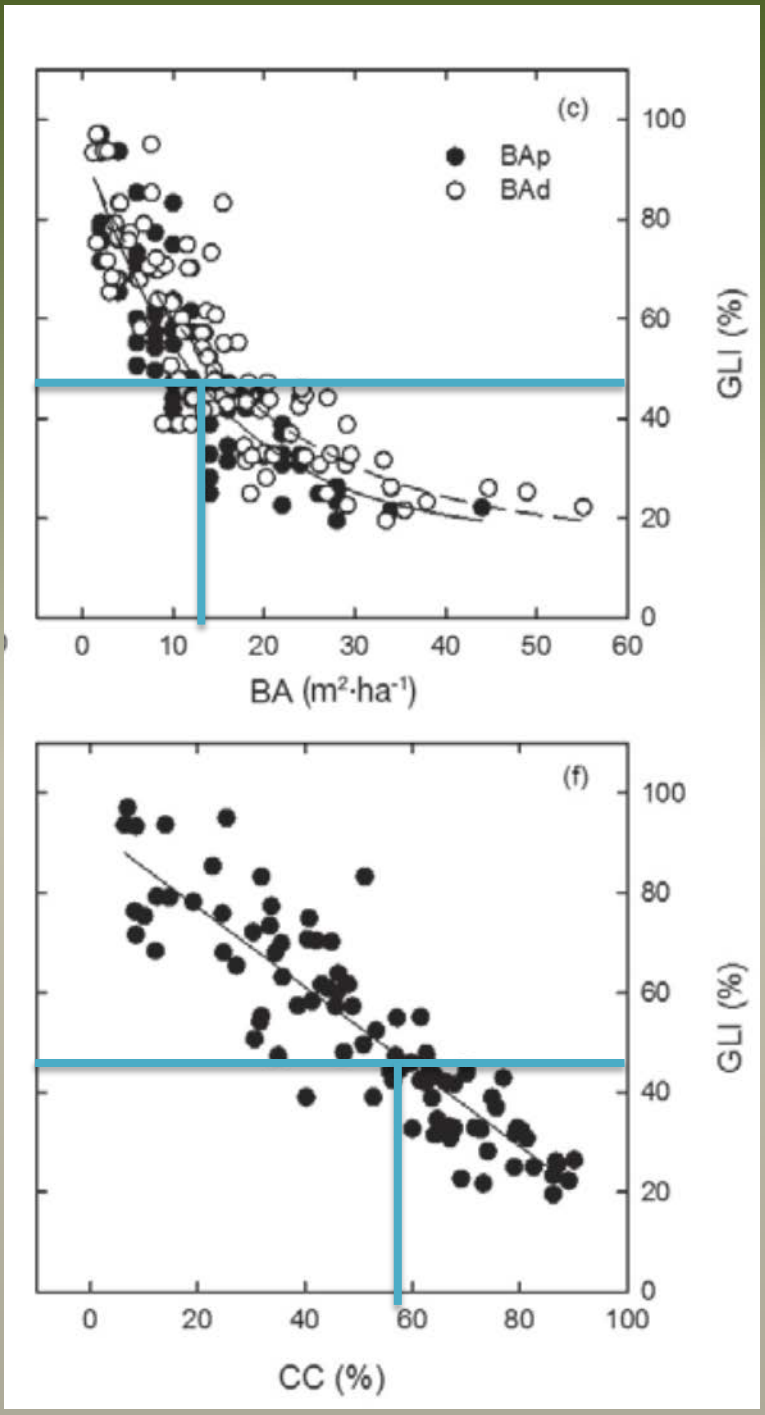
Understory

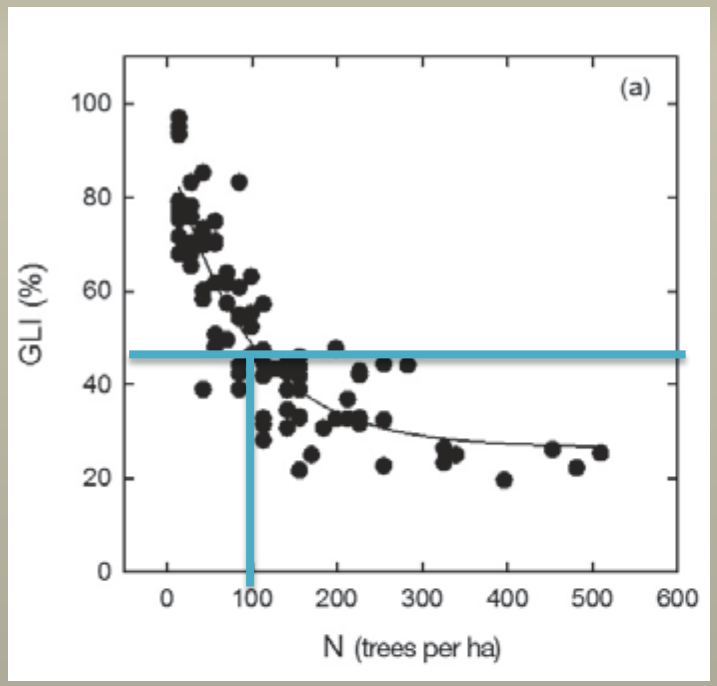
# Partial shade and competition

- Shade does not “control” competition
- Overstory reduces light, any additional competition reduces light even more
- Shade can reduce the vigor of intolerant competition
- Deep shade can reduce soil temperature – reduce root suckering of poplar, germination of seedbanking species

6 years

# Relationship between stand metrics and light




(Parker 2014)

# Relationship between Basal Area & Crown Closure

| Basal Area Prism 2 | Crown closure % y=plot data | Crown Closure % y=prism |
|---|---|---|
| 0 | 0.00 | 0.00 |
| 2 | 10.74 | 13.20 |
| 4 | 20.18 | 24.45 |
| 6 | 28.49 | 34.04 |
| 8 | 35.81 | 42.21 |
| 10 | 42.24 | 49.17 |
| 12 | 47.90 | 55.10 |
| 14 | 52.88 | 60.16 |
| 16 | 57.27 | 64.46 |
| 18 | 61.12 | 68.13 |
| 20 | 64.51 | 71.26 |
| 22 | 67.50 | 73.93 |
| 24 | 70.13 | 76.20 |
| 26 | 72.44 | 78.13 |
| 28 | 74.47 | 79.78 |
| 30 | 76.26 | 81.19 |
| 32 | 77.83 | 82.39 |
| 34 | 79.22 | 83.41 |
| 36 | 80.44 | 84.28 |
| 38 | 81.51 | 85.02 |
| 40 | 82.45 | 85.65 |

# Crown Closure Including Mid-Canopy

# Crown Closure Mid Canopy Removed

# So What Is Crown Closure Anyway?

- A measurement identifying the amount of light that is able to penetrate to the forest floor.

- 0-9% Very Sparse – Full Sunlight
- 10-29% Sparse – Abundant Sunlight
- 30-49% Low – Moderate Sunlight
- 50-69% Medium – Some Sunlight
- 70-84% Dense – Limited Sunlight
- 85-100% Very Dense – No Sunlight

# 30 % Crown Closure

- 31.62% Crown Closure
- 8 m2/ha
- Manage for Red Pine
- High Blister Rust Risk
- High Weevil Risk

# 40% Crown Closure

- 40.74% Crown Closure
- 10 m2/ha
- Weevil Risk
- Blister Rust Risk
- One Removal Cut

# 60% Crown Closure

- 59.96% Crown Closure
- 20m2/ha
- Two Removal Cuts

# 30 % Crown Closure

- 30.58% Crown Closure
- 6 m2/ha
- Manage for Red Pine
- High Blister Rust Risk
- High Weevil Risk

# 50% Crown Closure

- 51.12% Crown Closure
- 10 m2/ha
- One Removal Cut

# 40% Crown Closure

- 40.46 % Crown Closure
- 8 m2/ha
- Weevil Risk
- Blister Rust Risk
- One Removal Cut

# 50% Crown Closure

- 48.78% Crown Closure
- 10m2/ha
- One Removal Cut

# 60% Crown Closure

- 61.52% Crown Closure
- 12m2/ha
- One Removal Cut

# Keys to Success

- Removal of mid canopy
- Ensure uniform crown closure through tree marking & harvest
- Vegetation management
- Tree plant
- Realistic & economic ability to perform removal cuts
- Need more flexibility in the FMP Process to complete removal cuts when required.