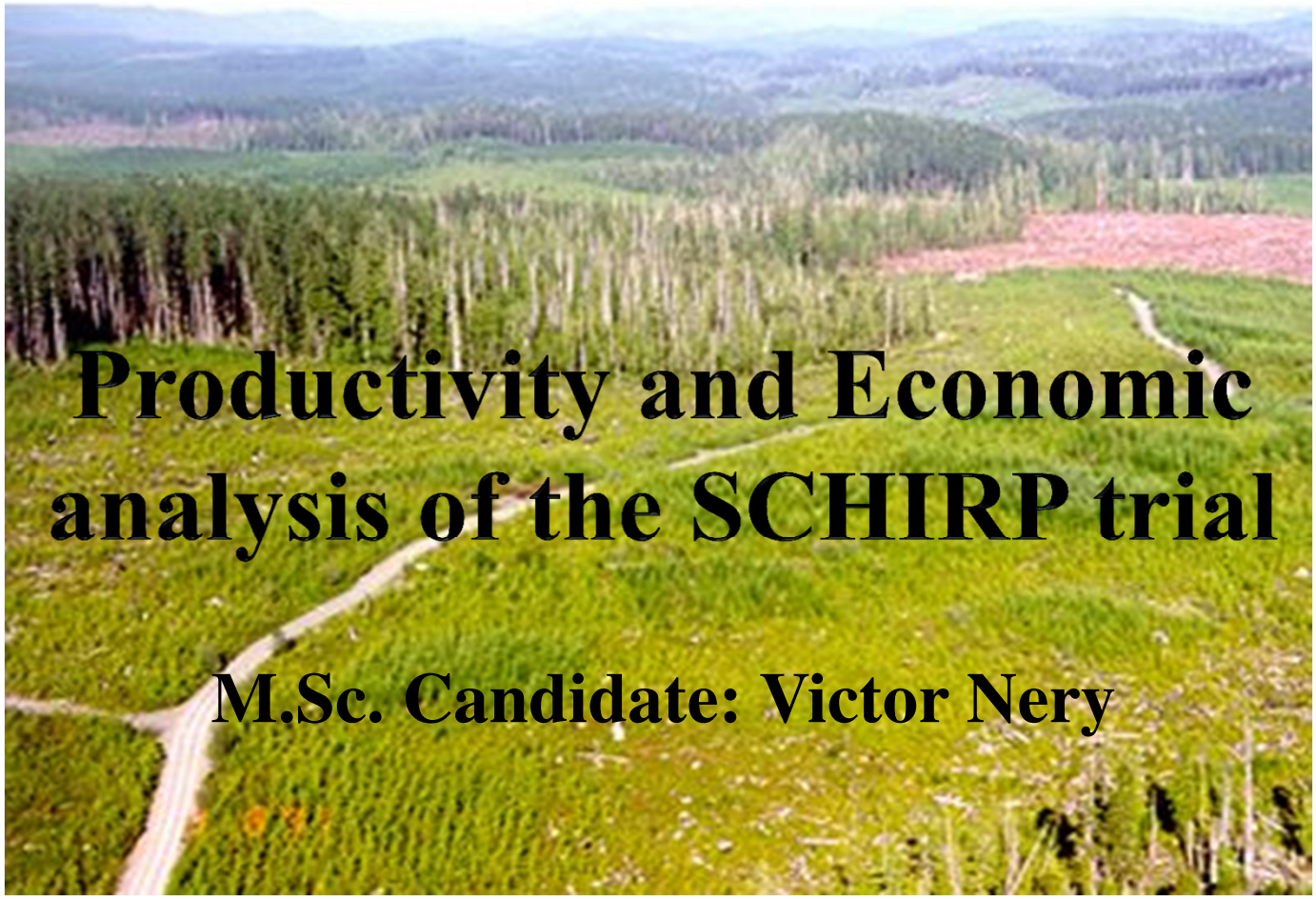


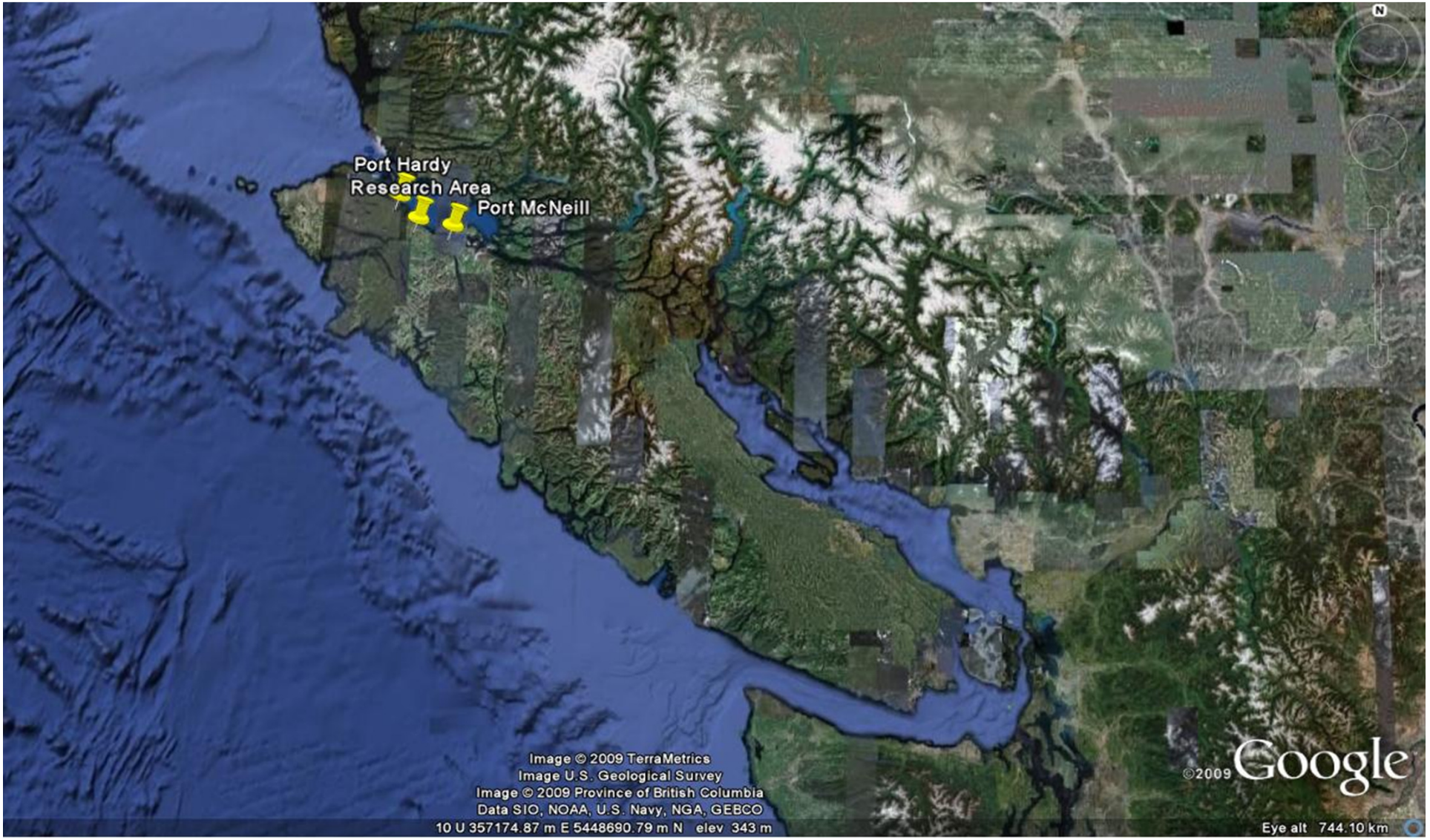
Productivity and Economic analysis of the SCHIRP trial

M.Sc. Candidate: Victor Nery

Committee:
Dr. Cindy E. Prescott
Dr. Peter L. Marshall
Dr. Harry Nelson

WESTERN FOREST PRODUCTS INC.

“SCHIRP”

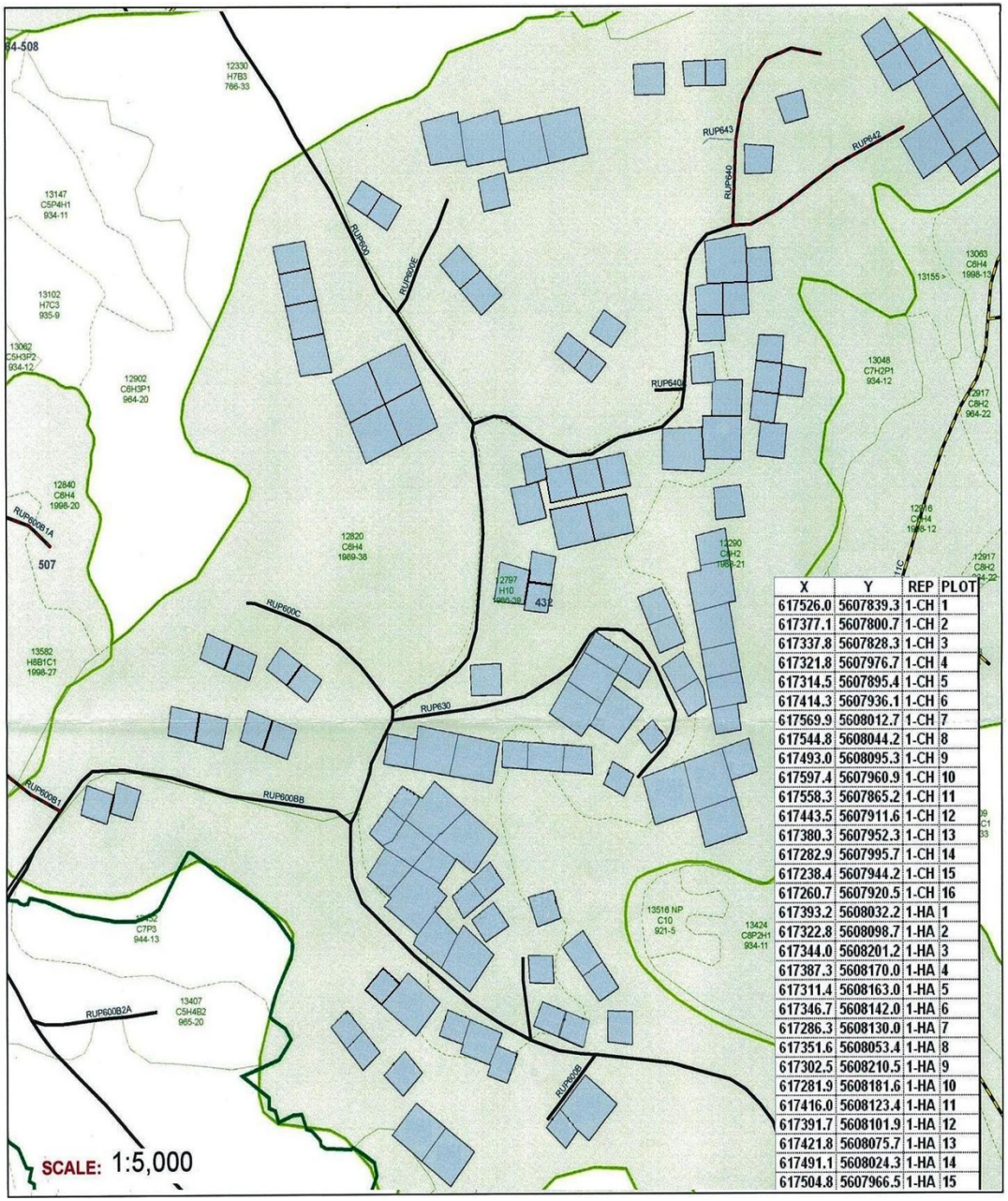

Port Hardy
Research Area
Port McNeill
Image © 2009 TerraMetrics
Image U.S. Geological Survey
Image © 2009 Province of British Columbia
Data SIO, NOAA, U.S. Navy, NGA, GEBCO
10 U 357174.87 m E 5448690.79 m N elev 343 m
©2009 Google
Eye alt 744.10 km

“SCHIRP”

- Salal Cedar Hemlock Integrated Research Program
- Established in the winter 1987/88
- Objectives:
  - to determine the underlying causes of poor growth of regenerating Western red cedar (Thuja plicata), Western hemlock (Tsuga heterophylla), Amabilis fir (Abies amabilis) and Sitka spruce (Picea sitchensis) on cedar-hemlock cutovers invaded by Salal (Gaultheria shallon) on the west coast of North America
  - to establish the best operational means for improving productivity on these sites

Website: http://www.forestry.ubc.ca/schirp/homepage.html

Research sites



X	Y	REP	PLOT
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617377.1	5607800.7	1-CH	2
617337.8	5607828.3	1-CH	3
617321.8	5607976.7	1-CH	4
617314.5	5607895.4	1-CH	5
617414.3	5607936.1	1-CH	6
617569.9	5608012.7	1-CH	7
617544.8	5608044.2	1-CH	8
617493.0	5608095.3	1-CH	9
617597.4	5607960.9	1-CH	10
617558.3	5607865.2	1-CH	11
617443.5	5607911.6	1-CH	12
617380.3	5607952.3	1-CH	13
617282.9	5607995.7	1-CH	14
617238.4	5607944.2	1-CH	15
617260.7	5607920.5	1-CH	16
617393.2	5608032.2	1-HA	1
617322.8	5608098.7	1-HA	2
617344.0	5608201.2	1-HA	3
617387.3	5608170.0	1-HA	4
617311.4	5608163.0	1-HA	5
617346.7	5608142.0	1-HA	6
617286.3	5608130.0	1-HA	7
617351.6	5608053.4	1-HA	8
617302.5	5608210.5	1-HA	9
617281.9	5608181.6	1-HA	10
617416.0	5608123.4	1-HA	11
617391.7	5608101.9	1-HA	12
617421.8	5608075.7	1-HA	13
617491.1	5608024.3	1-HA	14
617504.8	5607966.5	1-HA	15

- 128 plots - 64 CH and 64 HA
- 8 blocks (4 CH and 4 HA)
- 2 species (Western Hemlock and Western Red cedar)
- 3 types of density (500, 1500, 2500 stems/ha)
- Fertilized at the time of planting (17-10-10, slow release)
- Re-fertilized in 1993 - broadcast application (225kg of N and 75Kg of P)
- Re-fertilized in 2004 - broadcast application (225kg of N)

Latest reports

CH

- Salal should be controlled
- The conifer should be planted immediately after harvest and if possible at high densities
- Fertilizing with N and P is strongly recommended at the time of planting
- In case of no fertilization, Western red cedar would be the species of choice
- Western hemlock is only feasible accompanied by multiple fertilizations

Blevins and Niejenhuis (2003)

HA

- "HA" sites showed a much greater growth rate
- In some cases, fertilized "HA" had double increment of volume and Periodic annual increment compared to "CH"
- "HA" sites should carry most of the investment in silvicultural treatments because of its higher growth rate

Negrave et al. (2007)

Field Work


Salal Cedar Hemlock Integrated Research Program
SCHIRP
MAJOR TRIAL AREA
1988
This area contains 128 plots of 35,000 western hemlock and red
cedar trees planted at 2500, 1500 and 500 per hectare on two
ecosystem phases with different cultivation/fertilization
treatments. The area was harvested in 1986, prescribed burned in

CH – Cedar not fertilized

CH – Cedar fertilized

CH – Hemlock not fertilized

HA – Hemlock fertilized

Statistical Analysis

CH

- Significant interaction between Species, Fertilization and Density for height, basal area and volume
- Significant interaction between Species and Fertilization

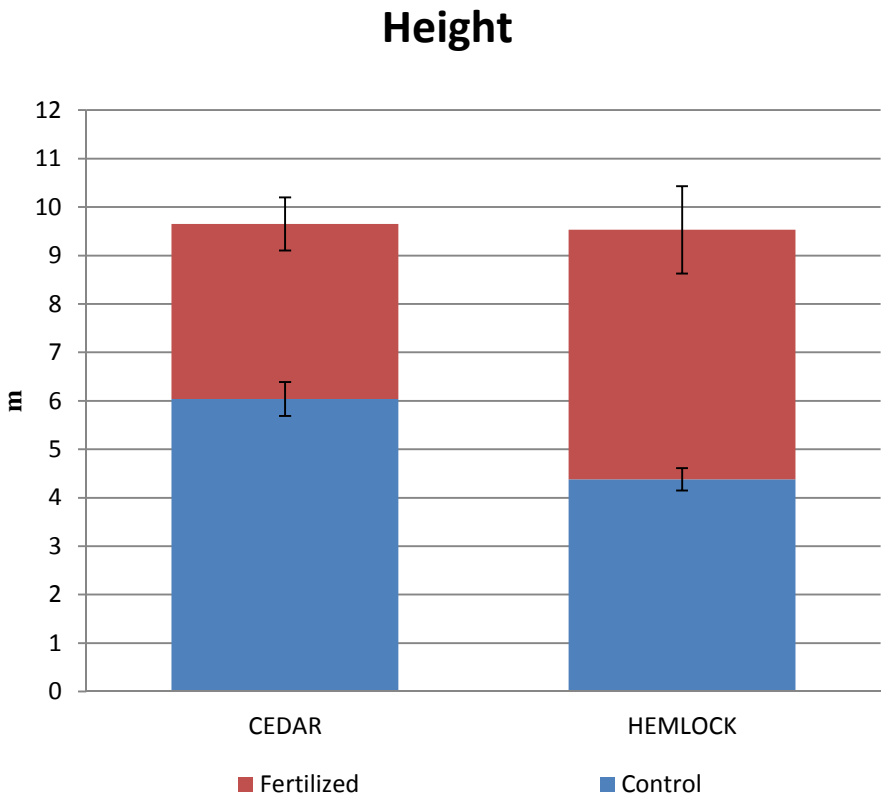
HA

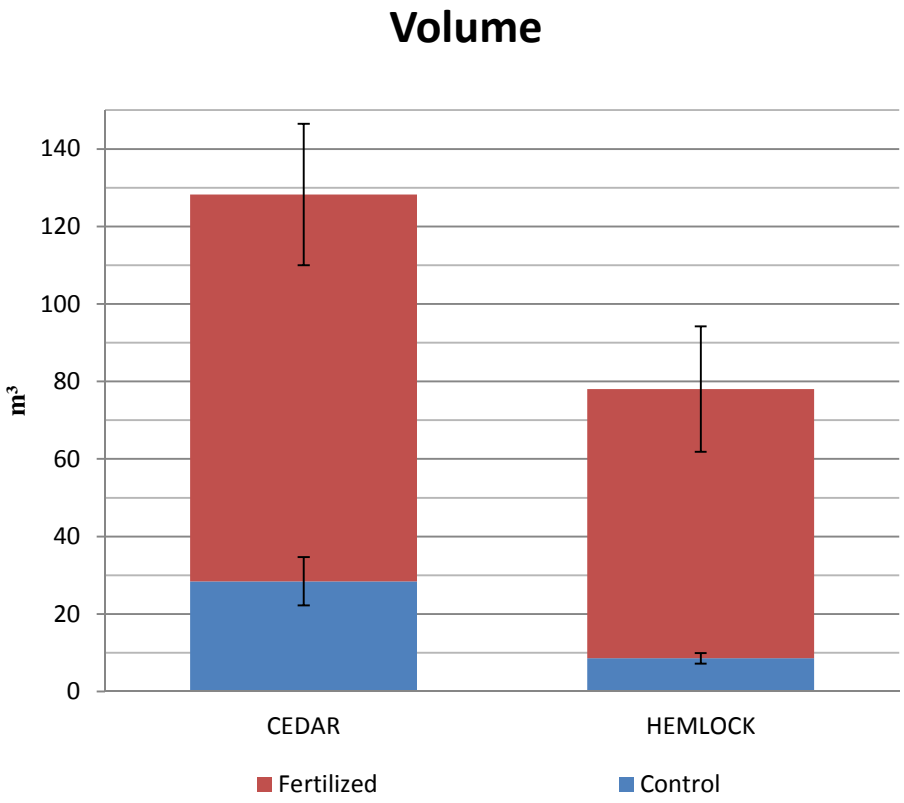
- Significant interaction between Species and Fertilization for height, basal area and volume
- No significant difference in height between different densities
- No significant interaction between species and fertilization
- Significant interaction between fertilization and density

Mixed-effects model (Proc Mixed in SAS) $P < 0.05$

Cumulative effect (21 years)

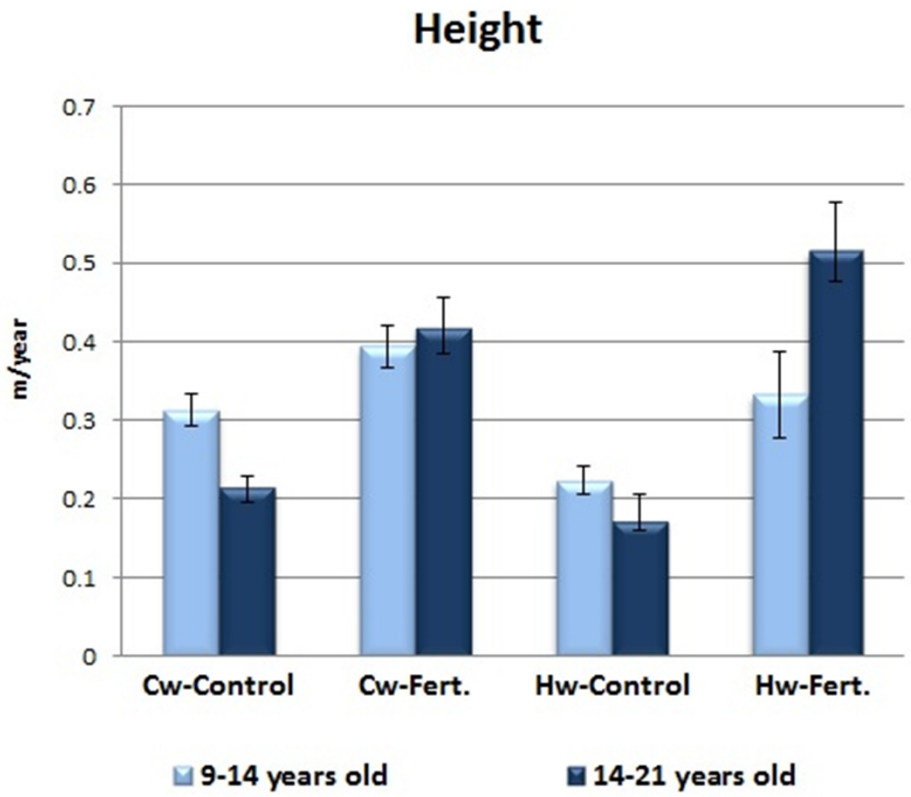
CH - 1500 st/ha

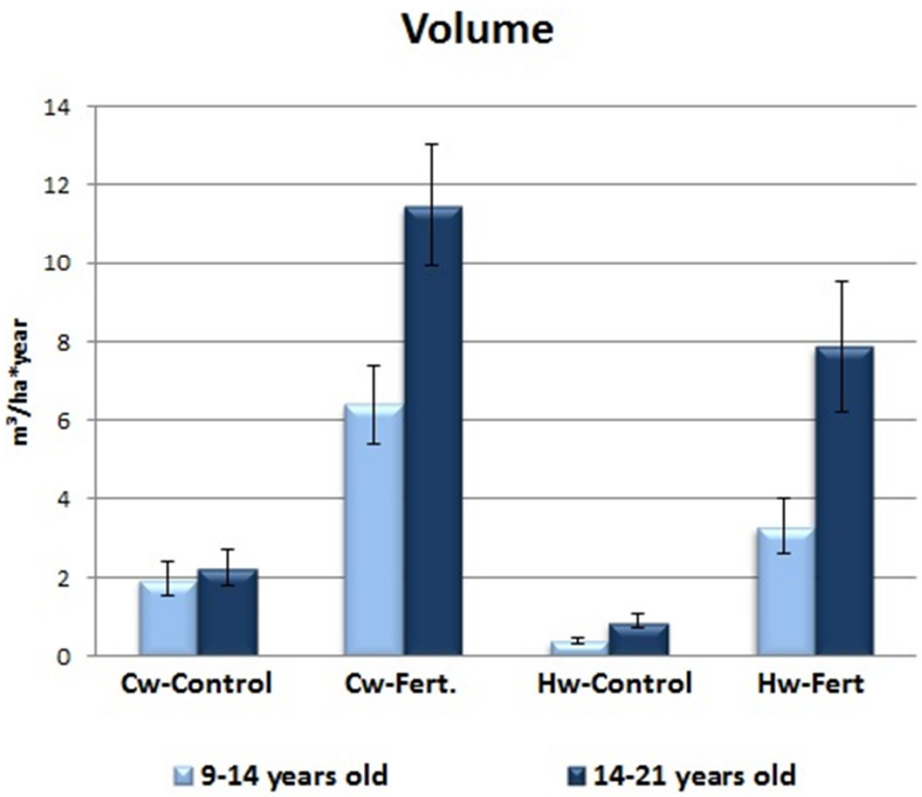




Annual Growth

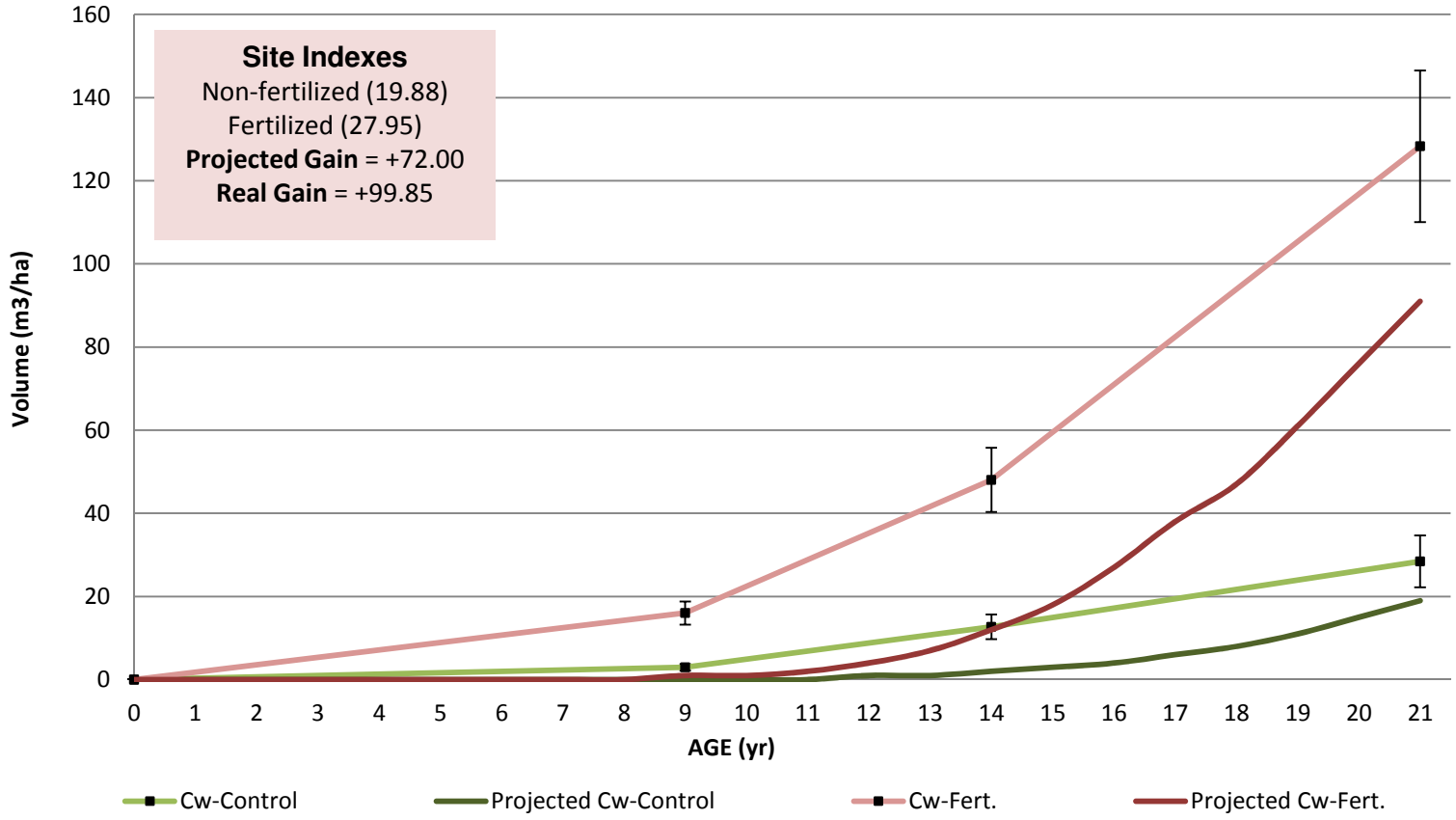
CH - 1500 st/ha





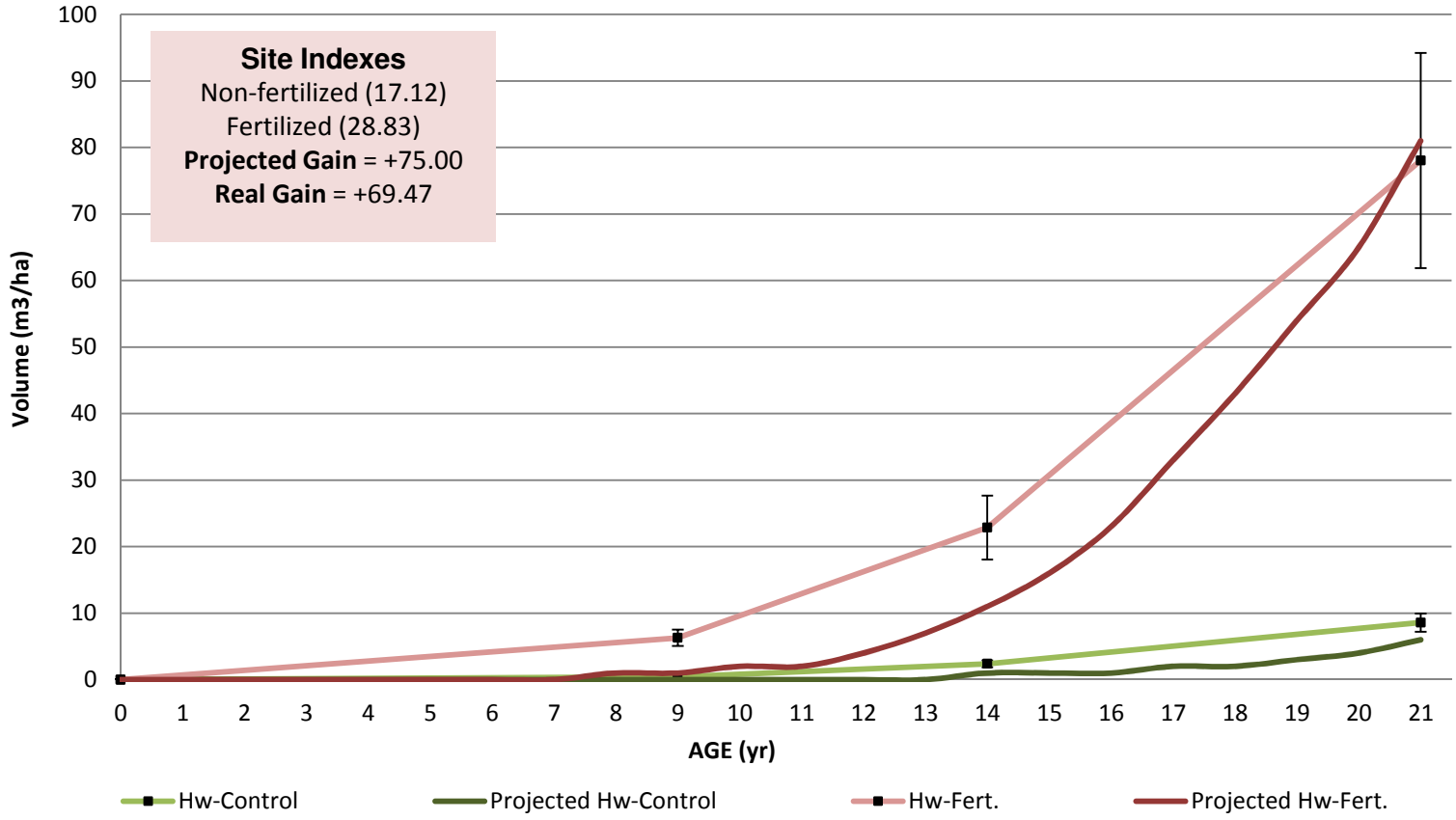
Comparison with Tipsy Projection

Volume - CH - Cedar - 1500 st/ha



Comparison with Tipsy Projection

Volume - CH - Hemlock - 1500 st/ha

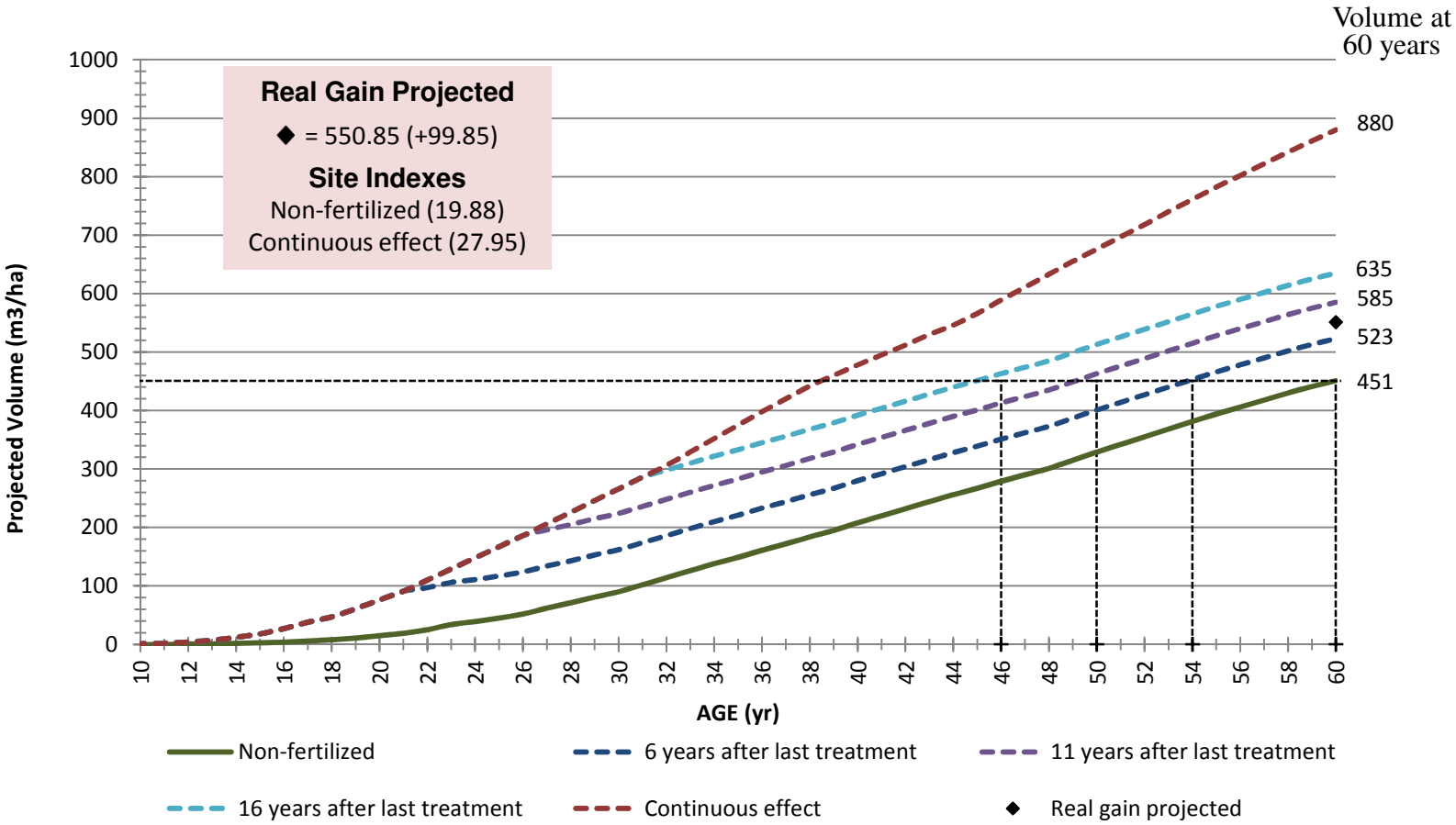


Conclusions at 21 years (CH)

- Fertilization significantly increased both height and total volume
- Height increased 60% in Cedar and 118% in Hemlock
- Volume increased 352% in Cedar and 810% in Hemlock
- Cedar seems to be having better basal area growth than expected

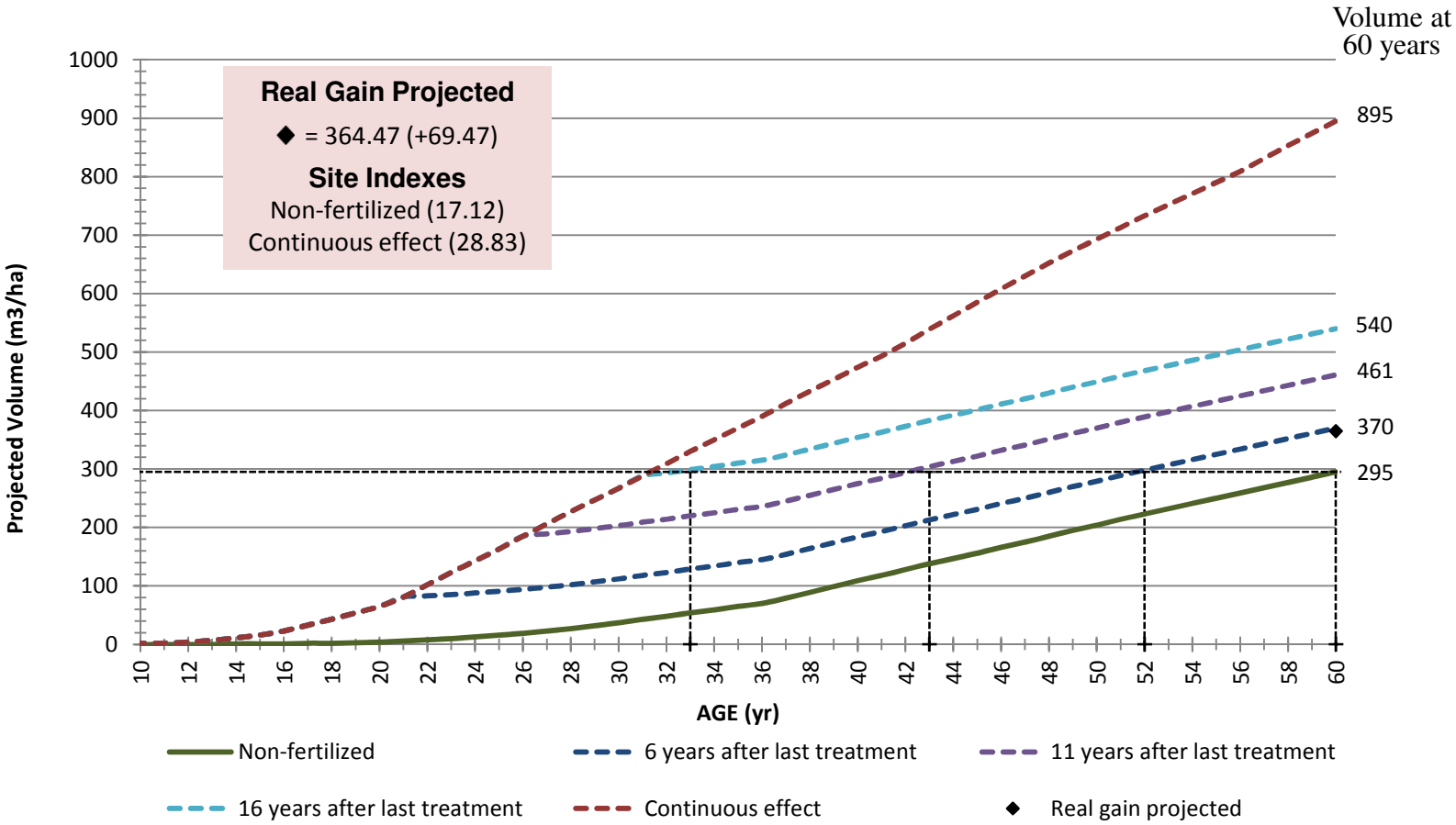
Projected productivity

CH - Cedar - 1500 st/ha



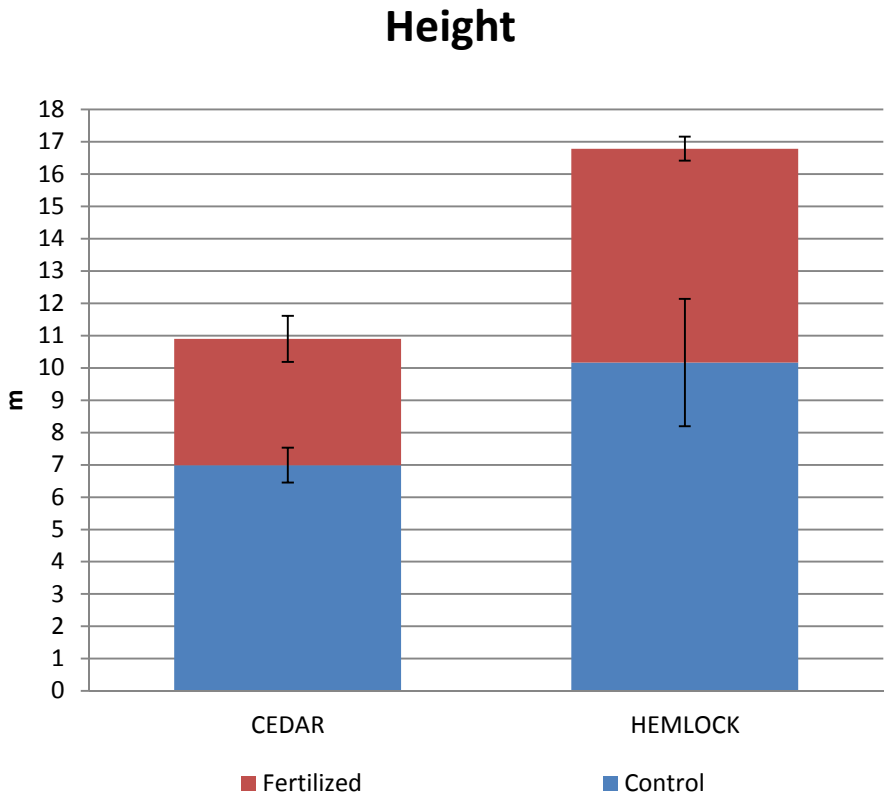
Projected productivity

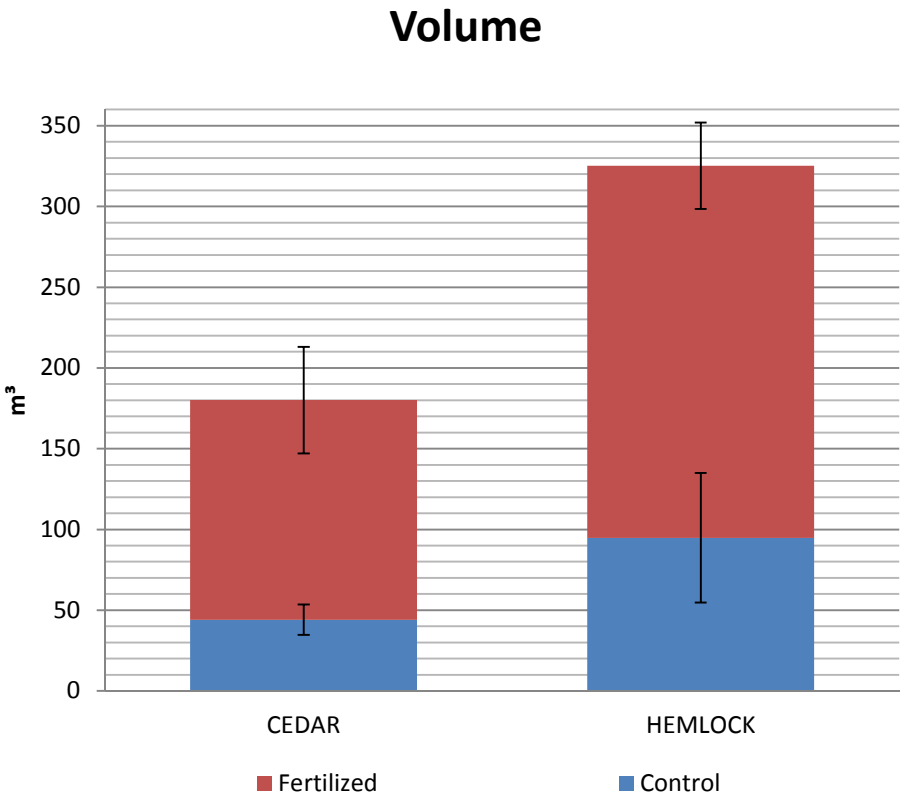
CH - Hemlock - 1500 st/ha



Cumulative effect (21 years)

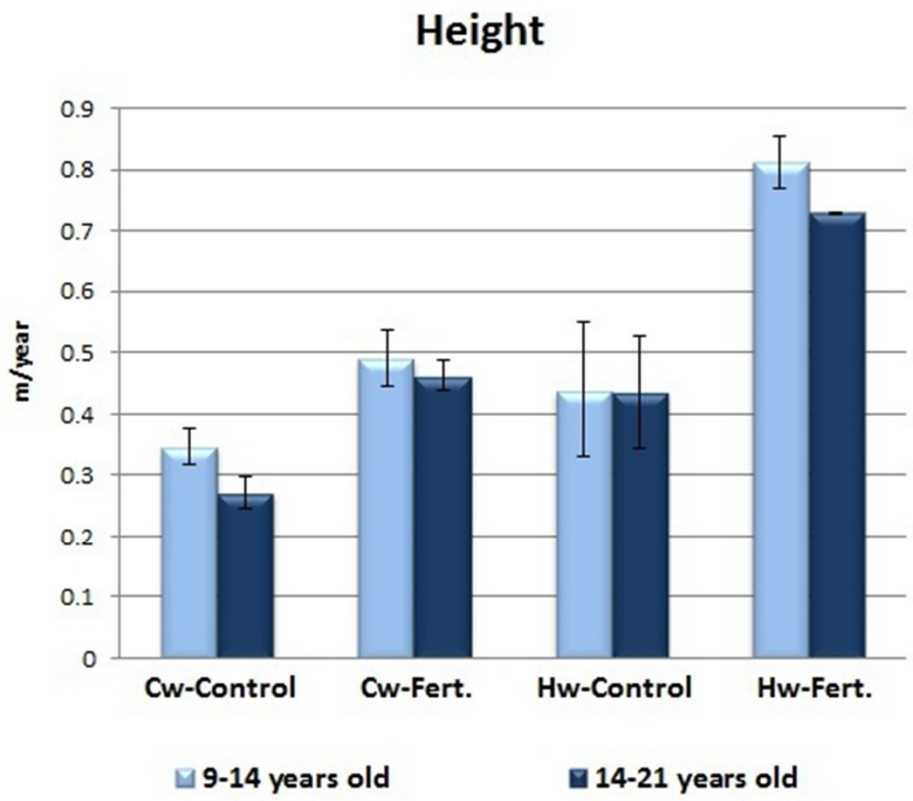
HA - 1500 st/ha

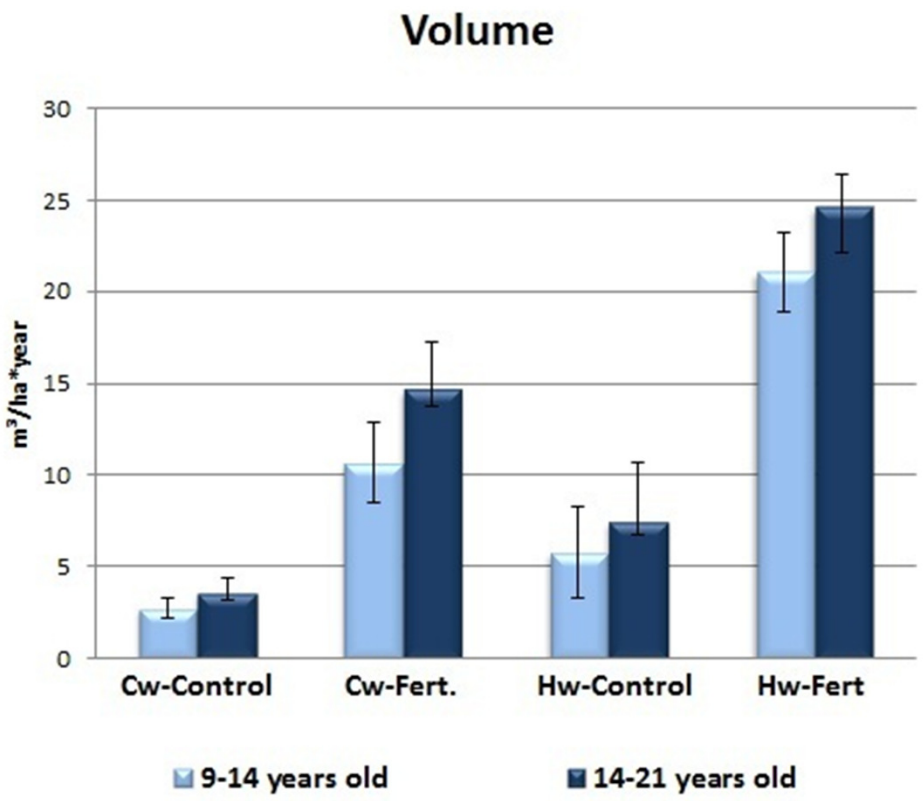




Annual Growth (HA)

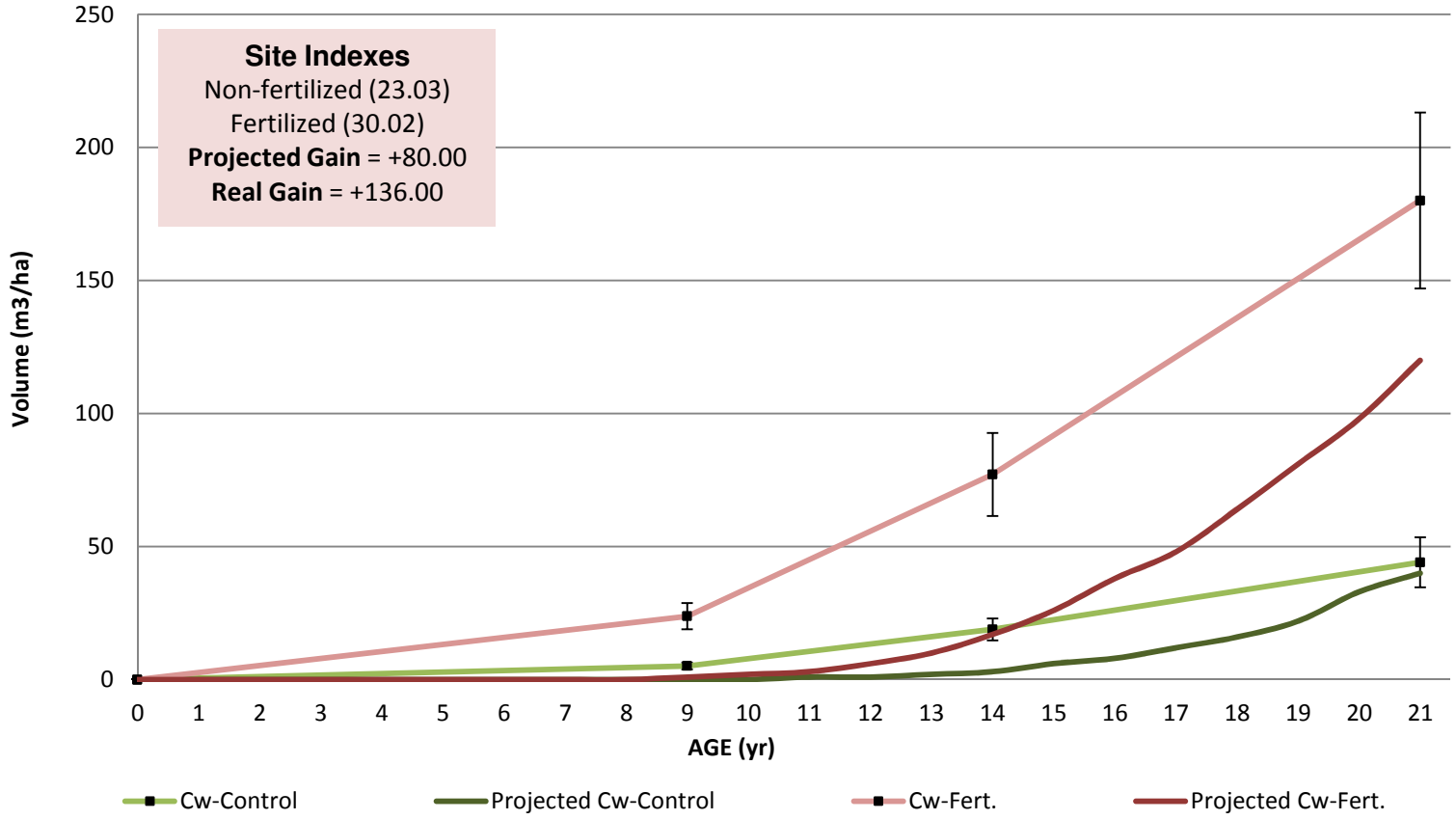
HA - 1500 st/ha





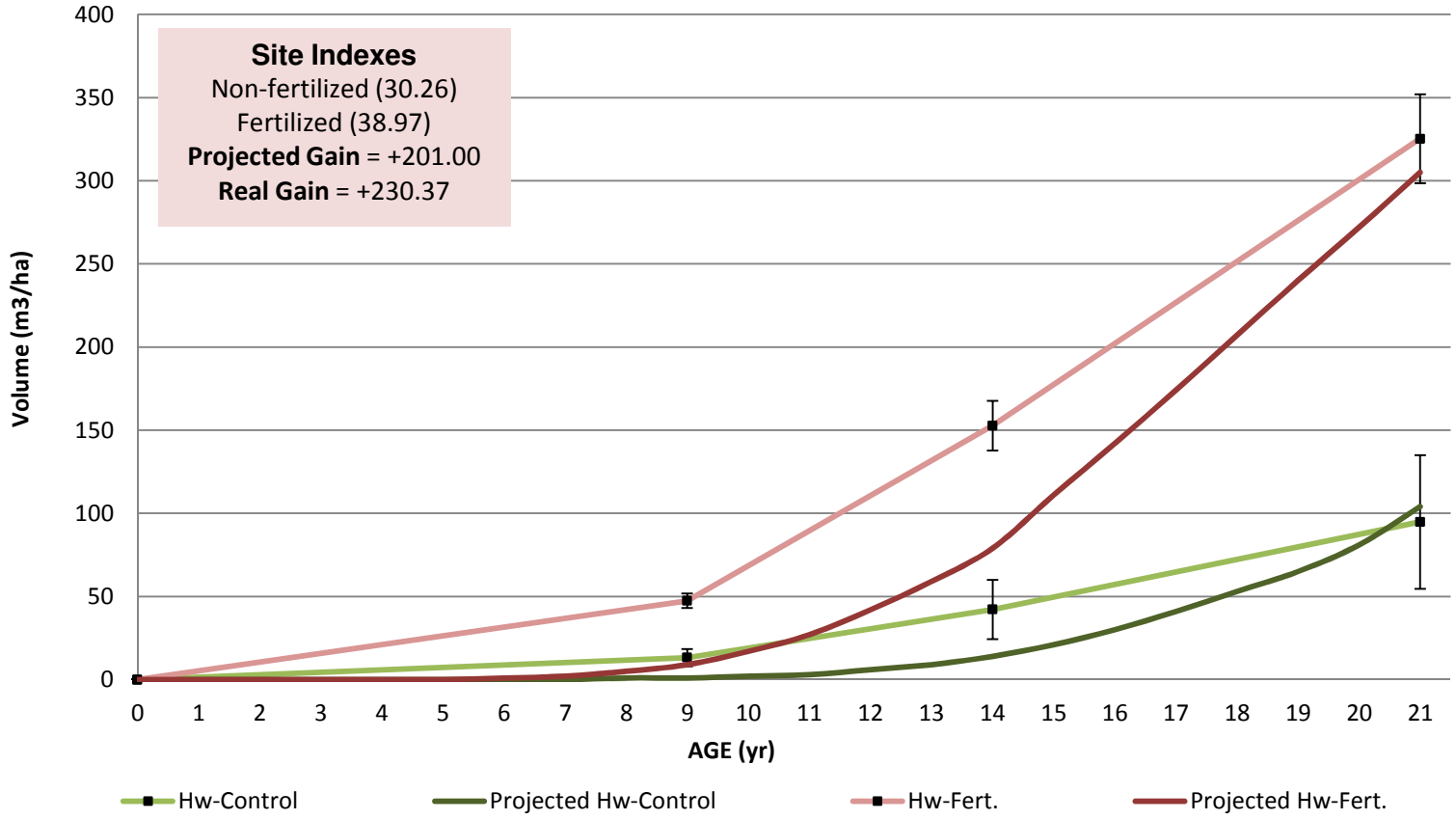
Comparison with Tipsy Projection

Volume - HA - Cedar - 1500 st/ha



Comparison with Tipsy Projection

Volume - HA - Hemlock - 1500 st/ha

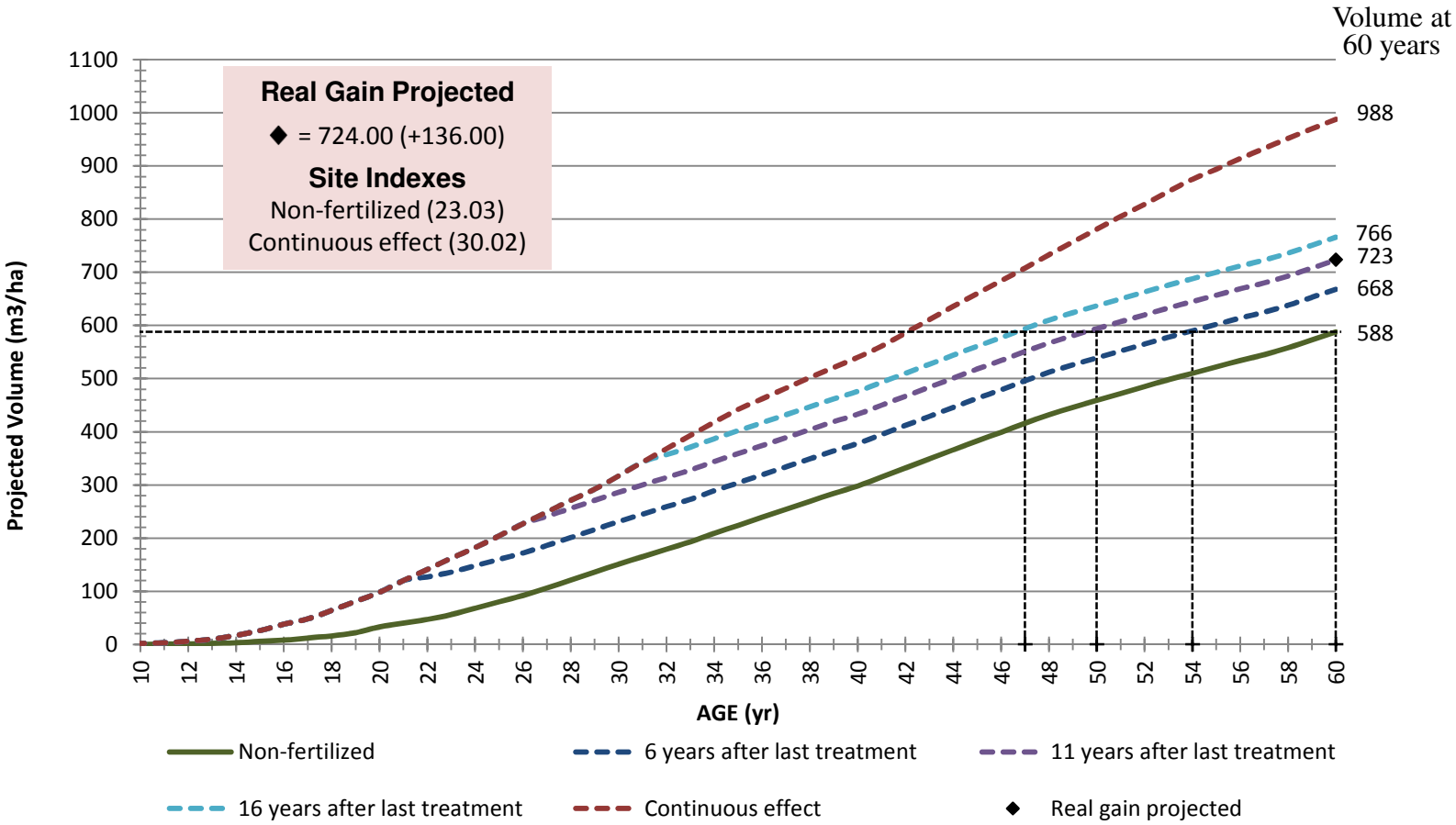


Conclusions at 21 years (HA)

- Fertilization significantly increased both height and total volume
- Height increased 56% in Cedar and 65% in Hemlock
- Volume increased 309% in Cedar and 243% in Hemlock
- Cedar seems to be having better basal area growth than expected

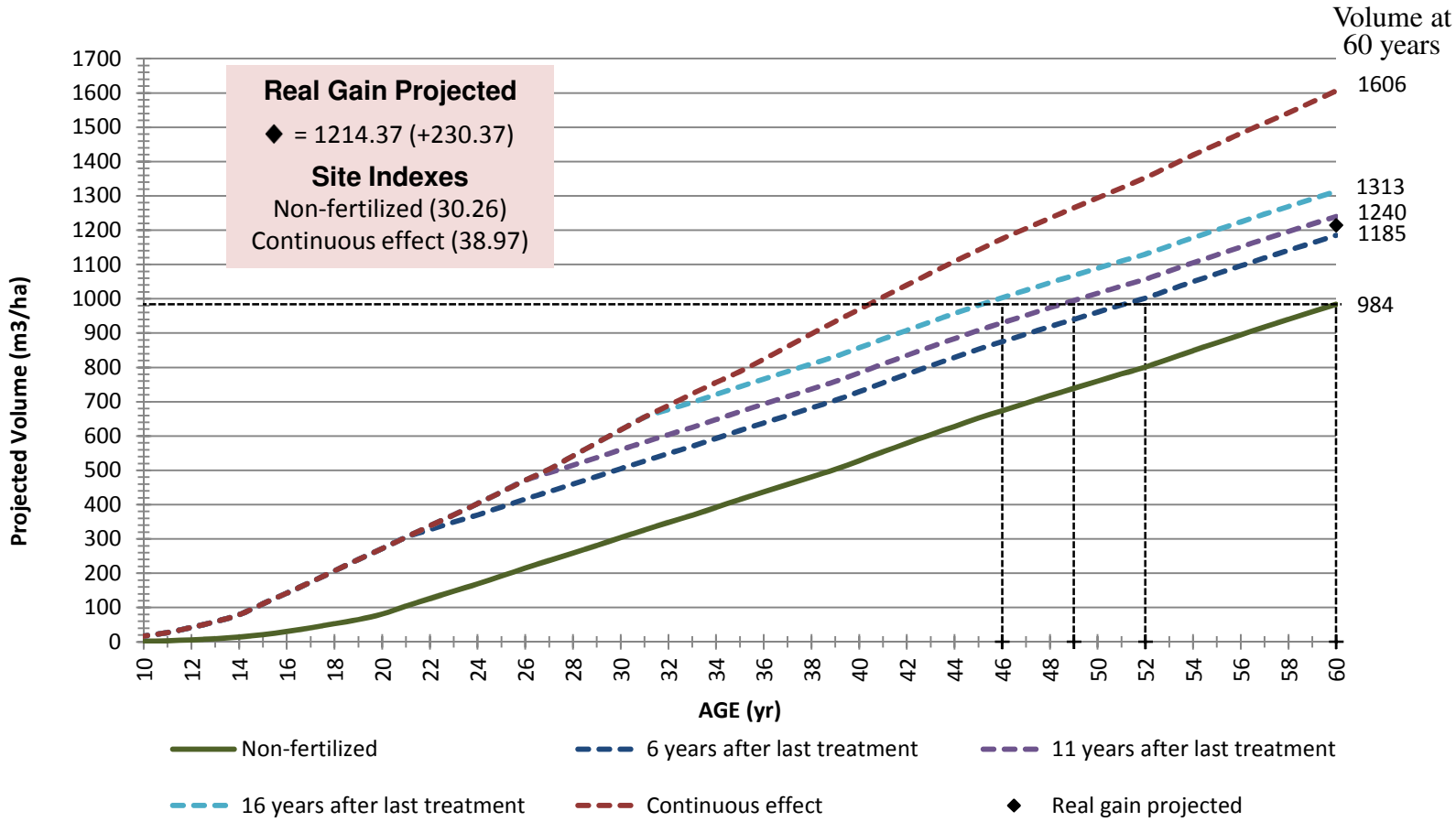
Projected productivity

HA - Cedar - 1500 st/ha



Projected productivity

HA - Hemlock - 1500 st/ha

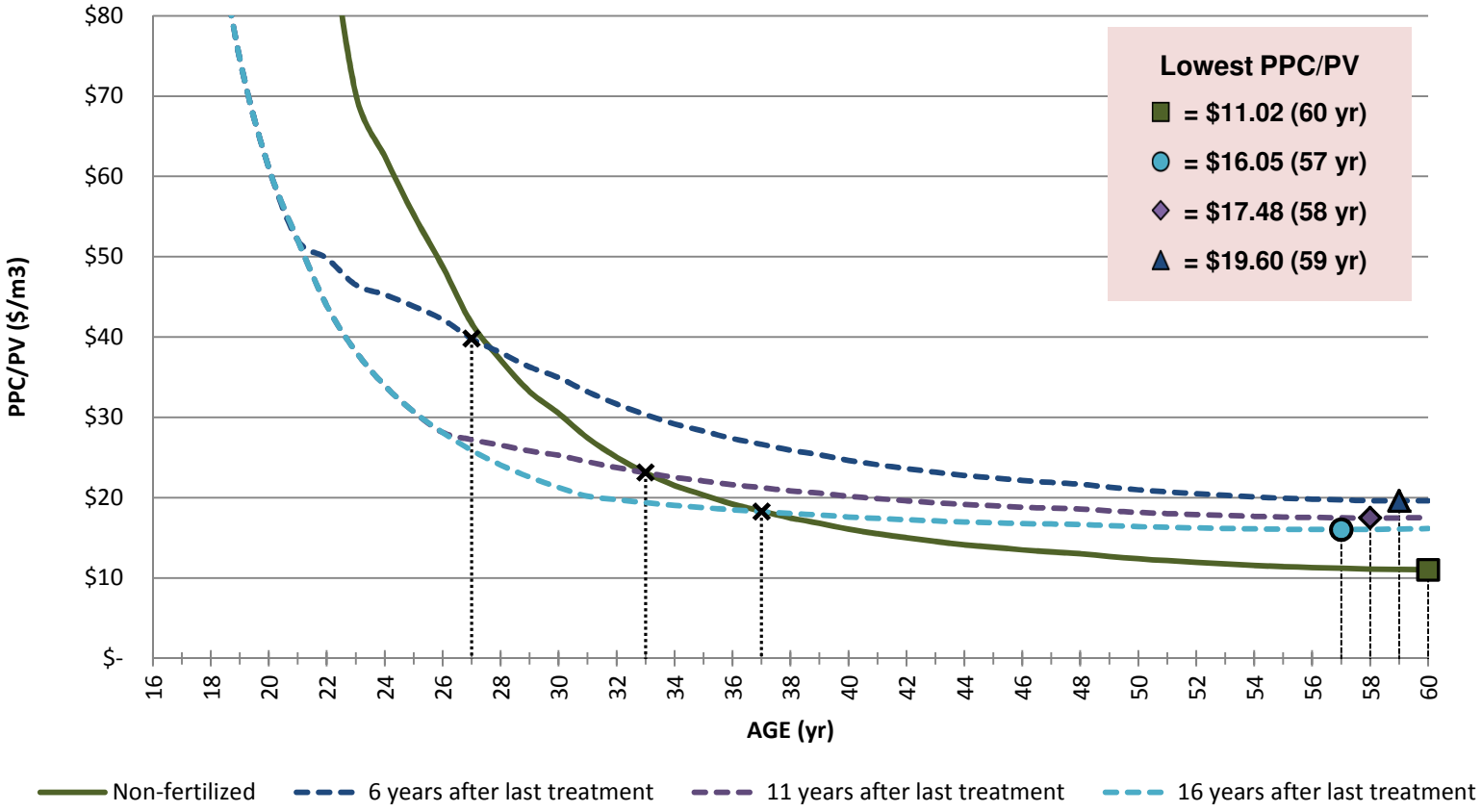


Economic Analysis

- Focus on planting costs ($/ha)
- Includes: Seedlings, tree planters, fertilizer, fertilizer app helicopter broadcast, surveys and brushing (5%)
- Compound interests used for planting costs were 2%, 4% and 8%
- Total Average of treated plots = $3336.00
- Total Average of untreated plots = $1545.00
- Projected planting costs were calculated based on expected volume by Tipsy

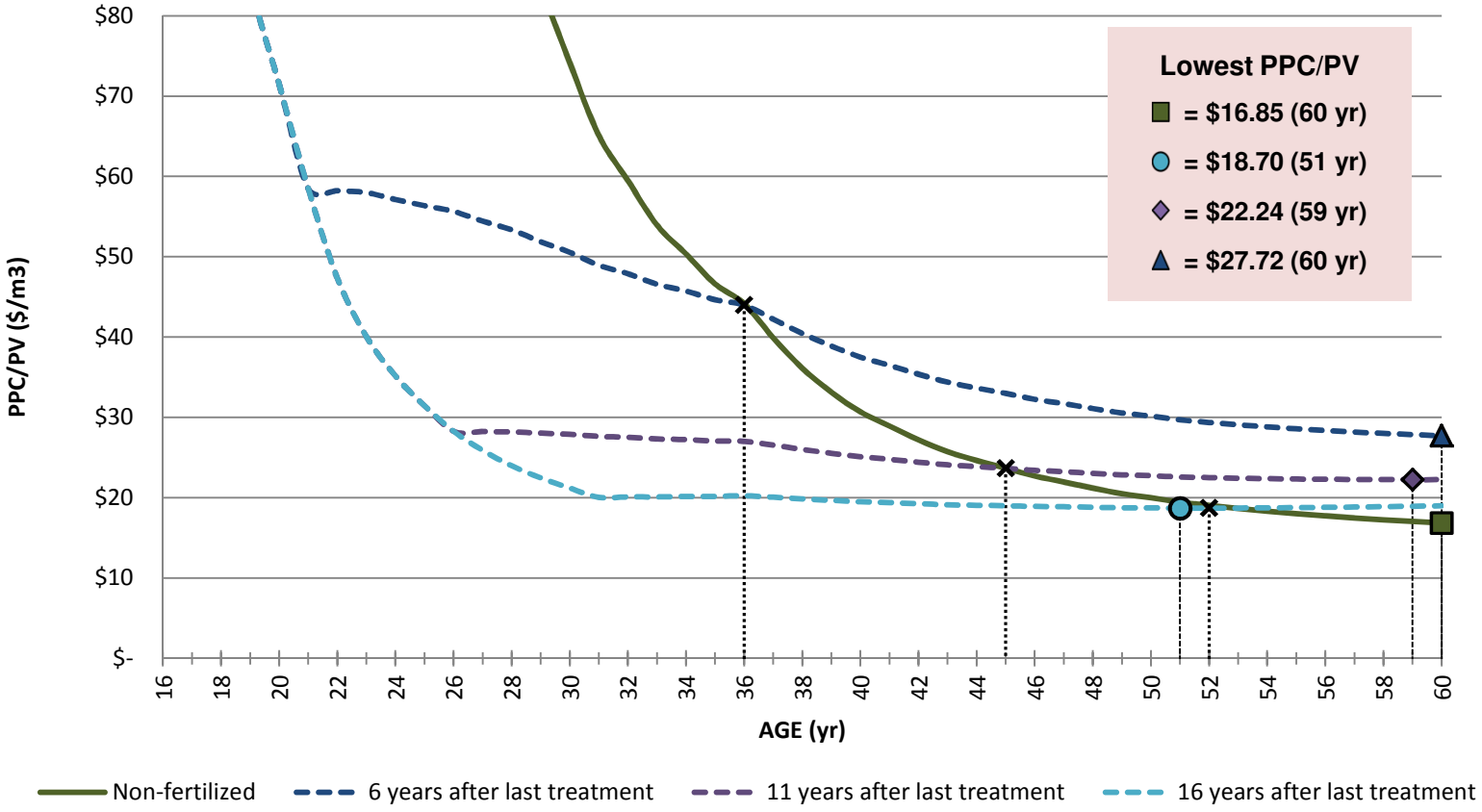
Economic Analysis

CH – Cedar - 1500



Economic Analysis

CH – Hemlock - 1500

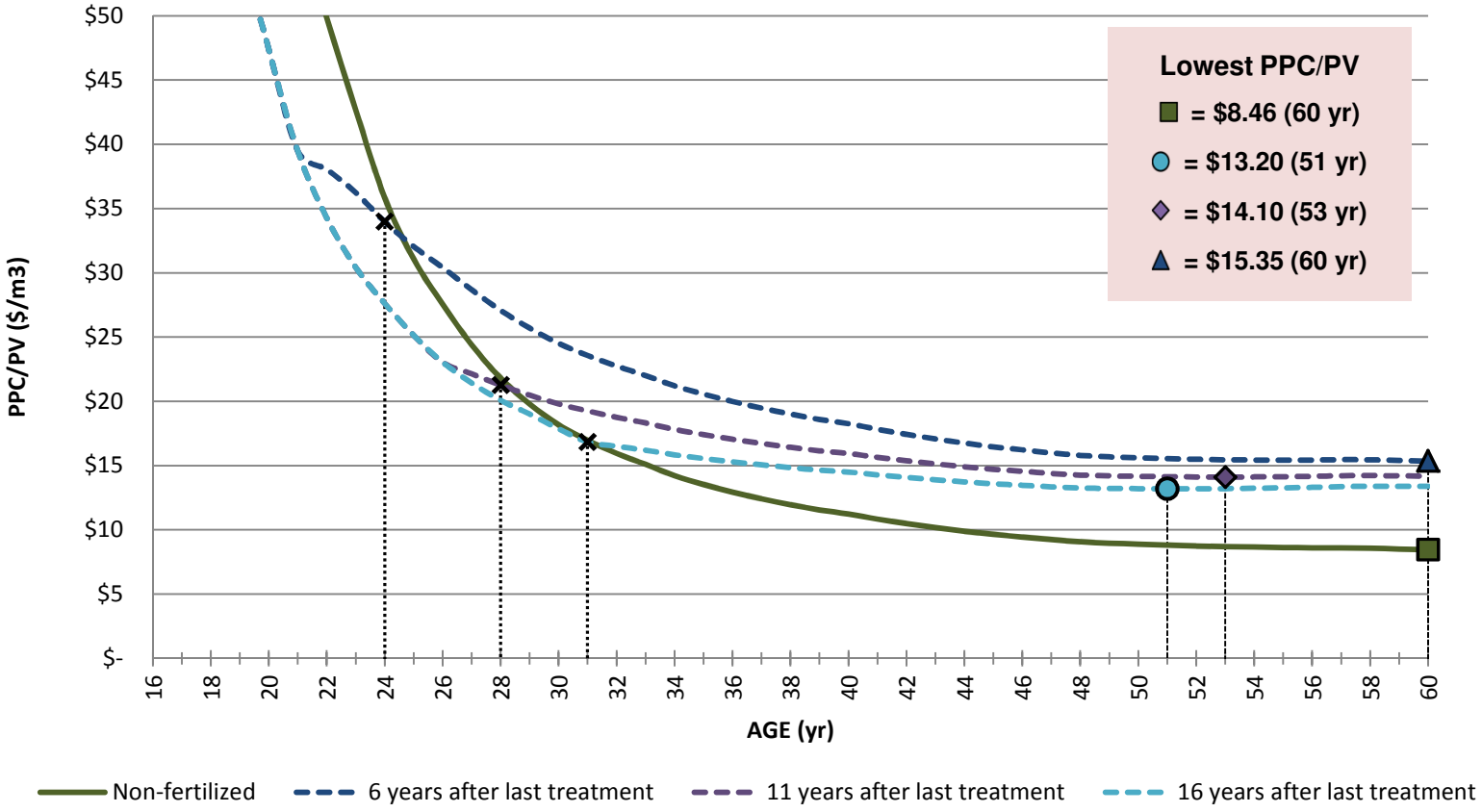


Conclusions (CH)

- Even though Hemlock responds very well with fertilizer, the total growth is the lowest of all treatments.
- Regardless of treatment, the costs of Hemlock in CH are quite prohibitive.
- The results suggests that Cedar is the more suitable species for CH sites.
- Cedar if fertilized should have extra fertilizations to maintain increasing annual growth and therefore mitigate compound interest.

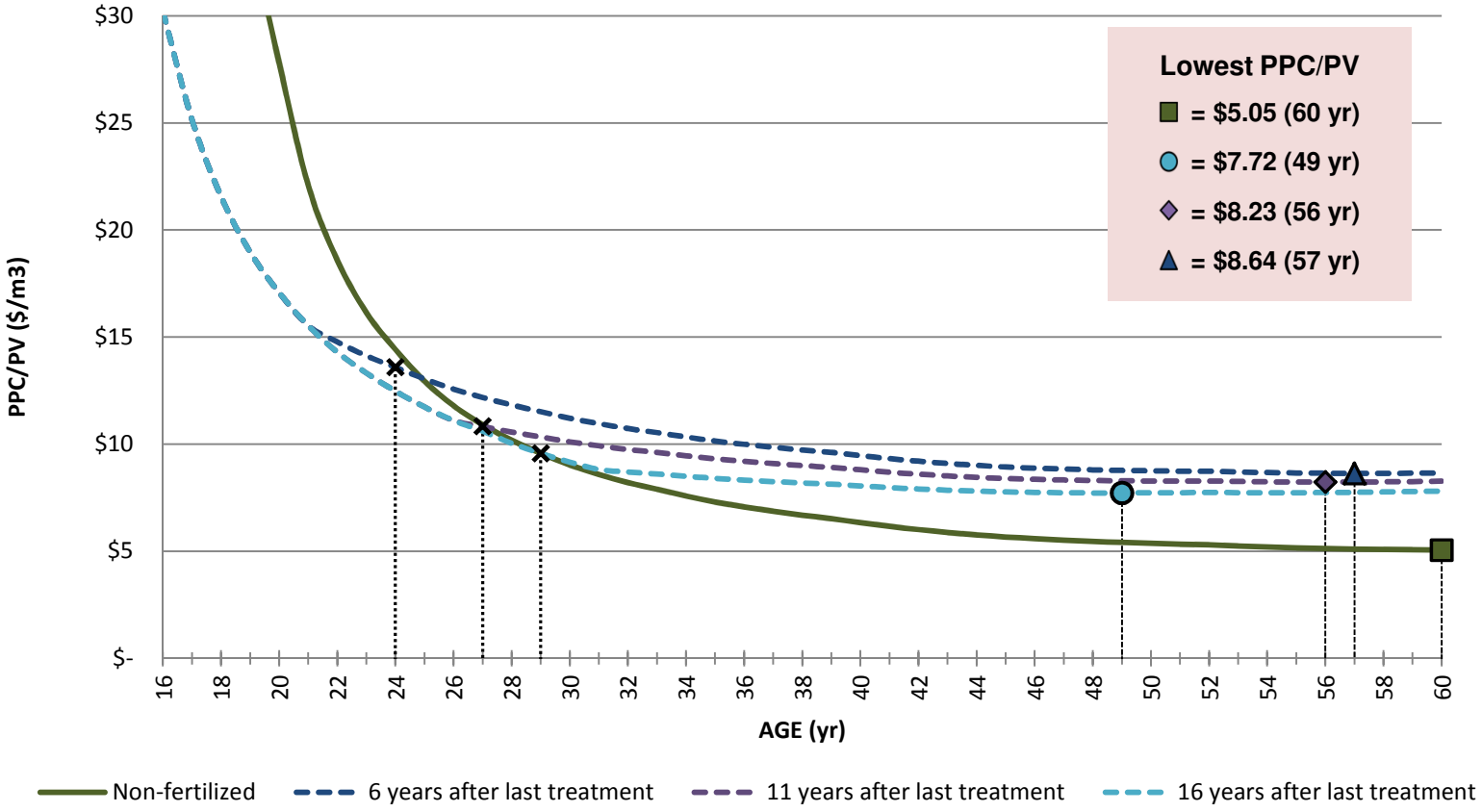
Economic Analysis

HA – Cedar - 1500



Economic Analysis

HA – Hemlock - 1500



Conclusions (HA)

- Hemlock with or without fertilization has incredible growth rates, which reflects low planting cost at very early ages
- Cedar has excellent growth rates in HA; but, not as good as hemlock. Therefore planting Cedar on HA would mostly depend on the difference between species selling price.
- If fertilized, both species are better suited for very short rotations (mid 30's – 40's)
- If not fertilized, hemlock and cedar plantations should be harvested at older ages (>60 years) and have minimum extra investments as a way to mitigate compound interest

Economic Analysis

General points:

- Fertilizer is mostly interesting for shorter rotations or to enhance productivity in stagnated areas
- For longer rotations (> 50 years); minimum investment is recommended or multiple fertilization; up to 10 years prior to harvest, could potentially mitigate compound interest by adding extra volume

Opportunities:

- Potential reduction of logging costs
- Opportunity to increase profit by reducing logging age
- Opportunity to mitigate compound interest by adding carbon credits

Economic Analysis

- Compound interests for planting costs by 2%
- $0.92/seedling + planting
- $0.20/ 4 teabag per seedling + application
- $730/tonne applied 740 kg (225 N 75kg P 46-0-0)
- $0.35 per Kg applied
- $600/tonne applied 490 kg (225 N urea 30.5-23-0)