Productivity analysis of silvicultural treatments on Vancouver Island, a case study

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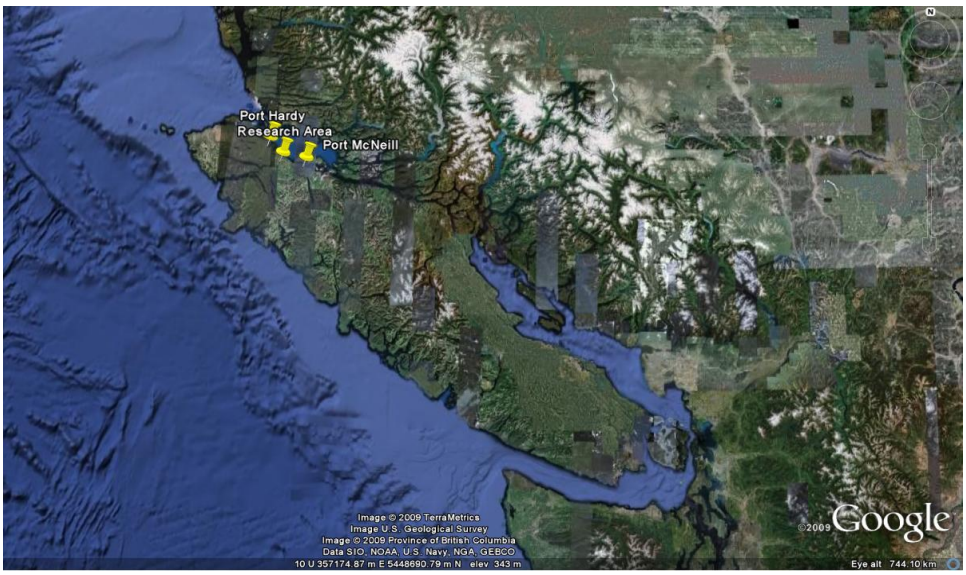
"SCHIRP"

Location

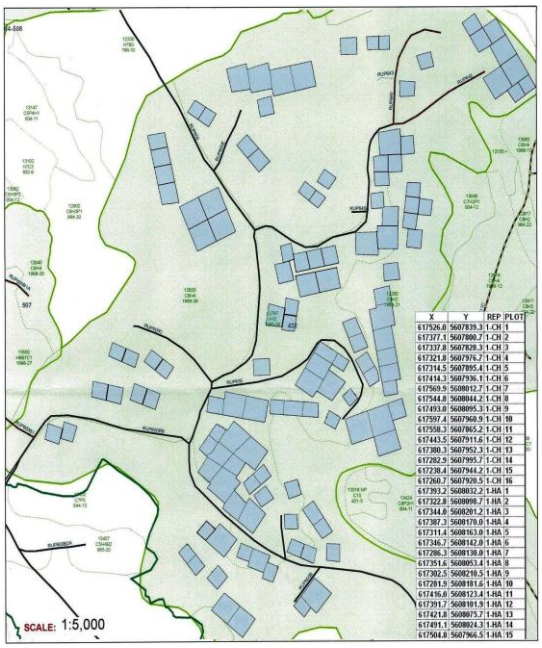


"SCHIRP"

- 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
617526.0	5607839.3	1-CH	1
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	5607868.9	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

CH – Cedar not fertilized

CH – Cedar fertilized

CH – Hemlock not fertilized

HA – Hemlock fertilized

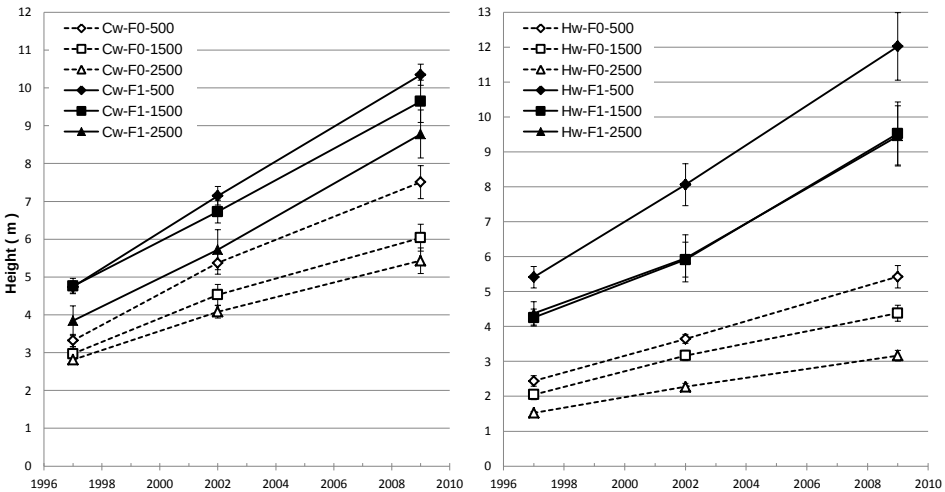
Statistical Analysis (CH)

- Fertilization, species and density have shown significant different averages in all measurements
- Significant interaction between Species and Fertilization

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

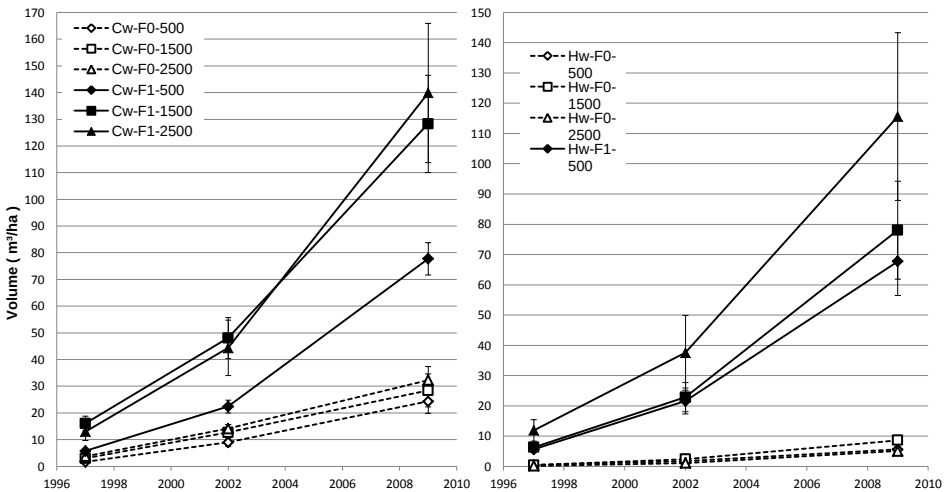
Average height development

CH - Height



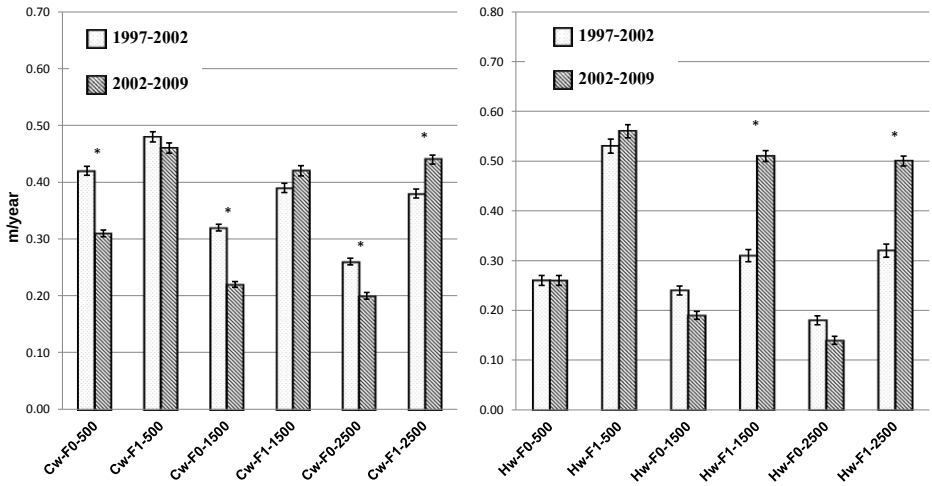
Average height development

CH - Volume



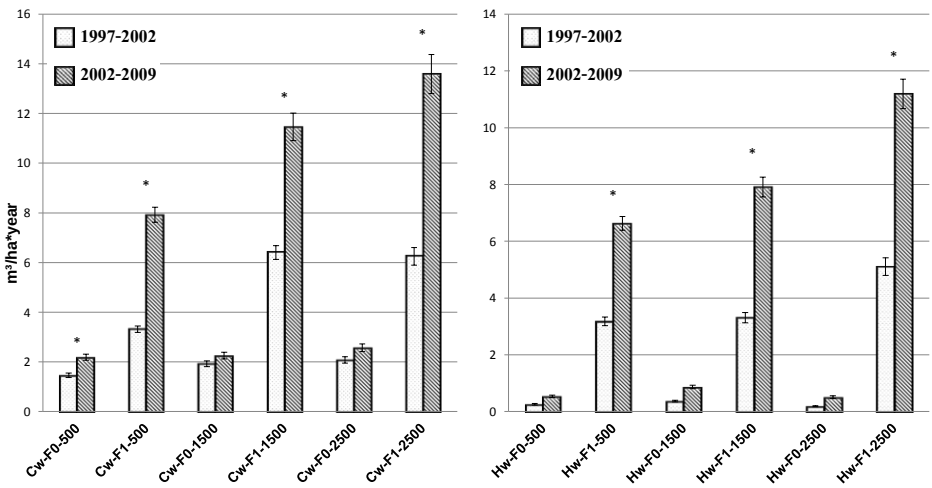
Periodic annual increment

CH - Height



Periodic annual increment

CH - Volume



Conclusions after 22 growing seasons (CH)

- Fertilization significantly increased height and volume averages in all measurements
- Average height is negatively affected by density
- PAI of volume jumped up significantly after last fertilization
- Cedar seems to be the better option to be used without fertilizer, hemlock shows better results if fertilizer is applied

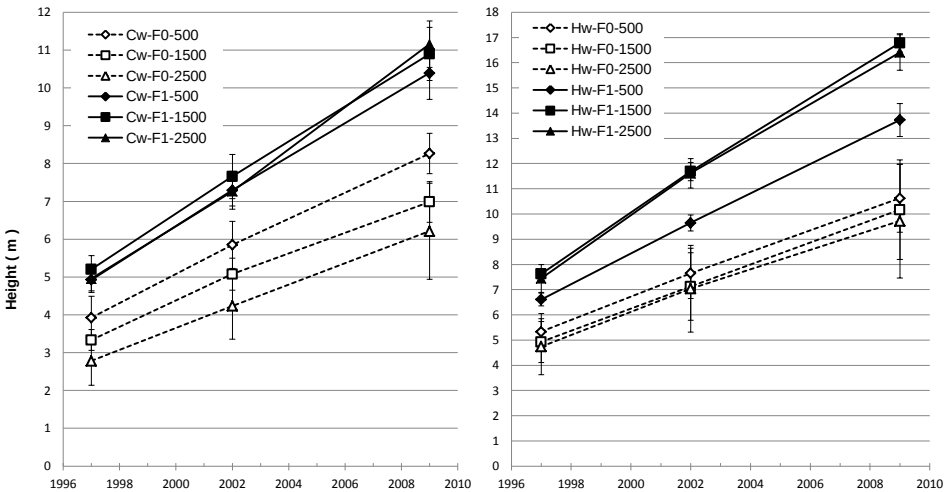
Statistical Analysis (HA)

- Significant interaction between Species and Fertilization for height 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) $P < 0.05$

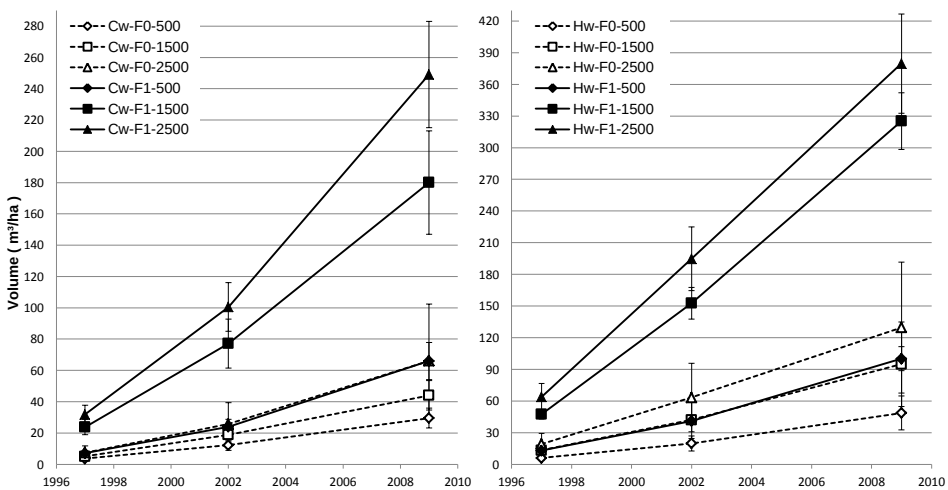
Average height development

HA - Height



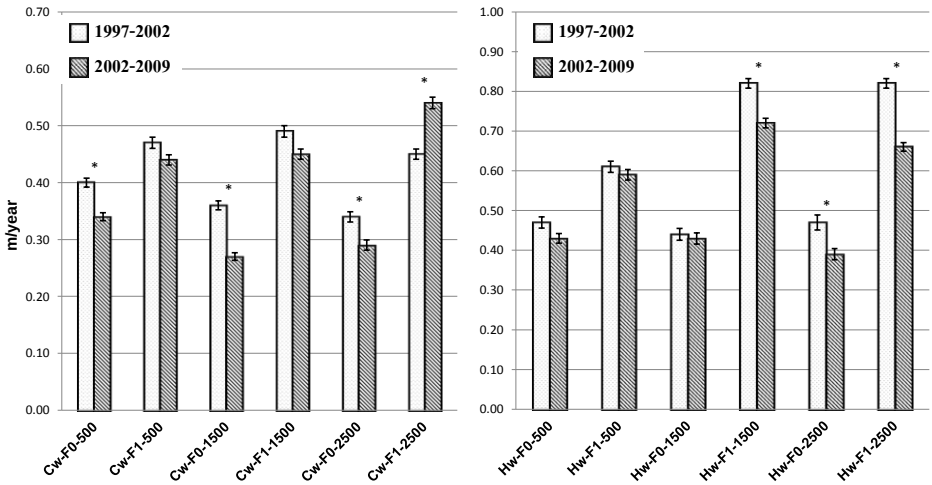
Average height development

HA - Volume



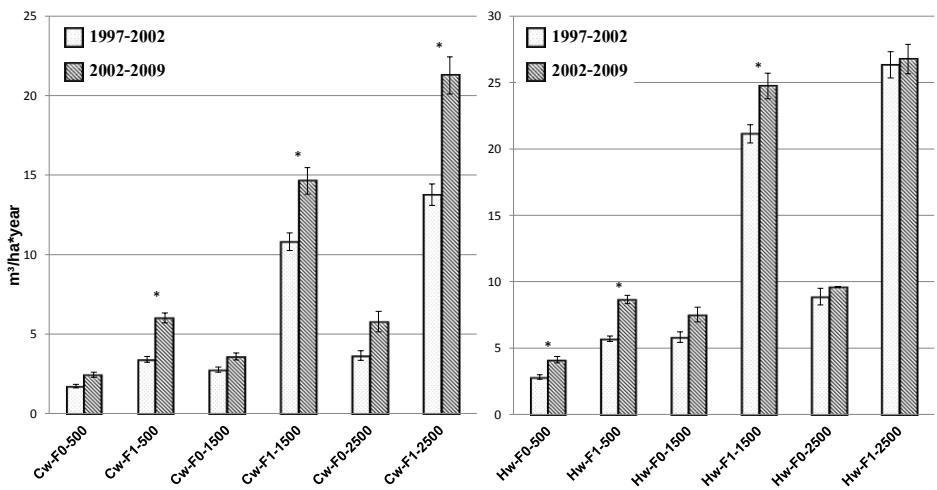
Periodic annual increment

HA - Height



Periodic annual increment

HA - Volume



Conclusions after 22 growing seasons (HA)

- Fertilization significantly increased height and volume averages in all measurements
- Average height is not negatively affected by density
- PAI of volume did not jumped up as significantly as in CH sites after fertilization
- Hemlock shows better results with or without fertilization
- Much greater variation within treatments

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.

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

Strategic Outcomes

General points:

- Fertilizer is mostly interesting for shorter rotations or to enhance productivity in stagnated areas (only if necessary)
- 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

Acknowledgements

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Dr. Cindy E. Prescott

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