



Canadian Wood Fibre Centre

Impact Assessment: Green River Pre-commercial Thinning Trials

CWFC researchers examined the benefits and costs of several silvicultural treatments on balsam fir and red spruce forests in New Brunswick.

Significant increases in productivity and profitability can be realized by applying brush control to similar forest regeneration in this region. Additional gains can be made by applying PCT treatments to highly productive sites.

The Green River Legacy project examines the results of pre-commercial thinning (PCT) trials. The trials were established in 1959 by Dr. Gordon Baskerville of the Dominion Forest Service (now the Canadian Forest Service [CFS]) and Fraser Papers (now Acadian Timber Corp.) to address concerns about future wood supply shortages.

Today, more than 50 years later, the now-mature Green River balsam fir and red spruce stands present a perfect opportunity to study how PCT affects the forest value chain. The study looks at harvesting and processing efficiency, end-product value and quality, and overall economic return.

The Green River PCT trials remain today as one of the CFS's long-term research gems because of their experimental rigour, realistic treatments and historical data. The empirical data from these long-term PCT trials is invaluable in supporting and enhancing the silvicultural prescriptions forest managers make for Canada's central and eastern conifer-dominated forests. More than 2.7 million hectares (ha) were similarly thinned during the past 20 years, and an additional 100,000 ha are thinned annually, making this long-term study highly relevant.

In 2008, Natural Resources Canada's Canadian Wood Fibre Centre (CWFC) and FPInnovations remeasured the study's 48 permanent sample plots and clearcut-harvested three of the study's six replicate blocks. The remaining three blocks were left so that long-term forest succession could be studied.

Need

Canada's forest sector needs a consistent supply of high quality fibre. As well, profitability is driven by volume and by the prices that this fibre can command at market. PCT treatments can help meet these needs by producing faster growing trees that are larger and straighter.

PCT trees produce more high-value lumber as opposed to pulp. In addition, applying PCT treatments allows an extra harvest for pulp or biomass to help at periods of low supply.

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This helps to maintain supply and demand in an industry whose business cycle is strongly cyclical. The Atlantic Maritime ecozone contains 7.8 million ha of forest that is dominated by fir and spruce trees with about 1 billion cubic metres (m³) of wood. A modest increase in volume – based on only 10 percent of Atlantic Maritime balsam fir and red spruce stands – could result in more than of \$10 million annually in increased sector profitability.

Relatively few silvicultural studies offer comprehensive empirical data, and none has addressed the effects of PCT on the full fibre supply and value chain. In 2008, researchers started a two-year project to determine the direct impact of PCT on specific fibre properties. The properties include fibre length and cell wall dimensions, density and other wood-quality attributes that directly affect lumber and pulp quality and performance.

Harvesting was recommended to prevent imminent age-related volume losses because the stands were 60 years old, on average. Consequently, the Green River PCT trials represented a unique opportunity to study the effects of PCT on end point fibre quality and product values at full rotation.

Approach

The PCT trials were performed in six replicate blocks of 8- to 12-year-old balsam fir and red spruce that had naturally regenerated following clearcut harvesting. Each block contains three 2-ha plots, with trees thinned to 1.2 m, 1.8 m, and 2.4 m nominal spacing. A fourth plot was not thinned. Brush control was applied to all the plots, including the one that was not thinned, to help the conifer trees flourish, consistent with good forest management practices.

Nearly 50 years later, the effects of PCT on roundwood product yield, harvesting and wood-handling efficiencies, disease losses, lumber product yield, and pulp and paper production were documented. CWFC and FPInnovations researchers published the findings of this assessment in a series of papers, culminating in a feature, “Valuing Long-Term Research – The Green River Legacy,” in the August 2013 edition of *The Forestry Chronicle*. The researchers also developed an economic model to determine which cases would benefit from PCT treatment. The model compares treatment alternatives and includes user inputs for treatment costs and transportation and stumpage rates.

Benefits

PCT offers several benefits:

- **increased stand yield** – PCT increased stand yield, reducing the number of unmerchantable stems and increasing the number of large trees. Thinned plots increased volume by 20 to 50 percent in the average harvested tree and increased stand uniformity. As well, PCT reduced the time required to grow trees to a harvestable size, suggesting that thinned stands can be harvested considerably sooner than stands that are not thinned. Rotation times are reduced from around 55 to 45 years. These improvements will have the greatest economic benefit if applied on highly productive sites that are close to sawmills.
- **increased merchantable volume** – PCT increased the merchantable volume of the trees. Although the incidence of root and butt disease was slightly higher following thinning – the result of infection ports being created by greater wind sway and the breakage of fine root systems – the volume increases generally outweighed any losses due to disease. Such losses could be reduced by thinning around the 10-year mark and harvesting before a stand approaches 50 years old, although timing is dependent on the condition of each stand. Thinning to a nominal spacing of 1.8 m was adequate for maintaining satisfactory lumber mechanical properties. The result was an increase of total product value of more than \$6,000/ha compared to stands that were not thinned.
- **equal quality** – The quality of the end-product did not change, although PCT treatments did cause a lower wood density in slab-wood chips as part of a trade-off for higher volumes. Because of this, producing northern bleached kraft pulp with wood from PCT stands was slightly more expensive than producing pulp with wood from untreated stands.
- **spin-off benefits** – Possible spin-off benefits include new interim revenues from selling the thinned trees and the process benefits that occur from having a steady supply of timber.

Competition

Under “extensive,” low-cost forest management, seedlings, whether planted or naturally established, are typically left to grow – without such treatments as ground scarification, brush control or thinning. While this approach produces variable results in stem density and species composition, individual conifer trees are usually smaller and have a higher probability of succumbing to competition from hardwood stems than with more “intensive” management.

Overall, the managed stands under the PCT approach have increased conifer growth and greater gross merchantable volume. Widespread use of extensive management has been associated with a reduced abundance and dominance of conifer across post-settlement North America. This change has led to a decline in the value of forests by permitting the growth of trees that have limited commercial value.

The economic data collected at Green River suggests that some initial silvicultural investment in brush control and/or PCT could positively affect the timber supply in the long term. This would affect the socioeconomic well-being of rural communities dependent on Canada’s sustainable forest resource.

In addition, using PCT can have other spin-off benefits not quantified within the study. These benefits include a steadier wood supply provided by thinning cuts and improved wood quality that leads to higher revenues throughout the forest sector supply chain. Outside of the forest sector, other benefits could include increased investment in forests that provide recreational and tourism benefits, habitat for wildlife, and storing atmospheric carbon.

For individual landowners, an initial investment in time and effort to control brush and thin trees could pay off in larger, healthier, more marketable trees and increased profitability in the long term. Most importantly, these effects are most noticeable on high-quality sites that have significant growth potential.

Intensive silviculture, such as a combination of brush control and PCT, is particularly recommended for the highest-value sites where the investment of time and effort is likely to have the greatest effect on increasing value and yield.

Why this matters

Landowners that use brush control and PCT can expect to realize significantly increased revenues as a result of their work. In the long term, the extra revenue will more than offset the costs of the treatments used on productive sites. This benefit is two-faceted: faster tree growth reduces the time to harvest and reduced competition between trees and more spacing allows for larger, healthier trees that potentially produce high-valued sawlogs.

Trees left to grow untended on highly productive sites similar to the Green River trials, with no silvicultural interventions, might reach maturity at about age 55, when their mean annual increase in wood volume peaks.

Using either brush control or PCT dramatically improves the productivity of a stand. Tree growth is considerably faster and healthier. If both techniques are used simultaneously, potentially trees can be harvested at 45 years – 10 years earlier than untreated stands.

Treatment costs are obviously higher with PCT but may be offset by the larger yields, earlier rotations, and the larger trees, which increase the amount of higher-value sawlogs relative to pulp material. The difference could increase land-owner revenue by as much as 100 percent.

These trials show that treatments need to be carefully considered for any parcel of land. Although brush control will improve yields, it may still be too expensive on tracts where the forest is not productive enough to take advantage of the investment. However, the advantage is obvious in forests of the quality of the Green River PCT trials, with a nearly 50 percent increase in profitability.

PCT is also useful, but only in areas where both the land’s productive capacity and market demand exist to make it worthwhile. On very productive sites situated near sawmills, the additional demand for steady lumber flows will justify PCT treatments. In most other cases, simple brush control may be sufficient to maximize profits.

For more information, see “Valuing Long-term Research – The Green River Legacy” by Doug Pitt in the August 2013 edition of *The Forestry Chronicle*.

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Aussi disponible en français sous le titre : Évaluation des effets : Essais d’éclaircie précommerciale de Green River
