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Pre-commercial thinning in balsam fir: Management implications for regeneration

Photo by
E. Russell

While the effects of pre-commercial thinning on stand growth and quality are well known, a New Brunswick study sheds light on the outstanding question of the impact on regeneration in the next rotation. The results of the study help assess the sustainability of the practice.

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Pre-commercial thinning is a silvicultural treatment frequently used to manage young and dense regenerating stands. It enables the reduction of stem density, which enhances diameter growth and volume of the remaining trees. The treatment results in more sawlog volume per harvested tree, although it rarely increases overall stand productivity. Pre-commercial thinning also offers the opportunity to control stand composition, reduce rotation length and lower future harvesting costs. Juvenile balsam fir stands of eastern Canada, which can easily reach 25 000 stems per ha, are generally favourable to pre-commercial thinning (Figure 1).

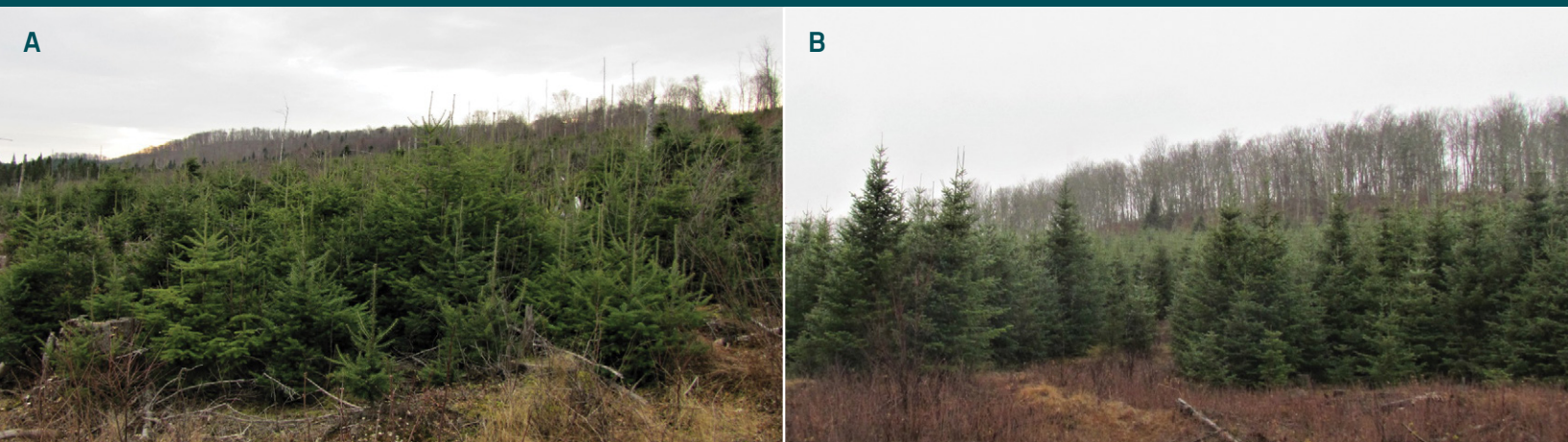
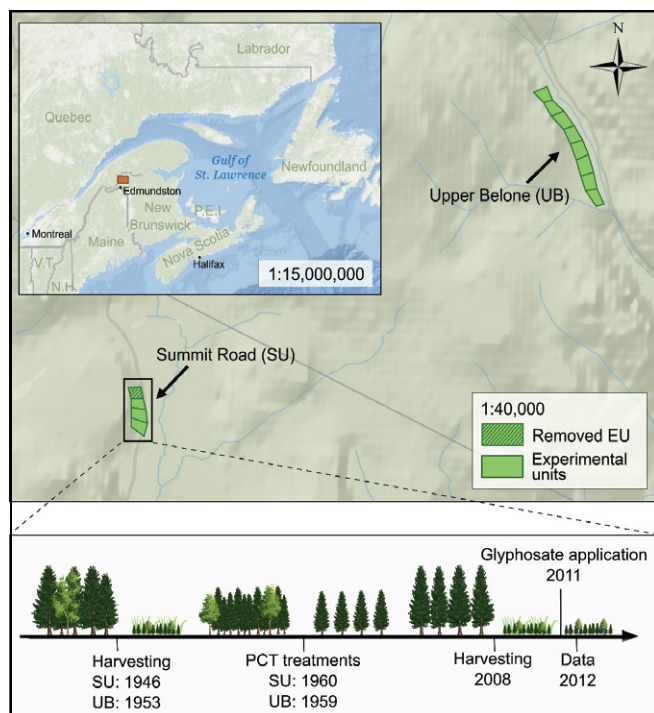


Fig. 1: Balsam fir dominated regeneration located at the study site in northwestern New Brunswick. Examples of (A) 5 years post-harvest (2013) and (B) 13 years post-harvest (2020) (Photos by J. Farrell).



Long-term stand characteristics like structure, density, crown development and light regime in the understory can be affected by pre-commercial thinning. Thus, it has the potential to influence competing vegetation and woody debris, which can affect regeneration density and stocking after harvesting.

A study of pre-commercial thinning was conducted in the long-term silviculture experiment established during the late 1950s in the Green River watershed of northwestern New Brunswick. The objective was to assess the legacy effects of pre-commercial thinning on the regeneration of natural balsam fir stands beyond a single rotation. Figure 2 shows the location of study sites and the sequence of treatments from 1946 to 2011.

Data from 396 regeneration plots across three stands harvested in 2008 were collected in 2012. Measurements included stocking of commercial species, density, size and vigour of conifer seedlings, and percent cover of woody debris.

Fig. 2: Location of Green River watershed experimental units (EU) and sequence of treatments applied on the Summit Road (SU) and Upper Belone (UB) stands. Each unit represents one out of four intensities of pre-commercial thinning in 1959-1960 (Canuel et al. 2019).

Management implications

Results illustrated in Figure 3 show that four years post-harvest:

- pre-commercial thinning in the previous rotation did not have any significant effect on conifer regeneration growth
- there were no legacy effects of the treatments on the abundance of competing vegetation and coarse woody debris
- pre-commercial thinning did not have any significant effect on seedling density for all regenerating tree species inventoried
- all sites were fully stocked, with values exceeding 80% in all cases
- balsam fir seedlings were more abundant than spruce and other species, accounting for 96% of inventoried seedlings
- conifer stocking was higher in thinned stands originating from the 1.8 m nominal spacing

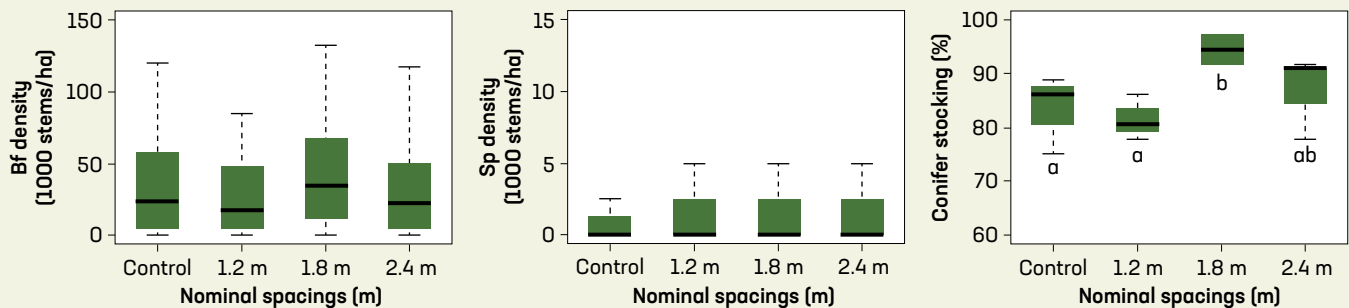


Fig. 3: Boxplots showing balsam fir density, spruce density and conifer stocking following different spacing levels in the Green River experiment (Canuel et al. 2019).

Pre-commercial thinning of dense balsam fir stands has few, if any legacy effects on next-rotation stand regeneration when applied within the ranges of intensity and timing that were tested. The initial differences in canopy closure between the thinned and unthinned stands did not influence regeneration density in the long-term. This response is mostly due to balsam fir being able to establish an abundant seedling bank in the understory of closed canopy stands (Figure 4). The treatments did not affect the abundance of coarse woody debris either, which might have influenced regeneration success.

Climate change considerations

The tested scenarios have resulted in a clear dominance of balsam fir, a species at high-risk to climate change in the Acadian region. Such species dominance raises concerns for the resilience of these ecosystems to future climate conditions. Tending treatments such as release, cleaning, and pre-commercial thinning should be adapted to increase tree diversity. This can be done by selecting for healthy individuals of other species, including hardwoods, to support the resilience of these ecosystems.



Fig. 4. Balsam fir can establish an abundant seedling bank in the understory of closed canopy stands (Photo by M. Hoepting).



For more information:

Canuel, C.-M., Thiffault, N., Hoepting, M.K., and Farrell, J.C.G. 2019. Legacy effects of precommercial thinning on the natural regeneration of next rotation balsam fir stands in eastern Canada. *Silva Fenn.* 53(4): article id 10209. doi: 10.14214/sf.10209.

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