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Institut de recherche sur les feuillus nordiques Inc.
Northern Hardwoods Research Institute Inc.

Effects of Commercial Thinning on Species Regeneration in Tolerant Hardwood Stands

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Technical Note

Silviculture

INTRODUCTION

In even-aged silviculture, thinning is often carried out to promote diameter growth of desired species and to improve stand composition and quality. While not the original intention, thinning in tolerant hardwood stands often allows new cohorts of trees to establish. This has the potential to transform even-aged stands to uneven aged stands if adequate space and time are provided for regeneration establishment and recruitment into the canopy layer. The composition of the new cohort depends on the magnitude of the removal and the local ability for species to get established. Different thinning intensities are expected to cause different species regeneration and recruitment. For example, low thinning intensities that enhance the availability of light to the stand much less than heavy thinning may favor the regeneration of shade-tolerant species such as beech and sugar maple.

On the other hand, heavy removals may promote the regeneration of mid– and shade-intolerant species. The composition, and density of the new cohort of trees following thinning treatment in even-aged stands are important factors that may influence future management options. Therefore, quantitative information on how thinning intensity affects species regeneration in the medium term (11 years) is needed.

HIGHLIGHTS

- **Beech density decreased while sugar maple density increased with thinning intensity, showing opposite response to the treatment.**
- **The density of sugar maple seedlings was higher than all other species across treatments.**
- **Higher basal area of dead trees increased the density of sugar maple but decreased the density of beech seedlings.**
- **Thinning can be used to control density of the regeneration of desired or interfering species.**

Reviewed: June 2018

METHODOLOGY

In 2005, a 15 ha commercial thinning experiment was established in a stand that was regenerated after clear felling in the early 1960's. The site is located in northwest New Brunswick and was dominated by yellow birch, with a significant proportion intolerant and shade tolerant species. Four levels of commercial thinning treatments were used: D1 (control); D2 (20% removal); D3 (30% removal); and D4 (40% removal).

Permanent sample plots (PSP, 400m^2) were established within each treatment block prior to the thinning treatment. All trees with DBH > 2cm in each PSP were tagged, numbered, and measured. The trees were inventoried post-treatment and 11 years after the treatment. During the last measurement, six circular regeneration subplots (0.00067 ha) were established within each PSP. Within each subplot, the seedlings of all tree species were counted. The densities of four species or species group: BE (beech); conifers (balsam fir, black spruce, white spruce, etc); other (mountain maple, pinch cherry, striped maple); RM-YB (red maple and yellow birch); and SM (sugar maple) were examined across the different thinning treatment and other stand attributes.

RESULTS

The study shows that the density of sugar maple seedling was significantly higher than all the species or species groups examined across the treatments. The seedlings also showed varied responses to the intensity of commercial thinning. While thinning intensity decreased the densities of beech and conifer seedlings, the densities of red maple, yellow birch and sugar maple seedlings showed consistent increase in response to thinning intensity (Figure 1). Among the treatments, D2 and D4 were effective at decreasing beech regeneration compared with D1. The lack of treatment effect on beech in D3 is related to the pre-treatment density of overstory beech trees. Hence, stands dominated by beech will require intensive silvicultural regimes to minimise beech regeneration and dominance. Sugar maple seedlings density was significant among treatments, with D4 having higher density than D1 and D3 but not D2. Across all treatments, sugar maple seedlings were also significantly higher than all other species examined in this study. The interesting observation in this study is in D3 where the minimal increase in beech seedlings coincided with or tended to decrease sugar maple seedlings regeneration.

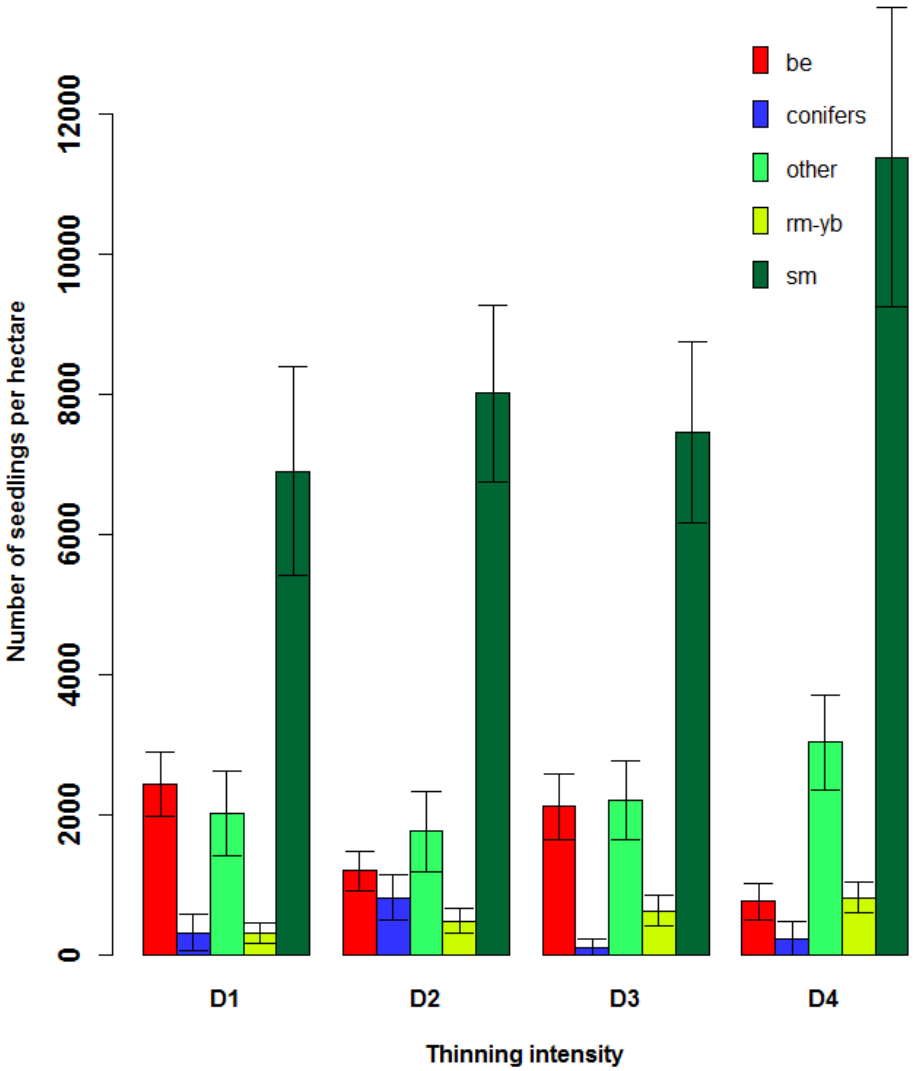

Figure 1: Tree seedling density of beech (BE), conifers (BF, BS, SW), other (MM, STM, PCH), red maple-yellow birch (RM-YB) and sugar maple (SM) across different intensities of thinning. D1 = Control; D2 = 20% removal; D3 = 30% removal and; D4 = 40% removal.

The densities of sugar maple, red maple and yellow birch increased as the basal area of dead overstory trees increases. However, the densities of beech, conifers and non-commercial hardwood tree species (other) declined with increasing basal area of dead overstory trees. Among the species, sugar maple had the highest density across the gradient of mortality of basal area while red maple-yellow and conifers were generally lower.

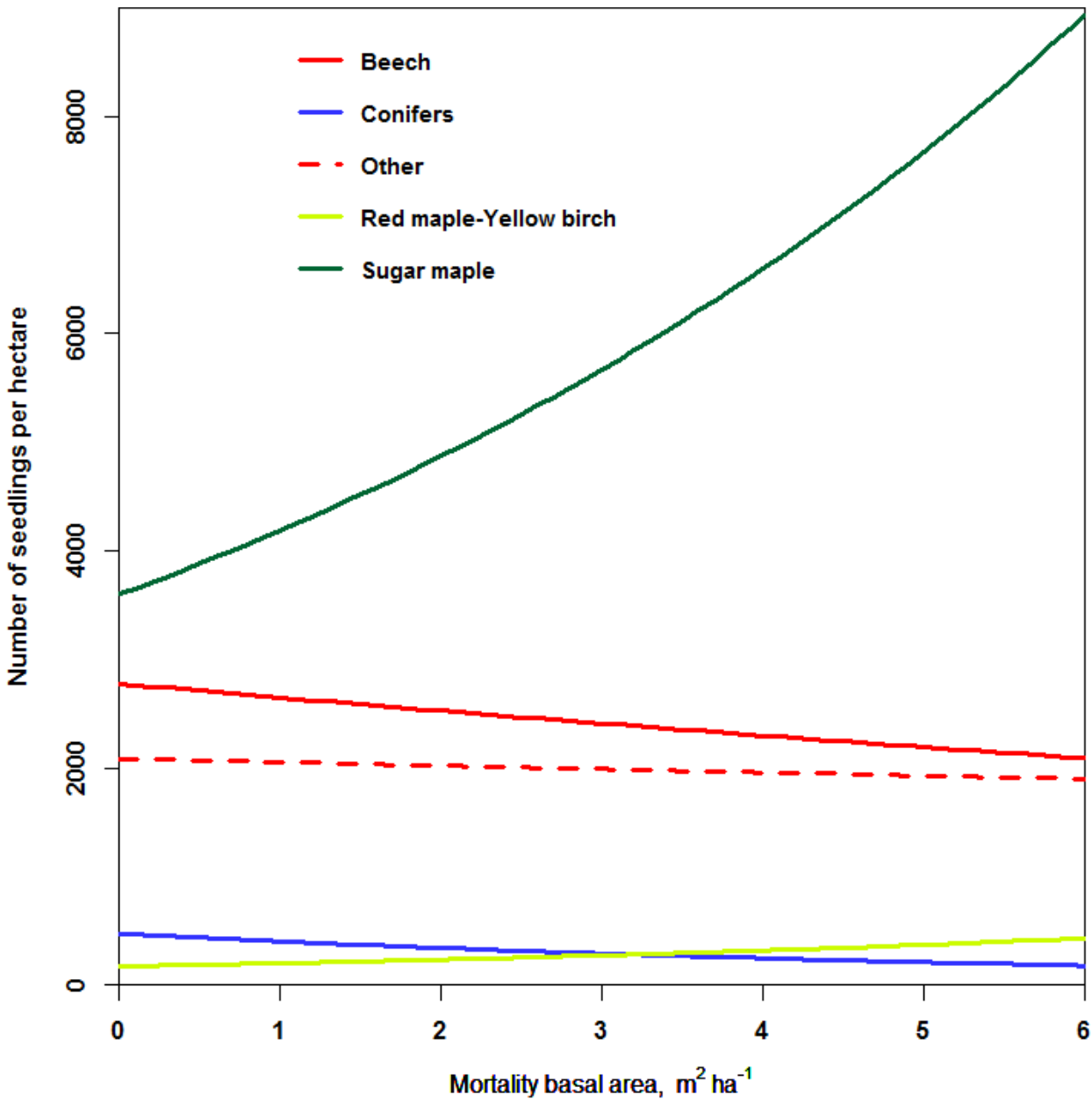

Figure 2: Relationship between seedling density by species and dead overstory trees basal area in the blocks.

CONCLUSION

The study demonstrates that seedling recruitment continuously occurred in the blocks 11 years after the treatment. This suggests that overstory canopy closure or competition from herbaceous species did not exclude tree species regeneration. Steady establishment of tree seedlings following thinning treatment in even-aged stands has the potential to transform the stands into multi-aged stands if the desired species composition can be sustained over time. In this study, however, the densities of red maple-yellow birch,

and conifers were low, partly because yellow birch and red maple are mid-shade tolerant species that often establish immediately after large-scale disturbances. The 11 years responses of the species to the treatment indicate that higher thinning intensity was effective at increasing the densities of sugar maple, and red maple and yellow birch combined. The differences in species density we observed in these stands will likely determine the trajectory of the stand development. The higher density of sugar maple across the treatment may present large pool of advance regeneration for future stand development.

Therefore, management options that protect sugar maple while increasing desired species mix should be applied. The density of beech seedling was significantly lower in the thinned blocks compared with the control. The decline in the density of beech seedlings as thinning intensity increases will reduce the ability of beech interfering with other commercial species in the stands. Periodic mortality of overstory trees which creates canopy gaps ensured continuous recruitment of tree seedlings after thinning treatment. This is especially important when subsequent thinning of the stand is economically unfeasible.

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