United States Department of Agriculture

Dominant-Tree Thinning in New England Northern Hardwoods—a Second Look

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Forest Service | Northern Research Station | Research Note NRS-201 | September 2015

Abstract

A dominant-tree thinning was conducted in 2003 in a 69-year-old even-aged northern hardwood stand, clearcut in about 1935, where a precommercial thinning study had been conducted in 1959. The 2003 commercial thinning concentrated on the removal of the early maturing, short-lived paper birch and aspen, the largest-diameter trees in the stand (hence the term "dominant-tree thinning"). Diameter growth rates after thinning, up to about 6 years per inch over the following 12 years, were acceptable although not greatly different from the unthinned plots. Basal area growth response was highly acceptable after thinning: about 2.3 ft^2 per acre per year. Annual basal area growth was about negative 0.9 ft^2 per acre on the unthinned plots. Understory development of beech and shrub species was dense under the thinned plots, and will require treatment/removal during the regeneration phase.

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Cover Photo

Uncut portion of Compartment 22, Bartlett Experimental Forest, in 2003 (69 years old). Photo by M. Yamasaki, U.S. Forest Service.

Manuscript received for publication 15 July 2015

Published by:

U.S. FOREST SERVICE
11 CAMPUS BLVD SUITE 200
NEWTOWN SQUARE PA 19073

September 2015

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INTRODUCTION

Commercial thinning in mixed northern hardwoods in New England presents unique problems. The stands commonly contain species that differ in longevity and commercial maturity. Species such as paper birch (*Betula papyrifera*) and bigtooth and trembling aspen (*Populus grandidentata* and *P. tremuloides*) mature much earlier (at roughly 50-70 years of age) than longer lived species such as sugar maple (*Acer saccharum*) and beech (*Fagus grandifolia*) that reach maturity at 120-140 years. Other species such as white ash *(Fraxinus americana*) and red maple (*Acer rubrum*) are moderate in maturity/longevity. Typical approaches to thinning such as crop-tree thinning or thinning from below would not be efficient due to impending mortality of the short-lived species. The natural approach would be to concentrate the removal on the short-lived species, which commonly are the larger, dominant stems, hence the term "dominant-tree thinning." This might be considered a form of crown thinning (Nyland 2002, Smith et al. 1997), except for the emphasis on removal of early maturing species rather than release of better residuals. The approach would not be applicable where stand composition was dominated by long-lived species.

A dominant-tree thinning was conducted in 2003 in a stand on the Bartlett Experimental Forest, New Hampshire. Preliminary (4-year) results from this thinning have been previously described (Leak 2007). This note describes responses after 12 years.

METHODS

The stand developed from a clearcut in about 1935, which had been experimentally precommercially thinned in 1959 (four treatments and twenty ¼-acre plots with 1-chain buffers between plots). Responses from the precommercial work were appreciable and have been well described (Marquis 1969). But the impacts from this early work were not readily evident before the dominant-tree thinning (Leak and Smith 1997), so the 2003 thinning was applied to plots irrespective of the earlier precommercial work.

The guidelines for the dominant-tree thinning were to remove paper birch and aspen as well as obviously declining stems but to maintain at least 50 ft^2 basal area per acre in the 4-inch (diameter at breast height, 4.5 ft above ground [d.b.h.]) class and larger. To meet these guidelines, a small proportion of paper birch was retained (about 6.7 percent of the residual basal area). The objective of the thinning was to salvage mortality of the short-lived species while maintaining stocking/ growth of the residual stand. The paper birch and aspen averaged 10-14 inches d.b.h.; the other species averaged 5-9 inches d.b.h. (and white ash averaged about 12 inches), so this was truly a thinning from above. Five plots were left as unthinned controls. The thinning also was applied to the buffer strips (1 chain wide) between treated plots. Residual basal areas ranged from about 134-148 ft^2 per acre on the five unthinned plots to 54-123 ft^2 per acre on the thinned plots. A high white ash component accounted for the largest values of residual basal area on the treated plots. This level of variability is common on small, northern hardwood plots in the region.

To assess the results of the thinning, complete tallies (4-inch class and larger) were made on the twenty ¼-acre plots in late summer of 2014, for comparison with the initial 2003 tallies. This included the remeasurement of more than 80 sample trees of the six most common species to assess diameter growth. In addition, understory stems (4.5 ft tall to 3.5 inches d.b.h.) were counted by tree/shrub species on 5 milacres per plot.

RESULTS

Species composition after the thinning clearly showed the effects of the thinning (Table 1). The unthinned plots had 49.0 and 6.8 percent of the basal area in paper birch and aspen, whereas the thinned plots averaged 6.7 and 0.0 percent in the respective species (Table 1). Residual basal areas averaged 140.9 and 74.4 ft^2 per acre, respectively.

Annual diameter growth was substantially higher for yellow birch (*Betula alleghaniensis*) on the thinned vs. unthinned plots (0.13 vs. 0.07 inches), and moderately

Table 1.—Basal area (4-inch class and larger) and percent basal area by species in 5 unthinned plots and 15 thinned plots (treatment in 2003), Bartlett Experimental Forest, New Hampshire, 2014

Treatment	Basal area/ acre	Beech	Yellow birch	Sugar maple	Red maple	Paper birch	White ash	Aspen	Other
	(*ft²/ac*)	*percent*							
Unthinned	140.9	4.3	3.6	18.8	10.4	49.0	7.1	6.8	--
Thinned	74.4	13.2	18.5	20.4	14.8	6.7	24.8	0.0	1.6

Table 2.—Annual d.b.h. growth, 2003 through 2014, in unthinned and thinned plots for six species of sample trees, Bartlett Experimental Forest, New Hampshire

Treatment	Beech	Yellow birch	Sugar maple	Red maple	Paper birch	White ash
	inches					
Unthinned	0.16	0.07	0.14	0.20	0.08	0.15
Thinned	0.16	0.13	0.18	0.18	0.07	0.17

Table 3.—Understory stems (number per acre) between 4.5 ft tall and 3.5 inches d.b.h. by species and thinning treatment (2003), based on 5 milacres per plot, Bartlett Experimental Forest, New Hampshire, 2014

Treatment	Beech	Yellow birch	Sugar maple	White ash	Striped maple[a]	Hobblebush	Pin cherry[a]	Aspen	All
	(*number of stems/ac*)								
Unthinned	200	40	80	--	320	--	--	--	640
Thinned	1,013	107	200	80	1,293	587	13	13	3,306

[a] Striped maple (*Acer pensylvanicum*), pin cherry (*Prunus pensylvanica*).

higher for sugar maple (0.18 vs. 0.14 inches) (Table 2). Paper birch grew slowly (annual rate of 0.07 inches on thinned plots vs. 0.08 inches on unthinned plots), which reflects its maturity. The growth rates are similar to the 4-year growth rates reported earlier (Leak 2007), and also similar to or slightly better than those reported for a comparable early thinning study laid out in 1936 and remeasured in 1941–1951 (Wilson 1953). Apparently environmental concerns (e.g., acid rain/ nutrient depletion, climate change) since this early period have had no noticeable effects on tree growth.

The primary effect of the dominant-tree thinning was on stand growth. Annual basal area growth (production) averaged negative (-) 0.92 ft^2 per acre on the unthinned plots and positive (+) 2.29 ft^2 per acre on the thinned plots. The average deviation in basal area growth among these small thinned plots was ±0.5 ft^2 per acre. The rates after thinning are comparable to or better than the rates reported for long-term growth studies on the Bartlett Experimental Forest for equivalent residual basal areas (Leak and Gove 2008).

Large numbers of understory stems were developing in the thinned plots—more than five times the number as on the unthinned plots (Table 3). Beech, striped maple (*Acer pensylvanicum*), and hobblebush (*Viburnum alnifolia*) are the most numerous. These will need to be dealt with during the regeneration of this stand, probably through group/patch selection or clearcutting with sufficient ground disturbance to remove this understory. Any type of thinning to this low level of stocking would have produced this understory response.

CONCLUSIONS

The dominant-tree thinning reported here produced good results over a 12-year period in both stand growth and tree diameter growth. Also on the plus side, the thinning presalvaged large volumes of paper birch and aspen (about 15-20 cords per acre) that otherwise would have been lost to mortality after standard and less aggressive forms of thinning. When the white ash and red maple reach optimum size, it is possible that a comparable thinning will be feasible for targeting these two species as well as low-quality and low-vigor sugar maple, beech, and yellow birch. On the negative side, this approach to thinning may lengthen the rotation age of the final crop due to the maintenance of the shorter-lived species in the overstory until they mature. Another concern is the loss of a seed source for the early maturing species; such a loss should be averted by maintaining species-rich no-cut zones. This system appears to work well for mixed northern hardwoods with a significant component of paper birch and aspen.

LITERATURE CITED

Leak, W.B. 2007. **Thinning northern hardwoods in New England by dominant-tree removal—early results.** Northern Journal of Applied Forestry. 24: 312-313.

Leak, W.B.; Gove, J.H. 2008. **Growth of northern hardwoods in New England: a 25-year update.** Northern Journal of Applied Forestry. 25: 103-105.

Leak, W.B.; Smith, M.-L. 1997. **Long-term species and structural changes after cleaning young even-aged northern hardwoods in New Hampshire.** Forest Ecology and Management. 95: 11-20.

Marquis, D.A. 1969. **Thinning in young northern hardwoods: 5-year results.** Res. Pap. NE-139. Upper Darby, PA: U.S. Department of Agriculture, Forest Service, Northeastern Forest Experiment Station. 22 p.

Nyland, R.D. 2002. **Silviculture concepts and applications.** 2nd ed. Long Grove, IL: Waveland Press Inc. 682 p.

Smith, D.M.; Larson, B.C.; Kelty, M.J.; Ashton, P.M.S. 1997. **The practice of silviculture: applied forest ecology.** 9th ed. New York: John Wiley. 560 p.

Wilson, R.W., Jr. 1953. **How second-growth northern hardwoods develop after thinning.** Stn. Pap. NE-62. Upper Darby, PA: U.S. Department of Agriculture, Forest Service, Northeastern Forest Experiment Station. 12 p.

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Leak, William B. 2015. **Dominant-tree thinning in New England northern hardwoods—a second look.** Res. Note NRS-201. Newtown Square, PA: U.S. Department of Agriculture, Forest Service, Northern Research Station. 3 p.

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KEY WORDS: basal area growth, diameter growth, northern hardwoods, thinning

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