FIELD NOTE

Thinning Northern Hardwoods in New England by Dominant-Tree Removal—Early Results

William B. Leak

ABSTRACT

Commercial thinning is a widely accepted practice in northern hardwood stands of New England. Commercial thinning guidelines for eastern hardwoods generally recommend releasing selected crop trees or the removal of trees in less-than-dominant crown classes unless they are of poor health or quality. However, many northern hardwood stands in New England have a dominant crown class with a high proportion of paper birch and aspen. These species mature at an early age (50–70 years) and usually are marketable in stands of that age. In this study, most of the paper birch and aspen (the largest trees) in a 69-year-old northern hardwood stand were removed in a thinning operation, leaving a medium- to well-stocked stand of longer-lived species. Analysis of 4 years of subsequent diameter growth showed that the thinned residual trees (1) grew faster than the unthinned ones, (2) generally responded as well as trees after a range of earlier precommercial treatments, and (3) generally responded as well as residual trees after a more conventional thinning conducted in 1936, indicating that potential growth after thinning has not changed materially over the last 60+ years.

Keywords: thinning, northern hardwoods, diameter growth

Commercial thinning in even-aged northern hardwood stands is a common practice although the methods vary widely. The most commonly recommended approaches are crop-tree thinning (Perkey et al. 1993) where the object is to release the crowns of selected crop trees, usually on four sides. A second recommended approach is primarily a thinning from below where a majority of the basal area (approximately 75%) is taken from below the average stand diameter (Marquis and Ernst 1991, Miller 1997, Nowak and Marquis 1997). Thinning strictly from above, removing the biggest and most dominant trees, usually is not recommended unless these trees are poor quality because of the risk of high grading. However, Smith (1986) mentions that such treatments (called selection thinning in his text) may be appropriate in certain stratified even-aged mixtures.

However, even-aged northern hardwood stands in New England commonly have an overstory with high proportions of aspen and paper birch, commonly among the largest trees in the stand. These stands meet the criteria suggested by Smith (1986). Because these species mature or die at an early age (50–70 years), the most reasonable commercial options at this age are (1) to remove the paper birch and aspen to release the longer-lived species or (2) regenerate the stand to birch-aspen-northern hardwoods through clearcutting or group/patch selection. A 69-year-old even-aged northern hardwood stand on the Bartlett Experimental Forest provided an opportunity to determine if the residual trees after aspen-birch removal would show acceptable rates of dbh growth.

Methods

This stand, 22 ac in size, had a typical species mix of predominantly paper birch (*Betula papyrifera*), bigtooth aspen (*Populus grandidentata*), sugar maple (*Acer saccharum*), yellow birch (*Betula alleghaniensis*), beech (*Fagus grandifolia*), and a few white ash (*Fraxinus americana*) and red maple (*Acer rubrum*). The stand had been subdivided at age 25 years (1959) into 20 ¼-ac plots with buffer zones and was precommercially thinned by three methods: heavy crop-tree (crop trees completely released), light crop-tree (crop trees released from the most competitive stem), and weed-tree removal (removal of most pin cherry, aspen, striped maple, and red maple sprouts); control plots also were established. Although there were diameter growth responses to the various precommercial treatments (Marquis 1969), the treated and control plots all were quite similar by age 56 years (Leak and Smith 1997).

In the spring of 2003 (stand age, 69 years), all the plots and buffer zones except for five control plots were commercially thinned by removing nearly all the paper birch and aspen. Basal area per acre (trees in the 4-in. class and larger) was reduced to 74 ft^2/ac when compared with 141 ft^2 remaining on the control plots. Average dbh of the paper birch and aspen was about 11 in., ranging up to about 20 in.; average dbh of the long-lived species was 6–7 in., ranging up to 18 in. Residual basal area per plot varied from 54 to 126 ft^2/ac. The goal on each ¼-ac plot was to leave a basal area of at least 50 ft^2/ac, so a few stems of paper birch (4.6 ft^2/ac) were left to meet that goal.

After the thinning, 84 sample trees (63 treated trees and 21 control trees) were designated for dbh growth measurements, roughly equal numbers of each major species. To obtain early results on the effects of the thinning, 4-year dbh growth was compared between sample trees on the thinned plots and control plots (Table 1). A 4-year growth period is sufficient in northern hardwoods to attain stabilized dbh growth (Solomon 1977). In addition, comparisons are shown between dbh growth for a 31-year period (1969–1990) after the 1959 precommercial thinnings in this stand; and to obtain a long-term perspective, comparisons are made with dbh growth after a more conventional thinning in 1936 (Wilson

Received December 13, 2006; accepted December 15, 2006

William B. Leak (bleak@fs.fed.us), USDA Forest Service, Northern Research Station, 271 Mast Road, Durham, NH 03824.

Table 1. Annual dbh growth (inches) by species for four thinning scenarios.

Scenario	Beech	Yellow Birch	Sugar Maple	Red Maple	Paper Birch	White Ash	No. Samples
Thinned 2003	0.16	0.11	0.17	0.19	0.05	0.18	63
Unthinned 2003	0.14	0.04	0.14	0.16	0.02	0.13	21
PCT 1959	0.09	0.08	0.15	0.14	0.11	0.18	128
Thinned 1936	0.16	0.11	0.15	0.13	0.10	0.12	—

1953). This early thinning was in a 60-year-old stand on a comparable site and removed wolf trees, defective and poor risk stems including all the aspen (about 12 percent of the basal area), reducing the basal area from approximately 122 to approximately 70–80 ft^2. The dbh measurements started in 1941, 5 years after the thinning, and continued to 1951.

To briefly summarize, the following is the available comparative information:

1. Four years of dbh growth on sample trees ($n = 63$) after the 2003 thinning.
2. Four years of dbh growth on sample trees ($n = 21$) on unthinned plots since 2003.
3. Thirty-one years of dbh growth (1969–1990) on sample trees ($n = 128$) after precommercial thinning in 1959. Same stand as mentioned previously.
4. Ten-years of dbh growth (1941–1951) on sample trees (number unknown) after a 1936 thinning in a very comparable 60-year-old stand.

Results

After the 2003 thinning, annual dbh growth by species ranged from 0.19 to 0.11 in./year except for paper birch, which grew poorly since it was overmature and declining (Table 1); this is equivalent to growth of 1 in. in 5–9 years. Growth on the uncut plots was somewhat less (averaging about 25% less), considerably less for yellow birch. The sample is small for statistical comparisons and precise growth predictions, but a paired *t*-test (paired by species) showed highly significant differences between treated and control trees. The dbh growth over the 31-year period beginning 10 years after the precommercial thinning treatments varied from similar to somewhat less than that after the 2003 thinning—except for paper birch, which was still young and vigorous. The dbh growth from 1941 to 1951 after the 1936 thinning was very similar to that after the 2003 thinning—generally a little less (except for paper birch). Despite environmental concerns, the growth potential appears undiminished over the past 60 years. After the 1936 thinning, the larger stems of white ash and red maple (12- to 16-in. trees) grew about 0.17–0.18 in./year—about the same as dbh growth for those species after the 2003 thinning.

Applications

A commercial thinning in a 69-year-old stand that removed overstory paper birch and aspen produced adequate rates of dbh growth in the residual long-lived northern hardwoods when compared with growth in the uncut plots, previous growth rates after precommercial thinning, and growth rates from a 1936 thinning study. The long-lived species, no doubt, were somewhat suppressed by the overstory paper birch and aspen, and many were smaller than desirable. Therefore, an earlier release would appear advantageous, as soon as a commercial harvest is feasible. One long-term consequence of this approach to thinning is to lessen the opportunity for maintaining a strong component of aspen, which regenerates vigorously by root suckers. This application of dominant-tree thinning applies only to the specific conditions described in this study: paper birch and aspen in a dominant position over an adequate stocking of longer-lived northern hardwood species.

Literature Cited

LEAK, W.B., AND M.L. SMITH. 1997. Long-term species and structural changes after cleaning young even-aged northern hardwoods in New Hampshire. *For. Ecol. Manage.* 95:11–20.

MARQUIS, D.A. 1969. *Thinning in young northern hardwoods: 5-Year results.* USDA For. Serv. Res. Pap. NE-139. 22 p.

MARQUIS, D.A., AND R.L. ERNST. 1991. The effects of stand structure after thinning on the growth of an Allegheny hardwood stand. *For. Sci.* 37:1182–1200.

MILLER, G.M. 1997. Stand dynamics in 60-year-old Allegheny hardwoods after thinning. *Can. J. For. Res.* 27:1645–1657.

NOWAK, C.A., AND D.A. MARQUIS. 1997. *Distribution-of-cut guides for thinning in Allegheny hardwoods: A review.* USDA For. Serv. Res. Note NE-362. 7 p.

PERKEY, A.W., B.L. WILKINS, AND H.C. SMITH. 1993. *Crop tree management in Eastern hardwoods.* USDA For. Serv., NA State and Private Forestry, NA-TP-19-93. 58 p. plus appendices.

SMITH, D.M. 1986. *The practice of silviculture*, Ed. 8. Wiley & Sons, Inc., New York. 544 p.

SOLOMON, D.S. 1977. *The influence of stand density and structure on growth of northern hardwoods in New England.* USDA For. Serv. Res. Pap. NE-362. 13 p.

WILSON, R.W. 1953. *How second-growth northern hardwoods develop after thinning.* USDA For. Serv. Sta. Pap. 62, Northeast Forest Experiment Station. 12 p.