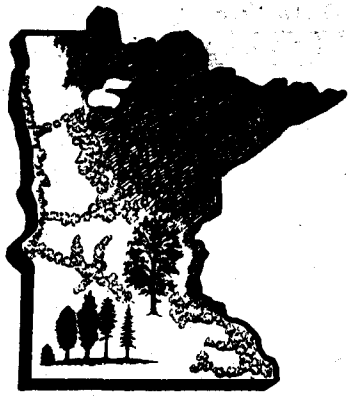

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OBSERVATIONS ON THE RESPONSE OF BALSAM FIR TO RELEASE

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The silvical characteristics of balsam fir (Abies balsamea) include abundant seed production and high tolerance, making it possible for this important northern Minnesota coniferous pulpwood species to become an increasingly numerous component of upland forest types of the region. It thus becomes important that forest managers know how and to what extent intermixed and understory balsam fir reacts to the commercial cutting of surrounding and overtopping trees. Some partial answers to these questions were obtained in 1952 by the senior author through a field study made in the vicinity of Big Falls and Effie, Minnesota, under the Minnesota and Ontario Paper Company Graduate Research Fellowship in Forestry.

The study was made in white spruce (Picea glauca) - balsam fir - mixed hardwood type stands which had been cut over from 6 to 12 years previously and for which the exact cutting season was known. Transects were run through these cutover areas and each balsam fir within 12 feet of one or more trees removed in the cutting was made a part of the released-tree sample.

For each of the 67 balsam firs in the sample an increment core was taken at 1 foot above the ground, and bole diameters, measured to the nearest 0.1 inch, were recorded for the core height and breast height points. The total height of sample trees was estimated to the nearest foot. A separate sketch was made for each sample balsam fir showing the size, species and relative location of all stumps and residual trees within a radius of 25 feet.

Increment cores were dipped in a 2 per cent solution of sodium tetrachlorophenate to prevent molding in storage and were soaked in distilled water for at least 24 hours before measuring. After this soak, using a 6-power dissecting microscope and an engineer's scale, the following radial growth measurements were taken: last 10 years and last 5 years before release; first 5 years and, for all trees except one, first 10 years after release. These measurements were taken to the nearest 1/50 inch.

Summarized age, size and response to release data for the 67 balsam firs which comprise the sample are set forth in the following table.

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Age, Size and Diameter Growth Rate Data for
67 Balsam Firs Released as a Result of Logging.

	Range	Average
Age (at core height of 1 foot)	19 to 82 yrs.	43 yrs.
DBH	1.3 to 7.5 in.	4.3 in.
DCH (diameter at core height)	1.9 to 8.4 in.	4.9 in.
Approximate height	14 to 55 ft.	28 ft.
Mean annual change in diameter growth rate (1)		
Five year comparison	-0.02 to +0.35 in.	+0.124 in.
Ten year comparison	-0.02 to +0.33 in.	+0.132 in.
Average percentage change in growth rate (2)		
Five year comparison	---	+139%
Ten year comparison	---	+150%

(1) The mean annual growth for the period after release minus the mean annual growth for the period before release.

(2) The mean annual change in diameter growth rate following release expressed as a percentage of the mean annual growth rate for the same period of years before release.

The last item in the above table indicates that, on an average, the balsam firs studied responded very well to the release effect of cutting surrounding and overtopping trees. The data indicate some major variation in the general response trend, as indicated below.

Though diameter growth response generally was evidenced by the sample trees in the first growing season following release, cases were noted where this result was not apparent for two or even more years. As indicated in the table, some released balsam firs showed no growth response.

The data indicate no direct association between the age of trees when released and their diameter growth response. However, there was specific indication that presence of butt rot in a released tree generally decreases this response.

Variation in the degree of diameter growth response resulting from release might be expected as a result of what has been termed intensity of suppression, this being comprised of the number, size and species of suppressing and crowding trees and their proximity to a released balsam fir. An examination of the data using an analysis of variance indicated that no one of these factors alone had any evident significant effect on the degree of diameter growth response of balsam fir to release. However, the size of overstory trees cut coupled with their distance from released balsam firs gave evidence of influencing the diameter growth response of these trees to release. In general, the larger the tree cut, regardless of species, and the shorter its distance from the released balsam fir, the greater the diameter growth response of the latter.

The above data and conclusions are the result of a limited study and should be considered and used accordingly.

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