INDIVIDUAL TREE FIVE-YEAR BASAL AREA AND CROWN DIAMETER GROWTH IN APPALACHIAN HARDWOOD STANDS AS INFLUENCED BY THINNING AND GYPSY MOTH DEFOLIATION

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Abstract—I evaluated silvicultural treatments to minimize gypsy moth effects on forests in experimental plots on the West Virginia University Forest. Two treatments, presalvage thinning and sanitation thinning, were used. As part of the evaluation, I measured individual tree basal area growth and crown diameter growth over a five-year period. This period began with pretreatment measurements of stem dbh and crown diameter in 1989 before thinning and defoliation. Thinnings were installed during the winter of 1989-1990 and had paired control stands that were not thinned with four replicates of each treatment and control. Gypsy moth defoliated six of the 16 stands in 1990 and 1991. Mortality resulting from the defoliation-induced stress along with drought stress in 1991 occurred over the following three years. At the end of this period of stress and mortality, stem dbh and crown diameter were remeasured for all living trees. Stem dbh was converted to basal area. Basal area growth and crown diameter growth (or shrinkage in some cases) were calculated by taking the difference between the two measures.

Mean change in crown diameter was 3.5 feet and was normally distributed. About 35 percent of the trees had a reduction in crown diameter due to dieback. The range of crown diameter changes was -28 to +31 feet. Crown diameter change was significantly correlated with species, treatment (control, control+defoliation, thinning, thinning+defoliation), and the pretreatment crown class, but was not correlated with the pretreatment crown vigor nor the number of sides released. Despite the significance of the correlated variables, they explained very little of the variation in crown diameter change.

Mean change in basal area growth was 0.07 square feet and had a skewed distribution. Less than 1 percent of the trees had a decrease in basal area and 65 percent had only small increases in basal area (0.0 to 0.1 ft^2). The distribution dropped in an exponential pattern up to the maximum change of 1.28 square feet. Basal area change was significantly correlated with species, treatment, pretreatment crown class, pretreatment crown vigor, number of sides released, and crown diameter change. In a forward stepwise regression, the first and most important variable was pretreatment crown class. It was then followed by crown diameter change, species, and pretreatment crown vigor but all of the variables explained only a small portion of the additional variation.

Evaluation of treatment effects on crown diameter change showed that defoliation reduced crown diameter growth regardless of thinning treatment and thinning treatment increased crown diameter growth regardless of defoliation. Mean crown diameter growth (in feet) by treatment was:

Control + defoliation	2.5a
Thinned + defoliation	2.9ab
Control	3.2b
Thinned	4.7c

Evaluation of treatment effects on basal area change showed that thinning treatments increased growth regardless of defoliation and defoliation actually increased growth of surviving trees but less so in thinned stands than in control stands. Mean basal area growth (in square feet) by treatment was:

Control	0.055a
Control + defoliation	0.073b
Thinned + defoliation	0.084c
Thinned	0.084c

The positive effects of thinning on crown diameter and basal area growth trends especially when defoliated along with information on the mortality rates in the thinned versus unthinned stands support the use of thinning before gypsy moth defoliation as an useful technique to minimize gypsy effects on forests.

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