SAPLING RECRUITMENT AND GROWTH DYNAMICS IN MULTI-AGED NORTHERN CONIFER STANDS: A 20-YEAR STUDY

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It has long been recognized that sustainable multi-aged management relies upon defining and attaining specific stand structural goals. These goals are typically defined in terms of residual basal area, maximum diameter and number of trees per size class. Most assessments of multi-aged stands focus on these attributes, i.e. the structure and growth of the merchantable classes. However, the amount, species, growth and mortality of the sapling classes have important implications for long-term sustainability.

The USDA Forest Service Northeastern Research Station established a long-term silviculture experiment on the Penobscot Experimental Forest in Maine in 1952. Treatments are replicated at the stand level and include selection cutting on 5-, 10-, and 20-year cycles (SC05, SC10, and SC20, respectively) as well as modified (MDL) and fixed (FDL) diameter-limit cutting at 20-year intervals. A subsample of trees 0.5 inches and larger in diameter at breast height have been numbered and followed individually since 1975, with measurements taken before and after treatment and at 5-year intervals between treatments.

Preliminary analysis of sapling ingrowth data from year 25 of the study to the present revealed high within-treatment variability. The amount of ingrowth recorded in a single inventory varied temporally within treatments by as much as tenfold, and spatially (between replicates) by twofold. Values ranged from as low as 109 stems/acre over a five-year inventory period in one of the SC05 stands, to 1918 stems/acre in one of the SC20 stands. The mean rate of ingrowth over the measurement period differed only for SC05 (53.7 stems/acre/year) and S20 (240.6 stems/acre/year). Species composition of sapling ingrowth did not differ by treatment.

Individual tree dynamics were evaluated using the sapling ingrowth in year 25 of the study, and following that ingrowth "cohort" over time. Twenty years later the proportions of this class that had died, remained saplings, and reached the poletimber did not differ by treatment. On average, 50% of the "class of 25" ingrowth had died, 48% remained sapling size, and 2% reached the pole classes. Principal cause of mortality differed between the 5- and 10-year selection (residual stand damage) and 20-year selection (suppression). There were no other treatment differences in amount or cause of sapling ingrowth mortality.

Rates of sapling diameter growth at the time of ingrowth did not differ by treatment and averaged <0.1 inch per year. This slow rate of sapling ingrowth diameter growth, combined with high mortality, suggests problems with subsequent merchantable ingrowth and long-term sustainability of structure and production in the multi-aged stands. Future work will address merchantable ingrowth dynamics.