EARLY DEVELOPMENT OF GAP ORIGIN NORTHERN CONIFERS: DO MODEST SIZED CANOPY OPENINGS PROVIDE FOR TIMELY RECRUITMENT OPPORTUNITIES?

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One of the greatest challenges faced by forest managers interested in transitioning from single to multi-aged stand structures is the establishment and timely recruitment of new age classes. The Acadian Forest of central Maine, characterized by long-lived shade-tolerant species that regenerate reliably, provides an ideal backdrop for identifying viable strategies. To that end, this study presents a retrospective analysis of the height growth of gap origin saplings in a mature single-storied northern conifer stand transitioning into the understory reinitiation stage of stand development. The tallest individual saplings of each of the three most common species [*Tsuga canadensis* (EH), *Picea rubens* (RS), *Abies balsamea* (BF)] were harvested from each of six densely regenerated canopy gaps of varying size (gap fraction range=0.19 to 0.33, roughly corresponding to the removal of 1-2 main canopy trees). Sapling age, measured at the root collar, averaged 29 yrs (range=19 to 46), and average total height was 4.9 ft (range=1.7 to 11.9), when sampled in 2004. Species composition of the overstory was dominated by EH (60% of total stand basal area which was 165 ft^2); RS (28 ft^2) and BF (10 ft^2) were also represented in the overstory. The average breast height age of main canopy trees on the margins of the studied gaps was >100 yrs.

In general, the radial growth patterns exhibited by these saplings did not indicate distinct periods of suppression and release, but rather suggested accelerating growth in response to increased resource availability in the gaps and their increasing capacity to utilize them. Further, radial growth patterns of the surviving overstory trees surrounding the gaps showed little evidence of enhanced increment in response to the vacated growing space, perhaps due to their advancing ages and/or current social position within the stand. Seventy-four percent of the variability in recent sapling height growth could be accounted for in a linear model including species (P=0.026), gap fraction (P=0.006), and relative sapling height (P=0.047) as inputs; means separation indicated that on average EH grew faster in height than either BF or RS under these conditions. Current rates of height growth among these leading saplings does not appear to be sufficient to ensure their timely recruitment into the main canopy layer (EH=0.48 ft/yr, BF=0.31 ft/yr, RS=0.15 ft/yr), with the possible exception of EH. Our findings highlight a potential bottleneck when converting single-cohort stands to multi-aged structures. In fairness, the modest sized canopy gaps represented in this study may have been too small to promote thrifty height growth, even among these shade-tolerant species. Observation of gap origin saplings within openings more typical of group selection cuttings (up to 0.5 ac) may lead to a different conclusion.