Effects of early herbaceous and woody vegetation control on eastern white pine

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Abstract – Oral and poster

Eastern white pine (*Pinus strobus* L.) is one of North America's most valuable softwood species. Historically, it thrived in regions characterized by frequent, low-intensity fires that created favorable regeneration conditions. Declining frequency of such fires, coupled with competition, insect, and disease problems, has seriously impeded white pine regeneration efforts. A greater understanding of the vegetation conditions favoring white pine survival, growth, and stem quality would enable more effective management of early stand conditions in the absence of fire.

In 2000, an experiment with 3 installations was initiated to quantify the temporal and spatial effects of woody and herbaceous vegetation on white pine seedlings. A response-surface design is being used to combine and test different durations of herbaceous vegetation suppression (0, 2, and 4 years) with various timings of woody vegetation release (time of planting, after 2nd growing season, after 5th growing season, and none). Four different hardwood densities are being studied: 0, 5000, 10000, and 15000 stems per ha. The research sites, situated near North Bay, Ontario, and Doaktown, New Brunswick, address the clearcut and 2 gradients of the shelterwood regeneration systems. After 4 growing seasons, white pine subjected to woody-only competition control had 1.2 to 1.4 times the stem volume of trees left untended, earlier release providing the larger gains. In contrast, pine receiving 2 growing seasons of herbaceous competition control averaged 4.3-fold gains in stem volume over untreated trees. Two seasons of herbaceous control, coupled with woody vegetation control after the 2nd growing season or at the time of planting, increased these gains to 6.0- and 7.7-fold, respectively. These responses to early vegetation control challenge the current operational strategy of planting, waiting 2 growing seasons, and then broadcast releasing with glyphosate (i.e., providing both woody and herbaceous control after the 2nd growing season), which provided 3.0-fold volume gains over untended pine. Moreover, these early growth responses were strongly correlated with observations of seedling physiology and microclimate. In general, low photon flux density and soil moisture content in the top 15 cm of mineral soil were associated with reduced photosynthetic potential of white pine seedlings. Herbaceous vegetation appears to be a greater competitor for soil moisture than woody vegetation during the first two growing seasons after planting, explaining the significant positive gains in white pine growth in response to early herbaceous vegetation control. After the second growing season, woody vegetation, with its rapidly increasing height and leaf area, become greater competitors for both light and soil moisture. Although light levels approached critical levels for white pine growth more rapidly in the shelterwood than in the clearcut, moisture and temperature extremes were moderated in the shelterwood environment. White pine height growth and weevil avoidance were greatest with either an aspen or a mature pine (shelterwood) overstorey, suggesting that early herbaceous vegetation control and maintenance of a moderate overhead canopy may maximize white pine stem growth and quality.

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