Effects of Early Herbaceous and Woody Vegetation Control on Seedling Microclimate and Physiology of Eastern White Pine

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In 2000, an experiment was established to quantify the temporal and spatial effects of woody and herbaceous vegetation on seedling microclimate and physiology of planted eastern white pine (*Pinus strobus* L.) seedlings in a clearcut and a uniform shelterwood near North Bay, Ontario. Treatments included the continuous (i.e., 5 year) control of woody vegetation (W), herbaceous vegetation (H), both types of competition (B), and no competition control (0). On 3 replicate plots of each of these 4 treatments, seedling microclimate was monitored the first 3 (shelterwood) and 4 (clearcut) growing seasons after planting. Periodic, diurnal assessments of leaf gas exchange and seedling water status were conducted on these same plots, beginning in the second growing season after planting at the clearcut (growing seasons 2 through 4) and shelterwood (growing seasons 2 and 3) sites. Total daily photon flux density (PFD) did not differ among treatments at the clearcut until the second growing season, after which the 0 and H treatments had lower PFD than the W and B treatments, with comparative treatment differences increasing over time, as competing vegetation developed. In contrast, the shelterwood overstory reduced understory light levels to about 50% of full sunlight, the threshold for maximum height growth of white pine. Further reductions in PFD were exhibited only in the 0 and H treatments. Treatment effects on mean seasonal soil moisture content in the top 15 cm of mineral soil (SMC) were accentuated during periods of little rainfall at the clearcut, with the B treatment having higher SMC values than the 0 treatment. Competition for soil moisture during drought periods was more intense in the 0 and W treatments than in the H and B treatments. By comparison, vegetation management treatments had less influence on SMC in the shelterwood than the clearcut, even during periodic drought. In general, low PFD and SMC were associated with reduced photosynthetic potential of white pine seedlings in all 3 growing seasons. Herbaceous vegetation appears to be a greater competitor for soil moisture than woody vegetation during the first two growing seasons after planting. Thereafter, woody vegetation, with its rapidly increasing height and leaf area, become greater competitors for both light and moisture. Observations of seedling physiology and microclimate were strongly correlated with early growth responses.