

Effects of stand composition on changes in productivity associated with hemlock decline.

MATES-MUCHIN, J.T.*¹, J.D. LEWIS¹ AND W. SCHUSTER²

Fordham University, Louis Calder Center, Armonk, NY 10504
Black Rock Forest Consortium, Cornwall, NY 12518

The loss of dominant species due to invasive parasites may significantly alter forest productivity. However, few studies have assessed how species composition and, in particular, the decline of a dominant tree species affects the initial forest response to the decline. Eastern hemlock (*Tsuga canadensis*) has been declining over the past 15 years in eastern forests, associated with the expansion of the hemlock woolly adelgid (*Adelges tsugae*), a non-native insect. We hypothesize that eastern hemlock decline will cause a decrease in productivity in hemlock-dominated areas, whereas in mixed and hardwood-dominated areas, the loss of eastern hemlock will be compensated for by increased growth of coexisting species. To test this hypothesis, we established 12 plots across a gradient of percent hemlock. Plots were divided based on the relative importance of hemlock: > 50% = hemlock-dominated, 5-50% = mixed, and 0-5% = hardwood-dominated. In the year 2000, the mean basal area of the trees was 40, 30 and 25 m² ha⁻¹ in hemlock, mixed and hardwood plots, respectively. Stem growth increment and annual leaf litter fall were measured to assess aboveground NPP. From 1985-2000 the amount of hemlock mortality was 13.4% compared with hardwood mortality of 7.7%. Additionally, the percent increase per year in basal area was 1.3, 1.5, 2.5% in hemlock, mixed and hardwood plots, respectively. Repeated measures analysis showed a significant interaction between stand type and growth rate from 1985-2000, suggesting that hemlock and mixed plots grew significantly slower than hardwood plots. Differences in stand-level NPP should reflect inherent differences in species growth rate and competitive interactions between species. Based on these factors, hardwood plots should grow faster than hemlock plots, and hemlock trees should competitively reduce the growth of coexisting hardwood trees. In fact, our data indicate that hardwood trees were growing faster in hemlock plots than in hardwood plots suggesting that the competitive ability of hemlock trees was suppressed because of high mortality and crown defoliation associated with HWA infestation and reduced hemlock growth. In addition, these data suggests that losses of dominant species may significantly alter regional carbon cycles by reducing NPP in areas where they are a dominant forest component.