

INFLUENCE OF ACID DEPOSITION ON REGENERATION DYNAMICS ALONG A DISTURBANCE INTENSITY GRADIENT

Sarah E. Stehn, Christopher R. Webster, Michael A. Jenkins, and Shibu Jose¹

Now considered one of the most threatened vegetation communities in North America, spruce-fir forests of the southern Appalachians have been devastated by the combined impacts of the exotic balsam woolly adelgid (*Adelges piceae*, BWA) and chronic acid deposition. Endemic Fraser fir (*Abies fraseri*), the dominant overstory species in these forests, has experienced near complete overstory mortality as a result of the adelgid. Forest regeneration patterns indicate high spatial variability, with dense patches of *Rubus* spp., fir, and deciduous regeneration repeating across the landscape. To quantify the spatial variability and density of fir, spruce, and deciduous regeneration in spruce-fir forests, we sampled 60 randomly selected plots within Great Smoky Mountains National Park. As a measure of local variability of regeneration, we used regeneration density of thirty 1-m² subplots per plot to calculate a coefficient of within-plot variation for each species.

Despite the impacts of the BWA and chronic acid deposition, fir remains an important part of southern Appalachian spruce-fir forests in all size classes at elevations above 1,750 m. Density of fir in all size classes was associated with time since disturbance. On plots where fir regeneration was present, its local variability was significantly greater than that of spruce or deciduous regeneration. Regression models attributed local variation in fir to the influence of elevation, *Rubus* spp. cover, B-horizon nitrogen concentration, and O-horizon calcium to aluminum ratio. We propose that concurrent influences of BWA infestation and acid deposition may have cultivated the development of soil nutrient hotspots that foster increased competition from nitrophilous ground-layer vegetation such as *Rubus* spp. Additional or co-occurring aluminum hotspots may also exclude sensitive plants by toxicity, further influencing ground-layer competition. Given that full recovery of this imperiled ecosystem remains uncertain, the persistence of this forest type may hinge on the response of ground-layer species and woody regeneration to continued disturbance.

¹ Sarah E. Stehn and Christopher R. Webster, Michigan Technological University; Michael A. Jenkins, Great Smoky Mountains National Park; Shibu Jose, University of Florida. Corresponding author: Christopher R. Webster, School of Forest Resources & Environmental Science, Michigan Technological University, 1400 Townsend Drive, , MI 49931-1295, 906-487-3618; Email: cwebster@mtu.edu.