

MANAGEMENT OF HWA AND RESTORATION OF HEMLOCK HEALTH

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ABSTRACT

Hemlock woolly adelgid (*Adelges tsugae*) populations have been dramatically reduced and the health of eastern hemlock (*Tsuga canadensis*) forest stands has been restored in two locations in northeastern Pennsylvania.

Bushkill Falls, Pike County, Pennsylvania has over 30-acres of hemlock-dominated forest. A comprehensive inventory and health assessment was conducted of individual trees in November 2000. Defoliation of 50 percent and significant individual mortality of hemlocks over 20-inches DBH was observed in five (5) hemlock-dominated stands. The economic and ecological importance of 1,500 trees was studied and 1,100 trees were chemically injected with imidacloprid in 2001-2002. The systemic insecticide was applied via soil drench (Merit® 75WSP) with a Kioritz® soil injector and via stem injections (Pointer®) with a Wedgle® tree injector. Sampling results and visual observations indicated adelgid populations were reduced to less than 10 percent of pre-application levels in the winter 2002-2003. Significant new growth was subsequently observed on all treated trees with exception of hemlocks that had experienced significant defoliation.

A foliar chemistry analysis was conducted in late winter 2003 to determine if elements necessary for optimal photosynthesis were lacking in the needles of previously infested hemlocks. An analysis of 12 micro-elements and crude fiber from samples taken at Bushkill Falls was compared to samples taken from healthy nursery-grown hemlocks. The results indicated hemlocks infested with HWA had deficiencies in micro-elements necessary to maximize photosynthesis and produce new growth in the absence of HWA. Deficiencies were observed in all five stands. In May 2004, a customized mix of chelated nitrogen and micro-elements was applied to the foliage of 30-acres of hemlocks via helicopter spraying. New growth of 3 inches or more was abundant throughout the forest in summer and fall of 2004, and foliar element levels examined after treatment showed significant positive changes.

The Henryville Troutfisherman own land bordering six (6) miles of Paradise Creek in Monroe County, Pennsylvania. Paradise Creek is an high value trout stream which maintains native reproducing brook trout. Hemlocks occupy approximately 30 percent of the

forest cover within 100 yards of the streambank. Hemlocks form greater than 80 percent of the forest over some pools and riffles. HWA was observed on greater than 60 percent of the hemlocks along the stream in April 2001. HWA canopy decline was observed and crown densities were 50 percent of normal in many locations. Scattered mortality of mature hemlocks was observed. In May and October 2001, approximately 500 HWA infested trees were treated with a systemic insecticide applied via soil drench (Merit® 75WSP) with a Kioritz® soil injector and via stem injections (Pointer®) with a Wedgle® tree injector.

Approximately 5,000 *Sasajiscymnus tsugae* beetles were released in May and June 2002 within stands treated with systemic insecticides; however, beetle-release trees were not injected. HWA surveys in the 2003 and 2004 indicated that HWA was observed on less than 5-percent of trees and HWA populations were limited to scattered individuals. New growth was abundant on treated and untreated trees.