

# USING DENDROCHRONOLOGY TO MODEL HEMLOCK WOOLLY ADELGID EFFECTS ON EASTERN HEMLOCK GROWTH AND VULNERABILITY

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## ABSTRACT

This study examined the relationship between eastern hemlock (*Tsuga canadensis* (L.) Carr.) crown condition and changes in radial growth associated with infestation by hemlock woolly adelgid (HWA), *Adelges tsugae* (Hemiptera: Adelgidae). Tree-ring chronologies of eastern hemlock were used to develop a binomial decline index based on three consecutive years of below-average growth. Radial growth decline was modeled using logistic regression as a function of an extensive array of tree, crown, and site variables that were collected over an 11-year period in Delaware Water Gap National Recreation Area. Some site-related variables, such as site-location and aspect, were significantly related to decline probabilities when considered individually. However, the total proportion of response variance accounted for was low, and the only site variable included in the final model was mean plot-level HWA infestation level. For every 1% increase in mean percent HWA infestation per plot, there was an 8% increase in the likelihood that a tree would be classified as being in decline. Tree crown variables such as live crown ratio, crown density, and the modified ZBadj index, a combination of foliage transparency and branch dieback, had the most explanatory power, both individually and in the final model. These crown variables were relatively accurate predictors of the degree of hemlock growth decline during HWA infestation.

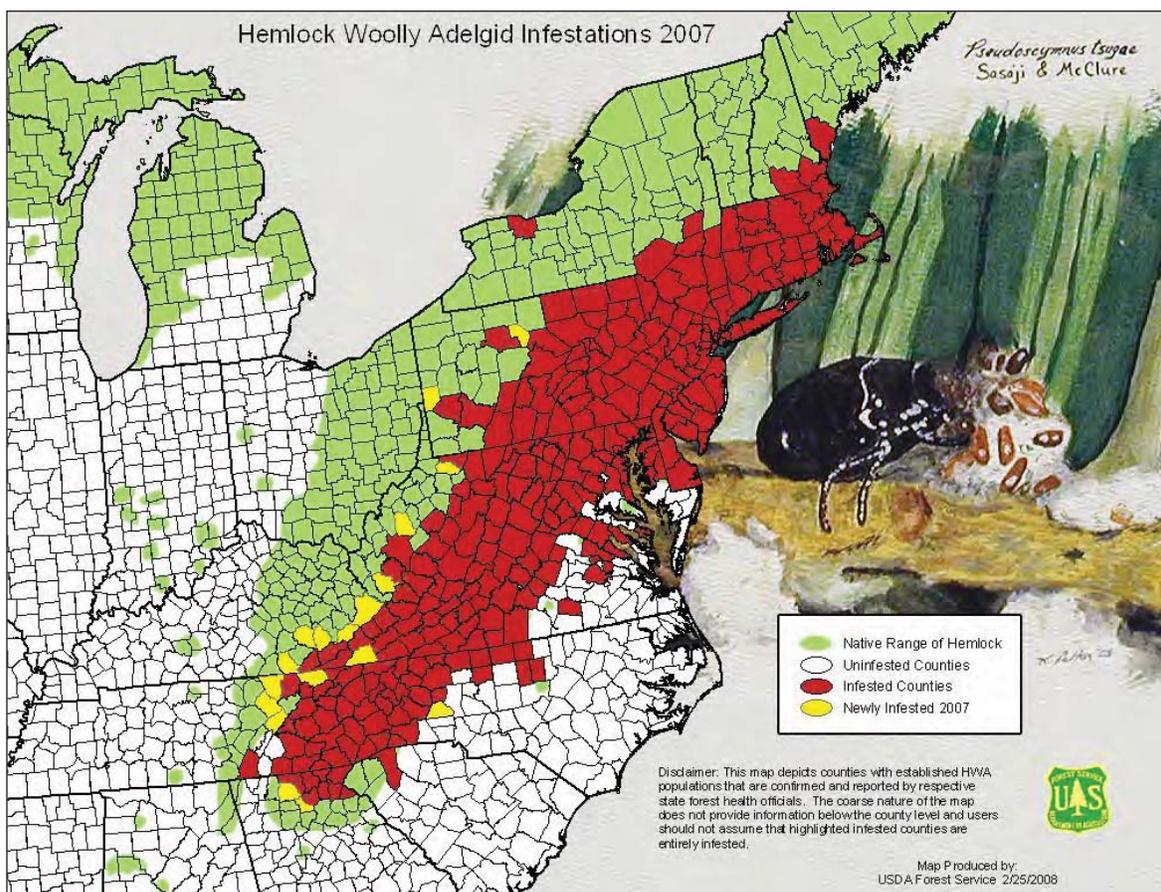
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TECHNOLOGY  
TRANSFER

*Hemlock Woolly  
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