

# Current Composition and Structure of a Disjunct Eastern Hemlock Ecosystem in Alabama and Modeling Hemlock Woolly Adelgid Infestation

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Eastern hemlock (*Tsuga canadensis*) serves a major role as a foundation species in eastern temperate forest ecosystems. The southernmost populations of hemlock occur in Alabama, and these populations will likely be among the last hemlock-dominated forests in the South to be impacted by the hemlock woolly adelgid (*Adelges tsugae*; HWA), an invasive insect that induces hemlock mortality. This study examines the current composition and structure of a hemlock-dominated forest in Alabama and predicts the impact of potential HWA infestation using the Forest Vegetation Simulator (FVS) model. It is hypothesized that the geographic location of this forest makes it highly susceptible to a HWA infestation that would significantly alter both the forest's successional trajectory and the ecosystem services that this forest provides. This study serves as a baseline to inform future HWA management efforts in the region. To examine the forest, plot sampling was performed in two hemlock-dominated stands on the William B. Bankhead National Forest in northwestern Alabama in May 2015, and quantitative measurements of the woody plants, physiography, and soil were collected. Hemlock makes up 49% of both the overstory and large saplings size classes, though deciduous species (e.g. *Quercus montana* and *Acer rubrum*) dominate other classes. It is predicted that the initial HWA infestation will occur between 2024 and 2027, and the FVS model predicts a decline in hemlock basal area of > 99% by the year 2060. Total basal area of the forest will remain relatively unchanged, suggesting that other woody plant species (e.g. *Quercus montana* and *Acer rubrum*) will replace hemlock in the future. The loss of hemlock in this region will serve as a significant reduction in landscape biodiversity, and this loss is expected to have long-lasting impacts on forest composition, nutrient uptake, hydrology, wildlife habitat, and recreation opportunities in the area.