SPATIO-TEMPORAL ANALYSIS OF REDBAY AMBROSIA BEETLE INVASION IN THE SOUTHEASTERN U.S.

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ABSTRACT

The redbay ambrosia beetle (*Xyleborus glabratus* Eichhoff), native to eastern Asia, was first detected in the U.S. in 2002 near Savannah, GA. Widespread mortality of redbay (*Persea borbonia*) trees on Hilton Head Island, SC, in 2004 has been attributed to the beetle; the trees were actually killed by an associated fungus (*Raffaelea* sp.). This fungal disease, referred to as laurel wilt, has since caused mortality of redbay and, in some cases, sassafras (*Sassafras albidum*) trees in coastal Florida, Georgia, and South Carolina. A number of other species from the Lauraceae family, including the commercially planted avocado (*Persea americana*), appear to be susceptible. While there are ongoing efforts to address unknowns regarding the biology and behavior of the beetle and fungus, policymakers also need information from broad scales when deciding how to manage this invasion. We completed a broad-scale assessment by exploiting relevant, available spatio-temporal data. First, we interpolated redbay and sassafras density maps from Forest Inventory and Analysis (FIA) Phase 2 plot data. Second, we performed climate matching with the beetle's native range in Asia to delineate potential U.S. geographic limits for the beetle. Third, we used county infestation data to estimate the beetle's rate of spread and then modeled spread through time, incorporating host density as a weighting factor.

Our results reveal that the invasion has developed over a region of the Southeast with numerous hotspots of moderate to high redbay density. High-density areas of redbay just beyond the currently invaded extent suggest spread will continue to be rapid in the short term. Lower densities elsewhere may translate to slower spread in the long term, although it is unlikely to be stopped completely due to the possibility of long-distance dispersal. Notably, there is no evidence that sassafras attracts the beetle as redbay does, so spread deep into eastern U.S. forests seems unlikely; our climate match also suggests the beetle will be constrained to the southeastern U.S coast. Nevertheless, if unchecked, the beetle may spread throughout the range of redbay in less than 40 years. The greatest potential economic impact may come if the redbay ambrosia beetle invades the avocado growing region in south Florida, although avocado appears to be somewhat resistant to the laurel wilt fungus. Disruption of anthropogenic, long-distance dispersal may be the most immediately effective measure for slowing the spread of both beetle and fungus.