# MODELING THE SPATIAL AND TEMPORAL DYNAMICS OF ISOLATED EMERALD ASH BORER POPULATIONS

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## ABSTRACT

The ability to predict the distance and rate of emerald ash borer (EAB) spread in outlier populations is needed to continue development of effective management strategies for improved EAB control. We have developed a coupled map lattice model to estimate the spread and dispersal of isolated emerald ash borer populations. This model creates an artificial environment in which several iterations of emerald ash borer dynamics may be performed to represent the spatial spread of EAB over time.

The general spread model involves initial dispersal of adult beetles (e.g., from infested firewood), population growth (potentially constrained by the availability of suitable ash phloem), loss of the ash phloem resource by pre-reproductive emerald ash borer numbers (i.e., larval feeding), and subsequent dispersal of the next generation of emerald ash borer adults. The shift from two-year to one-year development of emerald ash borer larvae with increasing tree stress has been incorporated into the model. Also, the density and distribution of ash and initial emerald ash borer infestation levels can be varied to estimate emerald ash borer spread and dispersal according to site-specific conditions. To develop realistic estimates of emerald ash borer spread and dispersal, model parameters have been fit to match EAB dynamics observed at several outlier sites. In addition, model calibration via large-scale field sampling in forested areas is currently in progress.

Potential applications of this model include: 1) evaluating management techniques and strategies at distinctly different sites (e.g., forest, urban, and riparian sites); 2) determining ash removal zones at emerald ash borer eradication sites given ash distribution, infestation levels, and number of years infested; 3) predicting emerald ash borer dynamics following varying degrees of ash removal; and 4) evaluating the effectiveness of biological control agents. Implications of this research were discussed in relation to future management guidelines.