DENDROCHRONOLOGICAL RECONSTRUCTION OF THE ESTABLISHMENT AND SPREAD OF EMERALD ASH BORER

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ABSTRACT

Since emerald ash borer was discovered in southeastern lower Michigan in July 2002, it has been found to be responsible for the death or decline of several million ash trees. We used dendrochronological analyses to reconstruct where emerald ash borer originally became established and how it spread throughout southeastern lower Michigan. The area sampled was approximately 15,000 km^2 in size and encompassed the original six-county emerald ash borer quarantine area established in 2002. Two to four increment cores and/or cross-sections from emerald ash borer-killed green ash were preferentially collected over declining or non-stressed ash trees on a sampling grid of at least 4.8 × 4.8 km and on a sampling grid of 2.4 × 2.4 km throughout the heart of the core infestation. Samples were dried, mounted, and surfaced in the laboratory prior to measuring annual growth rings to the nearest 0.01 mm using a Velmex measuring system. Skeleton-plots depicting annual relative growth rates for each sample were generated and used to visually cross-date samples to a known master chronology compiled from ash trees surrounding the sample area.

Preliminary cross-dating analyses of ash trees in the sample area suggest that emerald ash borer initially became established and began to kill trees in the greater Westland-Garden City vicinity by 1997-1998. Additional analyses are currently in progress to verify the accuracy of the preliminary cross-dating analyses. In related research conducted at several emerald ash borer outlier sites, we have found that an area is typically infested for three to four years before tree mortality occurs. In turn, this suggests that emerald ash borer was introduced and became established in southeastern lower Michigan in the early to mid-1990s.

Preliminary measurements of the reconstructed spread of emerald ash borer in southeastern lower Michigan indicate that the emerald ash borer population exhibited a biphasic expansion following an initial establishment phase. This type of expansion is fairly characteristic of invasive species in which nearby expanding satellite colonies coalesce with their primary core infestation. The core emerald ash borer infestation initially radiated from the epicenter by about 6.5 km each year, then increased to 30 km per year as nearby satellite emerald ash borer colonies started to coalesce. Jump distances of new satellite colonies of emerald ash borer averaged 20 km from the nearest edge of the core infestation (95% core infestation = 15 to 24 km). In five years (1998 to 2003), the area occupied by the core emerald ash borer infestation increased 170-fold.