

RECONSTRUCTION OF THE ESTABLISHMENT AND SPREAD OF EMERALD ASH BORER THROUGH DENDROCHRONOLOGICAL ANALYSIS

Nathan W. Siegert¹, Deborah G. McCullough¹, Andrew M. Liebhold²,
and Frank W. Telewski³

¹Depts. of Entomology and Forestry, Michigan State University
243 Natural Science Bldg., East Lansing, MI 48824-1115

²U.S. Forest Service, Northern Research Station
180 Canfield St., Morgantown, WV 26505-3180

³Dept. of Plant Biology, Michigan State University
166 Plant Biology Bldg., East Lansing, MI 48824-1312

ABSTRACT

Emerald ash borer (EAB) (*Agrilus planipennis* Fairmaire [Coleoptera: Buprestidae]), a phloem-feeding beetle native to Asia, was identified in 2002 as the cause of widespread ash (*Fraxinus* spp.) mortality in southeastern Michigan and Windsor, Ontario. We used dendrochronological analyses to reconstruct where EAB originally became established and how it spread throughout southeastern Michigan. The area we sampled was greater than 15,000 km² in size and encompassed the original six-county EAB quarantine established in 2002. Increment cores from EAB-killed green ash were preferentially collected over declining or non-stressed ash trees on at least a 4.8 × 4.8 km sampling grid. Cores were dried, mounted, and surfaced prior to measuring ring widths to the nearest 0.01 mm using a Velmex measuring system. Skeleton-plots depicting annual relative growth rates were generated and used to visually crossdate cores to a known master chronology compiled from ash trees surrounding the study area.

Preliminary crossdating analyses suggest that EAB initially became established and began to kill trees in the Westland-Garden City vicinity by 1997-1998. Related research has shown that an area is typically infested for 3 to 4 years before tree mortality occurs, suggesting that EAB was introduced and became established in southeastern Michigan in the early to mid-1990s. Preliminary measurements of the reconstructed spread of EAB indicate that the EAB population exhibited a biphasic expansion following an initial establishment phase. This type of expansion pattern is characteristic of invasive species in which nearby expanding satellite colonies coalesce with their primary core infestation over time. The core EAB infestation initially radiated from the epicenter by about 6.5 km each year and then increased to 30 km per year as nearby satellite EAB colonies started to coalesce. Jump distances of new satellite colonies of EAB averaged 20 km from the nearest edge of the core infestation (95% C.I. = 15 to 24 km). In 5 years (1998 to 2003), the area occupied by the core EAB infestation increased 170-fold.