

North American Emerald Ash Borer Infestation: Ashes, Ashes, All Fall Down

By Dr. Randall Frost

S ometime around 1994, a new Asian beetle arrived in southeastern Michigan, probably on pallet wood loaded on a cargo ship bound for the Motor City. From there the insect flew into Windsor, Canada. By 2002, the beetle – by that time recognized as the emerald ash borer (EAB) – was well established in Michigan and Ontario, Canada, and estimates were that it had already killed or infested at least 5 million ash trees in open settings, woodlots and forest stands. In response, quarantines were enacted in the United States and Canada to stop the human-assisted spread of the infestation.

But the pest was not to be stopped that easily. At least five isolated EAB populations were discovered in Ohio in 2003, having apparently arisen from the transport of infested firewood, nursery stock or logs out of Michigan. In April 2003, 121 ash



Ashes in decline due to emerald ash borer.

trees were moved from Michigan to a nursery in Maryland. By the time that the situation was recognized, 94 of the trees remained in the nursery, with 27 sold. Although all of the nursery stock, some of which was shipped to Virginia, was later accounted for, many of the recovered trees exhibited signs of infestation and EAB larvae, indicating that EAB adults had emerged and reproduced in Maryland. There is now also evidence that the pest may be established in Indiana, where a dead borer was found in 2003 on an ash tree that had been moved to that state from Michigan two years earlier.

North American ashes have commercial importance as timber, landscape trees, and sources of food for wildlife. USDA Forest Service scientist Dr. Robert Haack feels that the entire continent is at risk from EAB attack, and that spread of the pest to the rest of the country would cause considerable economic and environmental damage.

The emerald ash borer (*Agrilus planipennis*) is native to northeastern China, North and South Korea, parts of Mongolia and Russia, Japan and Taiwan. In China, the beetle has only been known to attack ash trees, but in Korea, elms have been found to be hosts. In North America, however, only ash trees have been found so far to be susceptible to EAB infestation.

Of the roughly 60 ash species worldwide, 16 are found in North America, occurring naturally in the eastern U.S. and along the West Coast. EAB susceptibility among species varies. Says David Cappaert, a research entomologist at Michigan State University, “Green ash (*Fraxinus pennsylvanica*) is probably more



Note epicormic branches being formed as crown dies back. Ed Czerwinski, Ontario Ministry of Natural Resources, www.invasive.org.

susceptible than white ash (*F. americana*); blue ash (*F. quadrangulata*) may be quite resistant ... We’ve looked quite a bit at the possibility that other species – elm, walnut, hickory – might host EAB, but it looks like the answer is no.”

Adult emerald ash borers are slender – from 7.5 to 15 mm long – and metallic, coppery-green in color. Studies in China have found the adult to be active from mid-May to July, during which time they feed, mate and lay eggs on the bark surface. Females are said to lay from 68 to 90 eggs during their lifetime.

From mid-June to October, the larvae feed in the tree’s cambial region. The larvae, which are white and about 30 mm

long when fully grown, have a characteristic pair of “pinchers” on their abdomen. Most of the larvae spend the winter in pupal cells constructed in the outer sapwood or in the outer bark. Pupation takes place the following spring or summer. Upon emerging from the tree, the adult beetle feeds on foliage throughout its several-week life.

A major difficulty with EAB is that it is practically impossible to detect an infestation in its first year because eggs are usually deposited in the upper trunk deep inside bark cracks, and because the larvae feed under the bark. The only way to detect these early infestations is to remove the bark and look for larval galleries. In the year following the initial attack, the insect’s characteristic D-shaped larval exit holes may easily be overlooked. Also, in the first year there may be little crown dieback. In subsequent years of infestation, however, the crowns become thinner and do show signs of dieback.

According to Deborah McPartlan, who is the operations officer for USDA APHIS’ emerald ash borer plant protection and quarantine program, there are no known natural enemies to the pest in North America. A few parasitic wasps that are predators, however, have been found in China.

Michigan State’s David Cappaert notes that woodpeckers have proven valuable indicators of the presence of EAB – particularly during the first year of infestation when the insect remains in the upper reaches of trees. Unlike the small EAB exit holes, woodpeckers are visible from the ground. “Woodpeckers are the highest natural mortality factor, typically killing about half of the EAB,” he says.

Surprisingly, no one knows exactly how the woodpeckers locate their prey. Most predation takes place in winter, when the larvae are presumably immobile, so Cappaert doubts that sound is a factor. Nor does he think that odor plays a role. Whatever the cues the woodpeckers are responding to, the birds seem to make direct hits on the larvae under the bark.



Emerald ash borer larva.



Emerald ash borer “D” shaped exit hole.

Shortly after the beetle’s initial detection in Michigan in 2002, the Michigan Department of Agriculture (MDA) initiated a plan of action that included a multi-agency task force, a quarantine, press releases, meetings, surveys, a 1-800 hotline, and an EAB Web site. That May, the USDA granted Michigan \$14 million to contain the beetle, which was actually \$3 million less than the state had requested.

When MDA enacted the quarantine that restricted the transport of live trees, limbs, firewood and untreated logs and lumber in July 2002, it included five Michigan counties. A sixth county was added in August, and seven more counties were added to the

quarantine in 2003. As of January 2004, there were 13 quarantined counties in the state – Genesee, Ingham, Jackson, Lapeer, Lenawee, Shiawassee, St. Clair, Livingston, Macomb, Monroe, Oakland, Washtenaw and Wayne.

Among the businesses hardest hit by the infestation have been Michigan’s nurseries. Bernie deWitt, president of Lincoln Nursery in Ottawa County, has found himself stuck with a couple of thousand healthy ash trees that he cannot sell. Says deWitt, “A blight is a cost of doing business. But this isn’t. They say it probably came in on dunnage on a ship. If I buy plants from Europe, they have to go through an intensive inspection process. I think they ought to do that with the dunnage.”

In October, the Lansing State Journal reported that Michigan had asked the USDA for an additional \$33 million to contain the EAB and destroy dead and infected ash trees, plus \$9 million from the U.S. Forest Service for research. An MDA official was quoted at that time as saying that he hoped the funds would be allocated before winter, when dead ash trees could fall under the weight of ice. The spokesperson estimated that the containment effort could cost up to \$350 million over the following 12 years. To eradicate the pest, MDA was proposing to cut buffers or “firebreaks” around outlying sites of infestation.

But not everyone saw the wisdom in MDA’s strategy. On Dec. 17, 2002, the Lansing State Journal published comments by TCIA member Chris Smith, president of



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Smith Tree & Landscape Service in Lansing. Smith argued that MDA's plan to eradicate the EAB was fundamentally flawed. Noting that estimates had placed EAB in Michigan for six to 12 years, and that the identification of outlier infestation sites typically lagged infection by one to two years, Smith concluded that the spread of the pest was too late to control. Meanwhile, he noted that the core infestation area in and around Detroit was being left to expand even as attention was being focused on outlying infestations.

Two days later, the Lansing State Journal reported that MDA was planning to cut 1,000 ash trees in Michigan's Delta Township, with an undetermined number of trees to be felled in February at a site near Potterville. Both sites represented outlying infestations, well away from the core area. MDA's expectation was that federal money would cover the cost of cutting the trees, and that federal funds would be matched with community funds to cover the costs of planting new trees.

According to McPartlan, the decision to cut the trees was based on a science advisory panel's recommendation that all ash

trees within the first half mile of an EAB infestation be removed by cutting, then chipped to pieces less than 1 inch in size. McPartlan added that eradication efforts would continue as long as federal and state funds remained available.

The Forest Service's Robert Haack was involved in the study that led to the half-mile-radius figure. He says the distance was arrived at based on a study done around infested ash firewood that had been inadvertently moved to a farm outside the core infestation area. Says Haack, "The firewood had been taken to a farm area, and there were ash trees growing along a drainage ditch. The trees were in a nice straight row for a long distance. About a year ago, we cut down all ash trees, and checked the bark. In that study, the last infested tree we found was about a half mile out."

But Haack has also performed laboratory experiments that suggest the insect can fly up to 5 km in a two-day period. "We don't know if they do that in nature because they might stop at the nearest encountered ash tree and lay eggs," he says. "Or maybe they can fly a couple of miles, but they never have to because there are so many ash trees nearby. If a fire break is cut, will the beetles fly over it? We don't know yet."

Haack adds, "If they could cut a half-mile buffer around every infestation, that would probably dramatically reduce the population. Probably in many cases it would take out all of the EAB in that area." He cautions, however, "If [the beetles] can fly several miles, then we're in trouble. But everything now is based on this field study where we went out to that firewood area. It was done under natural conditions. But [we don't know] if a couple of beetles flew five or 10 miles, because we didn't cut trees that far out."

McPartlan notes that there is no aerial spray capable of preventing the movement of female borers to new trees, and that injectable treatments have the drawback of requiring periodic re-application. But according to Kenneth Rauscher of MDA,

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chemical treatments will be considered beyond the half-mile radius if peeling efforts and trapping along perimeters in the summer of 2004 indicate the need for them.

In Ohio, plans are to cut and chip all ash trees within a quarter mile – rather than a half mile – of an infestation, and then to treat all ashes within the next quarter-mile radius with the systemic insecticide imidacloprid. Canada, meanwhile, is planning to cut a 10-km, ash-free zone around its infested area. On Jan. 16, 2004, the Toronto Star reported that more than 60,000 ash trees would be destroyed over the following 10 weeks. The Canadian Food Inspection Agency has announced that there will be no compensation for property owners whose trees are cut in the 25-kilometer-long, 10-kilometer-wide “ash-free zone.”

McPartlan expresses sympathy for those who stand to lose their trees. “We understand that cutting trees down is often a sad experience for residents in an infested area. However, in the case of this pest, it is the best available action to take in order to totally remove the pest from the environment and keep it from spreading to your neighbors’ yards and their woodlots, to additional cities in the state, or to other adjacent states,” she said.

Robert Haack summed up his perception of the conflicts of interests in January, shortly before MDA was to begin its tree removals: “Some in the tree care industry want to protect trees with insecticides. Logging groups say ‘There’s no hope for your trees, sell your trees to us and we’ll give you a good price for them.’ Regulatory agencies like MDA and APHIS are trying to handle quarantine issues.”

By mid-January 2004, MDA had begun performing tree inventories and conducting public meetings about the planned tree cuttings. Kenneth Rauscher announced that tree removal would begin in the outlying areas in late February. Ominously, however, the Grand Rapids Press had reported just one day earlier that a new EAB infestation in Berrien County had been found

outside of the quarantined counties, near Michigan’s border with Indiana.

Later in January, the Michigan Forestry and Park Association (MFPA) and the Michigan Nursery and Landscape Association (MNLA) issued a joint statement on EAB that called for tree removals, chemical and/or biological treatments, further research, continued monitoring efforts, tree restoration and exchange of information. The statement read in part:

“We support what the Michigan Department of Agriculture (MDA) has done thus far, however, in our best expert opinion, the financial resources the MDA has been given are not sufficient to eradicate the pest. The severity of the impact of the Emerald Ash Borer (EAB) on the state’s natural areas, community and urban settings, consumers, industries, and state and federal economies cannot be understated. Immediate focus on this issue requires astronomical resources in terms of both manpower and funding. The Michigan Forestry and Park Association and the Michigan Nursery and Landscape Association, representing the experts in the fields of tree care, urban forestry, land-

scape contracting, growing facilities, landscape suppliers and retail garden centers, support suppression and containment and ultimately eradication of this devastating invasive insect pest.”

On Jan. 22, 2004, the Lansing State Journal reported that survey crews were poised to begin marking ash trees targeted for removal in Delta Township. Tree cutting was also targeted for 11 other isolated infestation sites, with the cutting at 10 of these sites contingent on federal funding from USDA. Tree removal was reportedly being timed to take place before the beetles began to emerge in April or May.

Chris Smith, meanwhile, argued that levels of funding for 2004 were inadequate for addressing all outlying infestations, and was predicting a 3,000-square-mile core infestation zone by September 2004. He also expressed concern that tree falls would continue to pose a threat to residents in the urban core area even as local politicians there attempted to find funds to pay for the removal of the dead trees. According to Smith, a fundamental flaw in the eradication plan was the attempt to eliminate the pest from outlying sites without adopting a

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This infested ash tree shows the typical root and stem activity below the EAB activity. The growth is often very lush.

firewall around the 900-sq-mile core area. "If the core area can't be contained and has been abandoned, anything done in the outlier areas is of no value either. There is no logical sense in pursuing outliers," he said.

But MSU's David Cappaert believes that containment in outlying sites is essential to slowing down the spread of the infestation. While he concedes that leaks are likely to occur in the control effort with the resulting spread of the beetle, he says, "In a worst case scenario, EAB could largely destroy the seven billion urban and forest ash in the lower 48 states, with costs at least in the tens of billions of dollars. But if the current quarantine and control program can provide additional years before EAB is established in Chicago or Boston, we will have far more information about how to forecast and mitigate damage."

TCIA board member Randy J. Owen, who operates Owen Tree Service in Attica, Mich., is currently under contract with MDA to remove the trees in outlying areas of infestation. While he is concerned about the ability of the containment effort to succeed, he is also optimistic. "I believe they

are going to have troubles. But if they have the proper management and aggressiveness they should be able to get a handle on it," he says. Owen feels that the loss of Michigan's ash trees would be a disaster for the state's ecology and economy, but he adds, "The ash tree population in Michigan might represent 10 or 15 percent of our forest trees. Our ash tree population is very minor compared to Tennessee, Kentucky and the Appalachians. It would be truly devastating if the infestation went through Ohio and into Kentucky and Tennessee."

But another TCIA member, Mike Barger, who operates Mike's Tree Service in Troy, Mich., thinks it's too late to start creating buffers around local infestation sites. "They talked about it too long. And I'm not sure it would have worked," he says. "My belief is the insect was beyond the quarantined areas to begin with."

Robert Haack remains cautionary but hopeful. "A lot of us suspect the beetle is in more sites than they have been found, but we haven't found them yet. Hopefully in a year we'll have better monitoring tools. People are looking visually instead of using a trap," he says.


Professor Michael Raupp, an entomologist at the University of Maryland in College Park, questions whether eradication is achievable. "I think eradication is going to be very difficult. This pest is distributed over an extraordinarily wide area of the North Central region. It's popping up in new places all the time. It is a big disperser and good flyer. It attacks healthy trees of all ages. That's a tough scenario."

"But containment is a different story," he says. "I think there is some sense to that perhaps. The gypsy moth project has been relatively successful. A slow-to-spread approach is very different from an eradication. The goal of the approaches is fundamentally different. Eradication means to get rid of. I don't think we are getting rid of this pest."

Raupp continues, "Everybody's hope is that they can reach some sort of balance here, that we can slow things down

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Professor Michael Raupp

enough that we can get some natural enemies in. I think ultimately the natural enemies are the solution. Of course there are all sorts of problems in terms of importing things. But that would clearly be the way to go." 

Additional resources

"Emerald Ash Borer Cooperative Eradication Program in the Lower Michigan Peninsula; Environmental Assessment," USDA, December 2003

Robert A. Haack, USDA Forest Service, "The Emerald Ash Borer (Agrilus planipennis): A New Threat to Hardwood Forests," January 2004; see also www.ncrs.fs.fed.us/4501/eab/downloads/MichEntSocEABarticle.pdf

"Emerald Ash Borer," USDA Forest Service; available online at: www.ncrs.fs.fed.us/4501/eab

"Emerald Ash Borer," Michigan Department of Agriculture; available online at www.michigan.gov/mda/0,1607,7-125-65294-,00.html