



**Figure 1—The adult EAB, an exotic wood-boring beetle, attacks ash trees exclusively.**

The emerald ash borer (EAB) is a very small but very destructive beetle. Metallic green in color, its slender body measures 1/2-inch long and 1/8-inch wide. The average adult beetle can fit easily on a penny.

Native to China and eastern Asia, the EAB probably arrived in North America hidden in wood packing materials commonly used to ship consumer goods, auto parts, and other such products. Although no one can say for certain when the EAB arrived in southeastern Michigan, the scientific community now believes the beetle may have been present for up to 12 years before it was detected, based on its widespread distribution and destruction. The U.S. Department of Agriculture (USDA) officially identified the EAB in the summer of 2002.

This beetle is responsible for the death or decline of tens of millions ash trees. At press time (June 2009), EABs have been detected in 13 States (Illinois, Indiana, Kentucky, Maryland, Michigan, Minnesota, Missouri, New York, Ohio, Pennsylvania, Virginia, West Virginia, and Wisconsin) and parts of Canada.

### Signs and Symptoms of EAB

It is extremely difficult to determine whether an ash tree is or is not infested with the EAB because tree decline is usually gradual. Early symptoms of an infestation might include dead branches near the top of a tree or wild, leafy shoots growing out from its lower trunk. D-shaped exit holes and bark splits exposing S-shaped tunnels are significant signs of the EAB. Woodpecker activity might also indicate the presence of EABs.

If a tree is infested with the EAB, tree removal is the most effective way to eliminate these exotic pests and prevent the species' further spread. Considering the most current science, USDA's Animal and Plant Health Inspection Service (APHIS) recommends felling infested trees and properly disposing of the wood.

### Humans Contribute to the Spread of the EAB

In terms of the range and extent of EAB infestation in North America, human behavior is a particularly significant factor. People unknowingly contribute to the *artificial* spread of the EAB by carrying out activities that are part of everyday living and commerce. The movement of common ash tree products—such as firewood, nursery stock, green lumber, branches, logs, and chips—has been a primary means of advancing the beetle's spread.

### EAB Quarantines in the United States

To prevent additional artificial spread of the EAB, USDA has established quarantines to prohibit the movement of ash materials and hardwood firewood out of States where EABs are known to exist. Today, the entire States of Illinois, Indiana, and Ohio, together with the Lower Peninsula of Michigan, are quarantined. USDA quarantines also exist in select areas of Kentucky, Maryland, Minnesota, Missouri, New York,

Pennsylvania, Virginia, West Virginia, Wisconsin, and the Upper Peninsula of Michigan.

The movement of ash material and firewood intra-state (within a given State) is also prohibited under State government quarantines. Currently, State quarantines exist in all of the above-mentioned States.

Because new EAB infestations are periodically discovered, the areas under quarantine also change. Therefore, to avoid penalties, homeowners and businesses should check with their State department of agriculture for the latest information regarding EAB quarantines prior to transporting any ash materials or firewood.

### Scientifically Speaking

Entomologists from the United States and Canada have been studying the EAB continually to learn more about its biology and behavior. Since the beetle had never been found anywhere in North America prior to 2002, information about the EAB is regularly updated.

Scientists now know that, in a temperate climate, the beetles can develop from eggs to adults in as little as 1 year. From May to August, adults emerge from overwintering sites under bark and mate. Females lay eggs in bark crevices, and the eggs hatch in about 10 days. The eggs develop into wormlike larvae, which tunnel under the bark to feed and grow throughout the fall. It is this tunneling and feeding that eventually kills the tree. Larvae lay dormant during the winter and emerge from trees in May as adults, leaving a unique D-shaped exit hole.

Here are some key discoveries scientists have made about the EAB:

- On this continent, the EAB attacks only ash trees (*Fraxinus* spp.), and all the ash species—including green, white, black, and blue—are at risk. The mountain ash (*Sorbus* spp.), is not a true ash and, therefore, is not threatened by EABs.

- EAB adults are strong fliers, yet most only fly short distances (about 1/2 mile). However, under certain conditions, individual beetles are capable of flying up to several miles to infest new trees.
- Several natural enemies have been discovered attacking EAB larvae in North America, including woodpeckers and at least two species of parasitic insects. Unfortunately, these enemies have not effectively prevented trees from dying or substantially slowed the spread of the pest.



**Figure 2—S-shaped tunnels, made by EAB larvae, riddle infested ash trees.**



**Figure 3—The D-shaped exit hole is a unique signature of the EAB.**



**Figure 4—Epicormic shoots are a telltale sign of a tree under stress.**

- An EAB infestation is always fatal to ash trees. Infested trees decline from the top down and will be dead in 1 to 3 years, even if the trees were healthy before being attacked by the EAB. Stressed or damaged trees appear to attract the beetles.
- Cut and stacked ash wood more than 1 year old can harbor viable EAB larvae and continue to pose a risk for the pest's artificial spread.

### Ash Tree Treatments

Because research is ongoing, and pesticide regulations differ from State to State, homeowners should contact their State department of agriculture or local extension office for current guidelines regarding pesticide use for EAB-infested trees.

Pesticides can serve as a control measure for the EAB, but they are not a cure.

Homeowners with individual, high-value ash trees can buy federally-approved insecticides at retail outlets or have their trees treated by State-certified pesticide applicators. Options include systemic and topical insecticides. These compounds will need to be applied on a regular basis, possibly several times within one growing season, and even then might not completely prevent the EAB from attacking an ash tree. In EAB-infested areas, even treated trees are likely to succumb to continued attacks from the pest as beetle populations increase.

### What You Can Do To Stop the Spread of the EAB

Detecting, controlling, and preventing the human spread of the EAB is a huge undertaking. Cooperation among Federal and State government agencies, municipalities, universities, the green industry, and the public is essential to minimize the impacts of this pest.

Here are some things you can do now to support the cooperative program and contribute to safeguarding the ash resource in the United States.



Figure 5—EAB larvae can be transported to new locations while hidden under the bark of firewood.

■ **Don't move firewood.** Humans unknowingly contribute to the spread of the EAB when they move firewood. EAB larvae can survive hidden under the bark of firewood. Play it safe: Don't move any firewood, and you won't move any beetles. Buy local, burn local.

■ **Visually inspect your trees.** Early detection is a key factor. If trees display any sign or symptom of EAB infestation, contact your State agriculture agency.

■ **Spread the word.** Talk to your neighbors, friends, and coworkers about the EAB and what they should look for on their trees.

■ **Know State and Federal regulations.** Make sure you understand the regulations that govern your own State and those States and Provinces you might visit.

■ **Ask questions.** If you receive ash nursery stock or firewood, know its point of origin and your supplier. EAB larvae could be hiding under the bark.

### Ash Tree Identification

Ash trees are used extensively in residential and commercial landscapes and are found naturally in woodlots, along creekbeds, and in low-lying wetlands. In the United States, ash trees are found from coast to coast and represent about 2 percent of the total leaf cover. Because the EAB attacks all species of ash, it is



Figure 6—Ash seeds are oar-shaped and can be found in clusters; however, not all ash trees reproduce seeds.

important to be able to tell ash trees from other hardwoods.

The following photos illustrate some characteristics of ash trees.



Figure 7—Ash tree branches are directly across from each other, almost as if you were looking in a mirror. This is called opposite branching.



Figure 8—Ash trees have compound leaves, composed of 5 to 11 leaflets.



Figure 9—In older trees, ash bark displays diamond-shaped patterns.



Figure 10—The female beetle lays eggs in bark crevices of ash trees.

### State EAB Hotlines

Call if you think you might have the EAB in your tree, have questions about the program or quarantines, or want to report illegal ash wood or firewood movement.

Alabama	800-642-7761
Arkansas	501-324-5258
Delaware	800-282-8685
Illinois	800-641-3934
Indiana	866-663-9684
Iowa	515-725-1470
Maine	800-367-0223
Maryland	800-342-2507
Michigan	866-325-0023
Minnesota	888-545-6684
Missouri	866-716-9974
Kansas	785-862-2180
Nebraska	402-471-2394
Nevada	775-688-1180
New Hampshire	603-271-7384
New York	866-640-0652
North Dakota	701-328-4765
Ohio	888-644-6322
Pennsylvania	866-253-7189
South Dakota	800-275-4954
Texas	936-639-8170
Vermont	802-241-3544
Virginia	804-786-3515
West Virginia	304-558-2212
Wisconsin	800-462-2803
National EAB Hotline	866-322-4512

The U.S. Department of Agriculture (USDA) prohibits discrimination in all its programs and activities on the basis of race, color, national origin, age, disability, and where applicable, sex, marital status, familial status, parental status, religion, sexual orientation, genetic information, political beliefs, reprisal, or because all or part of an individual's income is derived from any public assistance program. (Not all prohibited bases apply to all programs.) Persons with disabilities who require alternative means for communication of program information (Braille, large print, audiotape, etc.) should contact USDA's TARGET Center at (202) 720-2600 (voice and TDD). To file a complaint of discrimination, write to USDA, Director, Office of Civil Rights, 1400 Independence Avenue, S.W., Washington, D.C. 20250-9410, or call (800) 795-3272 (voice) or (202) 720-6382 (TDD). USDA is an equal opportunity provider and employer.

This publication reports research involving pesticides. All uses of pesticides must be registered by appropriate State and/or Federal agencies before they can be recommended.

CAUTION: Pesticides can be injurious to humans, domestic animals, desirable plants, and fish or other wildlife—if they are not handled or applied properly. Use all pesticides selectively and carefully. Follow recommended practices for the disposal of surplus pesticides and pesticide

Cover photo: Bark's-eye view of the EAB, a foreign insect that attacks all species of ash trees except the mountain ash, which is not a true ash.

Photo credits: The cover photograph and figure 10 were taken by APHIS employee Dr. James E. Zaboltny. APHIS gratefully acknowledges the cooperation of Michigan State University's David Cappaert, who supplied the images used in figures 1 and 5; these photographs are reproduced by permission. The images in figures 2, 3, and 4 were supplied by APHIS employees David R. McKay, Brian Sullivan, and James W. Smith, respectively. The images in figures 6-9 were taken by Paul Wray (Iowa State University; reproduced from the Bugwood.org Web site), Robin Osborne (Michigan State University), Diane Brown-Rytlewski (Michigan State University), and Keith Kanoti (Maine Forest Service; reproduced from the Bugwood.org Web site), respectively.

Web sites: <http://www.aphis.usda.gov>  
<http://www.na.fs.fed.us/fhp/eab>  
<http://www.emeraldashborer.info>

Revised December 2008  
 Slightly Revised June 2009



United States Department of Agriculture  
 Animal and Plant Health Inspection Service

Program Aid No. 1769

# Emerald Ash Borer

## The Green Menace

