About a decade ago there were a lot of sickly looking or even dead ash trees in the Detroit, Michigan area. Ash is susceptible to a number of insects and diseases, some not easily diagnosed. Ash yellows, caused by a tiny organism called a phytoplasma, produces symptoms similar to those observed and, in the early 90s, widespread ash decline occurred across the Upper Midwest and Northeast. Multiple stressing factors were blamed. Not until 2002 was a beetle native to eastern Asia identified as the culprit. We know now it arrived at least ten years before being detected.

Emerald ash borer, *Agrilus planipennis*, probably entered the country in ash used in shipping crates or pallets. It infests only ash, *Fraxinus* spp., and resistance has not been observed in any of our native species. Although it seems counterintuitive for a forest insect to become established in an urban area, it is these areas along our coasts and the Great Lakes that receive goods transported from around the world. Organisms that infest solid wood packing material constitute an ongoing threat for introduction of nonindigenous and potentially invasive insect pests. At least eleven forest insect pests identified in the United States and Canada since 1990 are believed to have arrived this way.

Roughly one half inch long, the shiny, emerald green insect belongs to a group of beetles known as metallic wood-borers (Fig. 1). Adults emerge from the trees they fed in primarily during June and July. Emergence produces one sure sign of infestation, a small, one-eighth inch hole flattened on one side, or D-shaped. Sun loving, the beetles feed on ash foliage for a week or more before mating and laying eggs. Females produce fifty or more eggs, and lay them individually in bark cracks and crevices. They hatch within two weeks. Immature beetles or larvae are called flatheaded borers distinguishing them from roundheaded borers, cylindrical larvae of a different beetle group that often utilize the same food resource. The insect during this stage is flattened, whitish, and with distinct segmentation, tapeworm-like (Fig. 2). They feed on inner bark or phloem tissue. Phloem is living tissue responsible for moving the products of photosynthesis around the tree. Larval feeding tunnels called galleries curve and wind under the bark much like mountain
roads until the tree’s translocation system is effectively severed (Fig. 3). When the tree is girdled, it
dies, often in as little as two or three years following the first beetle bite.

On all but the smallest trees, beetles initially infest the upper portion of the tree within the canopy
where evidence is very difficult to see. While the ash is vigorous, it responds by producing callus.
This pushes the bark out causing vertical splits. Following heavier attack, branches die back and
as they do, buds may break further down the trunk and at the base producing dense clusters of
leafy branches. There will be no sawdust because larvae pack their excrement mixed with
sawdust-like wood chips behind them in the gallery. Woodpeckers are efficient predators of all
insects feeding under the bark. Increased woodpecker activity should precipitate inspection of
unhealthy looking ash. A year after attack the first generation of beetles exit through their D-shaped
emergence holes. Within a year or two, in all likelihood, the tree will be dead (Fig. 4).

In the core area, that region of southeastern Michigan where the beetle was first discovered, the
dead tree total is estimated at 40 million. Numbers are mounting in surrounding states. Removals
add hundreds of thousands as communities and forest owners seek to reduce losses, limit the
numbers of beetles and limit the numbers of potential hazard trees.

As of October 2008, the emerald ash borer can be found in the following states; Michigan (2002),
(2008), Virginia (2008), West Virginia (2008), and Wisconsin (2008), and in two Canadian
provinces; Ontario (2004) and Quebec (2008). On Dec. 1, 2006, the federal quarantine expanded
to cover the entire states of Ohio, Indiana and Illinois in addition to the already covered lower
peninsula of Michigan. Individual counties are quarantined in the other states. The more likely
avenues of beetle movement, in addition to nursery stock, include green lumber and firewood.
Because of difficulties with identification, movement of all hardwood firewood is regulated as are
wood chips, whether composted or not.

States with infestations, as well as some not yet infested, including New York, are conducting
surveys for the insect. Detection efforts involve four different methods. The first, visual inspections
has proved ineffectual. The second, trap trees, is expensive and time consuming. Emerald ash
borer prefers to attack stressed trees, attracted by the chemicals produced, but will readily attack healthy ones as populations build. The creation of a trap tree involves girdling a healthy ash in the spring. Green ash, *Fraxinus pennsylvanica*, is used most often. This provides the beetle with ideal host material. Tree placement occurs on a grid with trap density increased around higher risk areas such as sawmills, campgrounds, and tree nurseries. During the winter, trap trees are peeled and examined for evidence of beetle larvae or galleries. The procedure works but the method is also problematic. Suitable host material is not always available and when it is, the method certainly is destructive. The numbers of trees to be examined may run into the thousands. When eradication was the goal, protocol called for the removal, chipping and burning of all ash within half a mile of any identified beetle tree and costs per site ran between $500,000 and $1,000,000. These protocols are followed now only when sites are located so early that the beetle population is small and there is little ash on site. The beetle flies much farther than the half-mile treatment boundary although it probably will not if suitable host material remains nearer. A third detection method, currently the method of choice by most state and federal agencies, involves the use of a purple panel trap, a large triangular boxlike structure without top or bottom. The color is attractive to the beetle and the trap’s attractiveness is usually enhanced with a chemical attractant. The outer faces of the trap are coated with an adhesive guaranteed to capture anything small that tries to land on it. Traps are hung before the beetles leave the trees in the late spring or early summer. They may be left out all summer or checked periodically but eventually they are brought in and examined for the presence of emerald ash borer. A final detection method exploits the habits of a native wasp that uses members of this family of beetles to feed its young. Fascinating work done at the University of Guelph, Guelph, ON, Canada by a graduate student named Philip Careless showed that this wasp, *Cerceris fumipennis*, which really doesn’t have a common name although it may be called the weevil wasp, can be used to detect the presence of emerald ash borer by staking out its nesting area and examining the prey it brings back. He also demonstrated the portions of nesting areas can be moved to bring the wasp into areas where its presence cannot be detected and where emerald ash borer activity is suspected. As a result, states are now surveying for activity of both insects, the emerald ash borer and the wasp.

The threat to our ash resource cannot be overstated. Different ash species play important ecological and economic roles. White ash is a component of forest cover types from Maine to
Florida and west from Minnesota to Texas. Green ash is common along riparian corridors, but its tolerance for a wide range of conditions led to widespread ornamental and urban use, ironically often to replace elms killed by Dutch elm disease. Native Americans use black ash, a more northerly species that will grow in poorly drained areas, for basket making. Waterfowl, songbirds and mammals feed on the innumerable seeds of ash. What American does not know that baseball bats are made from ash?

Eradication efforts have largely been abandoned. A pilot study to reduce the beetle’s impact is ongoing in the Upper Peninsula of Michigan. Called “Slow Ash Mortality” or “SLAM” it involves a 4-faceted approach. Infested trees are removed. Trap trees serve as sinks, removed before beetle emergence, rather than as detection tools. Large diameter hosts are thinned out to reduce available breeding material and finally insecticides may be used. Research is underway to identify effective lures to simplify detection. Control agents from areas where the insect is native have been identified. Resistance mechanisms are being investigated. All of these will take time to develop and incorporate into a management program.

For now, when the beetle arrives, the landowner has few options. Individual, high value trees can be protected with an insecticide. These treatments have to be repeated regularly and should a beetle tree be located within a designated area and an eradication cut performed, the treated tree would be removed. Removal and utilization of ash, particularly larger diameter ash from woodlots retards population buildup because the larger the tree, the more beetles that tree is capable of feeding. Ash value, already diminished, will probably continue to shrink. Once the beetle arrives in New York options available to the forest owner will also shrink due to quarantine. The picture is bleak. Emerald ash borer continues to devastate ash in this country and it is headed our way.

For the reader interested in additional information, the websites at http://www.emeraldashborer.info/ and http://na.fs.fed.us/fhp/eab/index.shtm provide links to information put out by states with infestations.

Much more extensive management recommendations for the forest owner in New York State can be found at http://www.dec.ny.gov/animals/7253.html as well as links from that site.
The author wishes to thank Therese Poland of the USFS for all her help and for supplying images.

Captions for figures:

Figure 1. Emerald ash borer adult
Figure 2. Emerald ash borer larva
Figure 3. Serpentine larval galleries
Figure 4. Ash dieback due to emerald ash borer infestation
Figure 5. Area of known EAB distribution

This article, presented here with revisions to provide more up-to-date information, first appeared in The New York Forest Owner 45(1): 16-17.