New Jersey Fact Sheet: Emerald Ash Borer
(January 2013)

Introduction
The Emerald Ash Borer (EAB) is an exotic insect from Asia that has invaded North American forests and is becoming increasingly detrimental to ecosystem health. First detected in Michigan in 2002, EAB has infested various species of ash in Illinois, Indiana, Maryland, Ohio, Pennsylvania, Wisconsin, Missouri, Virginia, Minnesota, New York, Kentucky, Iowa, Kansas, Tennessee, Massachusetts, Connecticut, and West Virginia as well as Ontario and Quebec, Canada. While EAB has not been detected in New Jersey, natural resource professionals and forest owners are continuing to monitor for this damaging forest pest. Because EAB occupies many neighboring states, its presence in New Jersey’s woodlands may be inevitable. Unfortunately, EAB may inhabit an area for several years before being detected. Careful monitoring and early management are recommended in order to protect and preserve New Jersey’s forest habitats from an EAB infestation.

Impacts of EAB in New Jersey
Feeding on white ash (Fraxinus americana), green ash (Fraxinus pennsylvanica), and black ash (Fraxinus nigra), EAB can have significant economic and ecological impacts. When EAB infests individual trees, vital tissues are destroyed, potentially killing the tree in less than two years.

According to the U.S. Forest Service’s 2008 Forest Inventory for New Jersey, ash is present on 24 percent of the state’s forested land. It generally makes up less than 25 percent of all live trees in a stand and is rarely the most abundant species. Several ash species make up almost 8 percent of all trees in the neighboring state of New York. Ash timber is valued for its use in several wood products, including baseball bats, furniture, lumber, and pallet manufacturing. New Jersey’s naturally growing ash trees are commonly found throughout the state’s northern and central regions; however, ash is a popular species planted in urban areas and has been used to replace native elms lost to Dutch Elm Disease. In Michigan and other locations where EAB is already present, the greatest economic impact has fallen on communities faced with the removal of tens of thousands of dead ash on streets and in yards.

Signs and Identification of EAB
Adult emerald ash borers are dark metallic green in color, and have a coppery red or purple abdomen. Individuals are ¼ to ⅜ inch long and ½ inch wide. Adults may be active from late May to September, but are typically observed in June and July. Although adults can be seen with the naked eye, they are sometimes difficult to find, especially at low infestation levels. At the larval stage, individuals are small and creamy white in color. They typically burrow under the bark, making them even more difficult to spot. The first sign of an infestation may be a thinned crown, but the best way to detect an EAB infestation is by removing the bark and observing the larvae’s expanding S-shaped galleries. As individual beetles mature and emerge, they leave a distinctive D-shaped exit hole in the outer bark of the tree. Because the signs and symptoms can be similar to other diseases, it is important to consult an approved forester or qualified natural resource professional to aid in identification.

Monitoring and Prevention
New Jersey forest owners, including public and private landowners, can consider working with the United States
Department of Agriculture (USDA) on surveying and monitoring efforts aimed at early detection of this insect. Foresters as well as volunteers can easily deploy baited traps and establish “trap trees” in an attempt to determine if EAB is present in a forest stand.

Since adult beetles are not particularly strong fliers, spread is typically caused by transportation of infested and untreated wood products. Restricting the movement of these wood products, including firewood, is recommended to help prevent the introduction and spread of EAB.

**Management Options**
A landowner can reduce the risk of an EAB infestation by using certain management techniques. Selective felling, cutting, girdling, or herbicide application can reduce the abundance of ash while shifting species composition to other native trees. Typically, preventive management activities will work to enhance the health of a forest stand while preserving ecological and economic integrity. These management techniques may be incorporated into a Forest Stewardship Plan, and may include:
- Selective felling and cutting of unhealthy or low-vigor ash trees
- Preserving individual trees that have strong, live crowns
- Reducing the overall cover of ash species in a forest stand
- Controlling native ash regeneration by selectively removing seedlings and allowing for other native trees to become established

Silviculture experts in Wisconsin have developed additional guidelines based on the percentages of ash within individual woodlots. The percentages are based on basal area, or the total area of the cross sections of all trees in a stand. These specific management techniques for different ash compositions, adapted from the Wisconsin Department of Natural Resources (WI DNR, August 2008), can help reduce the risk of an EAB infestation while promoting overall forest health. It is important to consult an approved forester or other natural resource professional for proper guidance before implementing management activities.

**Management in Established Stands Where Ash Is Less Than 20% of the Basal Area**
Remove low-vigor ash trees to increase and promote diversity of other species, while preserving healthy ash trees. An approved forester can assist with selective removal of low-vigor trees by following standard silvicultural guidelines. Some silvicultural practices will lead to increased ash regeneration, which may require additional control treatments in order to keep the stand’s
susceptibility to an EAB infestation low. Herbicide applications can help maintain ash seedlings at an appropriate level.

**Management in Established Stands Where Ash Is 20 to 40% of the Basal Area**
If possible, reduce the percentage of ash to less than 20% while maintaining a fully stocked stand dominated by other tree species exhibiting good health and vigor. Stands may require multiple treatments to reduce the ash to an appropriate level while maintaining adequate stand stocking. Follow-up treatments to control excessive ash regeneration may be needed.

**Management in Established Stands Where Ash Is Greater Than 40% of the Basal Area**
Stands with a large percentage of ash (such as a bottomland, swamp, or plantation) may be heavily impacted by EAB unless ash species are drastically reduced. When planning harvest activities, consider the following:
1. Shorten the rotation age for harvestable ash trees
2. Consider silvicultural methods that allow for complete stand conversion to other species tolerant of the site conditions

If practical, reduce the ash abundance during regularly scheduled management activities while preserving high diversity and forest health. Other species that are competing with healthy trees may also be removed during EAB management activities. Stands may require multiple entries to reduce the ash to an appropriate level. Active treatment of ash regeneration, as noted earlier, may be necessary, and it is important to consider planting or seeding other tree species that can tolerate the site conditions.

When working in a wetland, it is important to follow New Jersey’s *Forestry and Wetlands Best Management Practices Manual.*

**Technical and Financial Assistance**
A Forest Stewardship Plan will usually present the best options for management based on the landowner’s goals and the current site conditions. The landowner is generally responsible for the cost of development and implementation of a Forest Stewardship Plan. However, qualifying landowners in New Jersey have several options for obtaining technical and financial assistance. The Natural Resources Conservation Service (NRCS) offers technical and financial assistance to forest landowners through the Environmental Quality Incentives Program (EQIP). Eligible landowners with 10 acres of land may receive cost-share assistance for the development and implementation of a Forest Stewardship Plan.

**NRCS office locations and more detailed information about NRCS assistance and the EQIP program can be found at:** [www.nj.nrcs.usda.gov/](http://www.nj.nrcs.usda.gov/)

An important method to prevent the spread of EAB is by restricting the movement of wood products, including firewood (Don Donnelly, NJA)
For More Information:

General Information on NRCS Forestry Programs
www.nj.nrcs.usda.gov/technical/forestry/index.html

Information on NRCS EQIP Program
www.nj.nrcs.usda.gov/programs/eqip/forestry.html

Locating an NRCS TSP
http://techreg.usda.gov/CustLocateTSP.aspx

General Information on Emerald Ash Borer
http://www.emeraldashborer.info/index.cfm

US Forest Service – EAB
http://na.fs.fed.us/fhp/eab/

US Department of Agriculture, New Jersey’s Forests

NJDEP, Division of Parks and Forestry – EAB Info
http://www.nj.gov/dep/parksandforests/forest/community/Eme rald_Ash_Borer.htm

NJ Statewide Forest Resource Assessment and Strategies

www.state.nj.us/dep/parksandforests/forest/nj_bmp_manual1995.pdf

List of NJDEP-Approved Consulting Foresters
www.state.nj.us/dep/parksandforests/forest/ACF.pdf

Wisconsin Department of Natural Resources – EAB Info and Management Guidelines

New York Department of Environmental Conservation – EAB Info
http://www.dec.ny.gov/animals/7253.html

Pennsylvania Department of Conservation and Natural Resources – EAB Info
http://www.dcnr.state.pa.us/forestry/fpm_invasives_EAB.aspx

Maryland Department of Agriculture – EAB Info
http://www.mda.state.md.us/plants-pests/eab/

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Emerald Ash Borer Update

New Jersey Department of Agriculture
Plant Industry

Paul Kurtz
John Cambridge
Emerald Ash Borer

*Agrilus planipennis*

- Is now confirmed in 18 states.
- The summer of 2012 found EAB in Connecticut, Kansas, and Massachusetts.
- It has not been found in New Jersey or Delaware yet.
Ash Basal Area (ft²/acre)

- > 20
- 10 - 19
- 5 - 9
- < 5
- No ash

Processing note: This map was produced by linking plot data to MODIS satellite pixels (250 m) using gradient nearest neighbor techniques.
Emerald Ash Borer

Signs and symptoms
Epicormic Shoots in Winter and Summer

L. Bauer

J. Gould
Detection and Monitoring
Bio-monitoring using native wasps

*Cerceris fumipennis*
Emerald Ash Borer

Treatment and population suppression
Emerald Ash Borer

• The main natural enemies for EAB are parasitoid wasps.
• Laboratory rearing of wild caught life stages in the USA has shown that native parasitoids do reproduce on EAB.
• Most EAB parasitoids are from one of the following families of Hymenopterans:
  – Chalcididae
  – Braconidae
  – Eupelmidae
  – Encyrtidae
  – Eulophidae
Emerald Ash Borer
Natural Enemies

• The USDA APHIS PPQ Biological Control Production Facility in Brighton, MI was designed to produce EAB parasitoids for field release.
• Three non-native wasp species are currently being mass reared.
Oobius agrili

- Originally from China
- 2 generations per EAB egg-laying season.
- Each adult females parasitizes ~80 eggs
- Potential to kill 60% of EAB eggs laid in a season.
- Overwinter as larva inside of EAB eggs.

EAB eggs start out white when newly laid and darken as they mature.

EAB eggs often turn dark brown when parasitized by O. agrili; unparasitized, healthy eggs remain amber in color (center egg).
Tetrastichus planipennisi

- Originally from China
- 1-2 generations per summer-fall season.
- Adults female lays egg inside larva under the bark.
- Polyembryony - A single EAB larva can produce >130 T. planipennisi
- Potential to kill 50% of EAB larva in trees in a season.
- Overwinter as larva in EAB larval
Spathius agrili

- Originally from China
- 1-2 generations per summer-fall season.
- Adults female lays ~8 eggs next to larva under the bark.
- Potential to kill 90% of EAB larva in trees per season.
- Overwinter as larva or pupa in EAB larval galleries.
Imidacloprid
DON'T MOVE FIREWOOD

Our forests are threatened by nonnative insects that can kill large numbers of trees. Three recently introduced insects—emerald ash borers, Asian longhorned beetle, and Sirex woodwasp—are wood-infesting species that can be transported long distances in firewood. Once transported into new areas, these insects can become established and kill local trees. We must STOP THE SPREAD of these insects and protect our forests and trees.

How you can help:
- Leave firewood at home—do not transport it to campgrounds or parks.
- Use firewood from local sources.
- If you have moved firewood, burn all of it before leaving your campsite.

HELP STOP INVASIVE PESTS

Moving firewood spreads forest pests.
Buy it where you burn it, and save trees.
Learn More »
A special thank you to:

• The Emerald Ash Borer Biological Control Release and Recovery Guidelines—a collaborative effort between USDA, APHIS, ARS, USFS, and state Departments of Agriculture.

• The New Jersey’s Forests 2008 resource bulletin—a collaborative effort between USDA, USFS, and the Northern Research Station.
John Cambridge: NJDA

John.cambridge000@gmail.com
(703) 472-1175

http://www.state.nj.us/agriculture/divisions/pi
Preparing for Emerald Ash Borer

Pam Zipse, Outreach Coordinator and Jason Grabosky, Urban Forestry Coordinator, Rutgers Urban Forestry Program of NJAES

Emerald Ash Borer is officially here. This exotic invasive beetle that attacks all species of true ash trees (*Fraxinus* species) was finally confirmed in New Jersey in summer of 2014. It was found infesting trees in Bridgewater and Hillsborough Townships in Somerset County, and caught in traps in Ewing Township, Mercer County and Westampton Township, Burlington County. EAB has killed hundreds of millions of ash trees since arriving in the United States in 2002, costing billions of dollars in removals, replacement plantings, and chemical treatments. We expect that New Jersey's experience with Emerald Ash Borer will be no different from that of the other states that have seen this insect move through their tree resource. As such we can assume that, in the landscape, all untreated ash trees will die. It is estimated that 80% of the costs related to EAB will be borne by municipal government and homeowners (Aukema et. al., 2011). Are you ready?

Representatives from the NJ Department of Agriculture, NJ State Forestry Services, USDA Animal & Plant Health Inspection Service, and Rutgers University have formed a task force to help consolidate and disburse information and resources relevant to EAB. The unanimous recommendation of this task force is that municipalities need to have a plan for managing EAB. It is agreed that there is no one correct answer to fit every municipality – but every municipality needs to develop a plan. At the core of this plan, and if you only do one thing this year to prepare for EAB... inventory your ash trees!

Management options for EAB in street trees can be boiled down to a few basic approaches. You can remove your ash trees, either when they die or preemptively (the latter being less costly and safer, as dead ash trees dry out quickly becoming brittle and difficult to remove), remove ash and replace with appropriate, non-host species, or treat healthy ash with appropriate insecticides (these treatments must be maintained for 15-25 years). Most municipalities will adopt a plan based on some combination of these basic options. Regardless of the options employed, municipalities will need to know the exact locations of all ash trees (to know where to send removal or treatment crews), and the size of these trees - at least grouped by diameter class (for determining cost estimates for removal and/or treatment).

There are several tools already in place to assist municipalities in making management decisions. The task force has prepared a web site (emeraldashborer.nj.gov) where you can find a template for developing a municipal EAB plan, tips for ash tree identification, a description of the various chemical treatment options, and a list of saw mills in NJ and the surrounding states who can utilize ash logs. You can also find contact information for task force partners, and for reporting EAB sightings. New information is added as it becomes available, so we encourage you to check this website often.

Another tool that we think can be very useful to municipalities is the Emerald Ash Borer Cost Calculator, which was developed by Purdue University to help municipalities with long term planning for EAB management (http://extension.entm.purdue.edu/treecomputer/index.php). This cost calculator allows you to enter your ash tree inventory along with tree removal, planting, and treatment costs (get quotes...
based on your inventory from local contractors), and compares the approximate short and long term costs associated with a variety of management options projected over a 25 year timeline. The calculator provides graphs and charts, along with descriptions of the various management options, to illustrate the costs in both dollars spent and diameter inches lost (or saved) for the different management strategies. This can be a powerful tool for shade tree commissions to use to convey the urgency and severity of this problem to local governments and decision makers.

Rutgers University used an existing street tree inventory to run basic management options through the Purdue EAB Cost Calculator for one New Jersey municipality. In this example, there are about 200 publicly maintained ash trees, making up less than 4% of the total public tree resource. Using tree removal and treatment costs generated by an anonymous poll provided by members of the NJ Arborists chapter of the International Society of Arboriculture, it was projected that even the least expensive management options totaled in about $250,000.00 over the 25 year management period.

EAB is a complicated issue, and there is much more to consider. For now we leave you with one more thought in support of developing a comprehensive plan. It is likely that costs for both removals and treatments can be significantly reduced by contracting in bulk. Coordinating management efforts throughout your municipality, including your residents, and partnering with neighboring municipalities, has the potential to significantly influence the overall costs of EAB management. This all starts with a reliable inventory of your ash trees.

Please check out New Jersey’s EAB website at emeraldashborer.nj.gov. You can find a link to the Purdue EAB Cost Calculator on the “for communities” page.