



### Understanding the Emerald Ash Borer: From Identification to Action

PJ Liesch  
UW-Madison  
Insect Diagnostic Lab  
pliesch@wisc.edu  
@WisconsinBugGuy

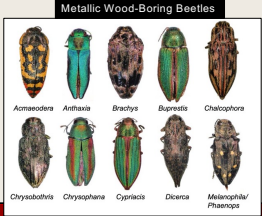

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### EAB: The Basics


- Invasive, metallic wood boring beetle in the Family Buprestidae
- Closely related to some of our native pests
  - Bronze birch borer
  - Two-lined chestnut borer
- Larvae feed under bark; kills trees in 2-5 years
- Billions of ash trees at risk in the US

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### Why is EAB so good at being invasive?

- Attacks healthy and stressed trees**
  - Closely related native borers primarily attack stressed trees
  - e.g. bronze birch borer and two-lined chestnut borer
- Difficult to detect**
  - Can take several years to detect an infestation
  - By the time an infestation is detected, EAB has likely spread elsewhere
- Easily spread by humans**
  - Firewood, wood packing materials, lumber, nursery stock, etc.



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### History of EAB



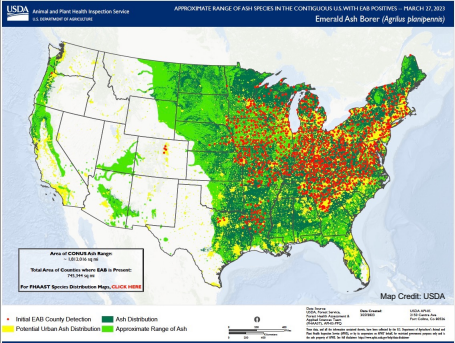

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### A Brief History of EAB:

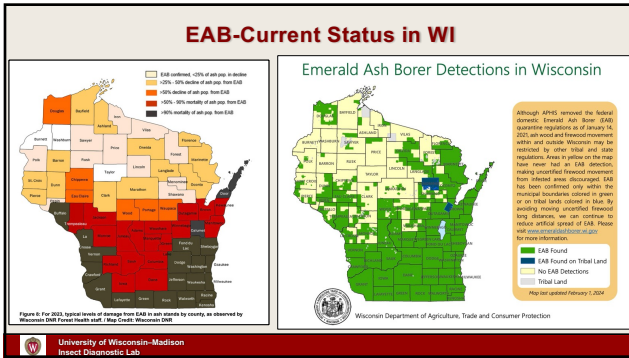
- Native to parts of east Asia
  - Likely introduced to the US in solid wood packing materials
- First detected in the US: 2002 - Detroit area
  - Difficult to detect → spread before scientists caught on
- Infestations were soon discovered in Ohio & Indiana
  - First detected in WI: 2008 in Newburg (Ozaukee Co.)
- Currently known from 36 US states & 5 Canadian provinces




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### Impacts of EAB

- Economic (Costs)**
  - Tree removal costs
  - Loss of timber revenue over time
  - Regulatory & monitoring efforts
  - Insecticide applications
- Ecological:**
  - Change in forest composition
  - Localized extinction of ash trees possible
  - Decrease biodiversity
- Social/Cultural:**
  - Loss of shade trees, changes in urban landscape
  - Baseball impacted
  - Loss of cultural resource (Native American use of black ash)
  - Hazards associated with dead ash trees

Photo Credit: Dan Herms, The Ohio State University, Bugwood.org

Photo Credit: Ed Lynch, The Ohio State University

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## Identifying Ash Trees

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### Wisconsin's Native Ash Trees

- Wisconsin is home to four species of ash trees:
  - Green Ash (*Fraxinus pennsylvanica*)
  - White Ash (*Fraxinus americana*)
  - Black Ash (*Fraxinus nigra*)
  - Blue Ash (*Fraxinus quadrangulata*)
- Knowing exact species isn't critical—EAB can attack all of these
- Mountain ash (*Sorbus*) is not a true ash species, not attacked by EAB

White ash (*Fraxinus americana*) - fall colors.  
Photo Credit: Jim Robbins CC BY-NC-ND 4.0

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### Ash Tree Identification

- Twigs/branches**
  - Opposite pattern
- Leaves**
  - Compound leaves; 5-11 leaflets
- Bark**
  - Diamond-shaped pattern
  - Smoother on young trees
- Other**
  - Seed shape (samaras)

Photo Credit: Colorado State

Photo Credit: Ohio DNR

Photo Credit: U. Minnesota

Photo Credit: U. Maine

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## EAB Biology

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## Signs and Symptoms of EAB

- 1 Woodpecker activity
- 2 Epicormic shoots
- 3 Canopy thinning
- 4 S-Shaped larval tunnels and bark splitting
- 5 D-shaped exit holes
- 6 Larvae and/or adults

Symptoms: suspicious, but don't specifically indicate EAB

Signs: direct evidence EAB

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## Woodpecker Activity Symptom

- Generally, indicates presence of insect larvae
- *Not specific to EAB infestations, but is seen on EAB-infested trees*

Photo Credit: P.J. Liesch, UW-Madison
Photo Credit: Art Wagner, USDA APHIS PPQ, Bugwood.org

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## Epicormic Shoots or "Suckering" Symptom

- Flush of new growth occurring at base of trunk
- Can have multiple causes, but often seen in trees with EAB

Photo Credit: Michigan Department of Agriculture, Bugwood.org
Photo Credit: Dan Herms, The Ohio State University, Bugwood.org

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## Canopy Thinning Symptom

- Can be caused by many things (insects, disease, physical damage, etc.)
- With EAB, canopy thins progressively over time

Photo Credit: David Cappaert, Michigan State University, Bugwood.org

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## Larval Tunnels and Bark Splitting Sign

- Larvae create meandering, S-Shaped tunnels beneath the bark
- Bark often splits open due to tree's response to infestation

Photo Credit: P.J. Liesch, UW-Madison
Photo Credit: P.J. Liesch, UW-Madison

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## D-Shaped Exit Holes Sign

- ~1/8 inch wide holes are created by adults exiting the tree
- Other boring insects have round or oval exit holes of different sizes

**Banded ash clearwing**  
Shape: Round  
Width: 6 mm ( 1/4 ")

**Redheaded ash borer**  
Shape: Oval - round  
Width: 6 mm ( 1/4 ")

**Eastern ash bark beetle**  
Shape: Round  
Width: 2 mm ( 1/16 ")

Photo Credit: David R. McKay, USDA APHIS PPQ, Bugwood.org
Photo credits: Dan Herms, OSU OARDC and J. Solomon, USDA FS

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### Larvae and Adults



Photo Credit: David Cappariello, Michigan State University, Bugwood.org



Photo Credit: P.J. Liesch, UW-Entomology

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### Management of EAB

1. Quarantines / restricting movement
2. Removal & replacement of trees
3. Host plant resistance
4. Insecticide treatments
5. Biological control

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### Removal and Replacement

- Can be costly, especially for large trees
- EAB Cost calculator (Dr. Cliff Sadof, Purdue)
- Costs of doing nothing...







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### Host Plant Resistance

- **Concept:** find or develop a tolerant or resistant ash through breeding programs
- Surveys for "lingering ash" are being conducted to look for surviving ash trees after EAB has killed trees in an area
  - Some lingering ash have been identified in Michigan (esp. blue ash)
  - *This offers a glimmer of hope for the future, but no immediate solution*

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### Insecticide Treatments

- **Professional Use Products** (arborists)
  - Several chemicals available
  - Several application methods available
  - Require specialized training and equipment
- **Homeowner products**
  - Imidacloprid\* and Acephate available
  - Soil drenches and trunk implants available
  - Can be purchased at hardware stores/garden centers

**Lots of misconceptions exist!**


- ALL ash trees are doomed
- Ash trees can NOT be saved or protected
- Insecticide treatments are NOT Effective
- Insecticide treatments are cost prohibitive
- Only ONE insecticide product is effective

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### Professional Insecticide Treatment Options

- Emamectin Benzoate
  - Trunk injection
- Imidacloprid
  - Soil applications (drench or injection)
  - Trunk injection
- Dinotefuran
  - Soil application (drench)
  - Trunk application (basal bark spray)
- Azadirachtin\*
  - Trunk injection
- Pyrethroids
  - Bark sprays



Extension Factsheet  
Available at UW EAB website

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### Professional Treatment Options

- Soil Drench
- Soil Injection
- Basal Bark Spray
- Arborsystems Wedge
- Mauget Capsules
- Drilling often required for trunk injections
- Arborjet

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Photo Credits: Adam Oak, U. Florida; Bob Hamm on Colorado Extension; Manufacturers

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### Homeowner Insecticide Treatment Options

- Imidacloprid (sometimes w/clothianidin)
  - Soil applications (drench); **rate lower than arborist products**
- Acephate
  - Trunk implants

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Extension Factsheet Available at UW EAB website

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### Timing of EAB Treatments

- EAB Adults emerge around 450-500 GDD (approx. Memorial Day for Madison area)
  - Around the time that black locust is in bloom
  - Systemic products need to be applied before this to allow for uptake**
- Soil Treatments**
  - In Spring to allow for uptake before adult activity
  - Typically: early May for small trees (< 8"DBH), April for larger trees (> 8"DBH)
- Bark sprays** (dinotefuran)
  - In spring; can be applied 2-3 weeks after timing for imidacloprid (faster uptake)
- Trunk Injections** (emamectin)
  - Ideally in spring just after the canopy leafed out; *other timings possible*

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### Final Thoughts on Insecticide Treatments:

- Temporary protection of individual trees**
  - Most effective as a preventative—*healthy, uninfested trees*
    - Trees with 30-50%+ canopy loss are unlikely to recover
- Need to be continued indefinitely to maintain tree health\***
- Will **NOT** eradicate EAB from an area
- NOT** for forested areas/woodlots
  - Cost, **annual chemical usage restrictions**
- Soil drench treatments less effective against larger trees

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### Should you treat your tree for EAB?

- Several factors to consider before to treating your ash trees:
  - Tree health
  - Tree location
  - Tree value
  - Costs to treat
  - Costs to remove

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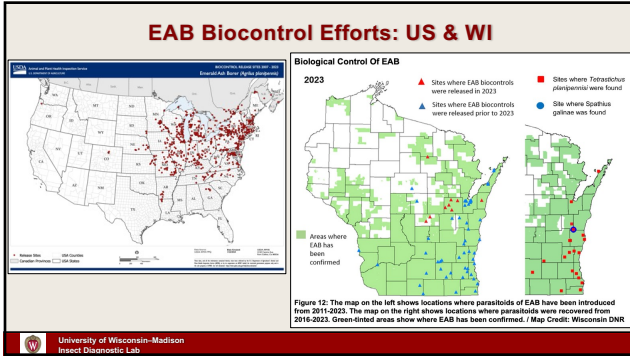
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### Biological Control

- Management of pests through the use of predators, parasites, and pathogens
- For EAB this involves small, stingless wasps imported from native range
- May be a sustainable, long-term option for managing EAB over large areas, such as woodlots and forested areas
  - Pesticides not suitable for large areas**
- Released began in WI in 2011
  - Persistence has been observed
  - Long term effectiveness unknown

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Photo Credits: USDA APHIS

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### Resources:

- UW EAB website: [eab.russell.wisc.edu](http://eab.russell.wisc.edu)
- EAB Information Network: [emeraldashborer.info](http://emeraldashborer.info)
- UW Insect Diagnostic Lab: [insectlab.russell.wisc.edu](http://insectlab.russell.wisc.edu)

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## Questions?

Handouts: [insectlab.russell.wisc.edu](http://insectlab.russell.wisc.edu)

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