Emerald Ash Borer, *Agrilus planipennis*

Biology

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Origin

- Asian origin
  -The natural range eastern Russia, northern China, Japan, and Korea
- Discovered in Detroit, MI in 2002
  - Most likely came in ash wood used for stabilizing cargo in ships or for packing or crating
- By the end of 2013, established in 22 states and two provinces
- Likely to spread **naturally** to eastern US, where ash is native
- Cannot be eradicated once it has become established
  - Early eradication efforts were abandoned largely because of the difficulty of detecting and delineating infestations

- New Hampshire-spring of 2013
- North Carolina and Georgia-summer of 2013
- Colorado-fall of 2013
- New Jersey-spring of 2014
- Arkansas-summer of 2014

Chestnut blight and Dutch Elm Disease

Chestnut blight –

Devastated American chestnut in early 1900s, caused by a fungus

Dutch elm disease –

Devastated American elm in mid century. Caused by a fungus, vectored by a bark beetle

Description

- Wood boring beetle
- Flat-headed borer, Family Buprestidae
  - Flatheaded borers as larvae
  - Metallic wood borers as adults

Complete Metamorphosis

- Adult
  - Dark, metallic green
  - ½" long, 1/8" wide, elongated body
  - Purple/reddish abdominal segments beneath wing covers
- Larvae
  - Creamy white, legless
  - Flattened, bell-shaped body segments
  - Terminal segment bears a pair of small appendages

http://www2.ca.uky.edu/forestryextension/eab/eabindex.php

http://www.palatine.il.us/departments/public_works/forestry/eab.aspx

- In EAB the dorsal surface of the abdomen is bright coppery-red.
- The dorsum usually black, green or blue on other *Agrilus*
- Hind wings on many *Agrilus* species can have this
  - Have to look under the wings

Life History

- 1-yr life cycle
- Adults begin to emerge in late May, with peak emergence in June
  - Emergence coincides with black locust bloom (CO)
- Adult moves to crown & feed on ash leaves
  - Small cuts along the edges of the leaves
- Mate
- Females live for about 1 month, laying several dozen eggs
- Eggs hatch in about 1 week

Life history

- Newly hatched larvae burrow through the bark
- Larvae feed downward
- During winter, full grown larva lives in outer sapwood
- In spring, pupal stage
- The adult emerges from tree, creating a D-shaped exit hole

Life History

- Feed on phloem, cambium and outer sapwood where they spend all of their larval life
- Produce meandering galleries that progressively widen as the larvae grow
  - 4 to 20" (10-50 cm) in length
- Larvae feed until cooler fall temperatures arrive
- Tunnel a bit deeper into the sapwood to produce overwintering chamber

Will cold temperatures kill EAB?

- Never cold enough to kill all larvae
- Larvae within trees may be killed if exposed to temperatures of -13°F or below
  - Several days of these temperatures WITHIN the tree to kill larvae

Damage symptoms

- Initially establishes in low numbers
- Very difficult to detect
- When symptoms visible, populations of EAB explode and damage accelerate
- Cracks in the bark where the individual EAB have been feeding
- Galleries exposed under bark split

Pennsylvania Department of Conservation and Natural Resources -Forestry Archive, Bugwood.org

Damage symptoms, cont.

- A thinning of the leaf canopy- most consistent symptom
- Begins in top one-third of canopy
- Progressive thinning of crown
- Leading to death

http://labs.russell.wisc.edu/eab/signs-and-symptoms

Damage symptoms, cont.

- Epicormic sprouting
- Sprouts grow from roots and trunk
- Leaves often larger than normal

http://labs.russell.wisc.edu/eab/files/2011/06/Excessive-amounts-of-green-shoots.jpeg

Damage symptoms, cont.

- D-shaped exit holes
- Unique to metallic wood borers
- Do not expel sawdust from their holes
- Existing wood borers that develop in ash make oval or circular exit holes

Damage symptoms, cont.

- Woodpecker damage
- Several woodpecker species (feed on EAB larvae/pupae)
- Bark flaking and peck holes
- Create large holes when extracting insects

Woodpecker holes | D-shaped exit hole | Woodpecker hole (yellow arrow) D-shaped exit hole (red arrow)

Credit: Mark Whitmore, Cornell University

Damage symptoms, cont.

Packed with frass (mix of sawdust and excrement)

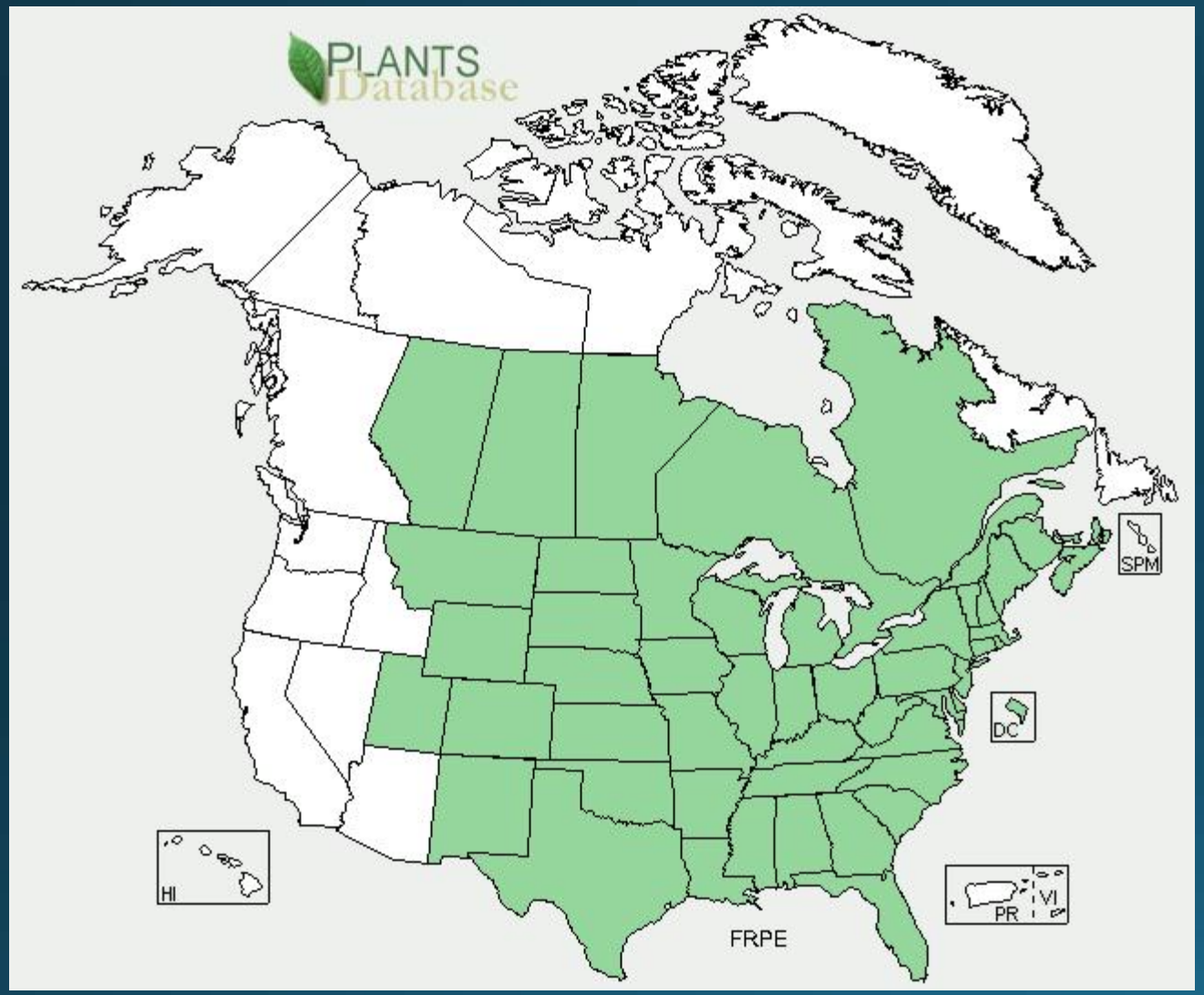
How does EAB kill ash trees?

- Damages trees by
  - Tunneling areas under the bark
  - The phloem, cambium and outer sapwood is progressively destroyed
  - Produces girdling wounds
  - Interferes with movement of water and nutrients
- Damage is progressive
  - Effects becoming visible as increasing numbers of insects develop within
- Trees typically are killed in 2-6 yrs
  - Ash populations in forested sites healthy to mortality of mature trees within 6 yrs (Knight et al. 2013)
  - More rapid mortality in stands with lower densities

- Why is EAB so destructive to ash trees in North America?
- NO resistance!!!!

Hosts

- Infests all *Fraxinus* sp.
  - green ash (*Fraxinus pennsylvanicus*) and white ash (*F. americana*) most susceptible
  - Mountain ash is not a *Fraxinus* sp.
- EAB attacks all ash trees regardless of their vigor, size, or age
- Ash native to North America have little resistance to EAB
- EAB will ultimately kill almost every unprotected ash tree present



Distribution of Green Ash

- 21 species of ash throughout US
- EAB is known to feed on the 4 major ash species found in the northeast U.S
- Not well known if it will infest other ash species

How it spreads…

- Natural spread
  - Can fly
  - Normally short distances
  - Can fly longer with wind and right conditions
- Transport of firewood
- Transport of infested ash nursery stock

Methods to Monitor Emerald Ash Borer

- No highly effective traps or lures
- Detection is largely dependent on
  - Adult identification
  - Damage symptoms
  - Larval damage symptoms

Impacts

- Large-scale loss of green ash in urban and rural plantings and natural forests
- High tree removal and replacement costs for cities and towns
- Drastic habitat change in natural forest areas and riparian (riverside) areas
- Negative impacts on water quality and aquatic life due to the loss of canopy trees in riparian forests
- Major reduction in resource conservation and crop protection benefits due to loss of shelterbelts

Questions?

- Trees can recover from EAB injury – to a point
- Current management is focused on biological control, insecticide protection of high-value trees, and integrated efforts to slow ash mortality
- Insecticides effective if ash tree is still relatively healthy
- If leaf canopy thinned to more than 30-50%, it is probably too late to save the tree