Emerald Ash Borer in the Mid-Atlantic’s Urban Forests

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Dept. of Forest Resources & Environmental Conservation
Virginia Tech
PRESENTATION OVERVIEW

• What is EAB?

• Where is EAB?

• How is EAB impacting us?

• What can we do about EAB?
PRESENTATION OVERVIEW

• What is EAB?
• Where is EAB?
• How is EAB impacting us?
• What can we do about EAB?
What is Emerald Ash Borer?

Agrilus planipennis (Fairmaire)
**What is Emerald Ash Borer?**

<table>
<thead>
<tr>
<th>Stage</th>
<th>Duration</th>
<th>Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td>Egg</td>
<td>7-10 days</td>
<td>On and underneath bark; size of pinhead</td>
</tr>
<tr>
<td>Larva</td>
<td>Typically 9-10 months</td>
<td>Underneath bark; most damaging stage to ash trees; up to 2.5 cm long</td>
</tr>
<tr>
<td>Pupa</td>
<td>28 days</td>
<td>Underneath bark in spring following over-wintering</td>
</tr>
<tr>
<td>Adult</td>
<td>3-4 weeks</td>
<td>Emerge when black locust bloom; size of a tic-tac candy</td>
</tr>
</tbody>
</table>
What is Emerald Ash Borer?

Native range of Emerald Ash Borer

Manchurian ash (*F. mandshurica*)

Chinese ash (*F. chinensis*)

Korean ash (*F. rhynchophylla*)

Manchurian walnut (*Juglans mandshurica*)

Japanese wingnut (*Pterocarya rhoifolia*)

Japanese elm (*Ulmus davidiana var. japonica*)
WHAT IS EMERALD ASH BORER?
Presentation Overview

• What is EAB?

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WHERE IS EMERALD ASH BORER?
WHERE IS EMERALD ASH BORER?

Map courtesy of Chris Asaro, VDOF
WHERE IS EMERALD ASH BORER?

http://www.wvagriculture.org/images/Plant_Industries/EAB.html
WHERE IS EMERALD ASH BORER?

Maryland Emerald Ash Borer Project
2008 to 2013 Positive Sites

Legend
- ★ 20091123 8800 Dangerfield Positive
- ★ 2010 Positive Trees
- ★ 2011 Positive Trees
- ★ 2008_2013Positive_Sites
- ⚡ DNR_Visual_Detections_2013
- ★ 2012_2013_NPS_Pos_sites

MD Counties
Federal & State Quarantine
- EAB Quarantined County
- EAB not detected

http://mda.maryland.gov/plants-pests/Pages/eab.aspx
WHERE IS EMERALD ASH BORER?

District of Columbia Now Under Emerald Ash Borer Quarantine

District of Columbia Now Under Emerald Ash Borer Quarantine

Quarantine issued by the United States Department of Agriculture

August 15, 2011

District of Columbia Now Under Emerald Ash Borer Quarantine

Quarantine issued by the United States Department of Agriculture

Media Contacts

- John Lisle, (202) 671-2004

(Washington, DC) The District of Columbia has been added to the list of domestic areas that are under federal quarantine for the Emerald Ash Borer (EAB), *Agrilus planipennis*. This quarantine was issued by the United States Department of Agriculture Domestic (USDA) Animal and Plant Health Inspection Service (APHIS) in order to prevent the spread of EAB.

The APHIS added District of Columbia, Baltimore City, and nine additional counties to the quarantine area because of their proximity to EAB infestations and known movement patterns of regulated articles. Specifically, the interstate movement of EAB-host wood and wood products is regulated, including firewood of all hardwood species, nursery stock, green lumber, waste, compost, and chips of ash species.

The EAB is an invasive wood boring beetle that is native to China and eastern Asia. Since its first US detection in Michigan tens of millions of U.S. ash trees. The interstate movement of pathway for spreading EAB. APHIS works with State cooperat and the potential threats associated with long distance movmen.

CASEY TREES NEWS IN BRIEF

Casey Trees News in Brief

URBAN FORESTRY NEWS

INVASIVE BEETLE OUTBREAK IN D.C.'S KENILWORTH PARK | Emerald ash borer (EAB) was recently spotted in D.C.'s Kenilworth Park. EAB outbreaks have now been recorded in 15 states and the District of Columbia. Early symptoms of an infested ash tree include dead branches at the top of the tree, D-shaped exit holes, vertical bark splits and S-shaped tunnels. Prince George’s County, Md., has introduced stingless wasps to combat their beetle problem. To further prevent the spread of EAB infestations, homeowners are urged to photograph the insect and damage. The transport of firewood across state lines is also prohibited. Homeowners are also instructed to report sightings to the U.S. Department of Agriculture’s Animal and Plant Health Inspection Service and the EAB hotline: 866.322.4512.
WHERE IS EMERALD ASH BORER?

Distribution of Ash (Fraxinus spp.)

Volume Density (cubic feet/acre)
- 0
- 0.0 - 10
- 10 - 50
- 50 - 100
- > 100

USDA Forest Service data sources:
County-level estimates of ash densities derived from Forest Inventory and Analysis (FIA) data.
PRESENTATION OVERVIEW

• What is EAB?
• Where is EAB?
• How is EAB impacting us?
• What can we do about EAB?
How is EAB impacting us?

SE Michigan:
• 20 million dead ash trees
  (Anulewicz et al. 2007)

Entire Impact Area:
• “Tens of millions dead ash trees”
  (Poland and McCullough 2010)

Trees Cut Down & Destroyed:
• Thousands? Tens of thousands?

Direct Economic Costs:
• Millions $? Tens of millions $?

Indirect Econ. / Env. Costs:
• Hundreds of millions $? Billions $?
How is EAB impacting us?

Cost of potential emerald ash borer damage in U.S. communities, 2009–2019

Kent F. Kovacs a,*, Robert G. Haight b, Deborah G. McCullough c, d, Rodrigo J. Mercader c, Nathan W. Siegert c, Andrew M. Liebhold e

<table>
<thead>
<tr>
<th>State</th>
<th>Ash trees (1000s)</th>
<th>Ash trees treated or removed (1000s)</th>
<th>Cost (2009 $ millions)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Arkansas</td>
<td>3299</td>
<td>492</td>
<td>240</td>
</tr>
<tr>
<td>Connecticut</td>
<td>556</td>
<td>11</td>
<td>4</td>
</tr>
<tr>
<td>Delaware</td>
<td>42</td>
<td>41</td>
<td>22</td>
</tr>
<tr>
<td>Illinois</td>
<td>5474</td>
<td>3497</td>
<td>2120</td>
</tr>
<tr>
<td>Indiana</td>
<td>944</td>
<td>527</td>
<td>333</td>
</tr>
<tr>
<td>Iowa</td>
<td>1149</td>
<td>611</td>
<td>321</td>
</tr>
<tr>
<td>Kentucky</td>
<td>263</td>
<td>228</td>
<td>127</td>
</tr>
<tr>
<td>Maine</td>
<td>968</td>
<td>531</td>
<td>255</td>
</tr>
<tr>
<td>Maryland</td>
<td>940</td>
<td>883</td>
<td>533</td>
</tr>
<tr>
<td>Massachusetts</td>
<td>811</td>
<td>46</td>
<td>18</td>
</tr>
<tr>
<td>Michigan</td>
<td>1719</td>
<td>353</td>
<td>230</td>
</tr>
<tr>
<td>Minnesota</td>
<td>1842</td>
<td>583</td>
<td>260</td>
</tr>
<tr>
<td>Missouri</td>
<td>4449</td>
<td>3111</td>
<td>1680</td>
</tr>
<tr>
<td>New Hampshire</td>
<td>518</td>
<td>259</td>
<td>121</td>
</tr>
<tr>
<td>New Jersey</td>
<td>1435</td>
<td>630</td>
<td>286</td>
</tr>
<tr>
<td>New York</td>
<td>2047</td>
<td>419</td>
<td>203</td>
</tr>
<tr>
<td>North Carolina</td>
<td>662</td>
<td>185</td>
<td>84</td>
</tr>
<tr>
<td>Ohio</td>
<td>1428</td>
<td>598</td>
<td>376</td>
</tr>
<tr>
<td>Pennsylvania</td>
<td>1850</td>
<td>1347</td>
<td>786</td>
</tr>
<tr>
<td>South Carolina</td>
<td>85</td>
<td>2</td>
<td>1</td>
</tr>
<tr>
<td>Tennessee</td>
<td>4485</td>
<td>811</td>
<td>336</td>
</tr>
<tr>
<td>Vermont</td>
<td>101</td>
<td>93</td>
<td>52</td>
</tr>
<tr>
<td>Virginia and District of Columbia</td>
<td>1334</td>
<td>1126</td>
<td>641</td>
</tr>
<tr>
<td>West Virginia</td>
<td>409</td>
<td>405</td>
<td>237</td>
</tr>
<tr>
<td>Wisconsin</td>
<td>1092</td>
<td>988</td>
<td>566</td>
</tr>
</tbody>
</table>

Total 37,902 17,777 9832

17 million trees

$9.8 billion
How is EAB impacting us?

Ash Abundance by FIA Sub-Region as a percentage of Total Forested Volume (all trees >= 5.0" DBH)
How is EAB impacting us?

- Street tree assessment
### How is EAB impacting us?

- **Zonation of state and identification of prospect localities**

<table>
<thead>
<tr>
<th>Zone</th>
<th>Complete</th>
<th>Sample</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td>2</td>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td>3</td>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td>4</td>
<td>4</td>
<td>3</td>
</tr>
<tr>
<td>5</td>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td>6</td>
<td>0</td>
<td>2</td>
</tr>
<tr>
<td>7</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>8</td>
<td>0</td>
<td>2</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>9</strong></td>
<td><strong>16</strong></td>
</tr>
</tbody>
</table>
## How is EAB Impacting Us?

### Ash Street Tree Composition

<table>
<thead>
<tr>
<th></th>
<th>Native Ash Trees (#)</th>
<th>Relative Abundance (%)</th>
<th>Relative Importance (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Minimum</td>
<td>0* Buchanan, Franklin</td>
<td>0* Buchanan, Franklin</td>
<td>0* Buchanan, Franklin</td>
</tr>
<tr>
<td>Median</td>
<td>84</td>
<td>1.8</td>
<td>2.7</td>
</tr>
<tr>
<td>Maximum</td>
<td>1,391 Richmond</td>
<td>6.0 Wytheville</td>
<td>11.3 Abingdon</td>
</tr>
<tr>
<td>Interquartile Range</td>
<td>23 – 271</td>
<td>1.2 – 2.6</td>
<td>1.4 – 3.7</td>
</tr>
<tr>
<td>Total</td>
<td>5,280</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

[http://urbanforestry.frec.vt.edu/streets/](http://urbanforestry.frec.vt.edu/streets/)
HOW IS EAB IMPACTING US?

- Ash Street Tree Benefits and Removal Costs

<table>
<thead>
<tr>
<th>N = 22</th>
<th>*Total Annual Benefits ($)</th>
<th>Annual Benefits Per Tree ($)</th>
<th>Annual Benefits Per Capita ($)</th>
<th>Tree Removal Costs ($)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Minimum</td>
<td>0* Buchanan, Franklin</td>
<td>0* Buchanan, Franklin</td>
<td>0* Buchanan, Franklin</td>
<td>0* Buchanan, Franklin</td>
</tr>
<tr>
<td>Median</td>
<td>$ 15,061</td>
<td>$ 134</td>
<td>$ 0.52</td>
<td>$ 34,429</td>
</tr>
<tr>
<td>Maximum</td>
<td>$ 207,046 Richmond</td>
<td>$ 222 Williamsburg</td>
<td>$ 1.58 Winchester</td>
<td>$ 705,577 Roanoke</td>
</tr>
<tr>
<td>Interquartile Range</td>
<td>$ 7,152 – 36,584</td>
<td>$ 79 – 160</td>
<td>$ 0.24 – 0.84</td>
<td>$17,889 – 81,245</td>
</tr>
</tbody>
</table>

*Real Estate Value, Stormwater Capture, Energy Conservation, Air Pollution Mitigation, Carbon Sequestration
How is EAB impacting us?

- Urban forest assessment

- Abingdon, VA
- Charlottesville, VA
- Falls Church, VA
- Roanoke City, VA
- Winchester, VA

http://urbanforestry.frec.vt.edu/eco.html
### How is EAB impacting us?

- **Urban forest assessment**

<table>
<thead>
<tr>
<th>Locality</th>
<th>Native Ash Trees (#)</th>
<th>Relative Abundance (%)</th>
<th>Structural Replacement Value ($)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Abingdon</td>
<td>3,926</td>
<td>1.9</td>
<td>6.3 million</td>
</tr>
<tr>
<td>Charlottesville</td>
<td>10,439</td>
<td>2.9</td>
<td>58.3 million</td>
</tr>
<tr>
<td>Falls Church</td>
<td>N/A</td>
<td>N/A</td>
<td>N/A</td>
</tr>
<tr>
<td>Roanoke City</td>
<td>30,893</td>
<td>1.3</td>
<td>12.1 million</td>
</tr>
<tr>
<td>Winchester</td>
<td>1,200</td>
<td>0.5</td>
<td>201 thousand</td>
</tr>
<tr>
<td>Washington, DC*</td>
<td>-</td>
<td>2.0</td>
<td>87 million</td>
</tr>
</tbody>
</table>

*2006 i-Tree Eco assessment, as reported by Casey Trees (2013)
Presentation Overview

- What is EAB?
- Where is EAB?
- How is EAB impacting us?
- What can we do about EAB?
WHAT CAN WE DO ABOUT EAB?

- Slow the spread and protect high-value trees

July 28, 2012

**VIRGINIA EXPANDS EMERALD ASH BORER QUARantine TO INCLUDE THE ENTIRE COMMONWEALTH**

Contact: Elaine J. Lidholm, 804.786.7686

The Virginia Department of Agriculture and Consumer Services (VDACS) has expanded the Emerald Ash Borer (EAB) Quarantine to include the entire Commonwealth of Virginia. This action became necessary after the recent detection of EAB in the counties of Buchanan, Caroline, Giles, Hanover, Lee, Prince Edward, Stafford and Warren. The quarantine previously included Arlington, Charlotte, Clarke, Fairfax, Fauquier, Frederick, Halifax, Loudoun, Lunenburg, Mecklenburg, Pittsylvania and Prince William counties and the cities of Alexandria, Danville, Fairfax, Falls Church, Manassas, Manassas Park and Winchester.

Under this statewide quarantine, the regulated articles, which include ash trees, green (non-heat treated) ash lumber and ash wood products, as well as hardwood firewood, are no longer subject to localized movement restrictions and may now move freely within the state.
What can we do about EAB?

- Slow the spread and protect high-value trees
What can we do about EAB?

- Slow the spread and protect high-value trees

SL.A.M. SUPPRESSION TACTICS

- Prompt removal of infested trees
- Insecticides Treatments
- Use of trap trees
- Harvesting and utilization of healthy trees
- Biological control

http://www.slameab.info/
What can we do about EAB?

Objectives

This module will introduce you to an invasive insect pest called the emerald ash borer (EAB). In this module, you will:

- learn about EAB and where it came from
- find out how it came to North America and how it is spread
- learn about the negative impacts EAB has on affected areas

http://www.hort.vt.edu/eab
What can we do about EAB?

New EAB iBook release
November 1st

Reviewed by
• Chris Asaro (VA DOF)
• Robin Usborne (MSU and emeraldashborer.info)
• Sharon Lucik (USDA APHIS)

Based on our EAB NPDN modules with updates.

Go to www.hort.vt.edu/eab to download it for your iPad after Nov 1.
**What can we do about EAB?**

- Diversify our urban forests

![Santamour's Ideal Distribution](Image)

Santamour's Ideal Distribution

<table>
<thead>
<tr>
<th>Family</th>
<th>Genus</th>
<th>Species</th>
</tr>
</thead>
<tbody>
<tr>
<td>30%</td>
<td>20%</td>
<td>10%</td>
</tr>
</tbody>
</table>

(Santamour 1990)

“A community forestry goal of a 10% limit on a single species could give a false indication of stability.... (t)here is probably little concern about the diversity of families used as street trees, but not enough concern on the reliance on a limited number of genera... a 10% limitation on genera may be our best measure of stability.” (Ball et al. 2007)
What can we do about EAB?

- Diversify our urban forests

What is holding us back?

- Ecology (site suitability: soil, space, pests, stress)
- Social norms (citizens want fast-growing, colorful trees)
- Design and management norms (symmetry and uniformity)
- Nursery production (nurseries produce what consumers demand)

Survey of Wholesale Production Nurseries Indicates Need for More Education on the Importance of Plant Species Diversity

Nicole R. Polakowski, Virginia I. Lohr, and Teresa Cerny-Koenig

Abstract. Recent pest outbreaks, such as emerald ash borer and Asian longhorned beetle, have renewed concerns about the lack of genetic and species diversity in landscapes across the United States. However, the level of understanding of these issues by people in the green industry is not known. A survey on the knowledge of plant species diversity issues was distributed to Washington, U.S., wholesale nurseries. Respondents indicated a general awareness of the issue, but they had insufficient understanding of why the lack of species diversity is a problem. Respondents who had learned about plant species diversity in educational settings beyond high school were more likely than others to understand the issues. These results indicate the need for increased, in-depth education on why plant species diversity among landscape plants is important.

Key Words. Biodiversity; Genetic Diversity; Nurseries; Overplanting.
What can we do about EAB?

- Diversify our urban forests

What is holding us back?

- Ecology *(site suitability: soil, space, pests, stress)*
- Social norms *(citizens want fast-growing, colorful trees)*
- Design and management norms *(symmetry and uniformity)*
- Nursery production *(nurseries produce what consumers demand)*

What do we do about it?

- Educate *(share results of assessments; websites; social media)*
- Incentivize *(tree replacement request preference for diverse spp.)*
- Subsidize *(rebate or discount on diverse spp. sales)*
- Regulate *(approved/prohibited spp. in policy or ordinance)*
WHAT CAN WE DO ABOUT EAB?

http://urbanforestry.frec.vt.edu/streets/treeselection.html
PRESENTATION SUMMARY

• EAB is poised to spread throughout Virginia
• Native ash species are a minor component of Virginia’s street trees
• Impacts of EAB will be significant in some localities, leading to canopy cover loss and substantial mitigation costs
• Short-term response to EAB is slowing spread to keep impacts manageable
• Long-term response to EAB is to learn to diversify our urban forests

October 15, 2013
Mid-Atlantic Chapter
Int. Society of Arboriculture
2013 Annual Meeting
Fredericksburg, VA