How are we going to deal with The Emerald Ash Borer?

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1-Year Life Cycle

- **May/June:**
  - Adult Emergence
  - Ovary maturation

- **June/July:**
  - Oviposition

- **Early spring:**
  - Pupation

- **Summer/Fall:**
  - Larval growth

- **Winter:**
  - Pre-pupae
Red-headed Ash Borer
*Neoclytus acuminatus*

EAB larva:
Nested bells
Small head
EAB Detection

• EAB will not attack just one tree
  • Look at others in the vicinity

• Use multiple symptoms in diagnosis

• The ash in our area look like heck, it must be EAB
  • Ash decline is common in White ash growing on saturated soils – look for signs and symptoms.
EAB Population Behavior

• Pest Pressure = The number of bugs in one place at one point in time.
  – How quickly a tree will be killed
    • Lots of EAB or High Pest Pressure, death is 2 to 3 years
    • Few EAB or Low Pest Pressure, death can be 7 years or more
  – Rate of spread in an infestation
    • Lots of EAB or High Pest Pressure, faster spread
    • Few EAB or Low Pest Pressure, slower spread

• Host tree density
  – Rate of population buildup
  – Rate of spread in an infestation
Visual Signs & Symptoms

Varies with Pest Pressure

- **Tier I**: Early infestation
  - Bark Splitting
  - Woodpecker foraging

- **Tier II**: Mid level infestation
  - Woodpecker foraging
  - Canopy thinning
  - Epicormic sprouting

- **Tier III**: Heavy infestation
  - Canopy thinning
  - Woodpecker foraging
  - Epicormic sprouting
Bark splitting
Bark splitting

5 year-old EAB wound
Red-headed Ash Borer

EAB
Signs & Symptoms

• Epicormic, or water sprouts
Signs & Symptoms

Canopy thinning
But it still has green leaves!
Look, no phloem!
January 2003

Cooperative Emerald Ash Borer Project
North America EAB locations

Map Key
- EAB positive
EAB Death Curve

EAB-Induced Ash Mortality in the Upper Huron River Watershed, SE Michigan

Exponential Increase in Ash Mortality (> 4 inch dbh)

Solid line: direct measurements
Dotted line: inferred from dendrochronology data confirming EAB-induced ash mortality from 1994 - 2004

Dan Herms, Ohio State University, 2012.
Emerald Ash Borer (EAB) Quarantine Boundaries
Binghamton, Hudson Valley, Montezuma, Nichols, Rome, Syracuse, Unadilla, Western Region

2016

Created 06/2016

S. McDonnell - Geographer
Division of Lands and Forests
Forest Health Unit
Economic Impacts of Non-Native Forest Insects in the Continental United States

Juliann E. Aukema¹*, Brian Leung²,³, Kent Kovacs⁴, Corey Chivers², Kerry O. Britton⁵, Jeffrey Englin⁶, Susan J. Frankel⁷, Robert G. Haight⁸, Thomas P. Holmes⁹, Andrew M. Liebhold¹⁰, Deborah G. McCullough¹¹, Betsy Von Holle¹²

• September 9, 2011

• “We found that costs are largely borne by homeowners and municipal governments.”

• “Wood- and phloem boring insects are anticipated to cause the largest economic impacts by annually inducing nearly $1.7 billion in local government expenditures and approximately $830 million in lost residential property values.”

• “Given observations of new species, there is a 32% chance that another highly destructive borer species will invade the U.S. in the next 10 years.”
What’s at stake?
What’s at stake?
What’s at stake?
What’s at stake?
What’s at stake?
Power Transmission Lines in NYS

Total Miles of Transmission lines: 109,358

Primary Distribution: 94,026
Sub Transmission: 6,706
Transmission: 5,150
TOTAL VULNERABLE: 105,885 miles of transmission lines

This estimate does not include lines going to homes or along driveways.

National Grid estimates there are about 242 trees/mile along their lines = 26,000,000 total trees

Conservative estimate is that 20% are Ash = 5,000,000 ash trees

Conservative estimate of tree removal by National Grid is $300/tree = $1,540,000,000

Thanks to Brian Skinner, National Grid, for the data estimates
What are MY objectives?

1. Restore ALL ash species to the North American landscape.

2. Mitigate the Economic Impacts of Emerald Ash Borer.
Restore Ash on Landscape

• The 3 point plan

1. Establish Biological Controls
2. Identify and incorporate resistance
3. Conserve the ash genome
EAB Biological Control

- **Classic Biocontrol from Eastern Asia**
  - Egg Parasitoid
    - *Oobius agrilli*
  - Larval parasitoids
    - *Tetrastichus planipennisi* – gregarious endoparasitoid
    - *Spathius agrili* – gregarious ectoparasitoid
    - *Spathius galinae* – Russia - not approved by EPA yet.

- **Native Biocontrol**
  - Larval Parasitoids of wood-borers
    - *Spathius floridanus* (Hymenoptera: Braconidae)
    - *Atanycolus spp.* (Hymenoptera: Braconidae)
  - Predators
    - *Enoclerus* sp. (Coleoptera: Cleridae)
    - Woodpeckers!
Ash Resistance to EAB

– Chemical and genetic work underway to **identify mechanisms of resistance**

– **Crosses with Asian species** and back-crosses are being made now.
  
  • Similar to the technique used for American Chestnut

– **Lingering ash project**
  
  • Identify individuals that seem to survive
Conserve Ash Genome

• Collect seed
  – Federal, regional, and state programs underway
  – Must act fast to preserve the breadth of the genetic diversity across the landscape

• Preserve magnificent individuals
  – Systemic insecticides
Mitigate Economic Impacts

• Proactive planning
  – Tree inventories/ EAB Cost Calculator
  – Identify priorities for management

• Engage communities
  – Inter-municipal cooperation

• Develop novel management techniques
  – Pesticide treatments
  – Wood utilization
Management Options

- Do nothing
  - Liability issues
- Remove all ash before they become infested
  - Loss of valuable canopy
- Remove ash as they become infested
  - Expensive reactive management – potential exposure to liability
  - REMEMBER THE DEATH CURVE!!!
- Treat with insecticides
  - Retain canopy
  - Many management options available with more time
EAB Population Behavior

• Pest Pressure Impacts Management Decisions
  – Pest detection
    • Difficult at Low Pest Pressure, but well worth the effort.
    • At High Pest Pressure... You are way behind the curve.
  – Treatment options
    • Timing of management decisions – the earlier the better.
      – Use the EAB Cost Calculator.
    • Pesticide effectiveness varies with pest pressure
      – Only the best pesticides work at High Pest Pressure.
      – My dog can protect your tree if there are no EAB in the vicinity.
Systemic Insecticides for EAB

- **Imidacloprid (Merit, Xytect, and others)**
  - Must be used annually, injection and soil drench
- **Dinotefuran (Safari)**
  - Must be used annually, fast acting bark spray
- **Emamectin benzoate (Tree-äge)**
  - Most effective product under high pest pressure
  - Effective for up to 3 years, injection only
- **Azadirachtin (Treeazin)**
  - Only product available in Canada
  - Must be used annually, injection only
  - Environmentally benign – insect growth regulator
Pesticide Use Strategies

- Use insecticides to spread out tree removals according to your schedule, not the bugs.
  - Plan for treatments at least 12 years in the future
  - Must start early in the infestation cycle to minimize costs and retain maximum tree health – Early detection!

- Determine which trees to protect for keeps
  - Pay attention to canopy characteristics and damage
    - Remaining structure must be able to form a balanced tree
  - Plan to aggressively protect these trees for 12 years or more
Tree Size Class Distribution

Please use your street tree inventory data to enter the number of ash trees of each size class in your forest in the table below. Size span should be entered the diameter of the trunk at breast height (DBH), or at 4.5 feet above the soil line. Use the default values for tree size range or change the size class to correspond with the summary statistics you have on hand.

<table>
<thead>
<tr>
<th>Size Span (inches)</th>
<th>Number of Trees</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 - 3</td>
<td>200</td>
</tr>
<tr>
<td>3 - 6</td>
<td>500</td>
</tr>
<tr>
<td>6 - 12</td>
<td>900</td>
</tr>
<tr>
<td>12 - 18</td>
<td>300</td>
</tr>
<tr>
<td>18 - 24</td>
<td>75</td>
</tr>
<tr>
<td>24 -</td>
<td>25</td>
</tr>
</tbody>
</table>

Save Changes  Add Span

Changes Saved

View Plan Comparisons Now  or  Customize Costs and Infestation Stage
<table>
<thead>
<tr>
<th>Option 1</th>
<th>Option 2</th>
<th>Option 3</th>
</tr>
</thead>
<tbody>
<tr>
<td>Remove All</td>
<td>Remove All</td>
<td>Remove All</td>
</tr>
<tr>
<td>Replace All</td>
<td>Replace All</td>
<td>Replace All</td>
</tr>
<tr>
<td>Treat All</td>
<td>Treat All</td>
<td>Treat All</td>
</tr>
<tr>
<td>Remove Unsafe Ash</td>
<td>Remove Unsafe Ash</td>
<td>Remove Unsafe Ash</td>
</tr>
<tr>
<td>Replace Unsafe Ash</td>
<td>Replace Unsafe Ash</td>
<td>Replace Unsafe Ash</td>
</tr>
<tr>
<td>Replace &gt;12</td>
<td>Replace &gt;12</td>
<td>Replace &gt;12</td>
</tr>
<tr>
<td>Replace &lt;12</td>
<td>Replace &lt;12</td>
<td>Replace &lt;12</td>
</tr>
<tr>
<td>Replace &lt;24</td>
<td>Replace &lt;24</td>
<td>Replace &lt;24</td>
</tr>
<tr>
<td>Save 50%</td>
<td>Save 50%</td>
<td>Save 50%</td>
</tr>
<tr>
<td>Treat 30% More to Buy Time</td>
<td>Treat 30% More to Buy Time</td>
<td>Treat 30% More to Buy Time</td>
</tr>
<tr>
<td>URBAN SLAM</td>
<td>URBAN SLAM</td>
<td>URBAN SLAM</td>
</tr>
</tbody>
</table>
Urban SLAM Cost Comparison

Replace as they die
Proactive removal

Cliff Sadof, Purdue University (2013)
Benefits of Urban Trees

- Two models used: CTLA & iTree
- Landscaping – up to 40% of property value
- Energy savings
- Water interception and use
- Business activity
- Human health
Benefits of Urban Trees

Results suggest that loss of trees to the emerald ash borer increased mortality related to cardiovascular and lower-respiratory-tract illness. This finding adds to the growing evidence that the natural environment provides major public health benefits.
Size of Remaining Ash Forest

Cliff Sadof, Purdue University (2013)
Urban SLAM – SLow Ash Mortality

The 20% Solution
20% EAB Solution
(McCullough and Mercator 2011)
Year 0
20% EAB Solution
(McCullough and Mercator 2012)

Year 1
20% EAB Solution
(McCullough and Mercator 2012)

Year 2
20% EAB Solution
(McCullough and Mercator 2012)
Year 3
20% EAB Solution
(McCullough and Mercator 2012)
Year 4
20% EAB Solution
(McCullough and Mercator 2012)
Year 5
The 33% Solution!
33% EAB Solution
(McCullough and Mercator 2011)

Year 0
33% EAB Solution
(McCullough and Mercator 2011)

Year 1
33% EAB Solution
(McCullough and Mercator 2011)
Year 2
33% EAB Solution
(McCullough and Mercator 2011)

Year 3
What can you do now?
As a homeowner or community member

• Inventory your ash.
  – Prioritize your management activities
• Explore management options.
  – EAB Cost Calculator from Purdue University
    • eabindiana.info
• Know where EAB is.
  – Early detection is critical!
• Participate in local EAB Task Force