Biological Control of the Emerald Ash Borer

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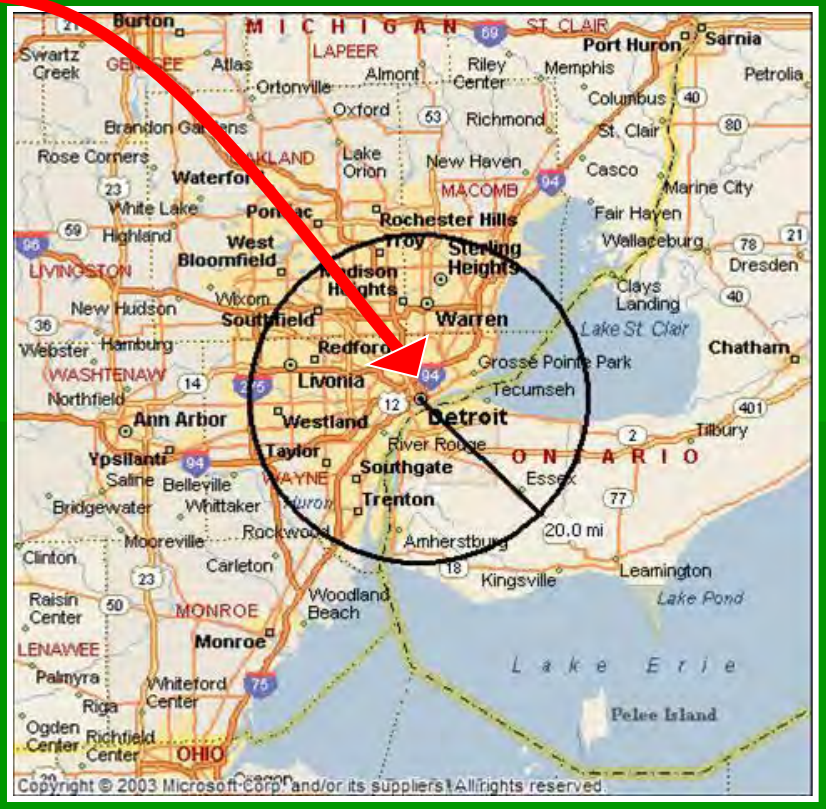
Discovery…

A New Pest In North America

❖ 2002 – feeding on ash in southeastern Michigan.

❖Identified as *Agrilus planipennis*, or the Emerald Ash Borer



❖Is thought to have been introduced to North America at least ten years before discovery, probably in solid wood packing.

Damage

What does this pest do? …

- EAB larvae feed in the phloem, cambium, and outer sapwood
- Produce galleries that cut off the flow of nutrients
- Eventually girdle and kill branches and eventually entire trees

Impact on Urban/Suburban Landscapes…

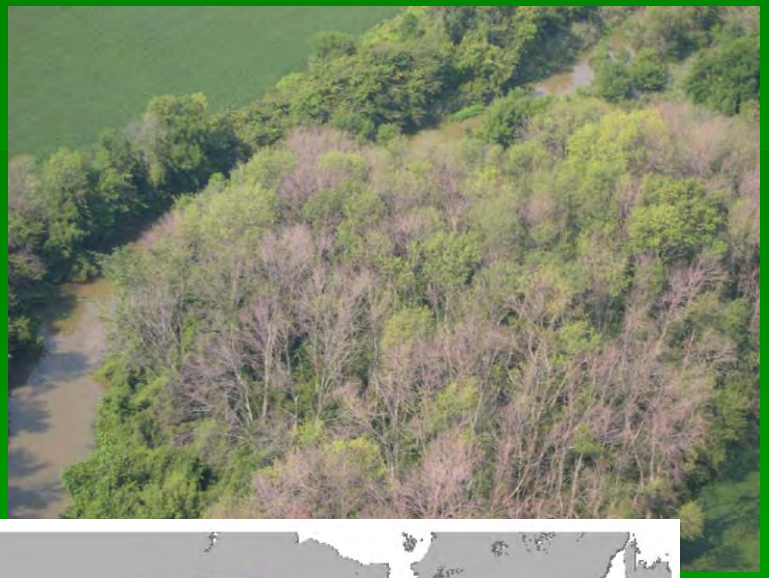
Before Removal

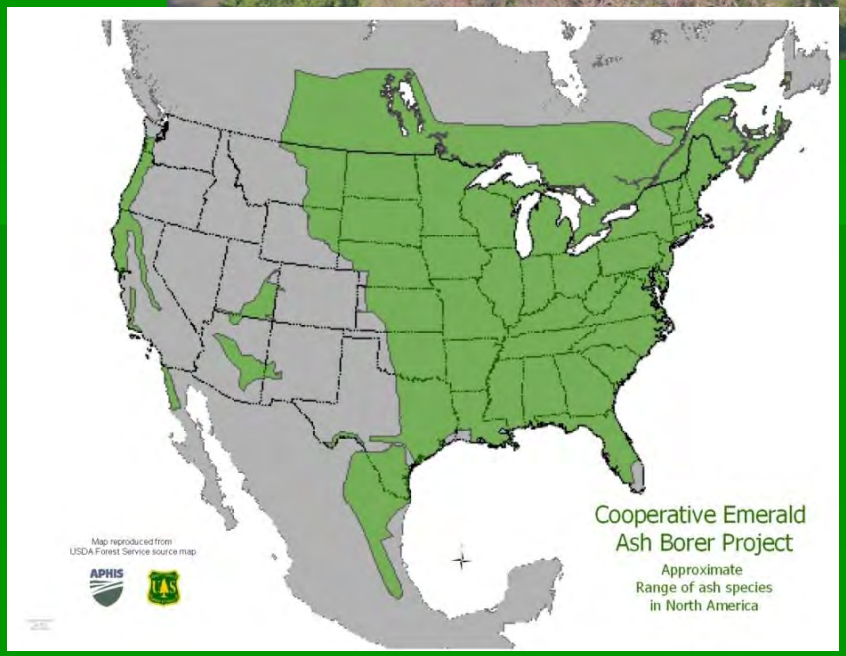
- In 8 cities surveyed in the eastern U.S., ash comprised 14% of the total leaf area.
- Trees provide shade and add to property value
- Dead or dying trees in need of costly removal, disposal, and replacement.

After Removal

Impacts on Forests…

- Ecosystem functions
  - Thermal cover, protection
  - Bark and seeds are consumed by wildlife
  - 17 Lepidoptera depend solely on ash.
- Forest Products
  - Tool handles, baseball bats, guitars, furniture, cabinets, crating, cardboard, paper, baskets.
  - firewood





Potential Economic Consequences of EAB

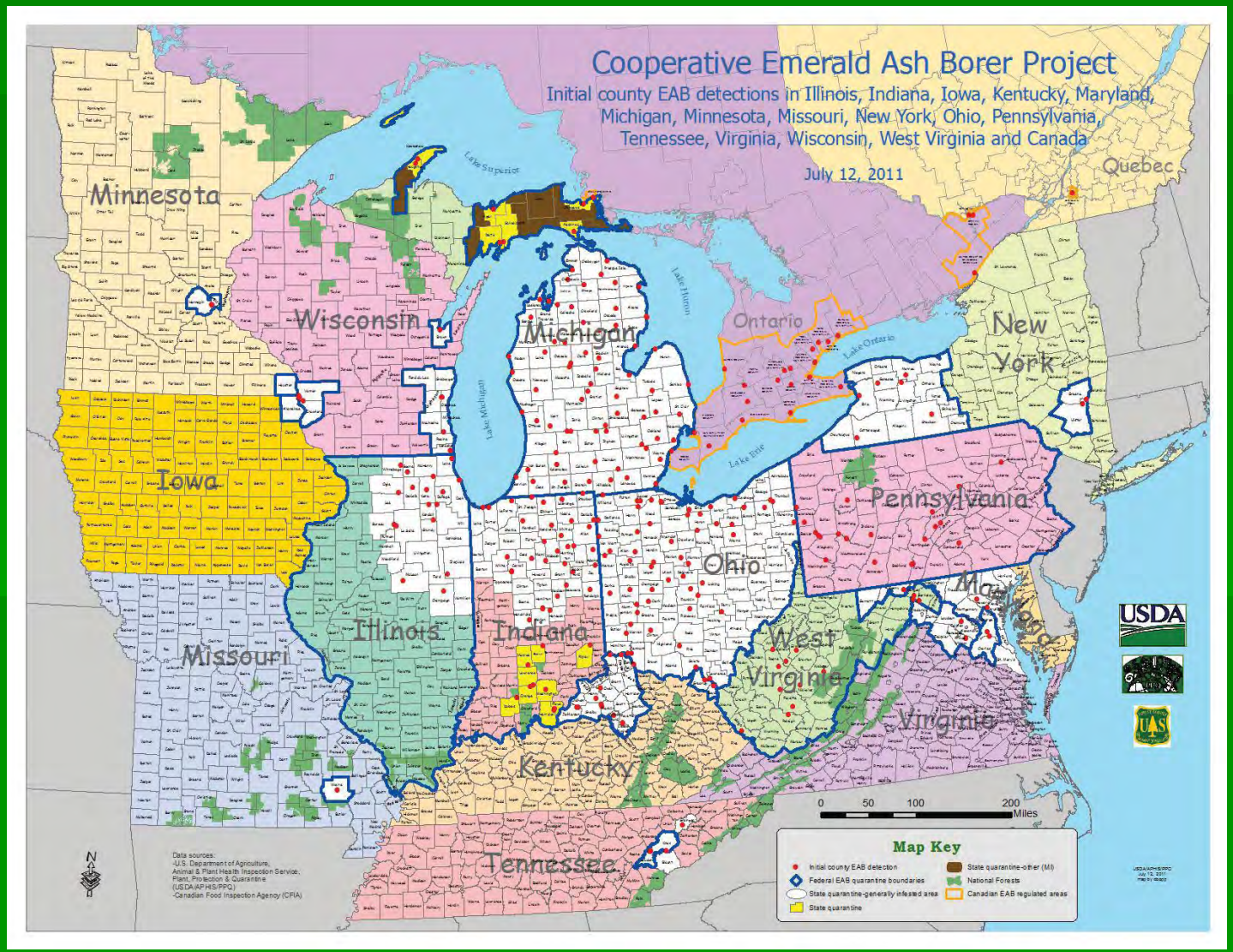
- APHIS and State Program Costs
  - $29.5 million per year average; $206 million total since 2003
- Urban/Suburban Areas
  - Cost of treating, removing, and replacing all 37.9 million ash trees in 25 states is $25 billion.
- Forests
  - Compensatory value of 8 billion ash trees in US timberland potentially infested with EAB is $282 billion.

EAB Potential for Spread

- Natural Spread:
  - Adults are strong fliers
- Artificial Spread:
  - Movement of EAB infested firewood
  - Movement of EAB infested logs
  - Movement of EAB infested nursery stock

Difficult to detect low density infestations.

Current EAB Distribution



Classical Biological Control

- The importation of a natural enemy from a foreign country for sustained control of a pest also of foreign origin.
- Successful natural enemies can provide enduring pest control
  - Reproduce and disperse without further human assistance.
  - Persist after pest population reduced to low density.

Exploration for Natural Enemies of EAB

- Mongolia
- Russia
- Japan
- South Korea
- China

Oobius agrili (Encyrtidae)

Female lays a single egg inside EAB egg

Parasitoid larva develops inside EAB egg

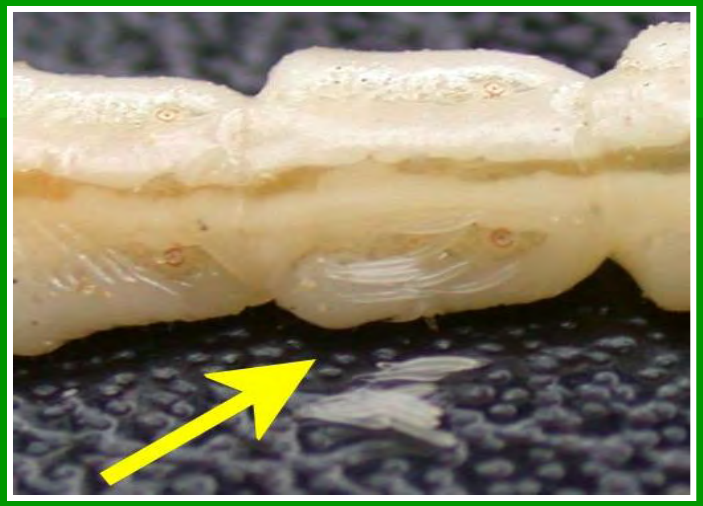
Oobius pupa (dissected from egg)

Parasite adult chews exit hole & emerges from egg

Tetrastichus planipennisi

- Gregarious endoparasitoid
- 4-92 per EAB
- 4 generations per year
- Up to 50% parasitism

Spathius agrili



- Paralyzes the host
- Gregarious ectoparasitoid
- 1-20 eggs per host

Spathius agrili

- 3-4 generations per year.
- Up to 90% parasitism in some stands

Summary of Host Specificity Evidence for EAB Parasitoids

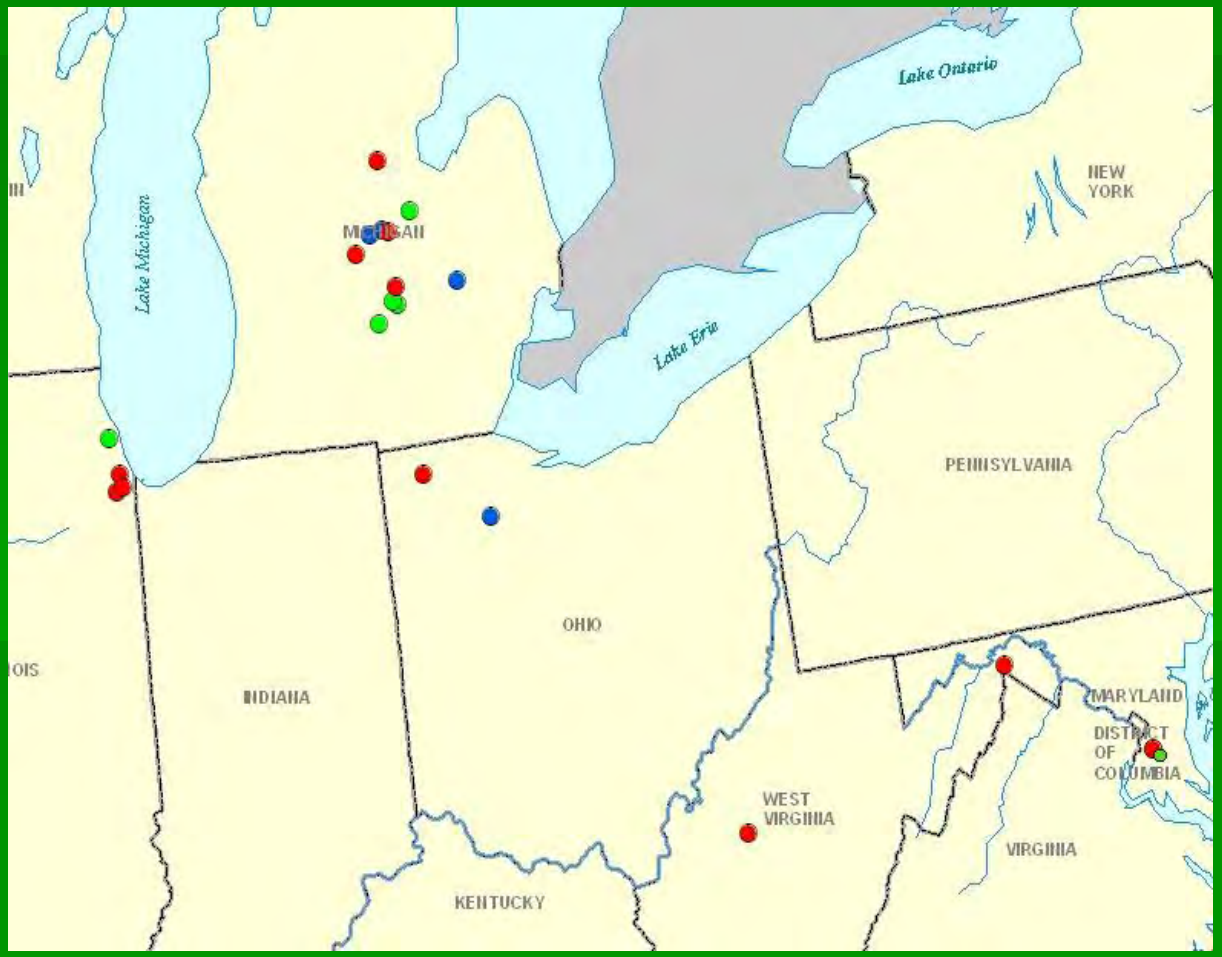
- EAB parasitoids attack significantly more EAB than non-target insects in laboratory no-choice and choice tests.
- *Spathius agrili* is attracted to leaves of ash but not to most other plants tested. Must be reared in the presence of EAB adults feeding on ash leaves.
- Neither of the two larval parasitoids were reared from any *Agrilus* other than EAB in China.
- *Spathius* native to the USA only sporadically attack EAB. No native *Tetrastichus* have been found ovipositing on EAB. They have not switched hosts.

Release of EAB Parasitoids

- Releases of small numbers began in 2007.
- Advances in rearing techniques and establishment of a mass rearing facility led to larger numbers released.
- APHIS has reared and released 375,000 parasitoids between 2009 and 2011 in 12 states.

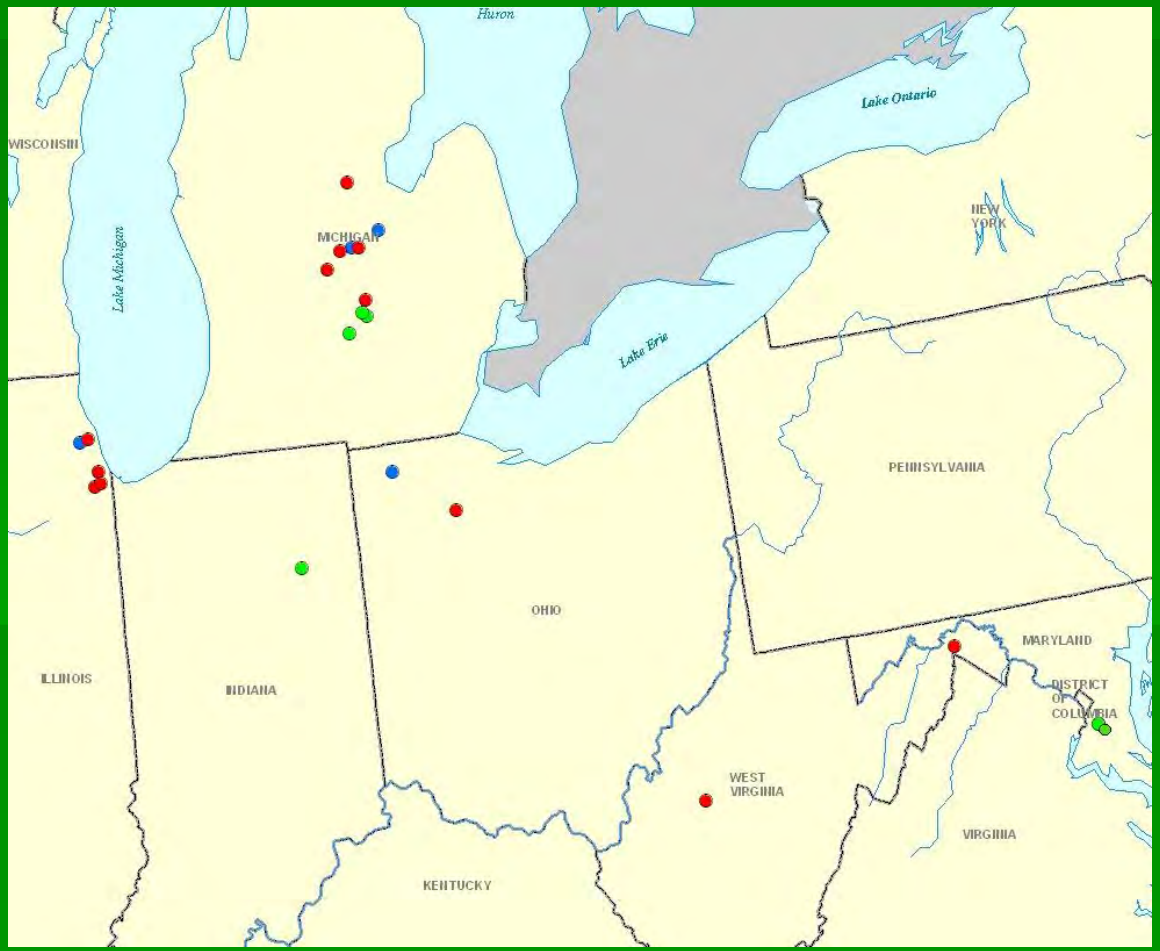
Recovery and Establishment: *Spathius*

- = Established
- = Recovered
- = Not Found



Recovery and Establishment: *Tetrastichus*

- = Established
- = Recovered
- = Not Found



Recovery and Establishment: Oobius

- = Established
- = Recovered
- = Not Found