

# Asian Longhorned Beetle

## Emerald Ash Borer



Claire Rutledge

Connecticut Agricultural Research Station







**Mating and Eggs**



**Larvae (immatures)**



**Adults**

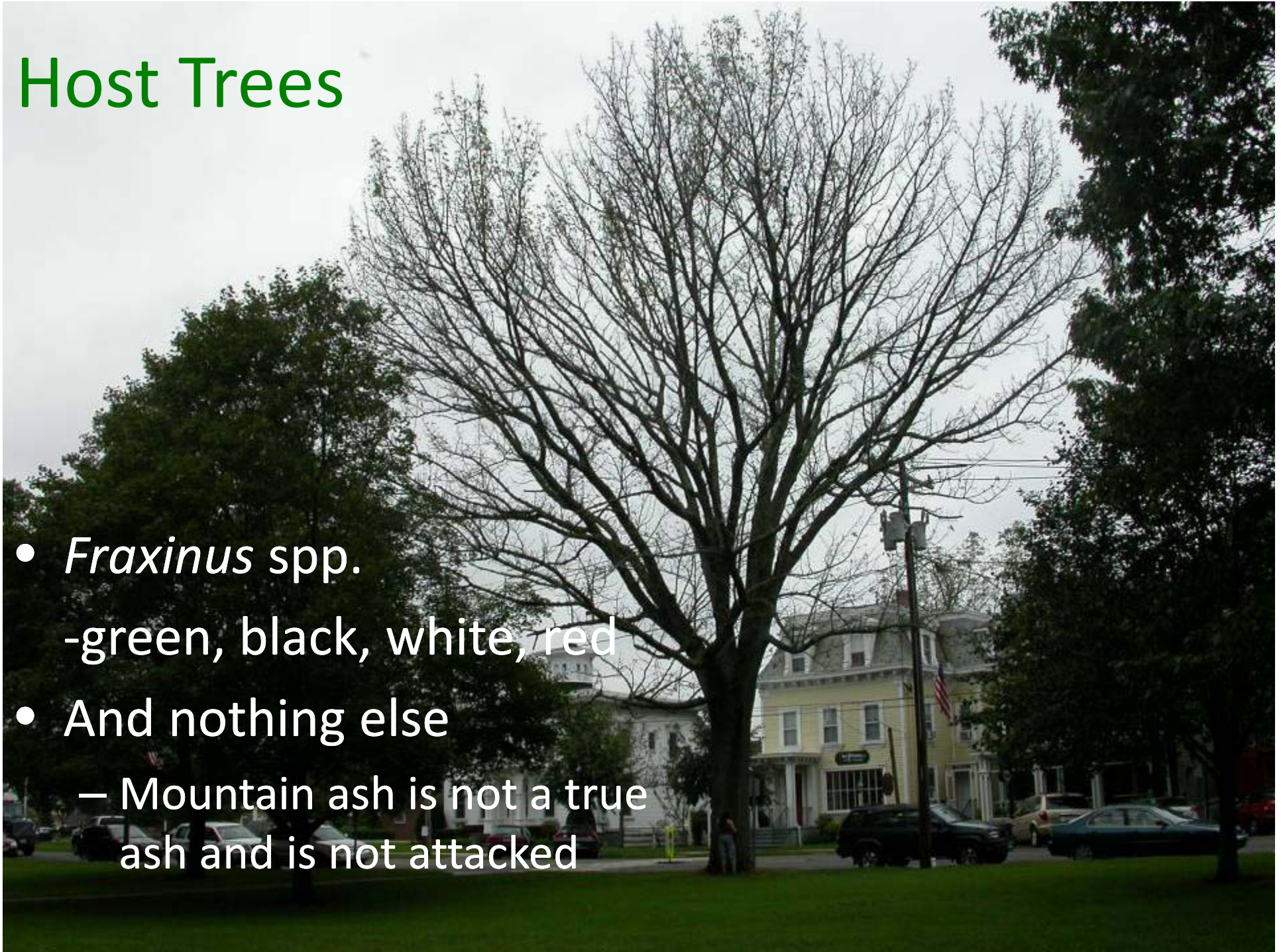


**Pupae**



# Host Trees

- *Fraxinus* spp.
  - green, black, white, red
- And nothing else
  - Mountain ash is not a true ash and is not attacked





# Why is EAB so dangerous ?

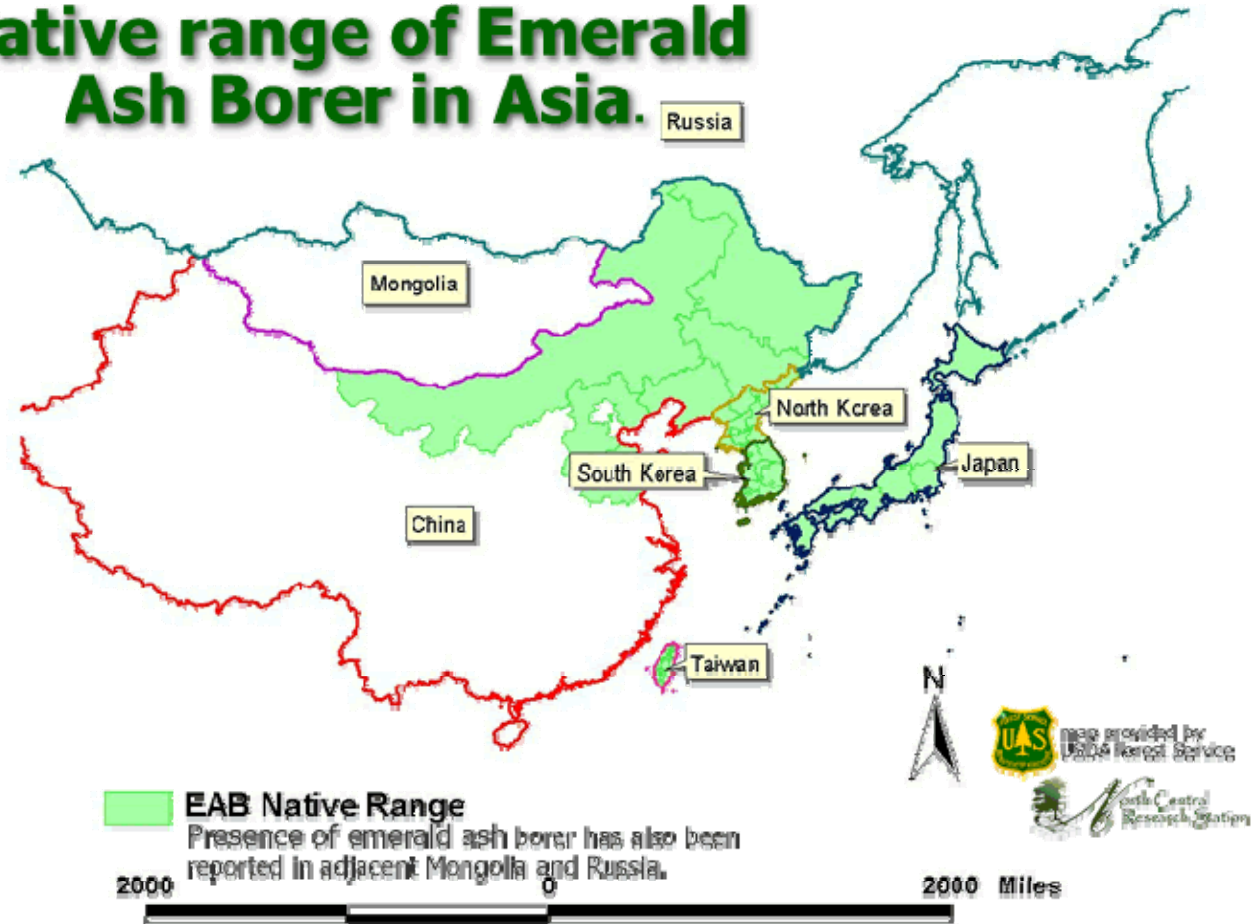
- Native American Ash has no resistance, it kills trees in 2-3 years
- Beetle is cryptic, hard to find
- Spreads quickly on its own
- Spread by people



# History

- From Asia
- First found in Detroit 2002
- Probably arrived in wooden packaging
- Killed > 40 MILLION ash trees in MI alone

## Native range of Emerald Ash Borer in Asia.

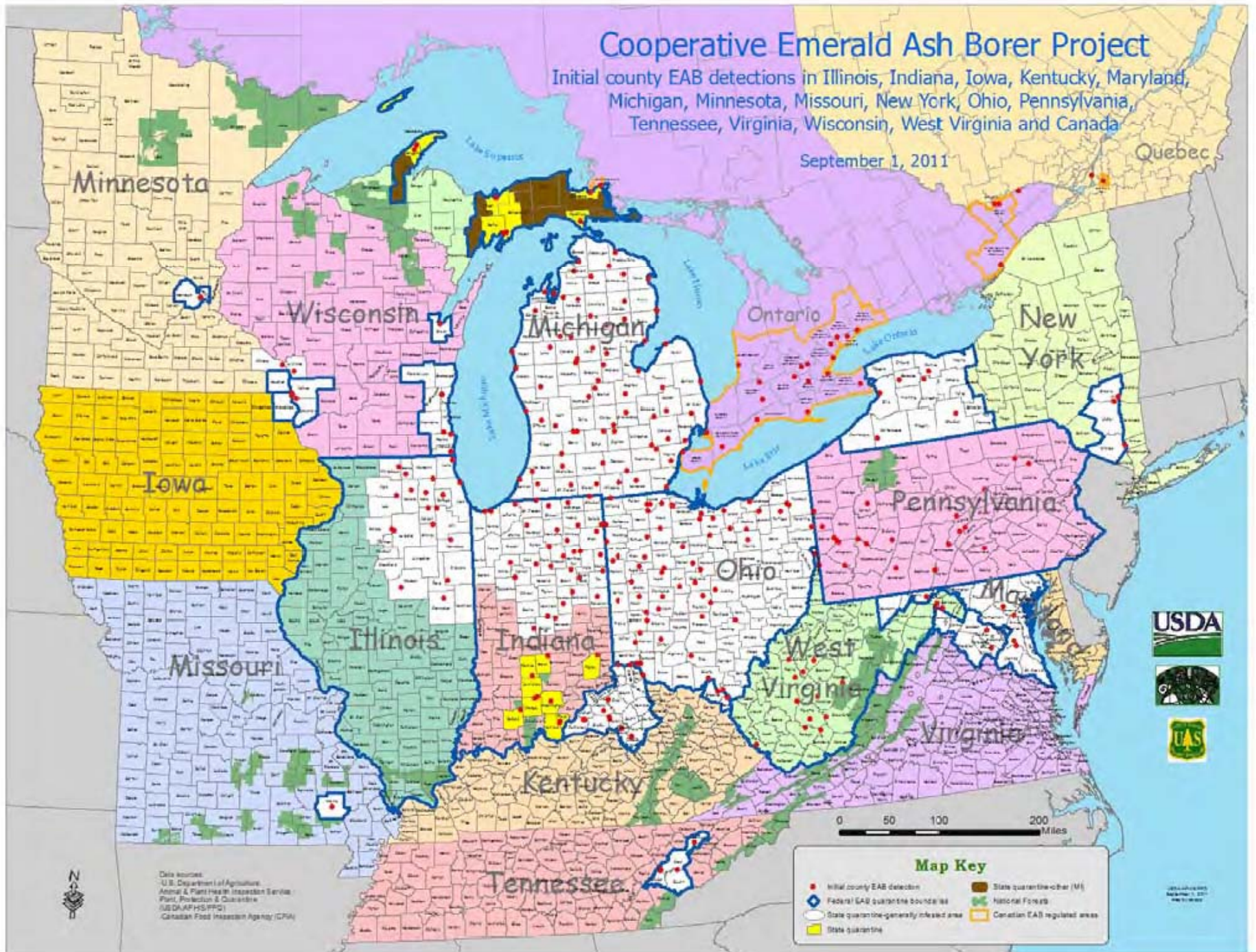




# Cooperative Emerald Ash Borer Project

Initial county EAB detections in Illinois, Indiana, Iowa, Kentucky, Maryland, Michigan, Minnesota, Missouri, New York, Ohio, Pennsylvania, Tennessee, Virginia, Wisconsin, West Virginia and Canada

September 1, 2011

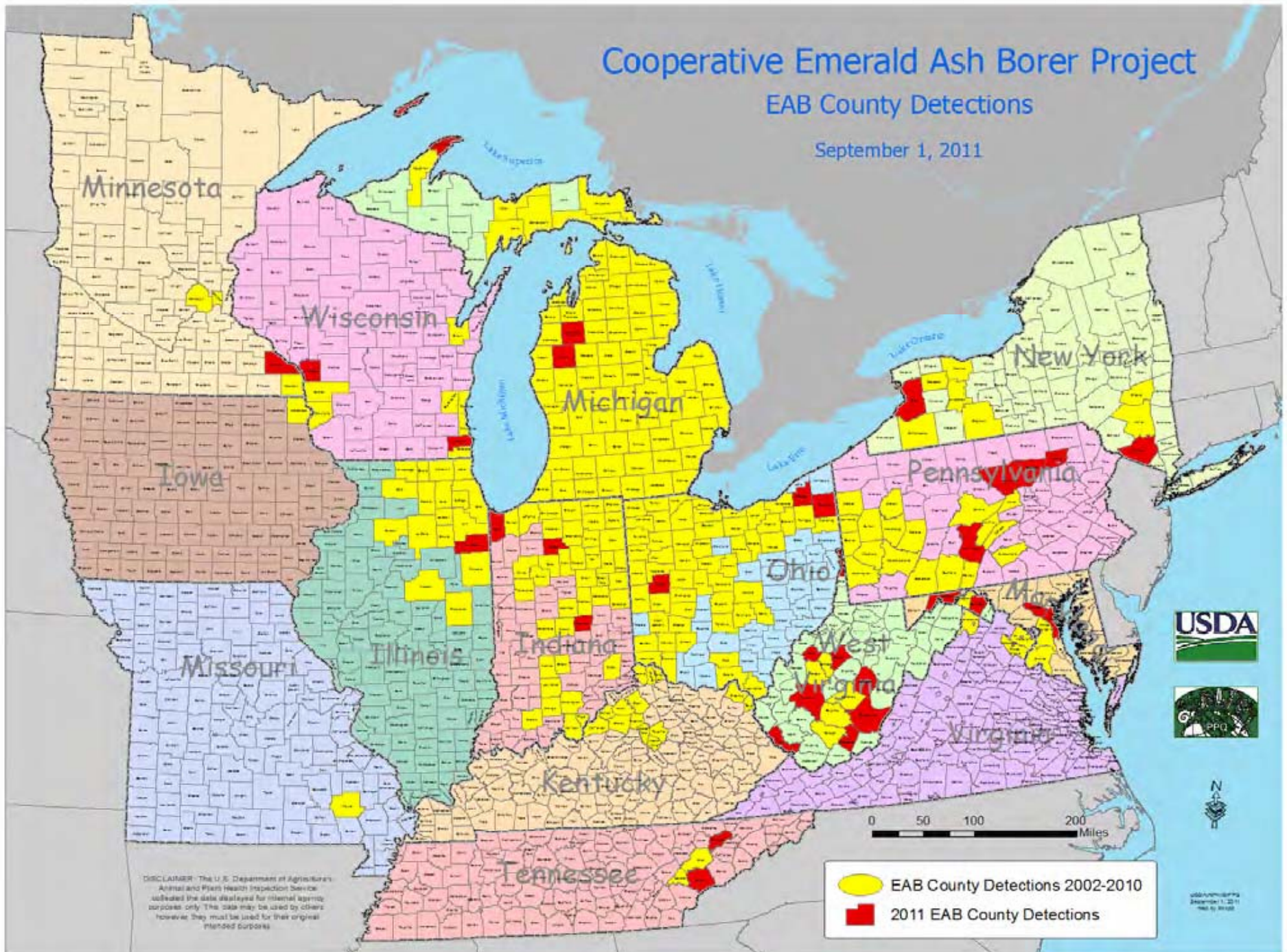




# Cooperative Emerald Ash Borer Project

## EAB County Detections

September 1, 2011

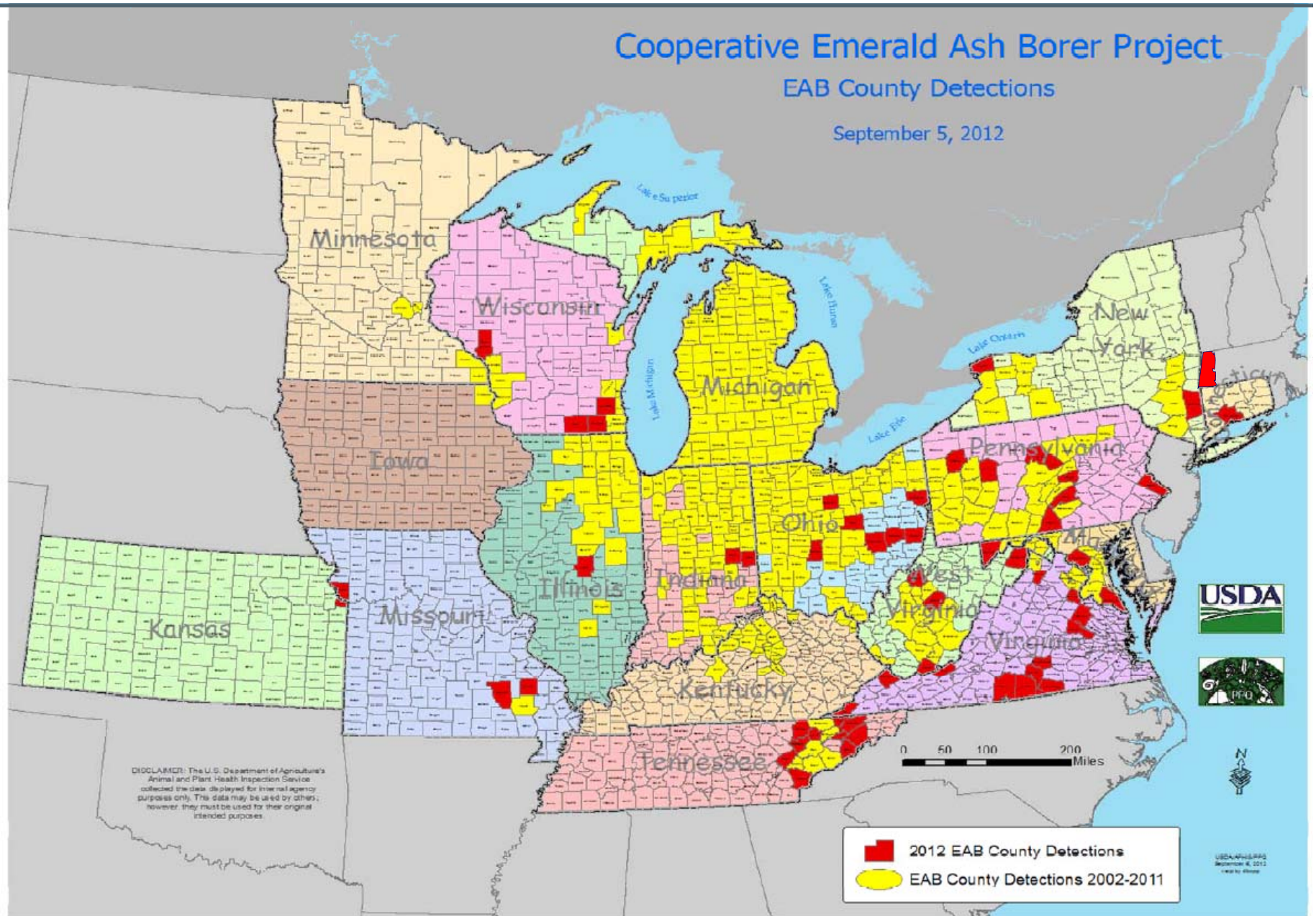




# Cooperative Emerald Ash Borer Project

## EAB County Detections

September 5, 2012



DISCLAIMER: The U.S. Department of Agriculture's Animal and Plant Health Inspection Service collected the data displayed for internal agency purposes only. This data may be used by others; however, they must be used for their original intended purposes.

USDA/APHIS/PPQ  
September 4, 2012  
1:48 by dhspp

# EAB in CT

- July 16 – Mioara Scott captured a *Cerceris* wasp carrying an EAB female at Canfield Park in Prospect CT

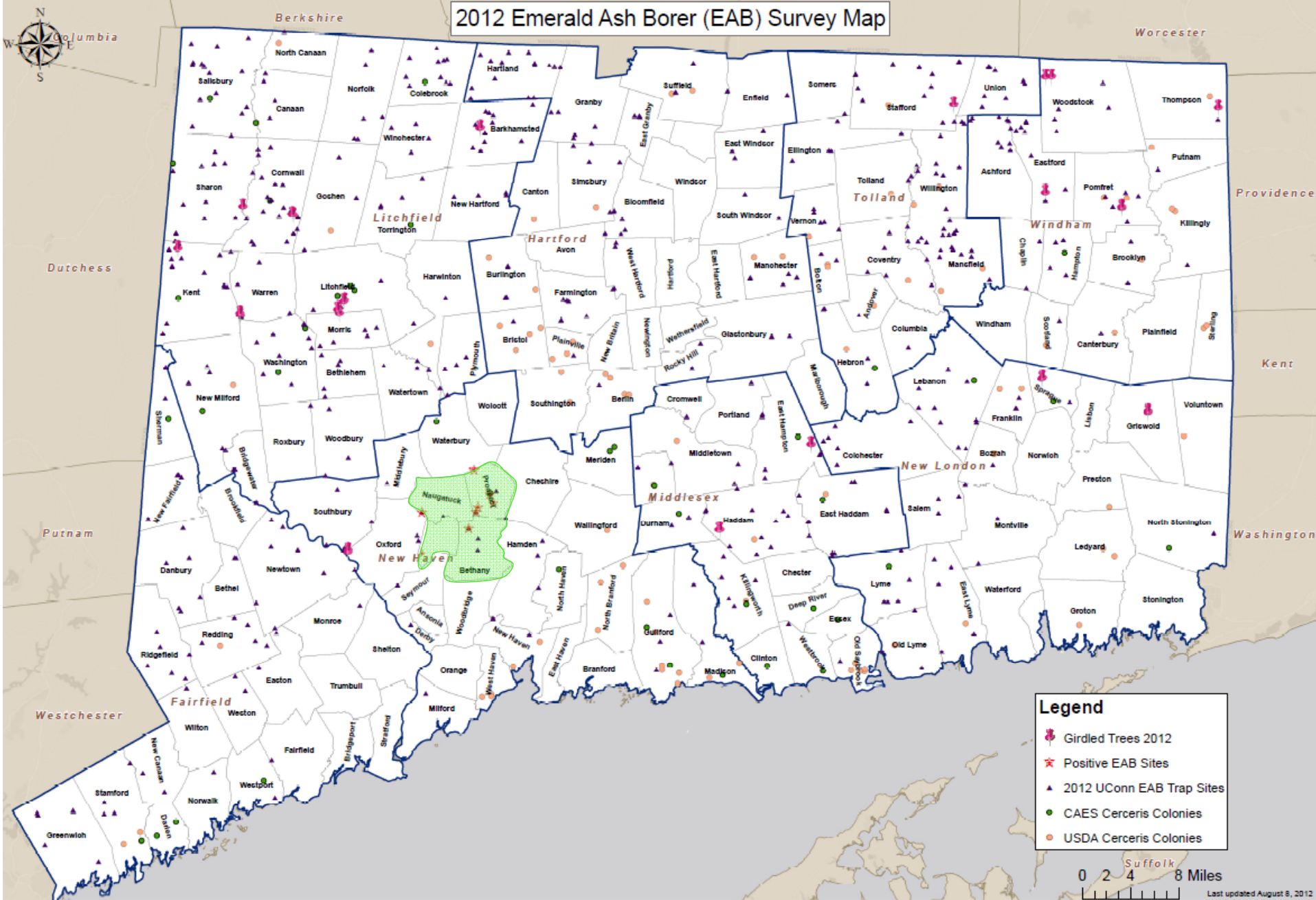




# EAB in CT



# 2012 Emerald Ash Borer (EAB) Survey Map



- Legend**
- Girdled Trees 2012
  - Positive EAB Sites
  - 2012 UConn EAB Trap Sites
  - CAES Cericis Colonies
  - USDA Cericis Colonies

0 2 4 8 Miles  
 Suffolk  
 Last updated August 8, 2012



# Native Relatives

Bronze Birch Borer



Two Lined  
Chestnut  
Borer



# A Look-Alike



Pebbly  
Texture

Smooth  
Texture

Big jaws





# What to look for:

- Branch Die-Back
- Witch's Brooms
- Splits over Galleries
- Woodpecker Damage
- Exit holes
- Serpentine Galleries



# Branch Die-Back



0%



10%



20%



30%



40%



50%



60%



70%



80%



90%



100%



# Witch's Brooms



# Splitting over Galleries



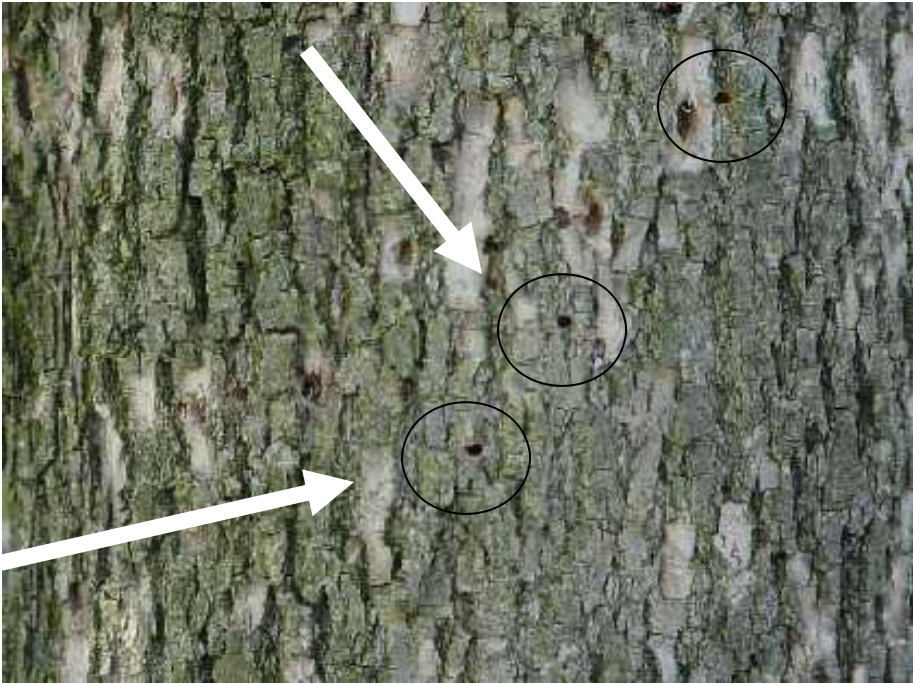


# Woodpecker Damage





# D- Shaped Exit holes





# Serpentine Galleries

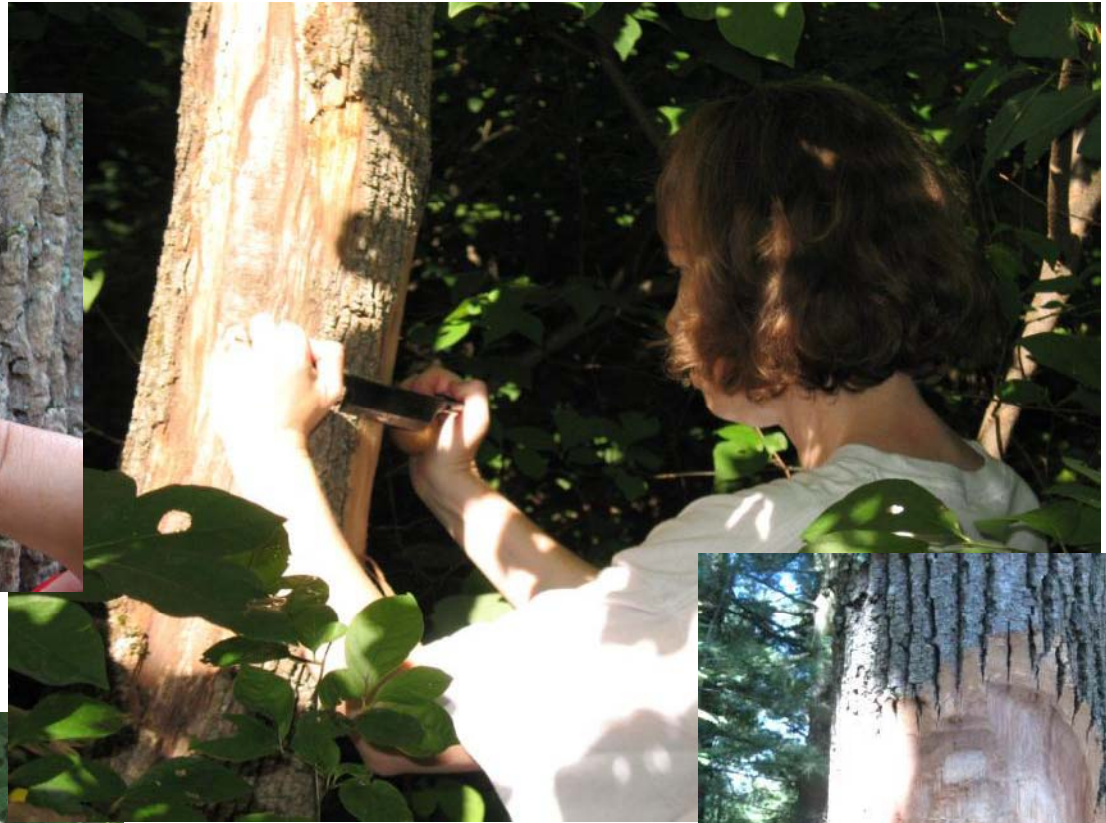




# Serpentine Galleries











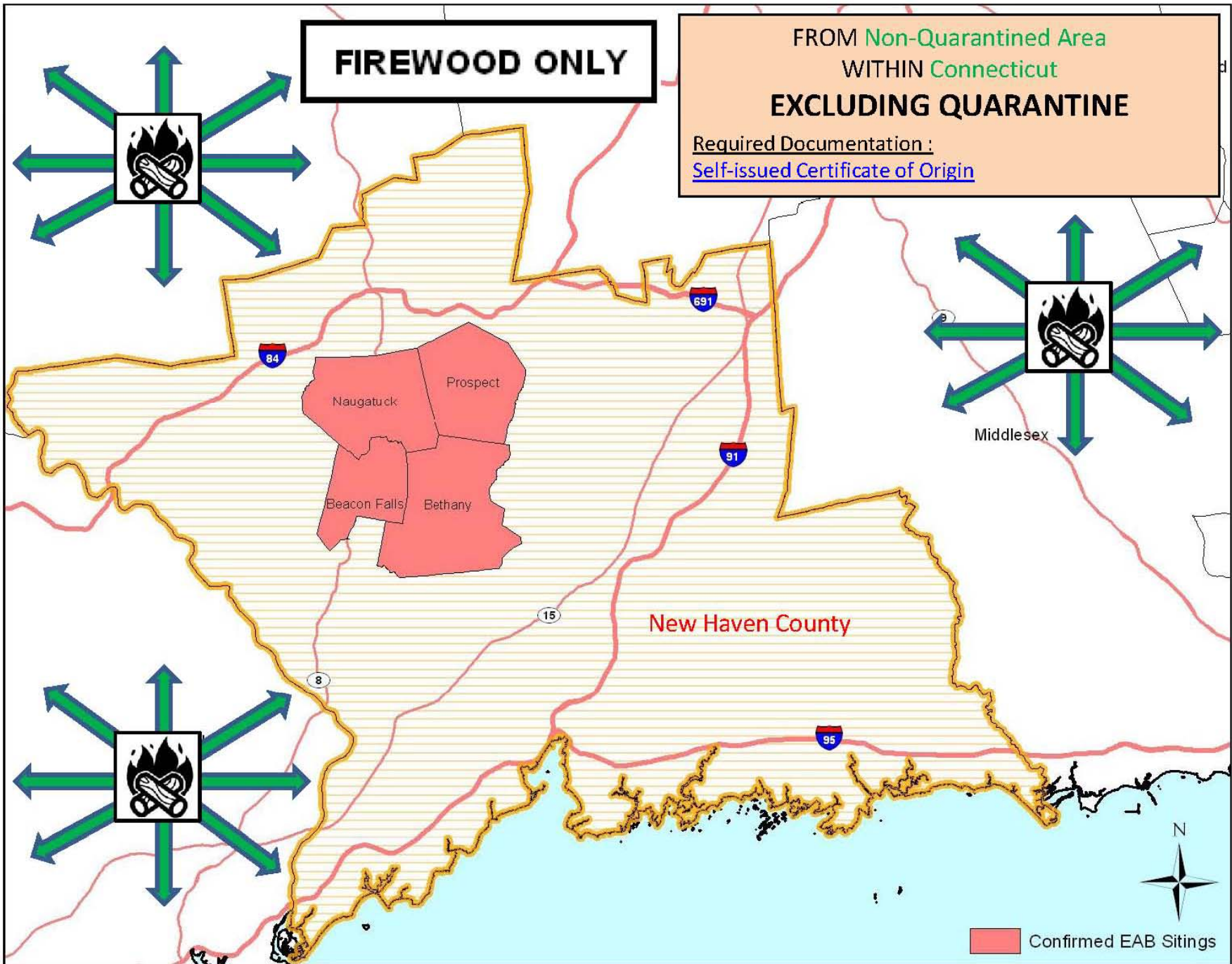




# What is being done? Management

- Regulatory
  - Quarantine
    - Local, State and Federal
    - CURRENTLY NEW HAVEN COUNTY IS UNDER QUARANTINE
      - SEE [CT.GOV/CAES](http://CT.GOV/CAES) FOR INFO
    - Limit movement of Ash trees, products and firewood
  - Enforcement
    - USDA PPQ
    - Compliance Agreements
    - Firewood Roadblocks





# FIREWOOD ONLY

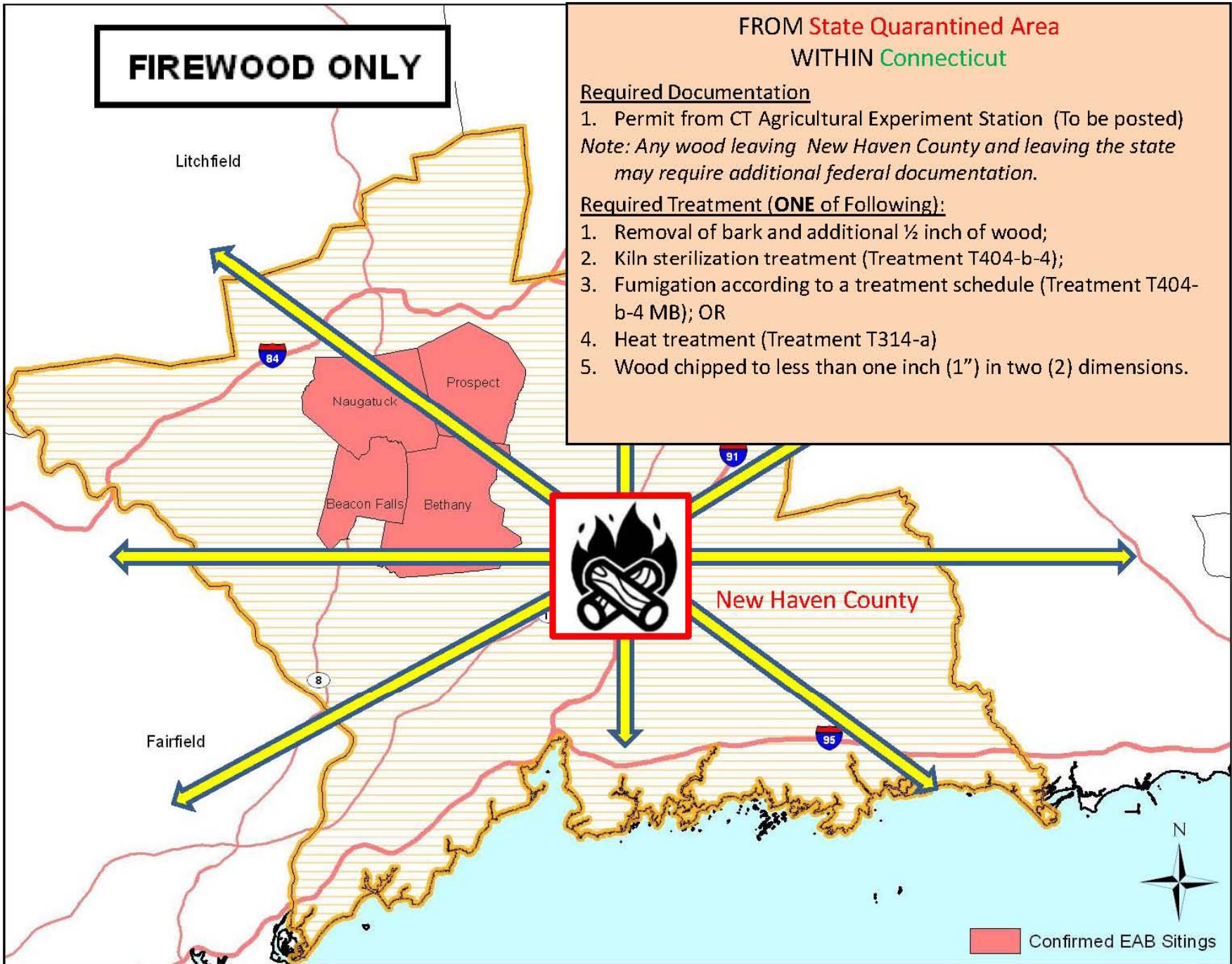
## FROM State Quarantined Area WITHIN Connecticut

### Required Documentation

1. Permit from CT Agricultural Experiment Station (To be posted)
- Note: Any wood leaving New Haven County and leaving the state may require additional federal documentation.*

### Required Treatment (**ONE** of Following):

1. Removal of bark and additional ½ inch of wood;
2. Kiln sterilization treatment (Treatment T404-b-4);
3. Fumigation according to a treatment schedule (Treatment T404-b-4 MB); OR
4. Heat treatment (Treatment T314-a)
5. Wood chipped to less than one inch (1") in two (2) dimensions.



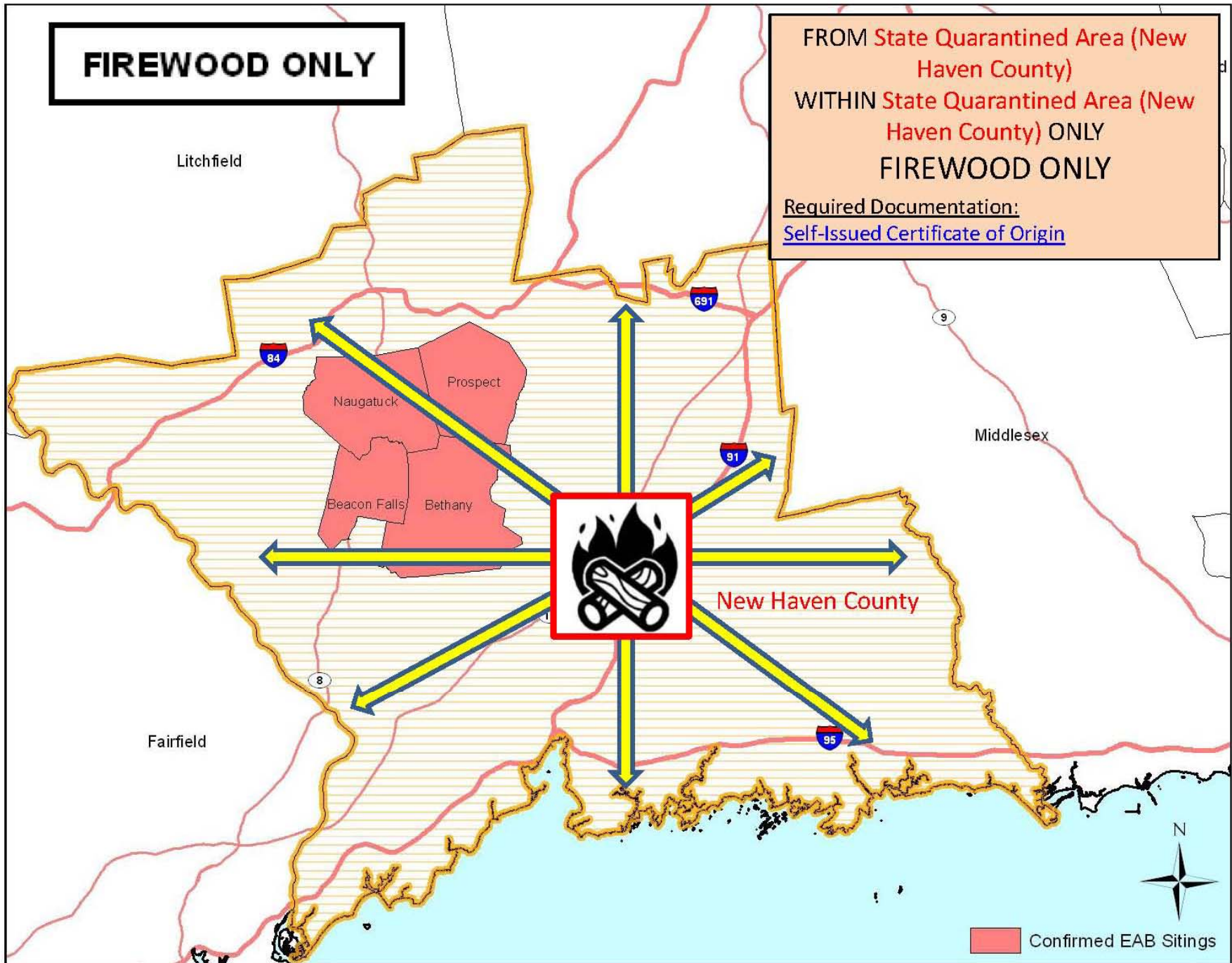
Confirmed EAB Sitings



**FIREWOOD ONLY**

FROM State Quarantined Area (New Haven County)  
WITHIN State Quarantined Area (New Haven County) ONLY  
**FIREWOOD ONLY**

Required Documentation:  
[Self-Issued Certificate of Origin](#)



# FIREWOOD ONLY

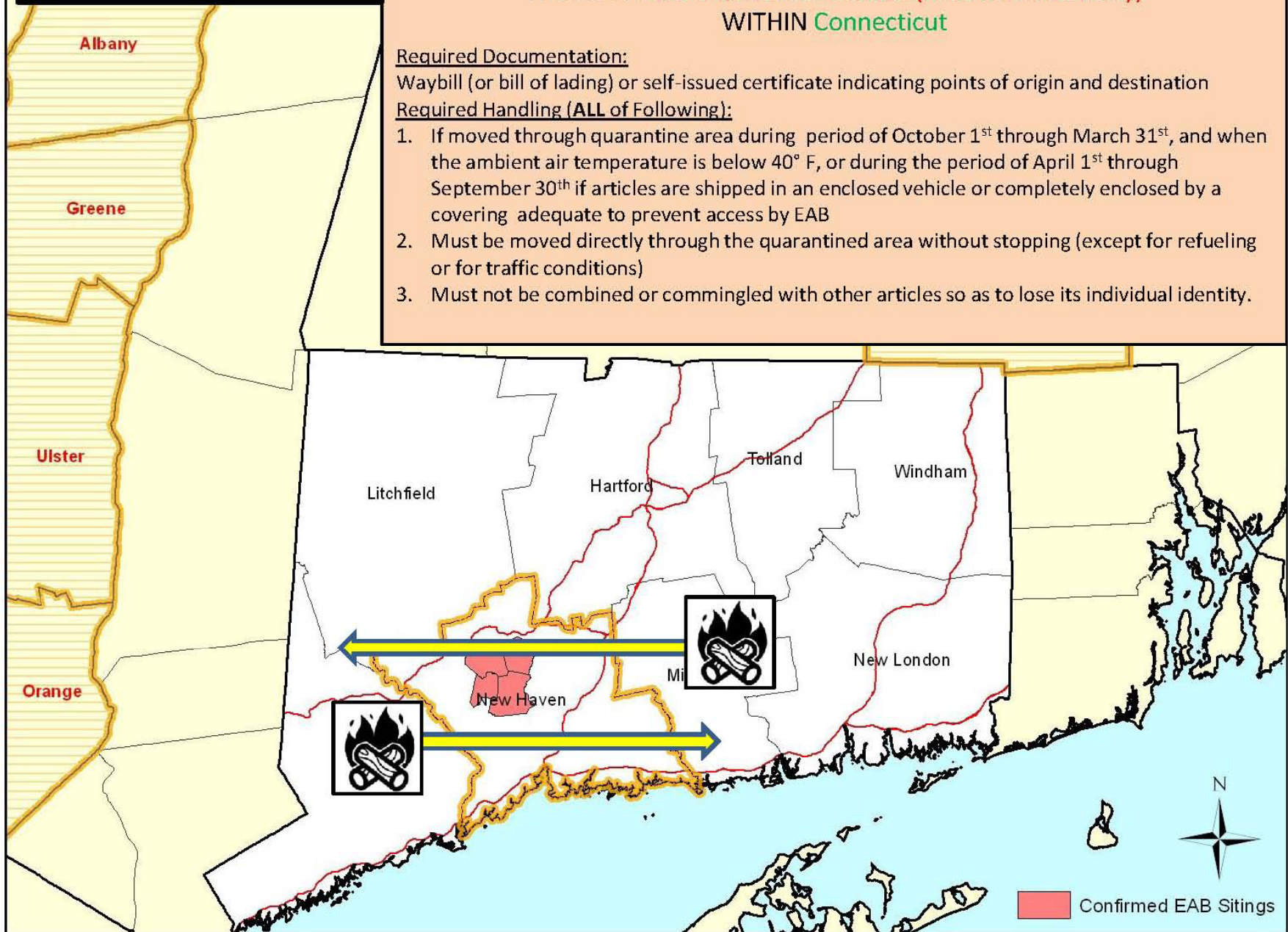
## FROM Non-Quarantined Area THROUGH State Quarantined Area (New Haven County) WITHIN Connecticut

### Required Documentation:

Waybill (or bill of lading) or self-issued certificate indicating points of origin and destination

### Required Handling (ALL of Following):

1. If moved through quarantine area during period of October 1<sup>st</sup> through March 31<sup>st</sup>, and when the ambient air temperature is below 40° F, or during the period of April 1<sup>st</sup> through September 30<sup>th</sup> if articles are shipped in an enclosed vehicle or completely enclosed by a covering adequate to prevent access by EAB
2. Must be moved directly through the quarantined area without stopping (except for refueling or for traffic conditions)
3. Must not be combined or commingled with other articles so as to lose its individual identity.





# FIREWOOD ONLY

## FROM Non-Quarantined Area INTO Connecticut

See Section 22-84-5g (a) (2)

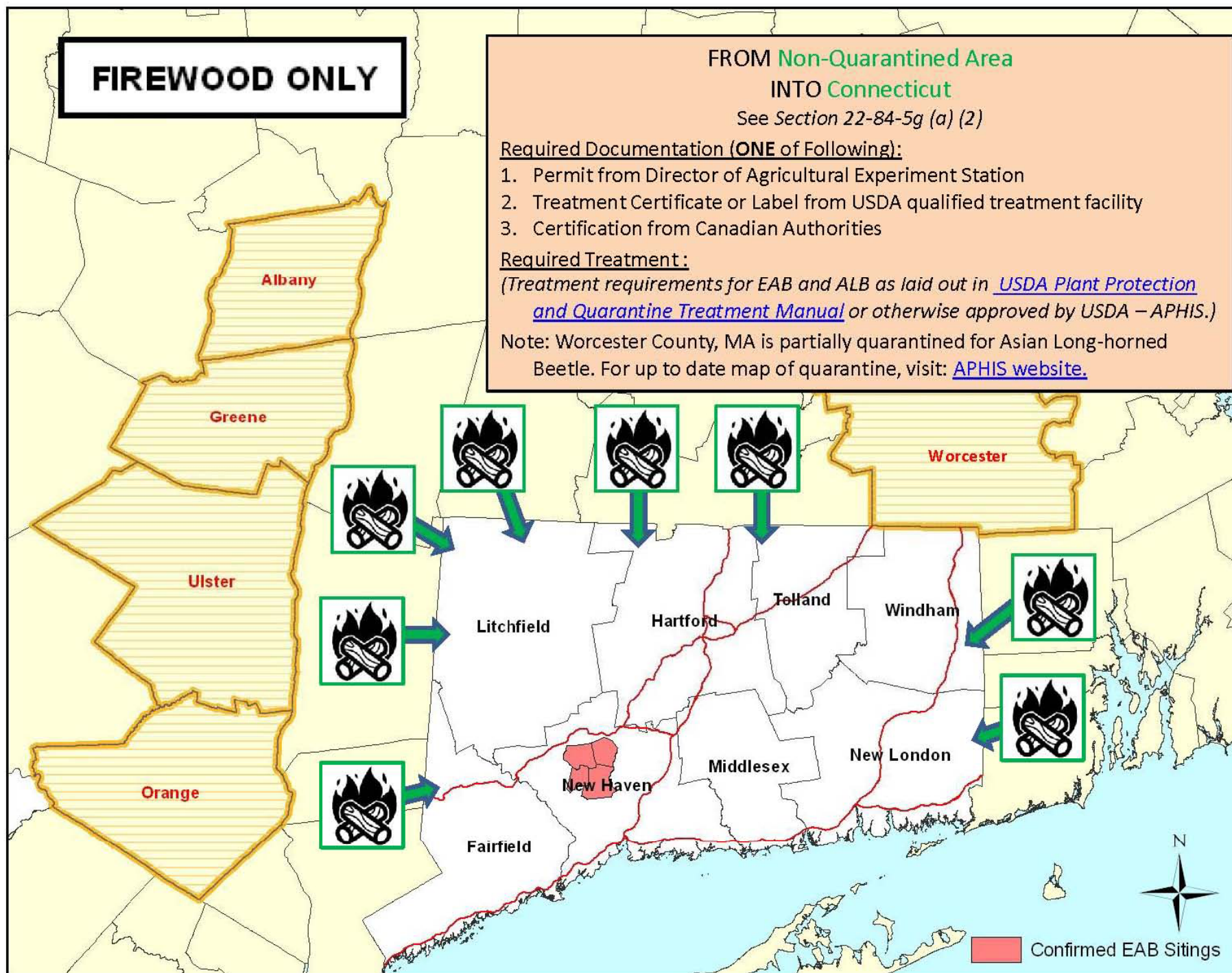
### Required Documentation (ONE of Following):

1. Permit from Director of Agricultural Experiment Station
2. Treatment Certificate or Label from USDA qualified treatment facility
3. Certification from Canadian Authorities

### Required Treatment:

(Treatment requirements for EAB and ALB as laid out in [USDA Plant Protection and Quarantine Treatment Manual](#) or otherwise approved by USDA – APHIS.)

Note: Worcester County, MA is partially quarantined for Asian Long-horned Beetle. For up to date map of quarantine, visit: [APHIS website](#).



# FIREWOOD ONLY

FROM Federally Quarantined Area  
INTO Connecticut

See Section 22-84-5g (a) (1) (i-iv)

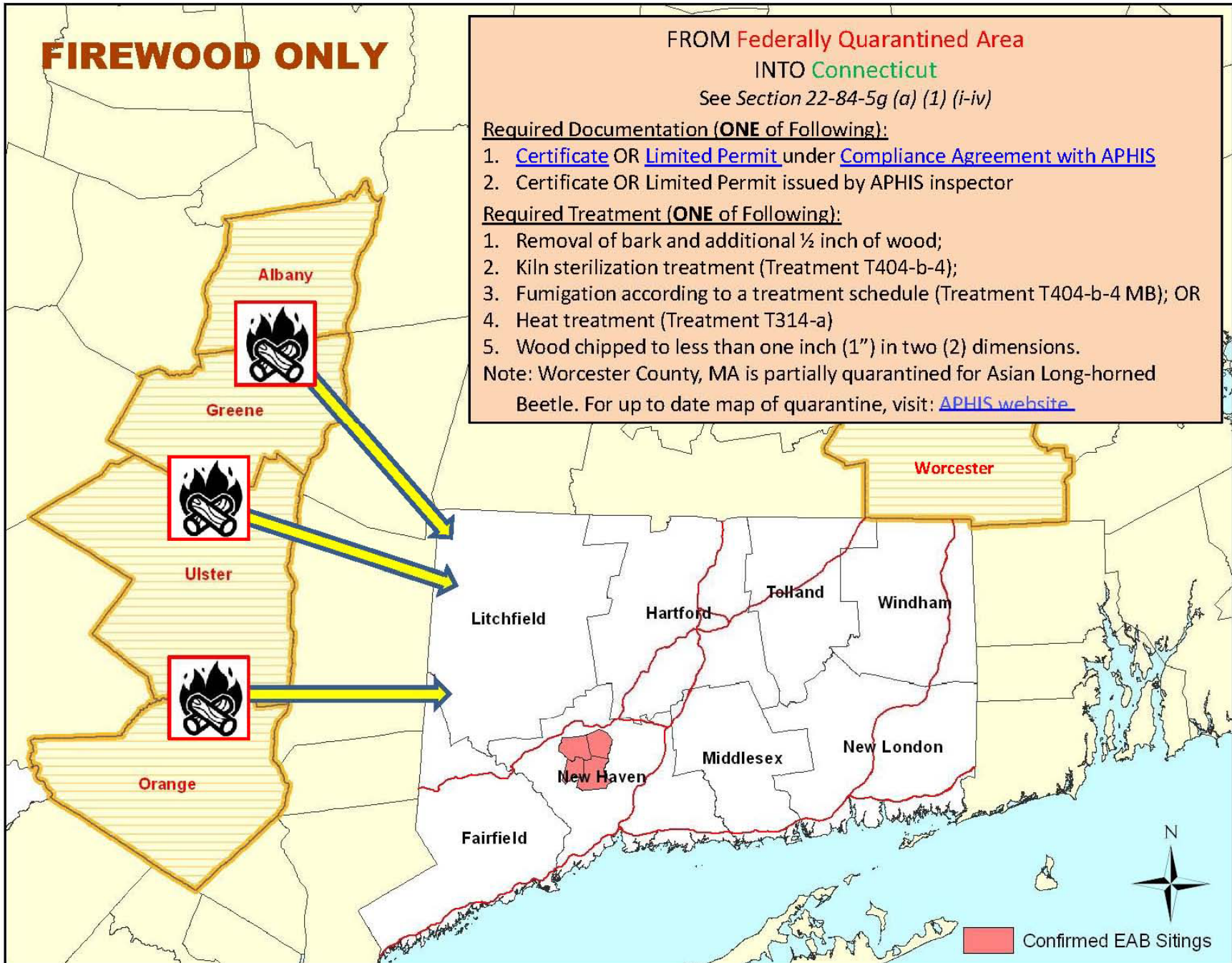
**Required Documentation (ONE of Following):**

1. [Certificate](#) OR [Limited Permit](#) under [Compliance Agreement with APHIS](#)
2. Certificate OR Limited Permit issued by APHIS inspector

**Required Treatment (ONE of Following):**

1. Removal of bark and additional ½ inch of wood;
2. Kiln sterilization treatment (Treatment T404-b-4);
3. Fumigation according to a treatment schedule (Treatment T404-b-4 MB); OR
4. Heat treatment (Treatment T314-a)
5. Wood chipped to less than one inch (1") in two (2) dimensions.

Note: Worcester County, MA is partially quarantined for Asian Long-horned Beetle. For up to date map of quarantine, visit: [APHIS website](#)





# FIREWOOD ONLY

FROM **Non-Quarantined Area**  
THROUGH **Federally Quarantined Area**  
INTO **Connecticut**  
See Section 22-84-5g (a) (3)

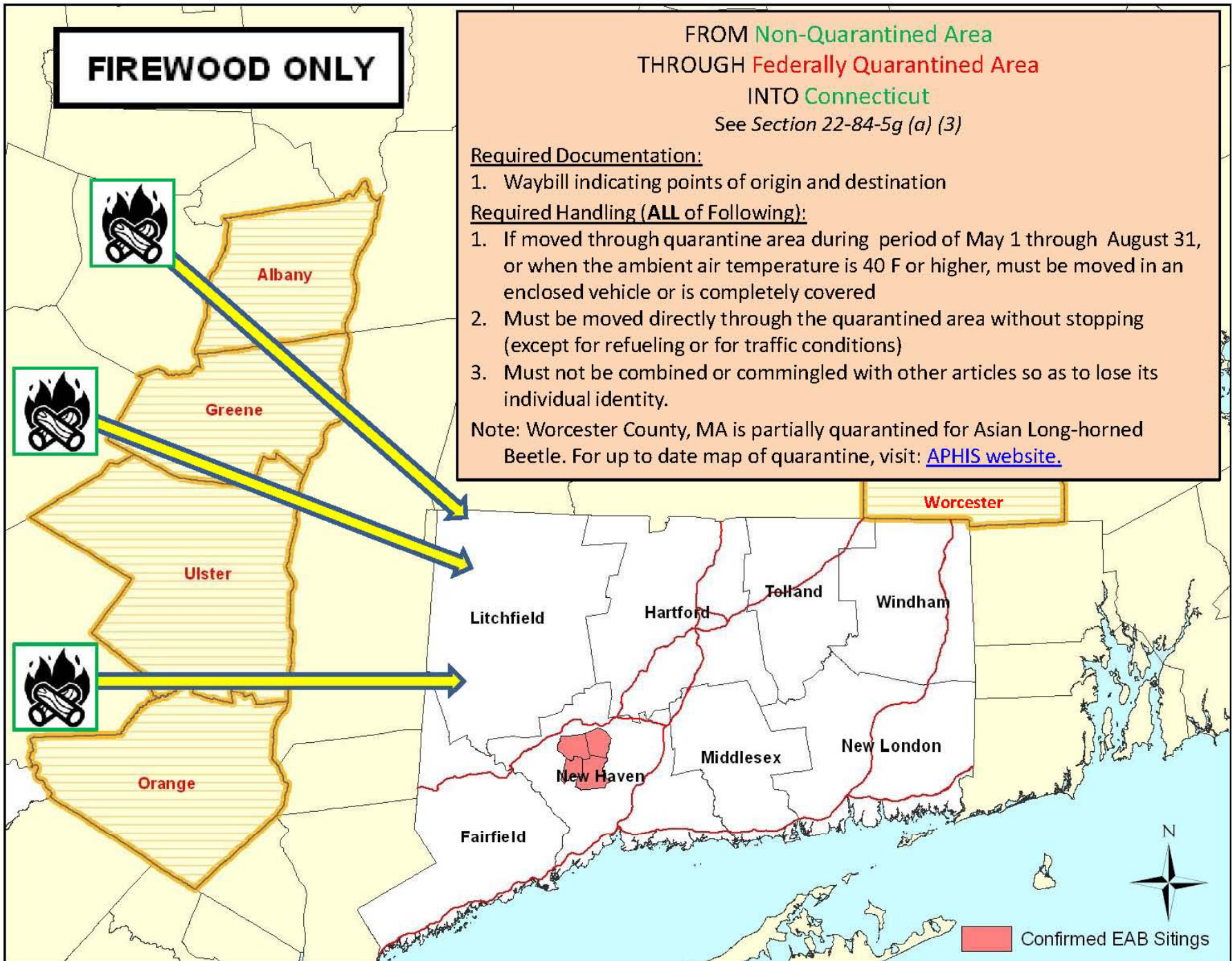
## Required Documentation:

1. Waybill indicating points of origin and destination

## Required Handling (**ALL** of Following):

1. If moved through quarantine area during period of May 1 through August 31, or when the ambient air temperature is 40 F or higher, must be moved in an enclosed vehicle or is completely covered
2. Must be moved directly through the quarantined area without stopping (except for refueling or for traffic conditions)
3. Must not be combined or commingled with other articles so as to lose its individual identity.

Note: Worcester County, MA is partially quarantined for Asian Long-horned Beetle. For up to date map of quarantine, visit: [APHIS website.](#)





# Public Awareness

**Never to move firewood.** I promise, because the outdoors means everything to me. Hiking, getting away from it all. But the Emerald Ash Borer beetle is killing the trees. It lives in firewood, and when people move firewood, they spread the beetle. Then more trees die. So promise you won't move firewood. Don't take it to your campsite. Or bring it home to your backyard. Burn it where you buy it. If you love the outdoors, then promise to help protect it. Go to [StopTheBeetle.info](http://StopTheBeetle.info).



**Three Out Of Four Ain't Bad**  
**Leave your firewood and bugs home.**

[www.emeraldashborer.info](http://www.emeraldashborer.info)



Jill Johnson poses as the emerald ash borer for the International Society of Arboriculture Field Days in Minneapolis.



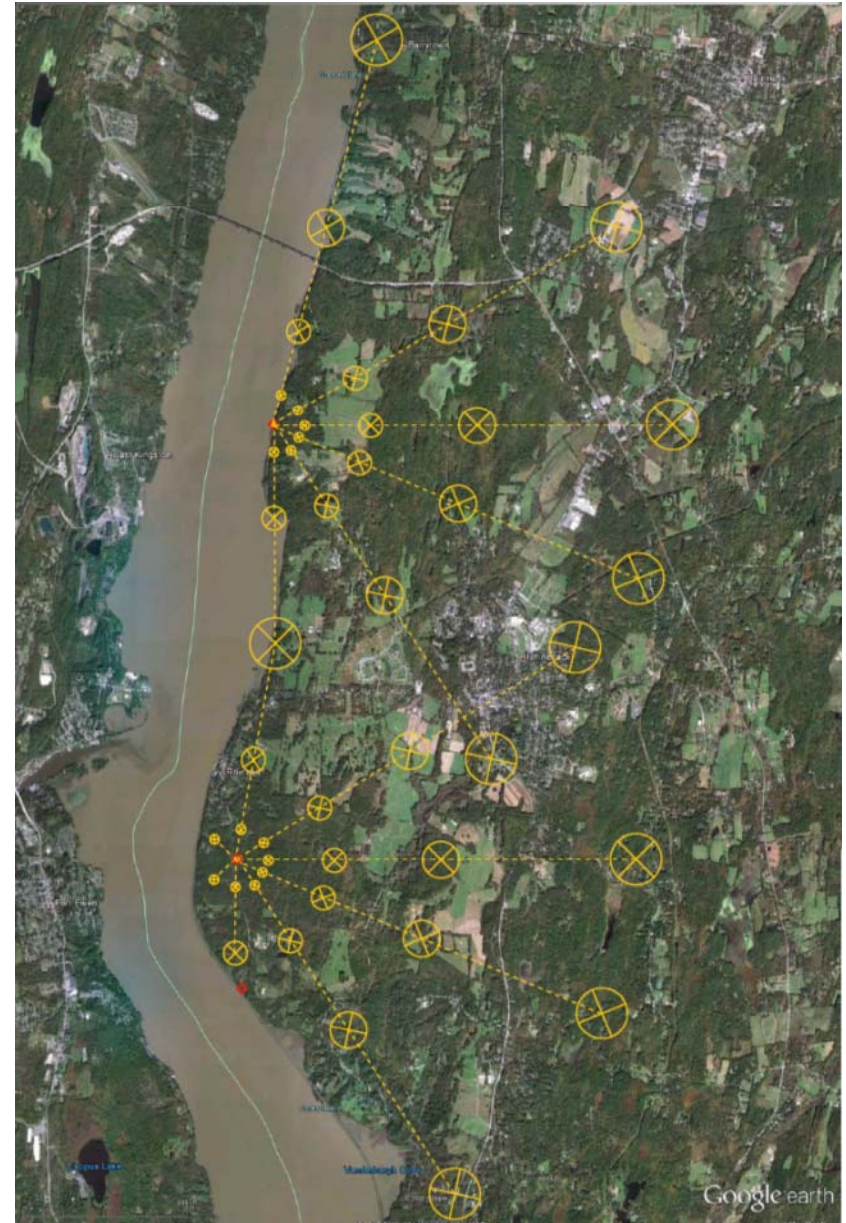
**Don't move firewood, it BUGS me!**

[www.emeraldashborer.info](http://www.emeraldashborer.info)



# What is being done? Management

- Delimitation Survey
  - DEEP, US FS and CAES
  - Finding the borders of the infestation
  - Creating a grid, sampling trees, peeling



# What is being done? Management

- SLAM – Sl.ow A.sh M.ortality – BUY TIME!!
- 3 Main Components
  - Girdle trees girdle in spring in a grid, fell /debark them in fall
    - Trees are a sink: females preferentially will lay eggs on girdled trees which are then destroyed
    - Help to keep females in the central area of the infestation
    - Help to define the area and density of infestation
  - Pesticides – treat trees around the infested zones as a buffer to absorb beetles coming from the central area
  - Harvesting trees – cutting down large trees in area can cut phloem area available for beetle production/ large ash stems may be only 5-6% of stems but contain 50% of phloem and wood may provide income to landowner



# What is being done? Management

- Biological Control
  - 3 wasps released in 12 of 17 infested states
  - Assessing CT for release sites for 2013 or 2014

Egg Parasitoid



Oobius agrili is a solitary, egg parasitoid. Shown here is a female laying her egg in an EAB egg.  
Photo by USDA Forest Service

*Oobius agrili*

Larval Parasitoid



*Spathius agrili*

Dr. Yang Zhong-qi,  
Chinese Academy of Forestry

Larval Parasitoid



Tetrastichus sp. is a gregarious, larval endoparasitoid. This image shows a female laying eggs in EAB larvae after drilling through tree bark.  
Photo by USDA Forest Service Researcher

*Tetrastichus planipennis*

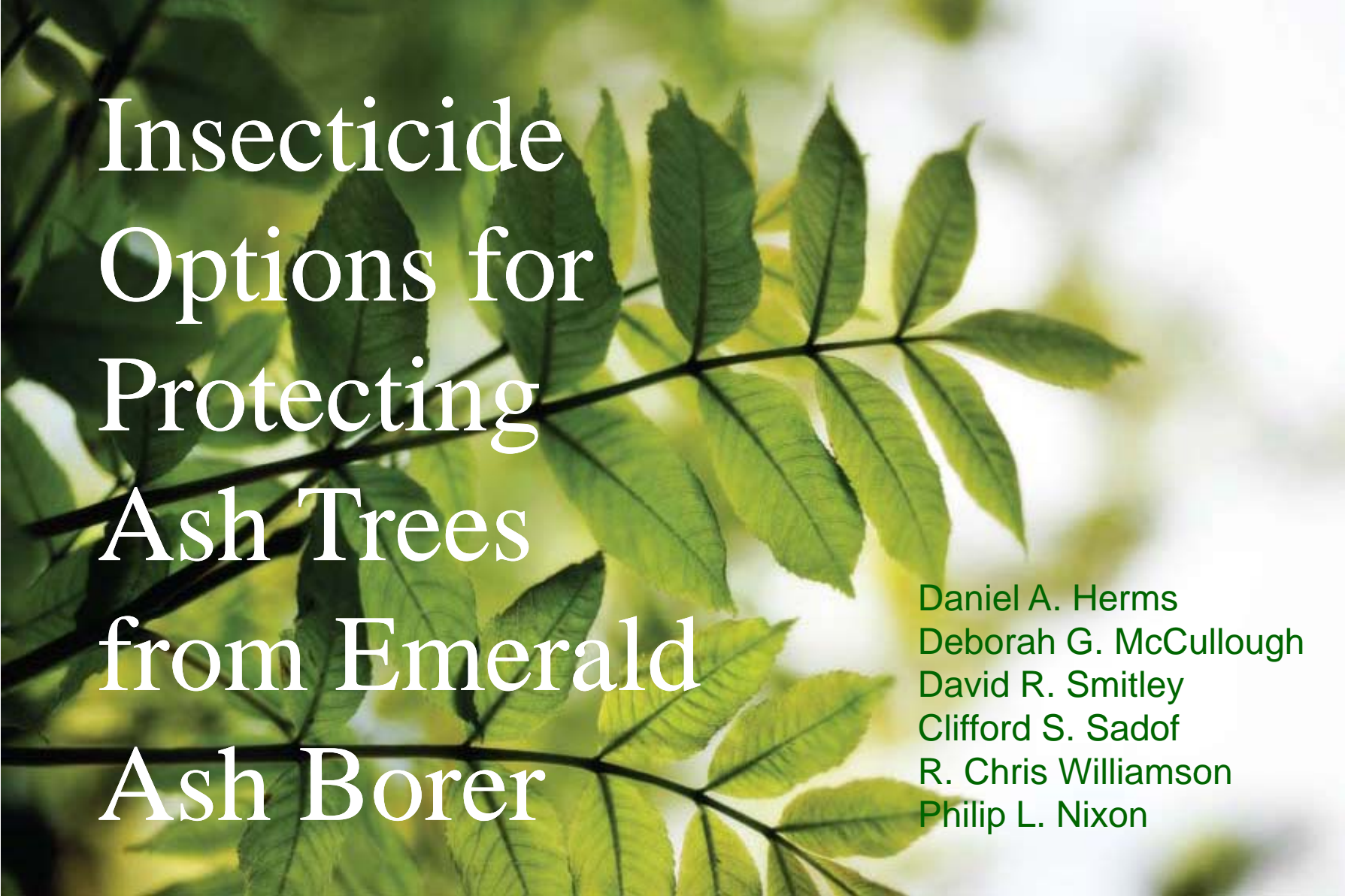
# What is being done? Management

- Fungus - insecticide-like use of entomopathogenic fungus
- Other pathogens - viruses, bacteria, microsporida and nematodes of native *Agrilus* are being examined for their potential against EAB





# What is being done? Management



## Insecticide Options for Protecting Ash Trees from Emerald Ash Borer

Daniel A. Herms  
Deborah G. McCullough  
David R. Smitley  
Clifford S. Sadof  
R. Chris Williamson  
Philip L. Nixon

| Insecticide Formulation  | Active Ingredient  | Application Method                |  |
|--------------------------|--------------------|-----------------------------------|--|
| Merit® (75WP, 75WSP, 2F) | Imidacloprid       | Soil injection or drench          |  |
| Xytect™                  | Imidacloprid       | Soil injection or drench          |  |
| IMA-jet®                 | Imidacloprid       | Trunk injection                   |  |
| TREE-äge™                | Emamectin benzoate | Trunk injection                   |  |
| Inject-A-Cide B®         | Bidrin             | Trunk injection                   |  |
| Safari™ (20 SG)          | Dinotefuran        | Systemic bark spray               |  |
| Astro®                   | Permethrin         | Preventive bark and foliage spray |  |
| Onyx™                    | Bifenthrin         | Preventive bark and foliage spray |  |
| Tempo®                   | Cyfluthrin         | Preventive bark and foliage spray |  |
| Sevin® SL                | Carbaryl           | Preventive bark and foliage spray |  |



# What is being done? Management

- Resistance Breeding
  - Trying to find ashes with some resistance to EAB
- Seed Banking
- Genetic Engineering

# Where to Go for More Info

<http://www.emeraldashborer.info>

<http://www.ct.gov/caes>



# If you suspect Emerald Ash Borer

- Contact the Connecticut Agricultural Experiment Station
- Don't move wood or the insect
- Take lots of pictures—document the situation

# If you capture a suspect:

- Put it in a jar
- Put in the freezer for 48 hours, or drown in rubbing alcohol
- Take lots of pictures—document the situation
- Contact the Experiment Station





Asian Longhorned Beetle

# PROTECT OUR TREES

- Exotic
- Invasive
- Kills trees
- No cure, except cut down
- Early detection easier to eradicate



# Talk Outline

- ALB life cycle and biology
- Host Range of ALB
- ALB Symptoms
- ALB in China
- Previous ALB infestations in USA
- ALB in Worcester



# Asian Longhorned Beetle





# Asian Longhorned Beetle Lifecycle



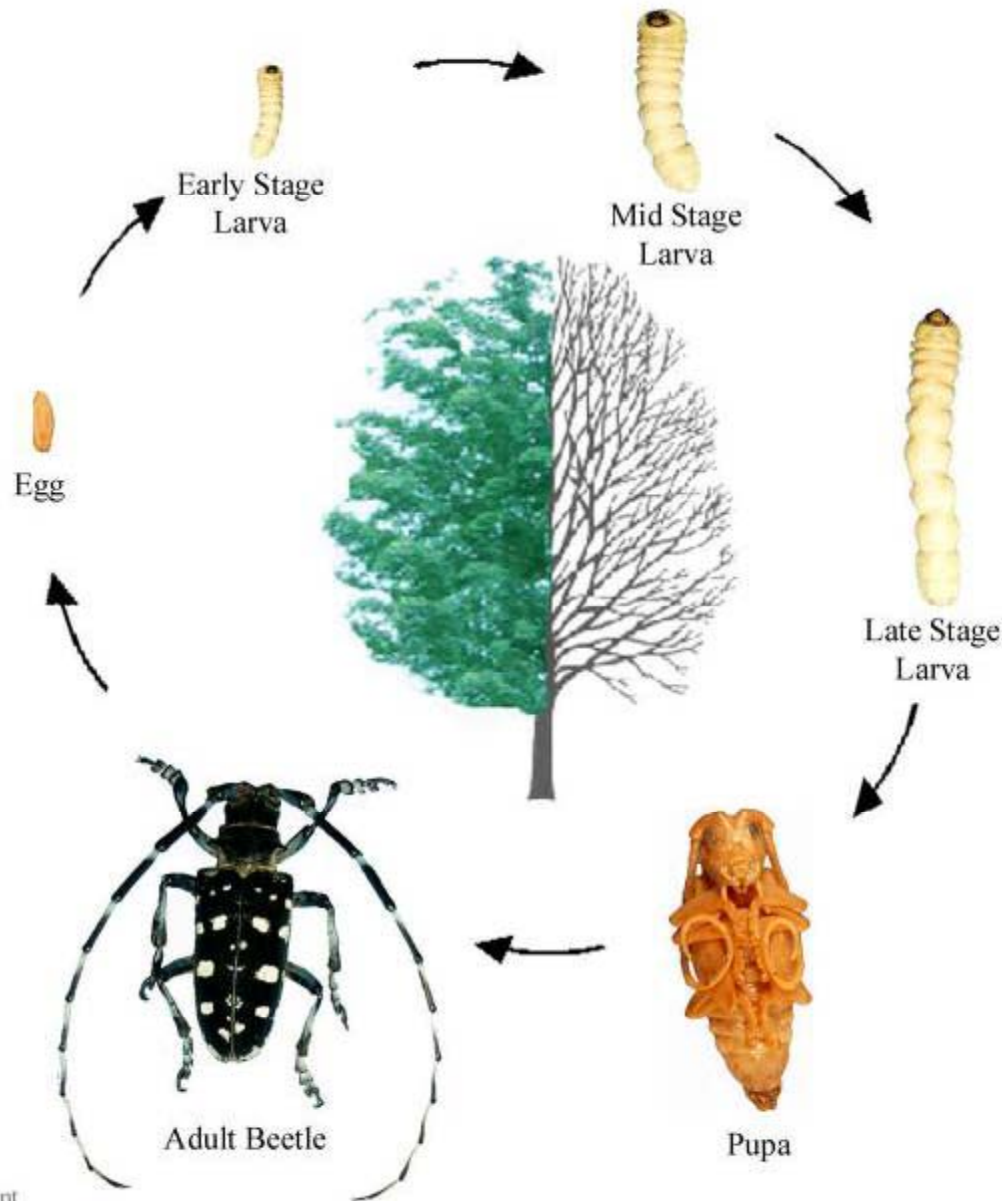
Adults and oviposition scars



Emergence holes



Adult emerging from tree



Larva in tree



Pupal chamber in tree

# ALB Life Cycle – Egg and Larvae

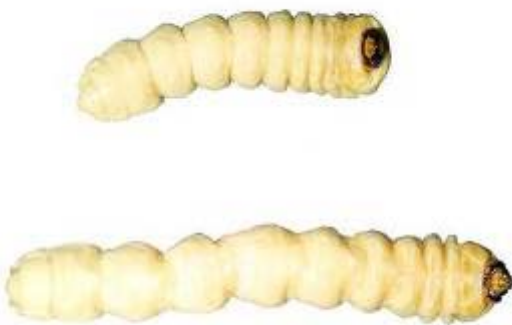
- Eggs laid during summer months
- Eggs hatch in 10-15 days
- 1st and 2nd instar larvae feed on the cambium layer





# ALB Lifecycle - larvae

- 3rd, 4th and 5th instars feed/tunnel on the sapwood or heartwood.
- Overwinter inside wood



# ALB Lifecycle - Pupa

- 5th instar develops into a pupa
- Pupal stage is approx. 2 to 3 weeks
- Non-feeding or inactive metamorphosis





# ALB Lifecycle - Adults



- Emerge late Spring thru late Summer
- Exit holes are approx. 3/8 to 5/8 inches in diameter
- Adults 1.5 – 2 inches in length

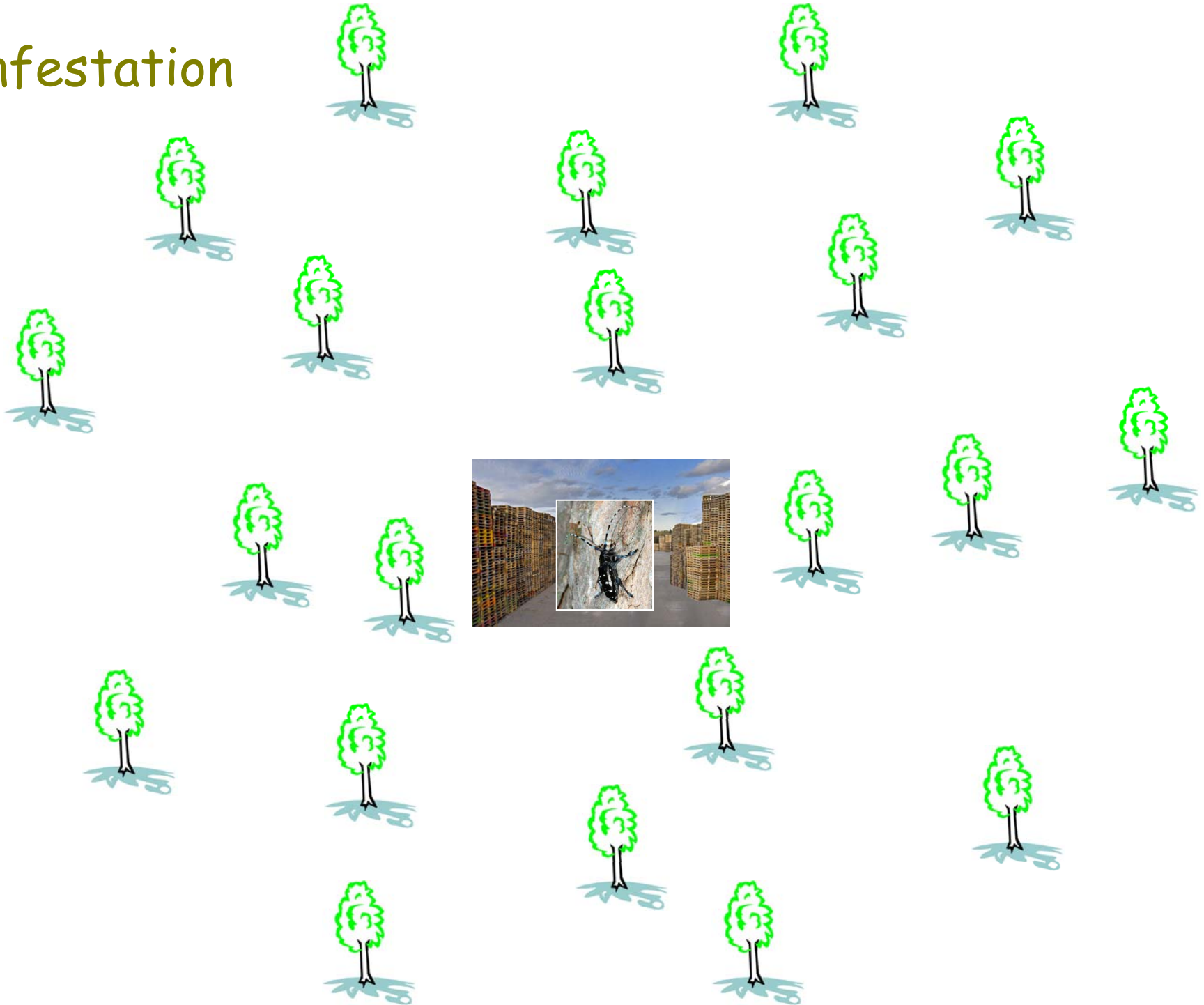
# ALB lifecycle - Adults

- Live for several weeks
- Can fly up to ½ mile, but often re-infest the same tree
- Feed on leaf midribs and mate
- Females lay between 35 to 90 eggs
- One generation per year

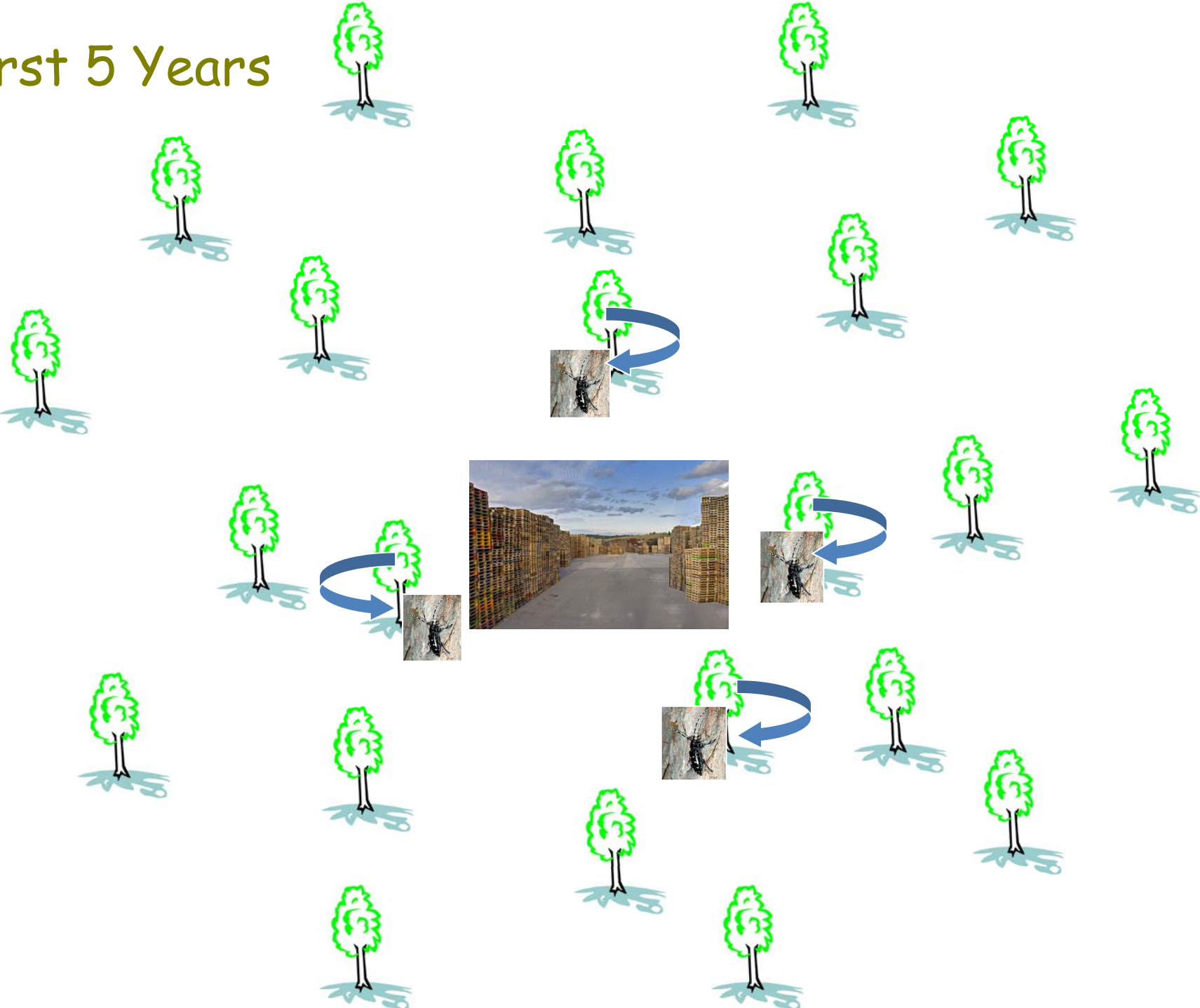




# Infestation

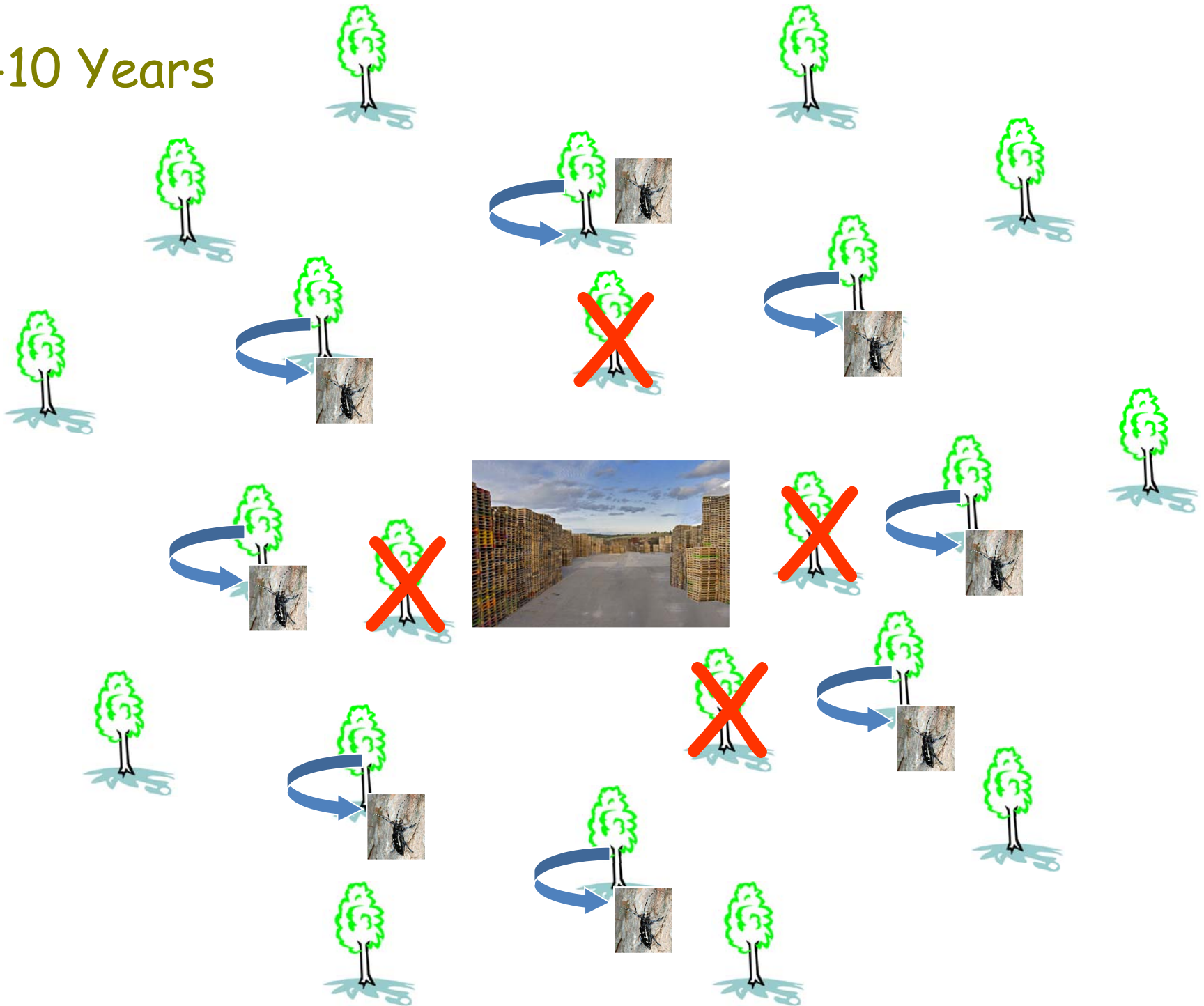


# First 5 Years

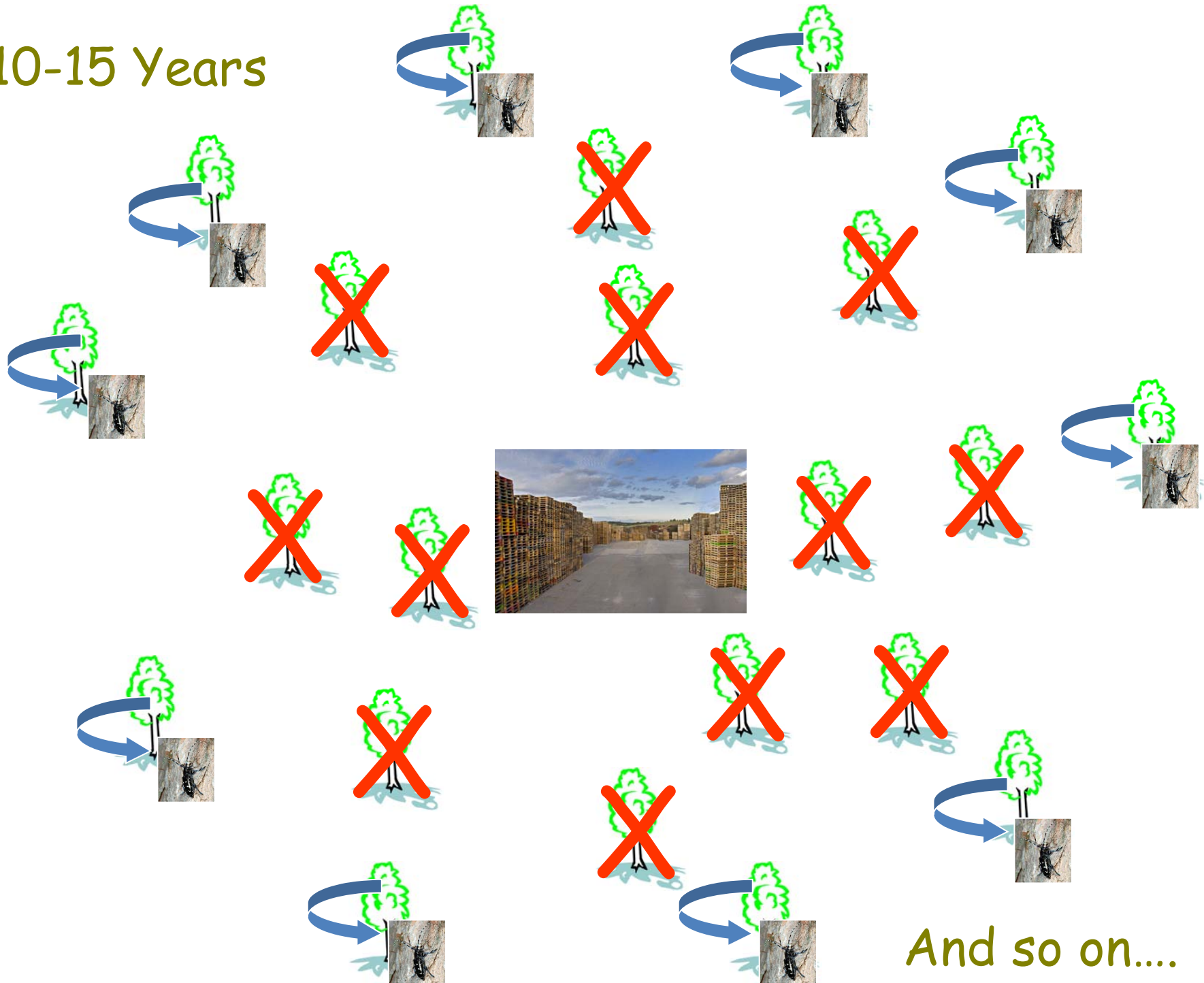




5-10 Years



10-15 Years



And so on....



# Host Range of ALB



Maple, Box Elder  
(*Acer* spp.)



Horse Chestnut/  
Buckeye  
(*Aesculus* spp.)



# Host Range of ALB



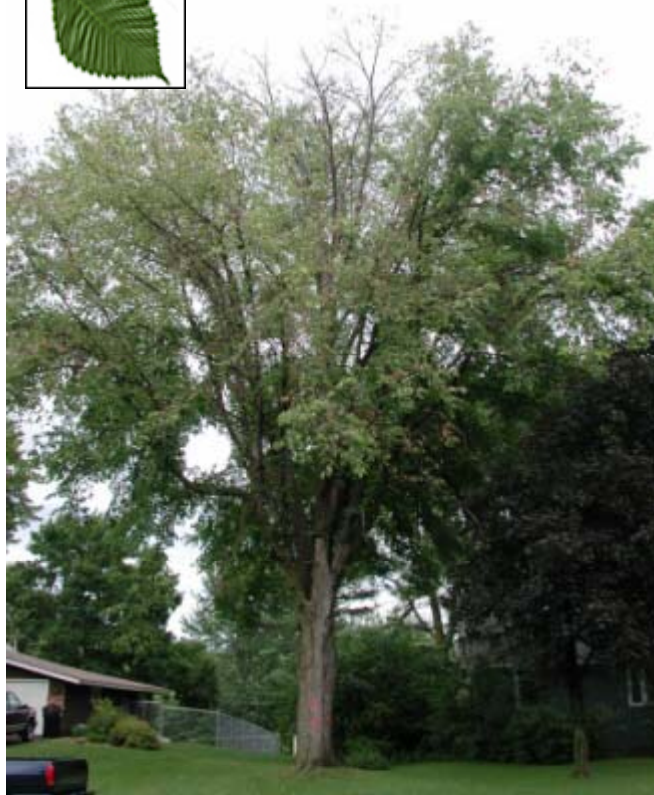
Birch  
(*Betula* spp.)



Willow  
(*Salix* spp.)



# Host Range of ALB



Elm (*Ulmus* spp.)



Ash (*Fraxinus* spp.)



# Host Range of ALB



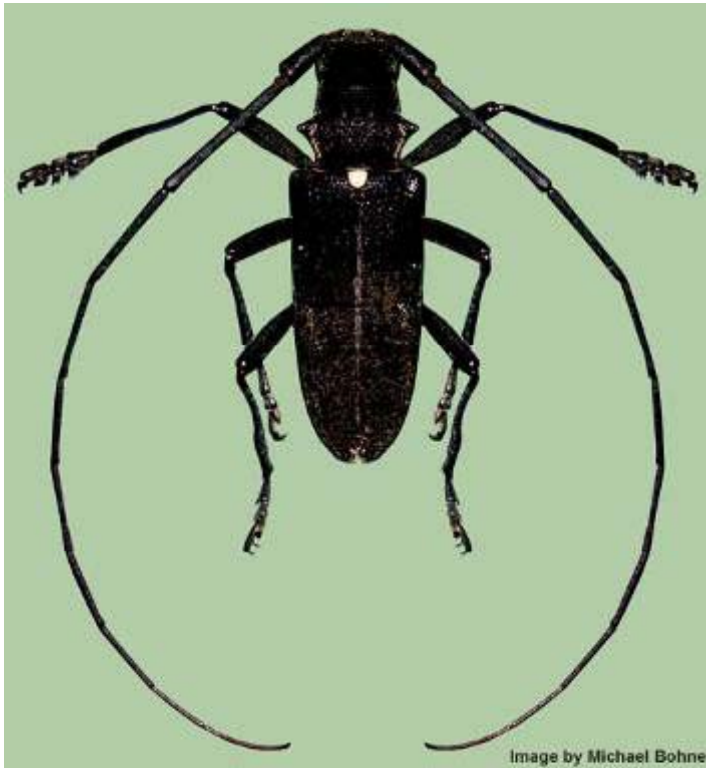
Sycamore/ London Plane Tree  
(*Platanus* spp.)



Poplar (*Populus* spp.)



# A look-a-like The Whitespotted Pine Sawyer



Male



Female

# How to Tell Them Apart

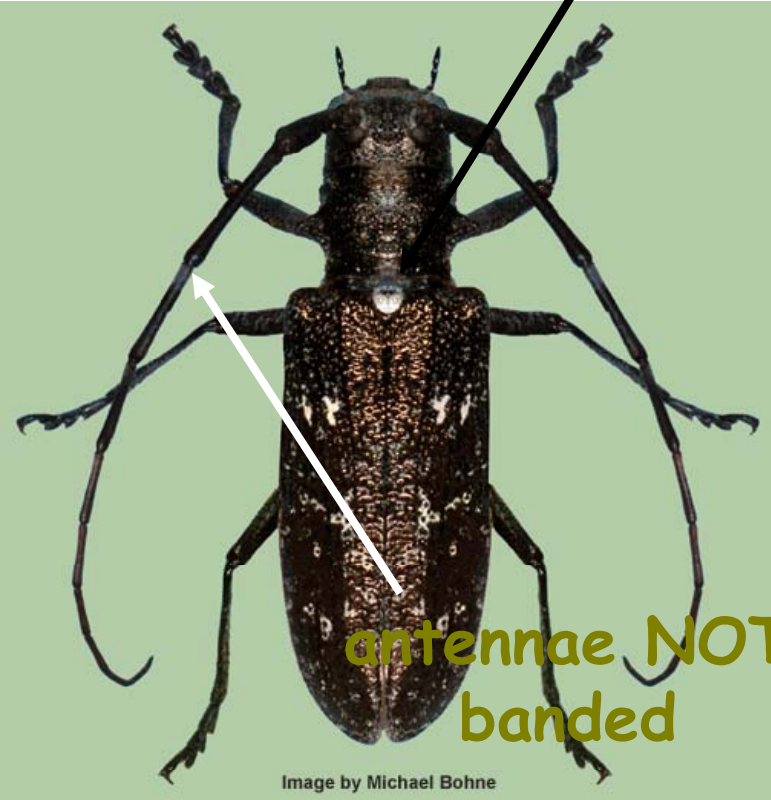
NO white spot



banded antennae

ALB

white spot



antennae NOT banded

Image by Michael Bohne

Whitespotted  
Pine Sawyer



# What to look for: Symptoms and Signs

- Early fall coloration
- Branch die-back
- Chewed out midribs
- Sawdust at base of trees
- Egg laying sites
- Exit holes



# Early fall coloration:



Vicki Smith CAES



# Branch Die-Back



Vicki Smith CAES

# Chewed out midrib:



Vicki Smith CAES



# Sawdust at base of trees:



Vicki Smith CAES



# Sawdust at base of trees:



Vicki Smith CAES



# Egg laying sites





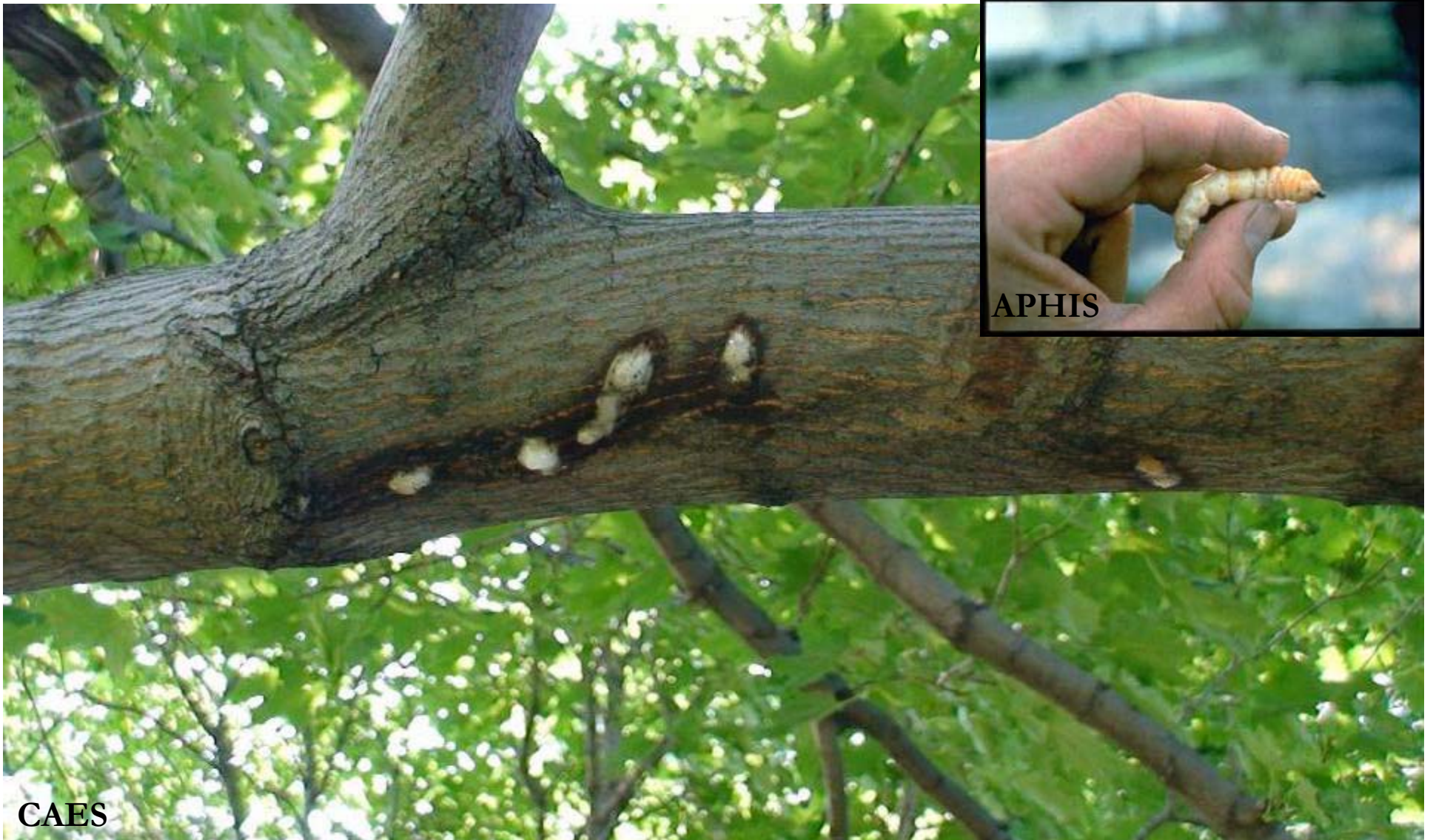
# Egg laying sites:



Pete Trenchard  
CAES



# Oozing sap



CAES

APHIS



# Larval activity:



Vicki Smith CAES



# Exit holes:



Vicki Smith CAES



# Exit holes:



Vicki Smith CAES



# Exit holes:



Vicki Smith CAES



# Sap sucker damage:





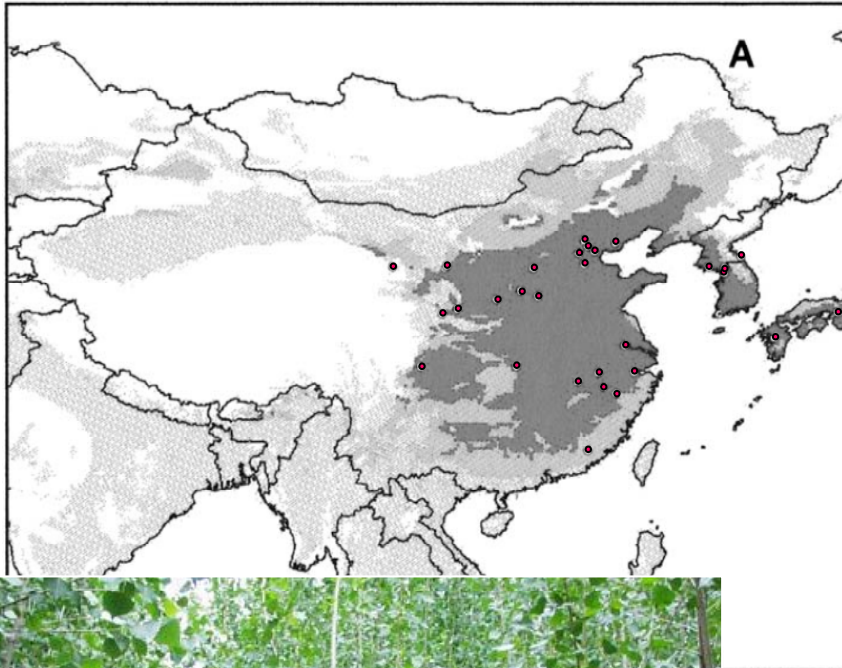
# Sugar Maple Tap Holes







# Where it Came From



- 40% of poplar plantations damaged (ca. 2.3 million ha.)
- Infested 240 cities or counties in 5 provinces alone (230 thousand ha.)
- Estimated 50 million trees cut down over 3 years in Ningxia Province alone (1991-1993).
- Damaging from 21-43°N and 100-127° E (represents 4 climatic zones in China)

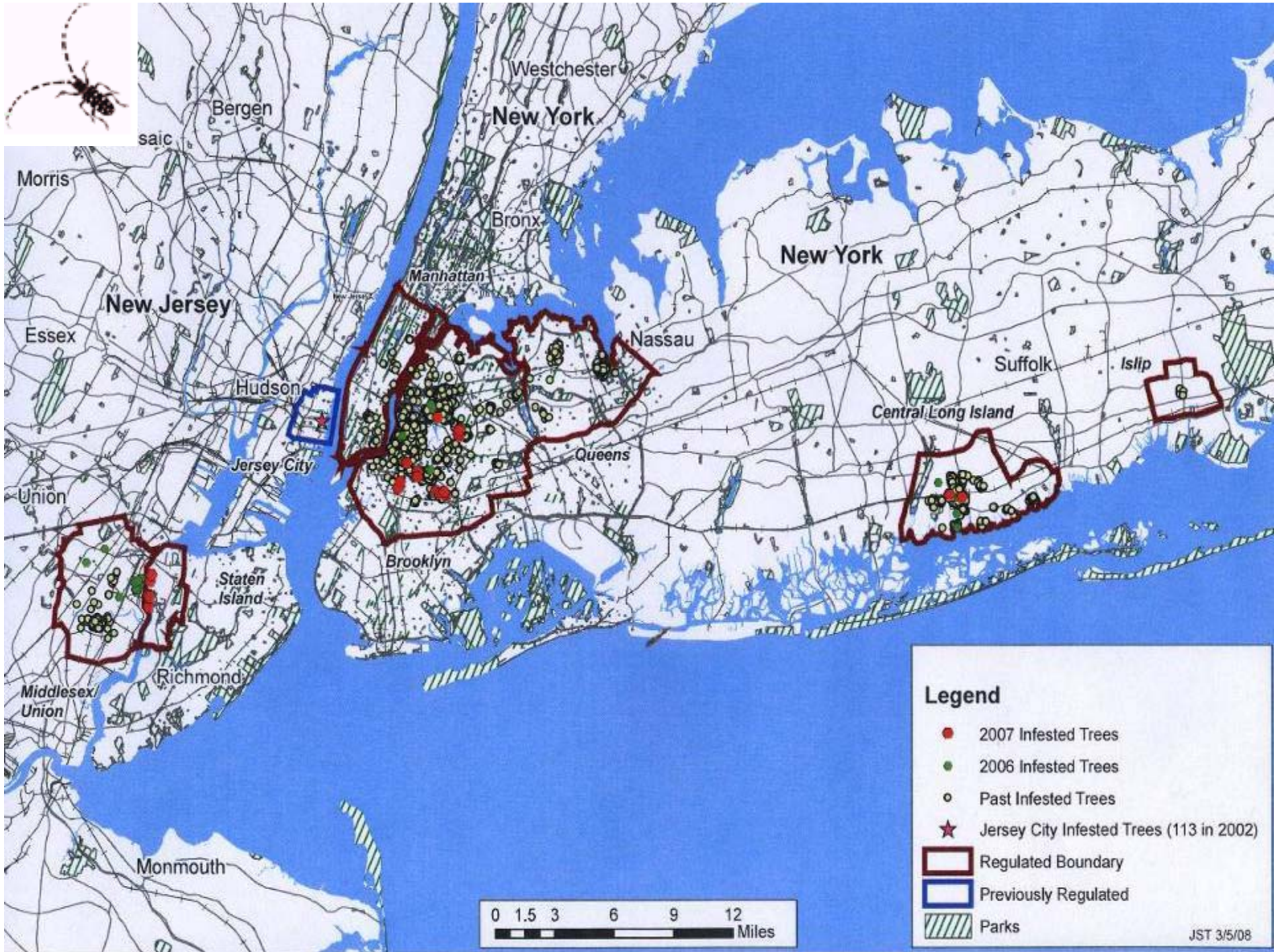


# Infestations

- 1996 Brooklyn and Amityville
- 1998 Chicago
- 1999-2000 Manhattan
- 2000 Queens
- 2002 Jersey City
  - (declared free 2007)
- 2003 Toronto
- 2007 Prall's Island, NY
- 2008 Worcester
- 2011 Clermont County Ohio



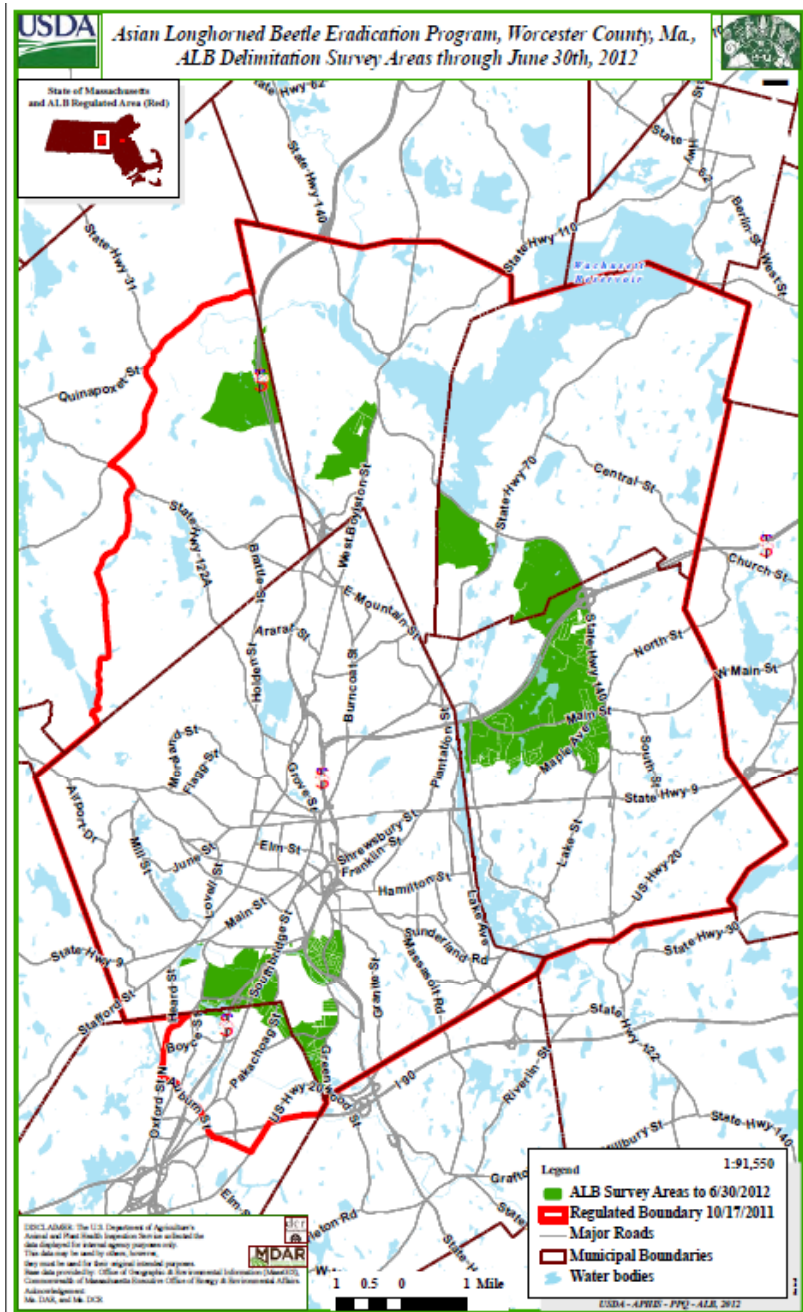






# Worcester MA, August 2<sup>nd</sup> 2008





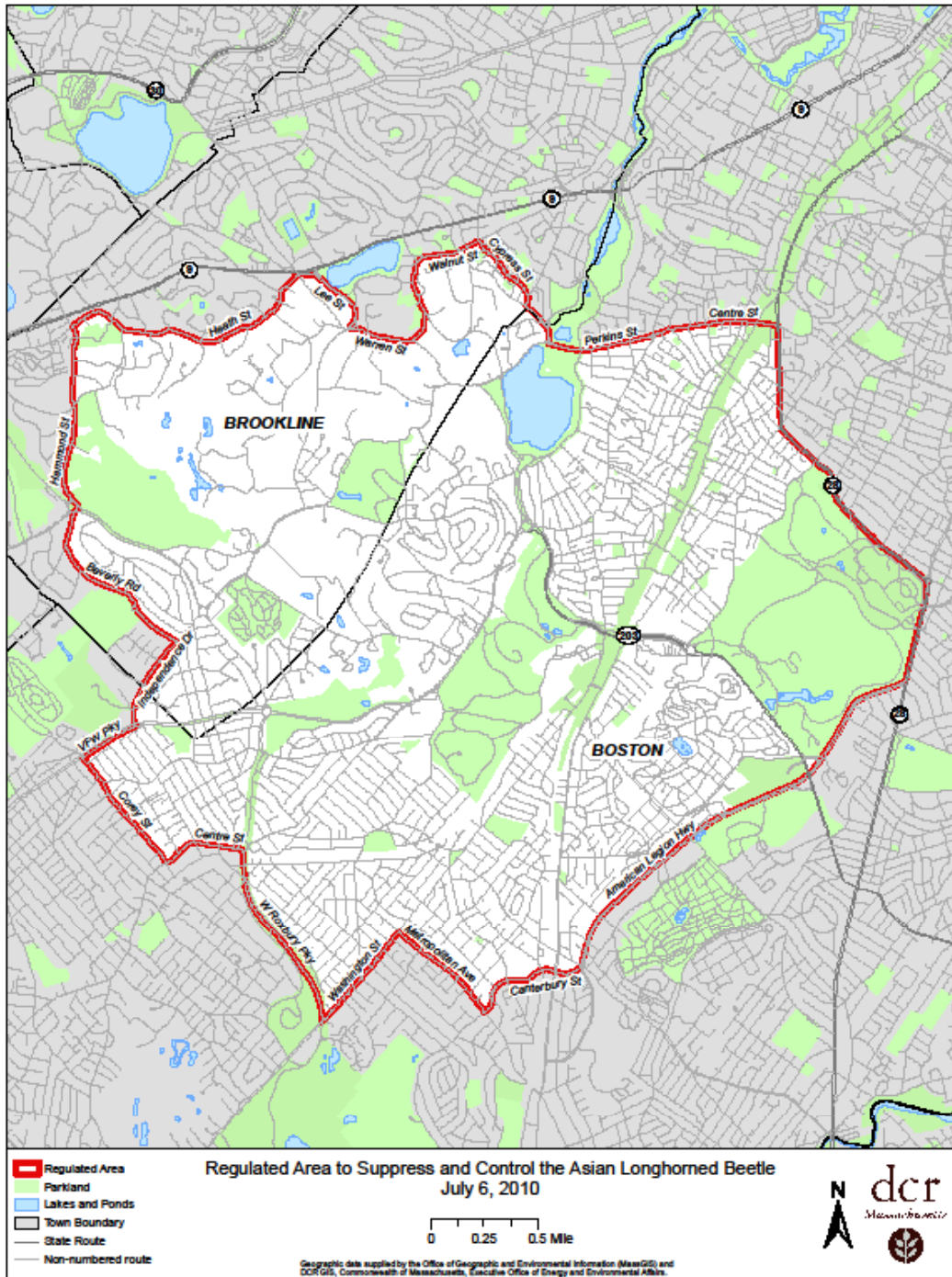
## Worcester, MA 2008

- Discovered August 2, 2008 @ Whitmarsh Avenue
- All Worcester; all Shrewsbury, portions of Boylston, West Boylston, and Holden
- 110 square miles
- Removal start 1/5/09
- Removed 30,310 trees to date
- Surveyed - 1,547,287 total

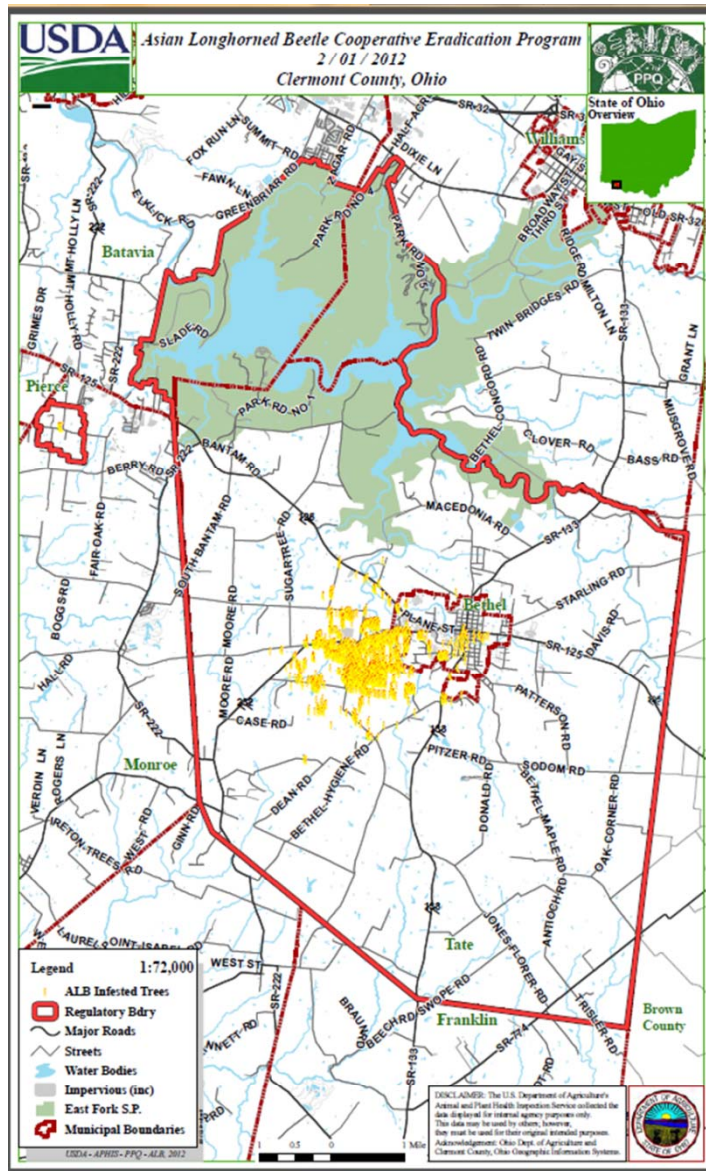


# Boston, MA 2010

- Discovered July 2, 2010 @ Jamaica Plains
- Regulated area now 10 square miles
- 6 infested trees found by arborist!
- So far only trees found
- Surveyed about 56 K trees in area



# Ohio



- Discovered 2011
- Not urban, mostly farmland
- Probably > 10 years old
- Surveys underway



## Massachusetts

- **Regulated Area: 120 sq. miles**
- 110 – Worcester County (Worcester, West Boylston, Boylston, Holden, Shrewsbury, Auburn)
- 10 – Norfolk/Suffolk Counties (Boston, Brookline)
- **Infested Trees: 21,648\***
- 19,559 – Worcester, 393 – West Boylston
- 1001 – Boylston, 181 – Holden
- 508 – Shrewsbury, 0 – Auburn
- 6 – Boston
- **Removals: 32,018\***
- 21,768 Infested:
  - 19,999 – Worcester, 361 – West Boylston
  - 830 – Boylston, 130 – Holden
  - 442 – Shrewsbury, 0 – Auburn
  - 6 – Boston
- 10,250 High-risk hosts:
  - 10,250 – Worcester
- **Surveys: 2,466,591**

## Ohio

- **Regulated Area: 56 sq. miles\***
- 56 – Clermont County (Tate Township, Monroe Township)
- **Infested Trees: 8,673**
- 8,629 – Tate Township
- 42 – Monroe Township
- 2 – Stonelick Township
- **Removals: 8,537**
- 8,537 Infested:
  - 8,493 – Tate Township
  - 42 – Monroe Township
  - 2 – Stonelick Township
- 0 High-risk hosts
- **Surveys: 155,381**











Tree cutting in Worcester



Chips sent to power plant



(T&G Staff Photos / RICK CINCLAIR)





# Trees for Replanting

**Gray Dogwood**

**Crabapple**

**Hawthorn**

**Hawthorn**

**Serviceberry**

**Eastern Redbud**

**Ornamental Cherry**

**Kousa Dogwood**

**White Fringetree**

**American Arborvitae**

**Chinese Juniper cultivars**

**Flowering Dogwood**

**Eastern Redcedar cultivars**

**Swiss Stone Pine**

**Carolina Silverbell**

**American Hophornbeam**

**Stewartia**

**Oak**

**Turkish Filbert**

**Silver Linden**

**Littleleaf Linden**

**Ginkgo**

**Japanese Zelkova**

**Upright White Pine**

**Blackgum/Tupelo**

**Beech**

**Honeylocust**

**Kentucky Coffeetree**

**Leyland Cypress**

**American Sweetgum**

**Baldcypress**

**Tulip Tree**

**Mountain Silverbell**

**Serbian Spruce**

**Magnolia**

**European Hornbeam**

**Goldenraintree**

**American Yellowwood**

**Dawn Redwood**

# What can you do?



- Learn to recognize ALB
- Don't move firewood
- Report any sightings
- Spread the word



**DON'T MOVE FIREWOOD**

Firewood may be infested with the Asian longhorned beetle (ALB). This exotic insect is a devastating pest of deciduous hardwood trees, in forests as well as urban areas. Moving infested firewood spreads this insect to new locations. Once in a new area, ALB can become established and kill trees.

Approximately 1.2 billion hardwood trees in the United States are at risk of attack by the voracious larvae of ALB. To protect trees from this nonnative pest, remember ...

- Use firewood from local sources.
- Do not move firewood.
- If you have moved firewood, **burn it!** Do not leave it.

ALB has been found in New York, New Jersey, and Illinois. If you visit, live, or work in one of these states, learn about quarantine locations. Search for "ALB" on the Web at [www.aphis.usda.gov](http://www.aphis.usda.gov), or call for information:

New York—(866)265-0301  
New Jersey—(201)533-9610  
Illinois—(312)742-3385



**STOP THE ASIAN LONGHORNED BEETLE**

USDA Forest Service  
NORTHEASTERN AREA  
State and Private Forestry

NA-PS-10-05  
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## If you capture a suspect:

- Don't move wood or the insect
- Take lots of pictures—document the situation
- Put it in a glass jar—it will eat through plastic
- Put in the freezer for 48 hours, or drown in rubbing alcohol
- Contact the CT Ag. Exp. Station or DEP