

Asian Longhorned Beetle

Emerald Ash Borer

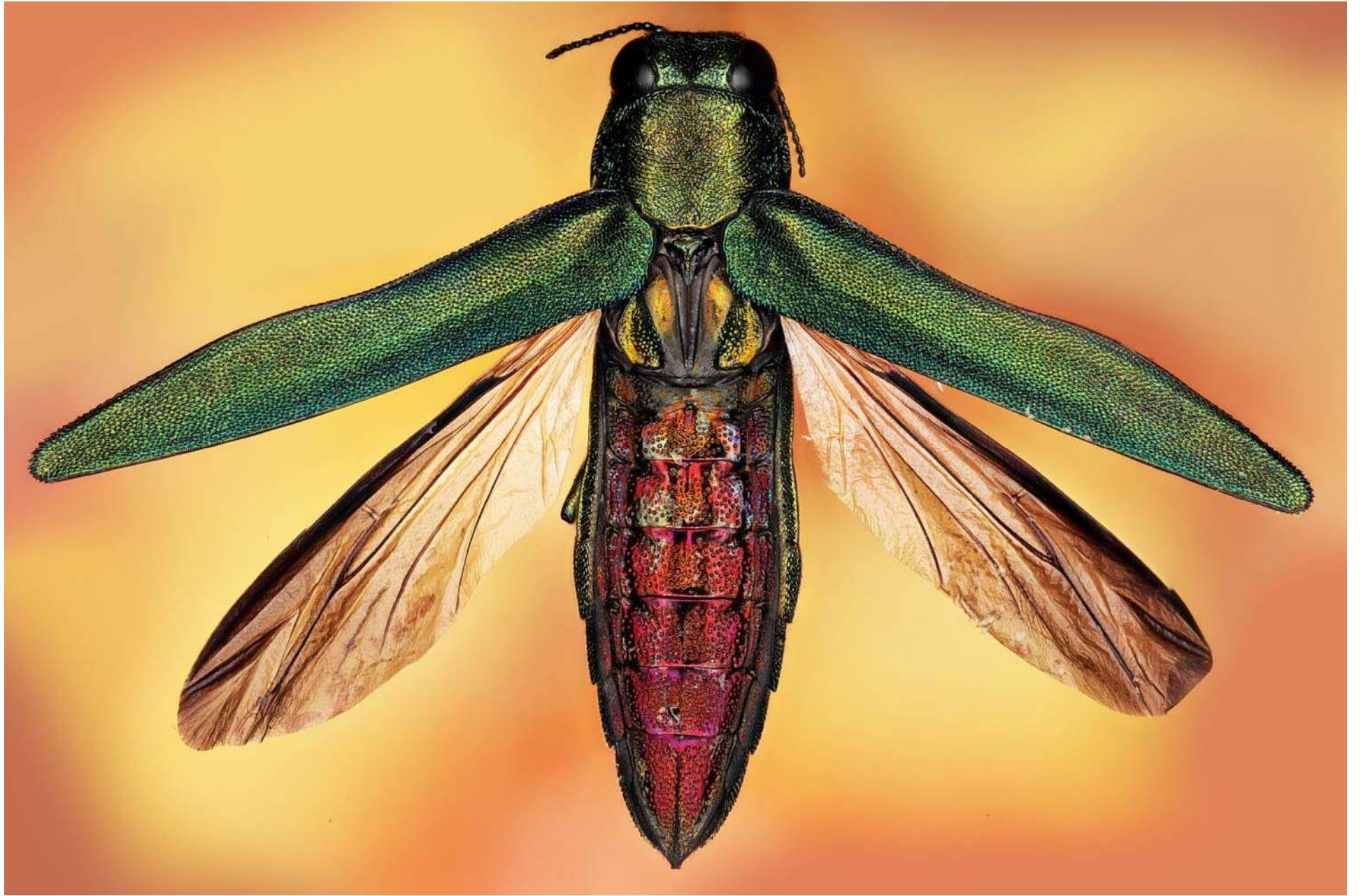


Claire Rutledge

Connecticut Agricultural Research Station

The Emerald Ash Borer





Host Trees

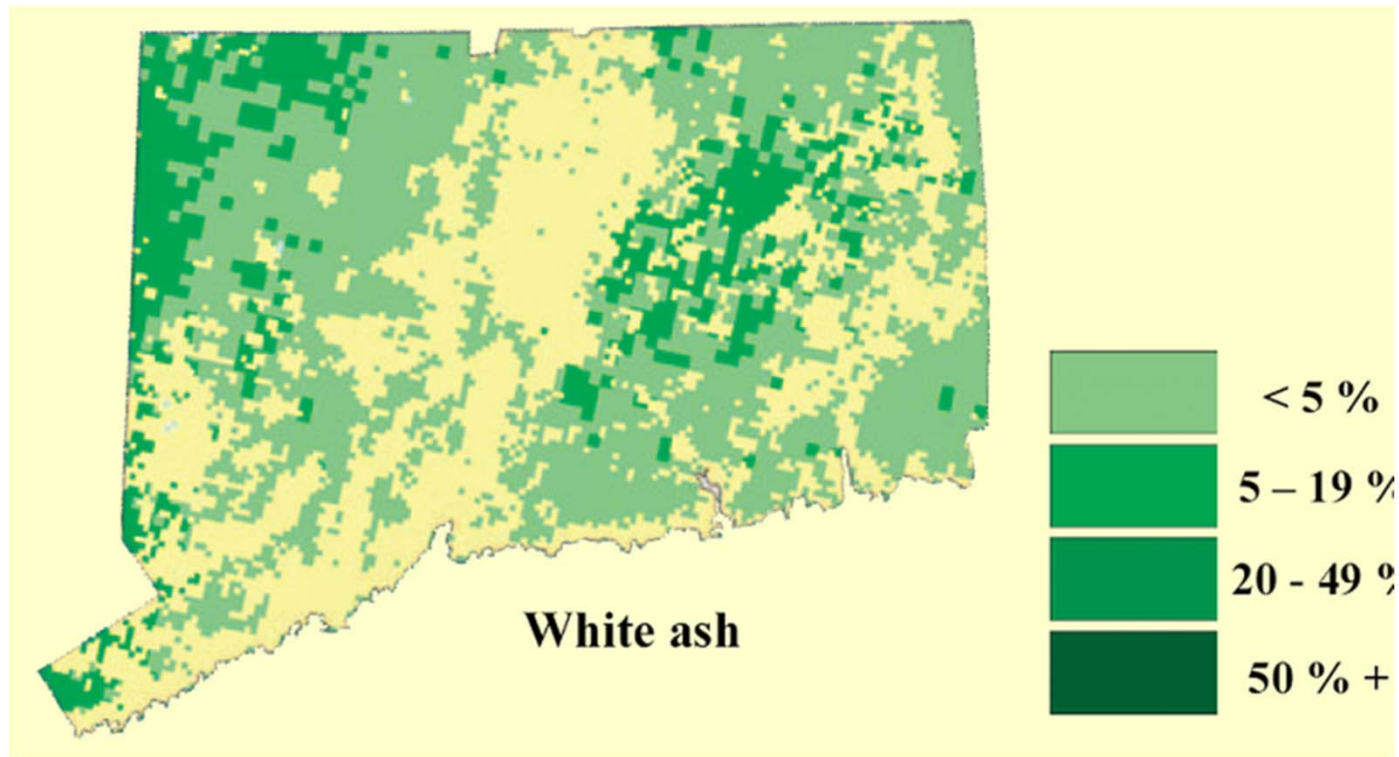
- All Ashes:
Fraxinus spp
 - green, black,
white, red
- And nothing else
 - Mountain ash is
not a true ash!



Why is EAB so dangerous ?

- Native American Ash has no resistance, it kills trees in 2-6 years
- Beetle is cryptic, hard to find
- Spreads quickly on its own
- Spread by people





- About 3% total forest trees
- Locally abundant
- Pioneer stands
- Riparian environments
- Currently over 100,000 urban ash trees

Ash Decline/ Ash Yellows



- Ash decline - combined symptoms of die-back, loss of apical dominance, and witch's brooms
- Ash yellows - disease caused by a mycoplasma-like organism, or MLO
- Discovered in mid 1980's, found only in Northeastern America
- Symptoms similar to emerald ash borer, and likely masked initial infestations



Mating and Eggs



Larvae (immatures)



Adults



Pupae

Biology

- Most adults emerge in June, but emergence can last all summer
- Adults feed for about 10 days before mating
- Both males and females mate multiple times
- Adults live about 5 weeks



Biology

- One Year or Two Year Life Cycle
- One female can lay up to 200 eggs, average is 50
- Eggs laid in crevices of bark
- Hatch in 10 – 12 days
- Larvae tunnel into and feed on cambium
- Feed through summer



Serpentine Galleries

- All stages eat the cambium and phloem
- Kills tree by girdling it
- Kills tree in 2-6 years



Biology

- Spend winter as pre-pupae in small chamber in wood or in thick bark



- Pupate and develop starting in spring



Mating and Eggs



Larvae (immatures)



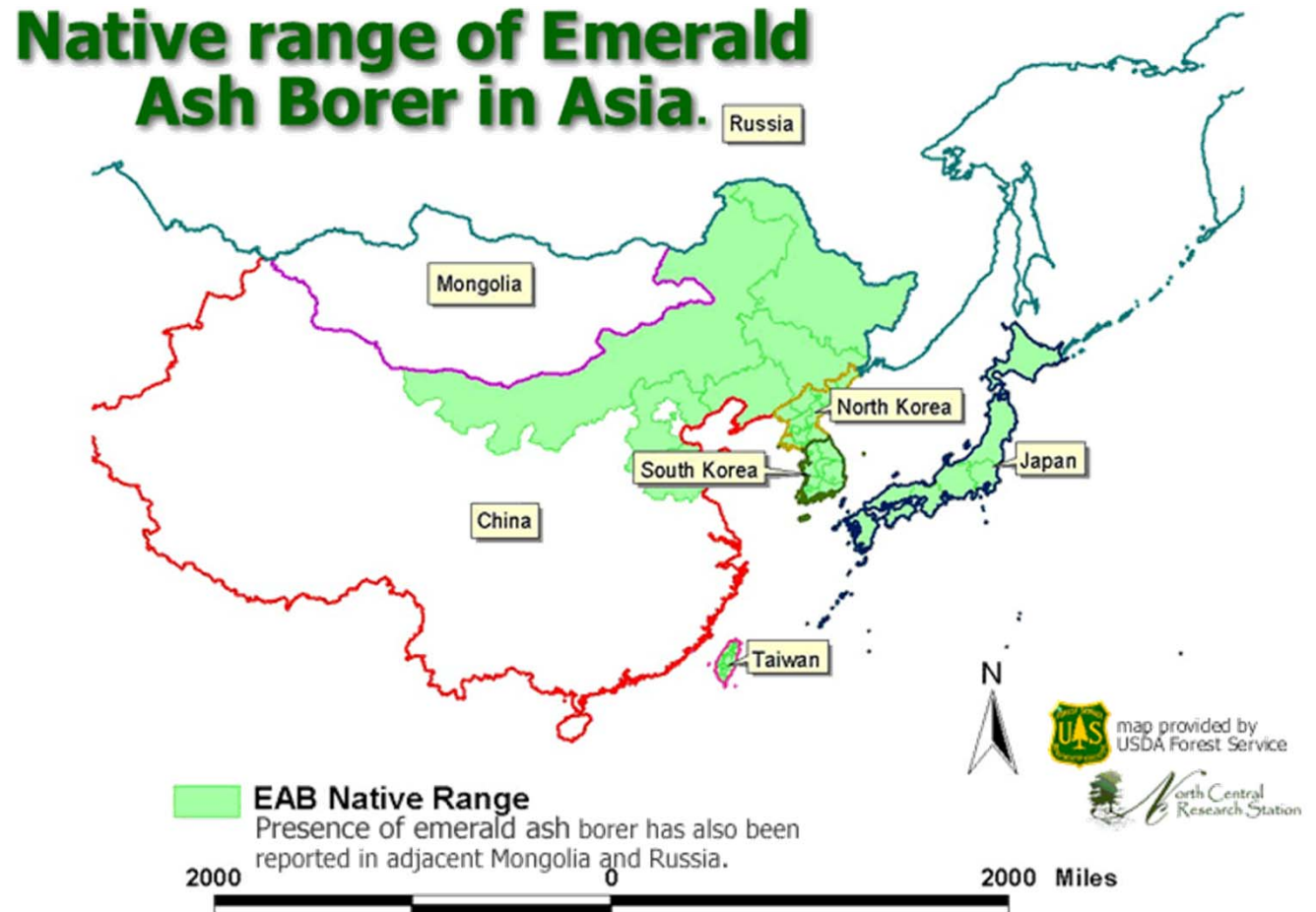
Adults



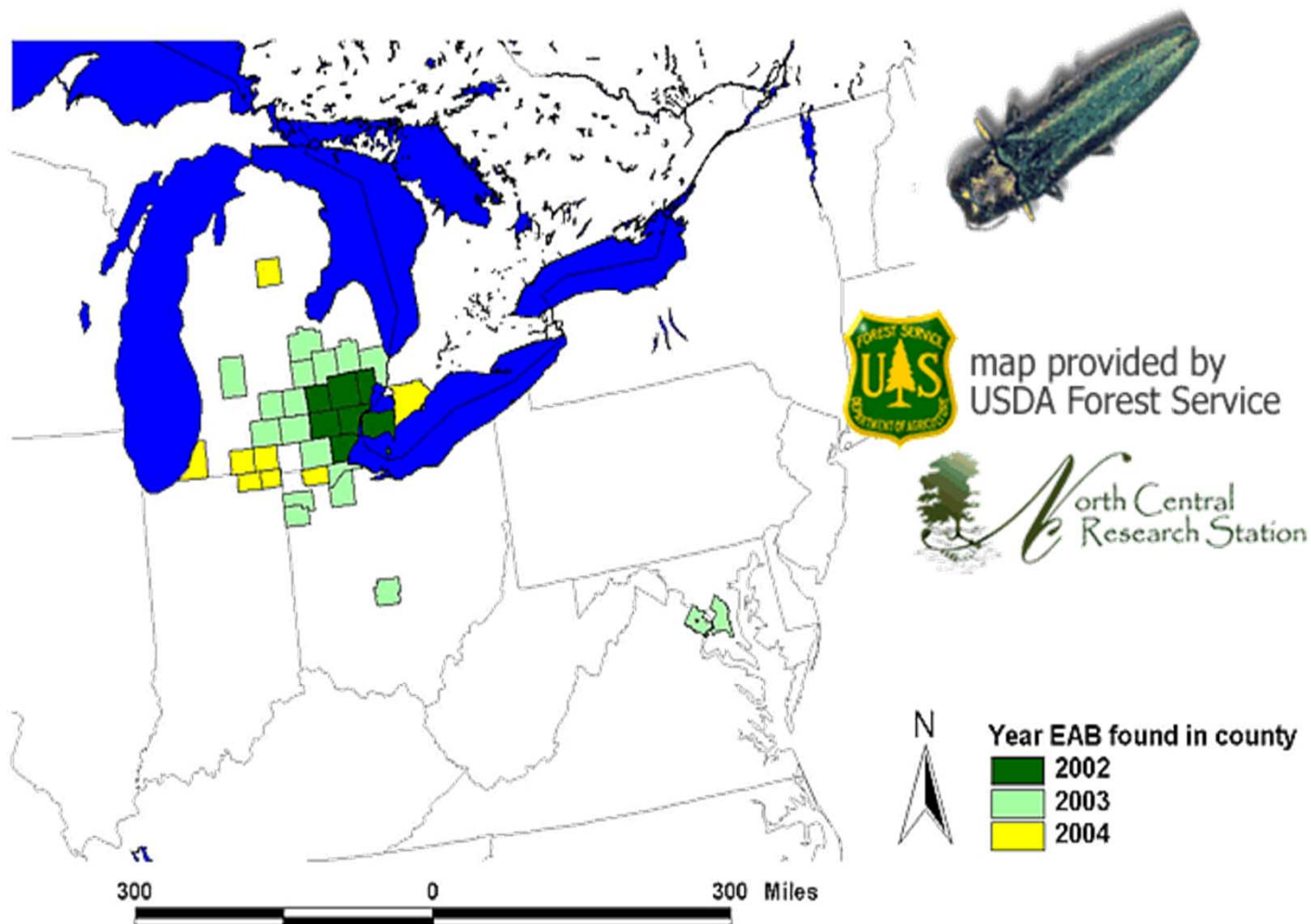
Pupae

History of Emerald Ash Borer in North America

- From Asia
- First found in Detroit 2002
- Probably arrived in wooden packaging



Emerald Ash Borer in North America, 2004.



Data sources (as of 7/7/2004):

http://www.michigan.gov/images/MDA_EAB_outlier_map_temp_84565_7.jpg

<http://www.ohioagriculture.gov/pubs/divs/plnt/curr/eab/images/eabfindings.pdf>

<http://www.ceris.purdue.edu/napis/pests/barkb/imap/eabmd.html>

<http://www.inspection.gc.ca/english/plaveg/for/pestrava/agrpla/infest2e.jpg>

Modes of Transport



firewood



Adult clinging
to car



Nursery stock



Flight

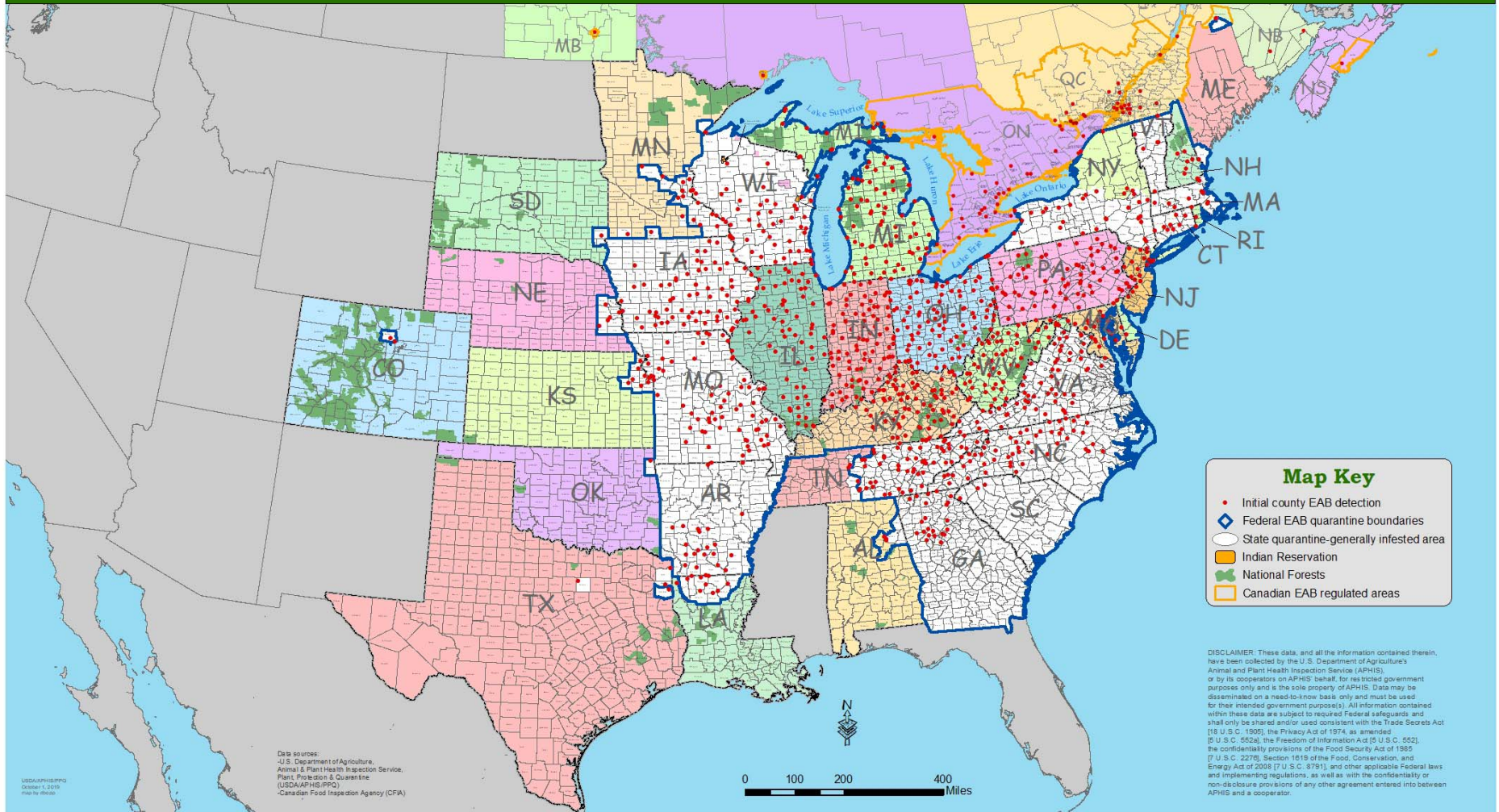


United States
Department of
Agriculture

Cooperative Emerald Ash Borer Project

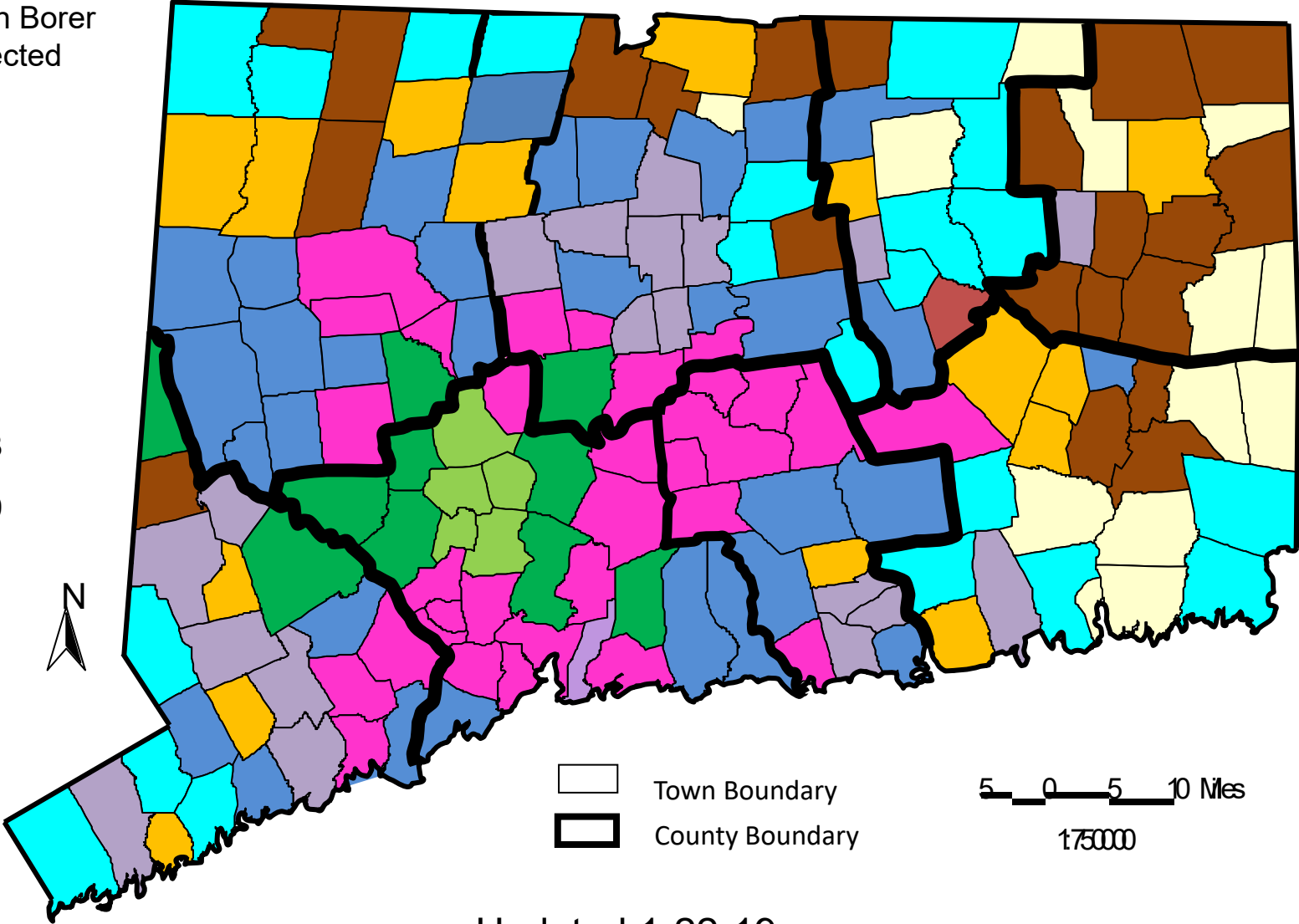
Initial county EAB detections in North America

October 1, 2019



**Emerald Ash Borer
First Detected**

- 2012
- 2013
- 2014
- 2015
- 2016
- 2017
- 2018
- 2019



Updated 1-22-19

Death of an Ash Tree

1



2



3



4



5



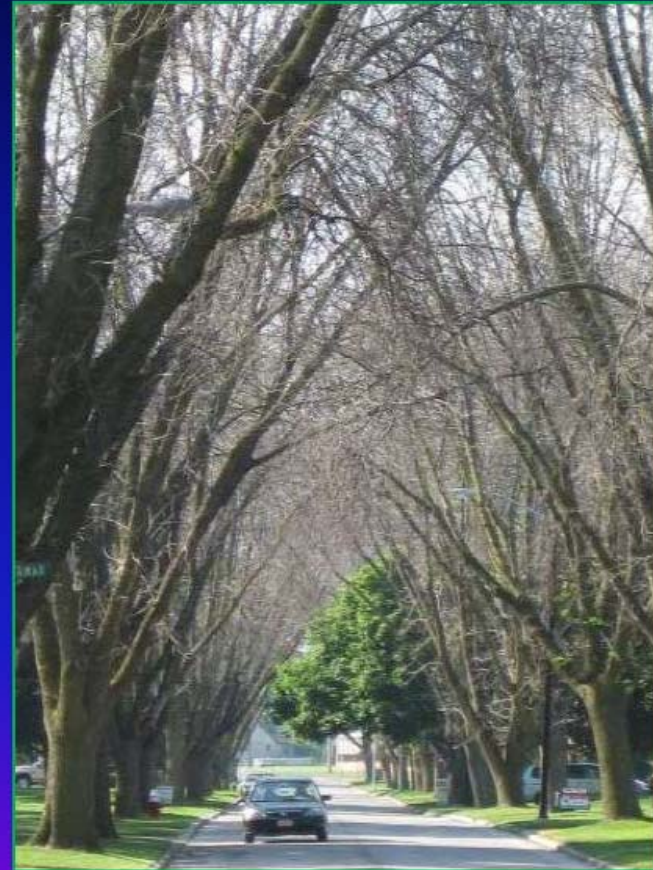
Ash canopy health condition rating scale

Smith (2006)

Toledo, Ohio – BEFORE & AFTER



June 2006



August 2009

Courtesy of Dr. Dan Herms

Death Curve – Ft. Wayne, IN

(From Chad Tinkel)

- Discovered in 2006
- 14,000 ash trees
- First 4 years – slow tree death
 - Can keep up with removals
- Next 4 years – exponential tree death
 - 80% die
 - Tree removal capacity - Inadequate



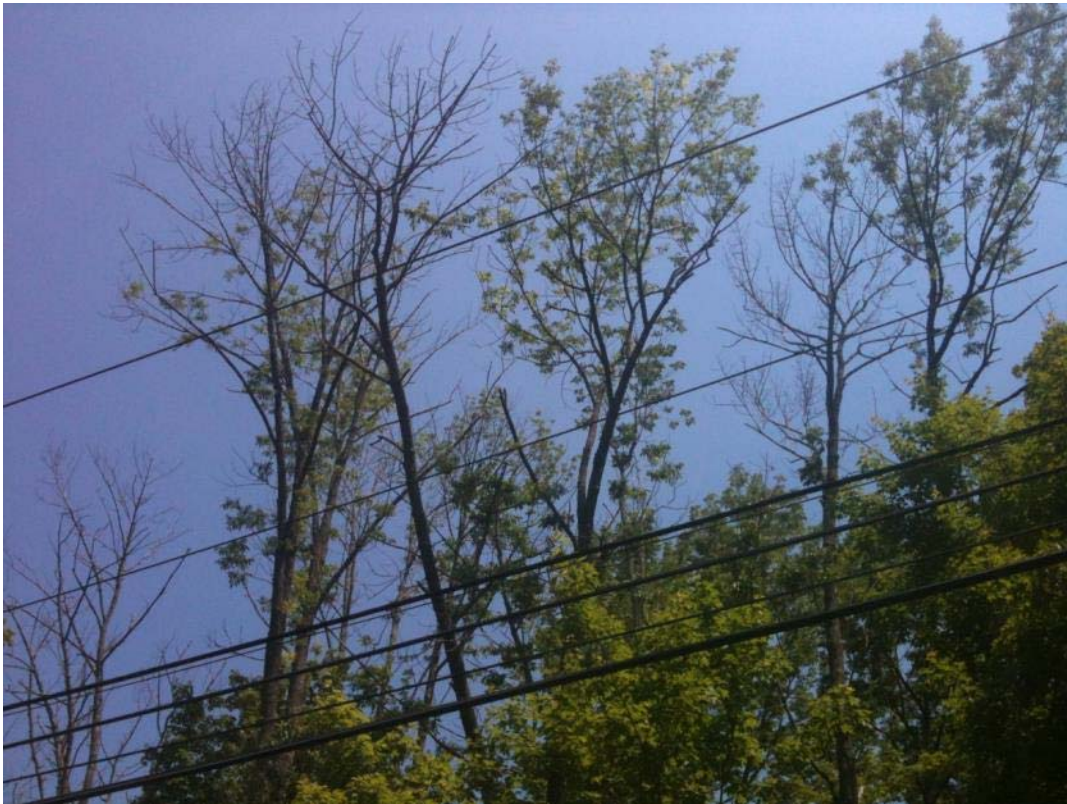
In 2011 Ft Wayne lost 3670 ash trees and were only able to replant 1766

Proposed loss of 5000 ash trees in 2012

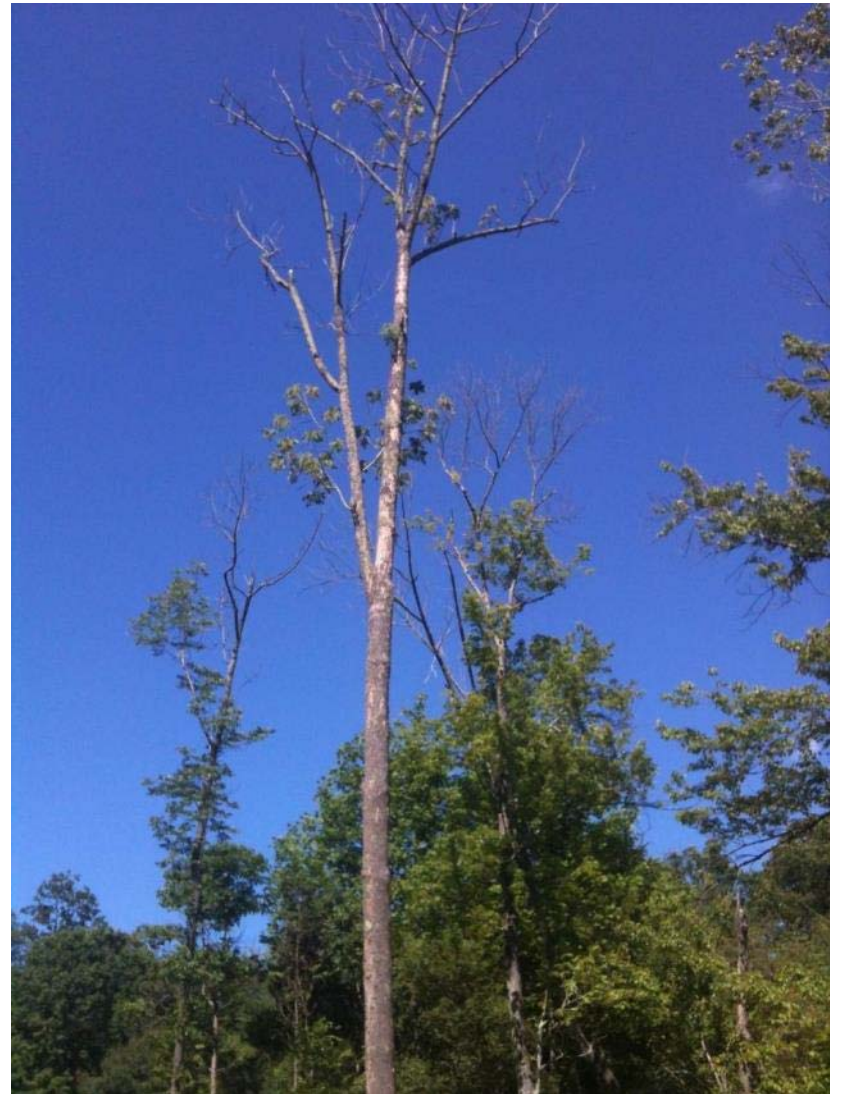


dead and dying ash
Prospect

Dieback



Hamden



Prospect

Woodpecker damage



Waterbury



Southbury



Middlebury





Tunnels



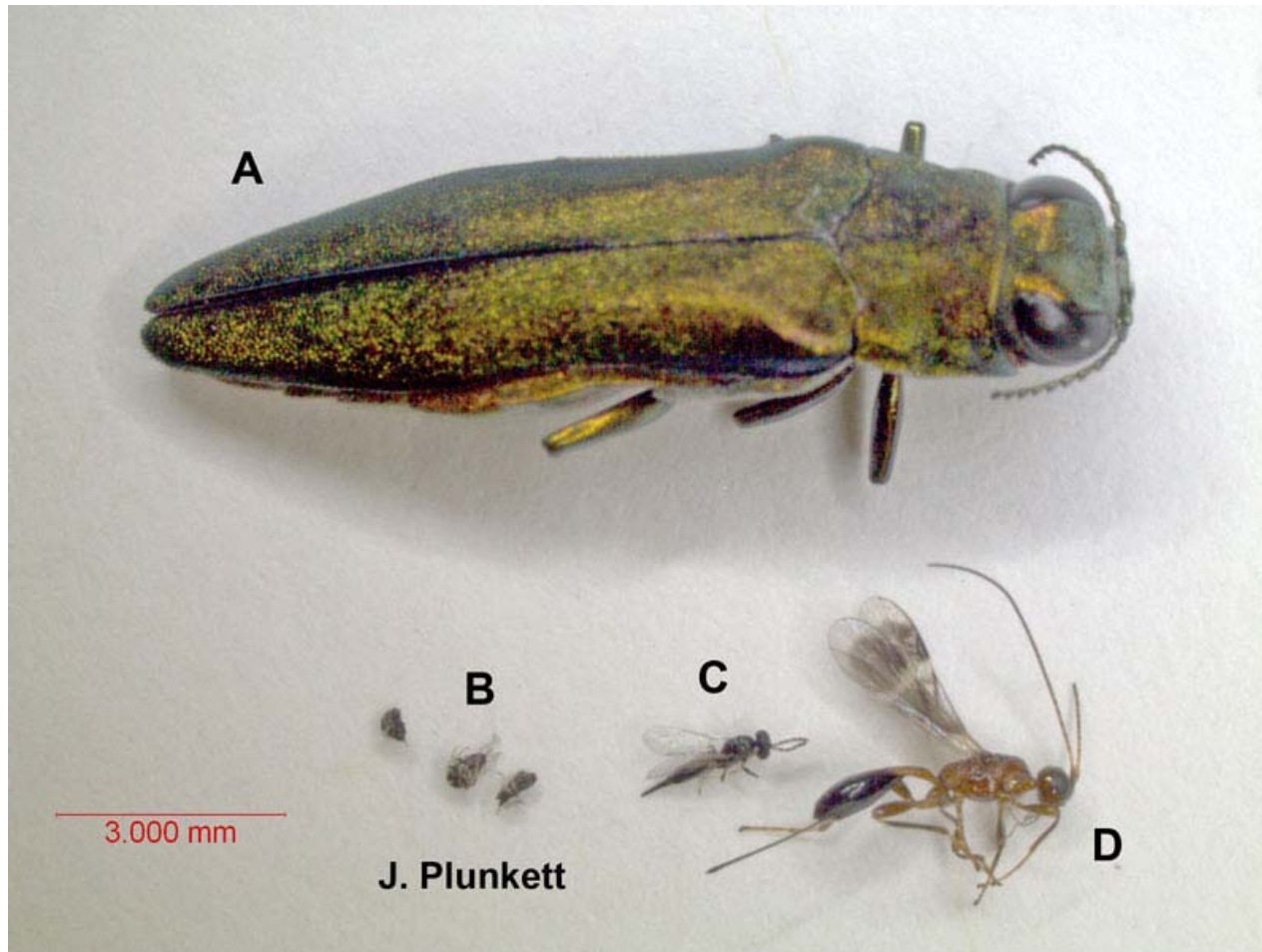
Prospect

Hamden

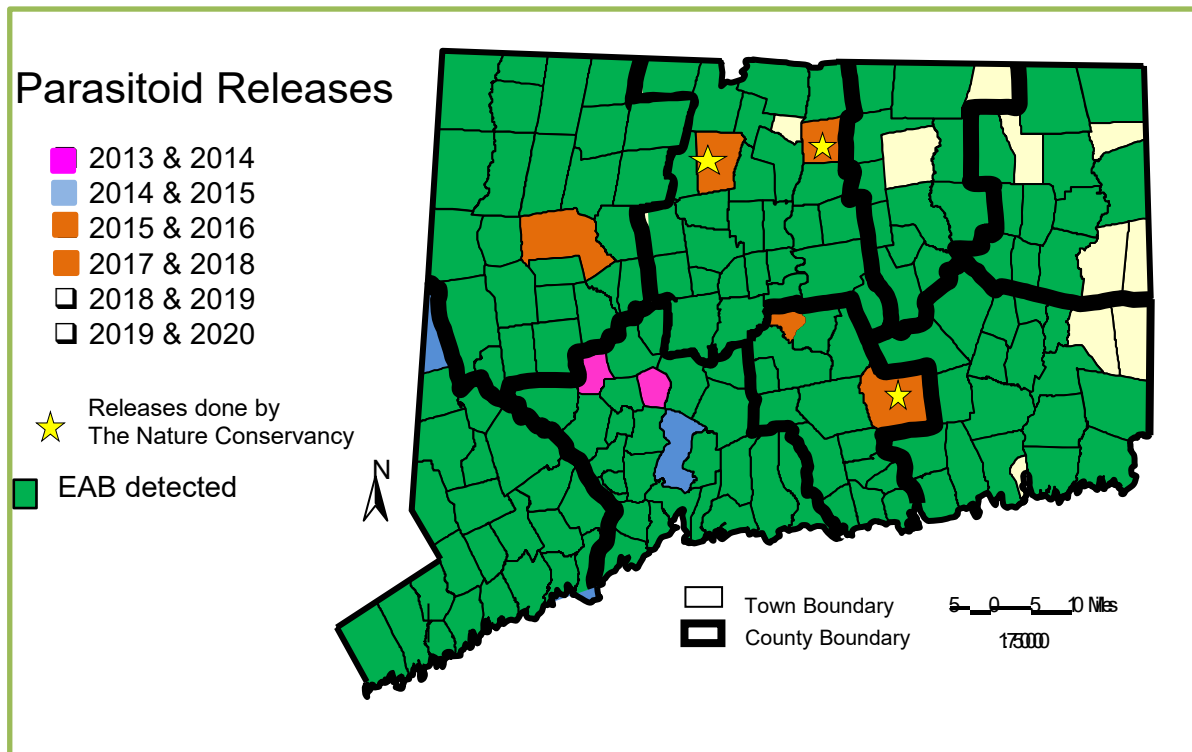
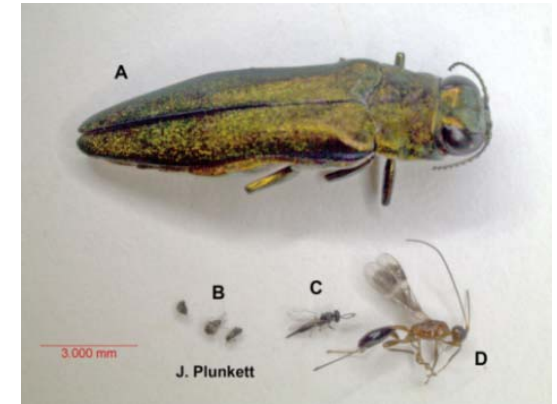




Emerald Ash Borer Parasitoids



2019 EAB Biocontrol



Oobius agrili
Spathius galinae
Tetrastichus
planipennisi

Town	Year	Tets	Oobius	Spathius
Middlebury	2013	4,663	1,702	
	2014	14,580	4300	
Prospect	2013	5,582	1,176	
	2014	14,580	4550	
Hamden	2014	14,580	4550	
	2015	11427	2220	
Sherman	2014	312	450	
	2015	6592	1040	
Cromwell	2015	11511	2220	
Litchfield	2015	11511	2120	
	2016	4754	3700	305
East Haddam	2016	4754	3700	305
	2017	6864	2800	1522
East Windsor	2016	4753.75	3700	305
	2017	6864	2800	1522
Simsbury	2016	4753.75	3700	305
	2017	6864	2800	1097
Weston	2017	6864	2800	1522
	2018	5382	1662	1701
Kent	2018	10139	2800	2483
		147,191	51,990	8,584



Parasitoid Recovery



- Wait 1 year after last release
- “Tets” & Spathius - peel trees in fall looking for larvae and parasitoids
- Oobius – collect bark and wait for parasitoids to emerge



Parasitoid Recovery

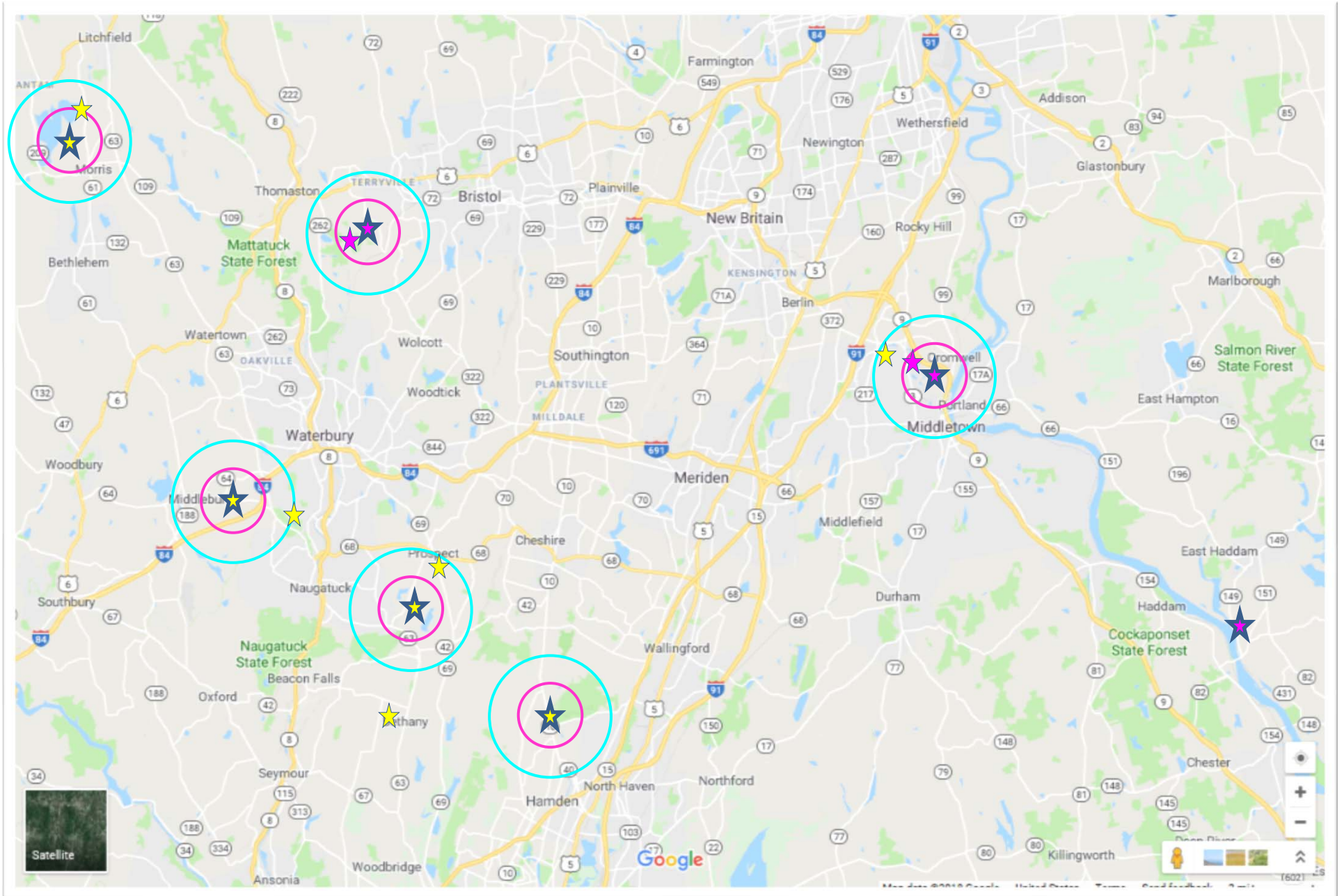


Whittemore Rd.
Middlebury, CT

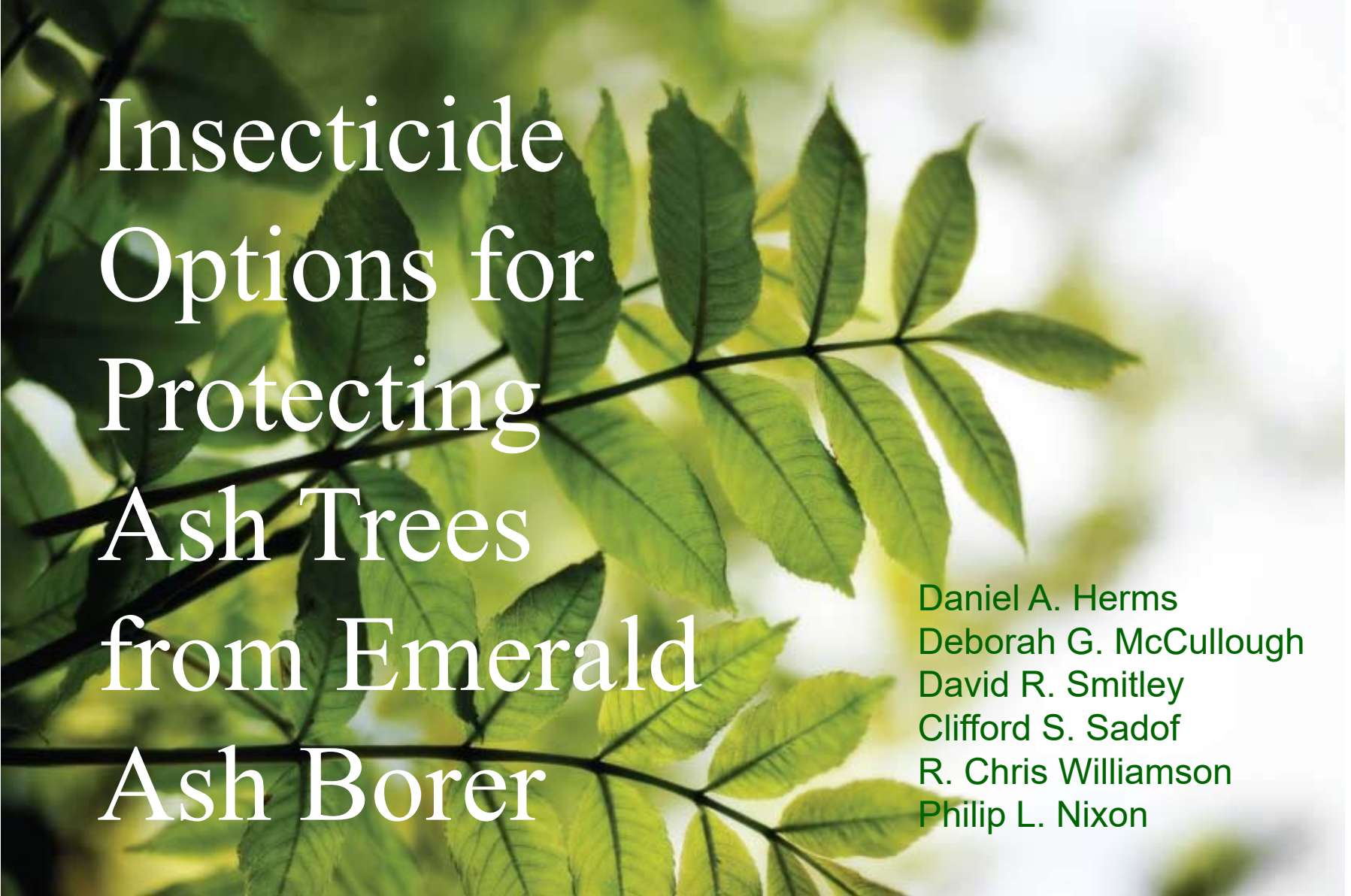


Prospect, CT

Parasitoid Recoveries



What is being done? Management

A close-up photograph of green ash tree leaves. The leaves are pinnately compound, with several leaflets on a central stem. One leaflet in the upper right quadrant has a small, white, oval-shaped insect on it. The background is a soft, out-of-focus light green and white.

Insecticide Options for Protecting Ash Trees from Emerald Ash Borer

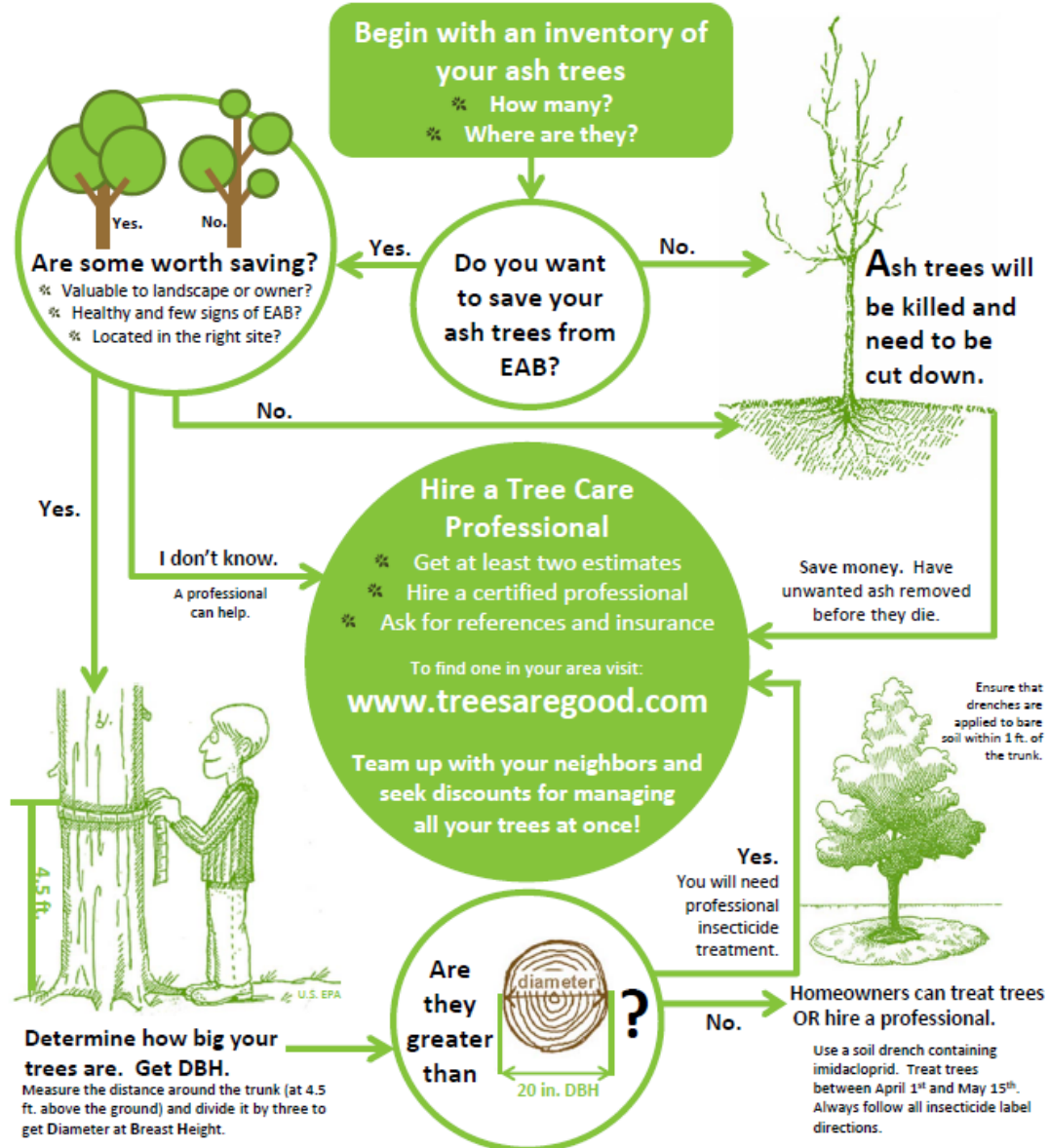
Daniel A. Herms
Deborah G. McCullough
David R. Smitley
Clifford S. Sadof
R. Chris Williamson
Philip L. Nixon

Insecticides Can Protect Ash Trees

Product	Time of Year	Other Considerations ^{ab}
Imidacloprid	Spring (early April to mid-May) Fall (October to November)	Spring treatments more effective than those in fall (up to 20")
Dinotefuran	Spring (early May to mid-June)	Soil injection or trunk sprays equally effective up to 16 " DBH
Emamectin benzoate	Bud-break** to mid-June Mid-Summer to Fall color	Spring 2012 treatments will kill this year's egg laying beetles Mid-Summer /Fall applications will kill next year's beetles (8 to 25"DBH)

^a Applications are timed so that enough insecticide is in the leaves to kill EAB adults that feed on leaves before they have laid most of their eggs

^b Trees must be actively transpiring to take up these products



Protect your urban forest. Act Now. Save Trees. Save \$!

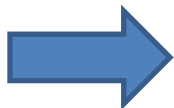
Aggressive treatments (annual) followed by maintenance treatments (every 3 years)

Highest annual cost



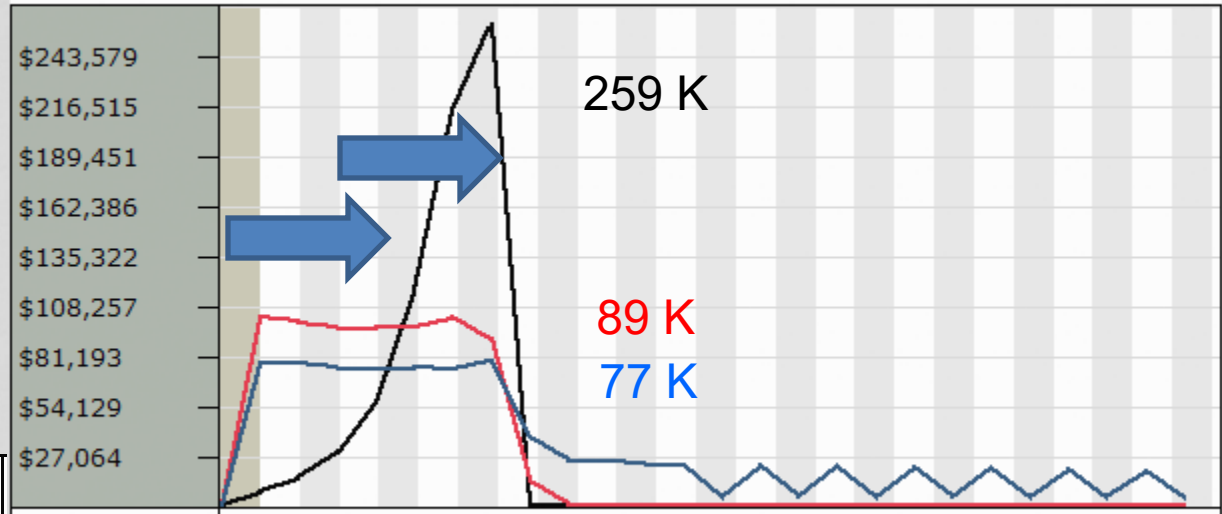
Replace Unsafe Ash
Replace All
Save 50%

Lowest annual cost

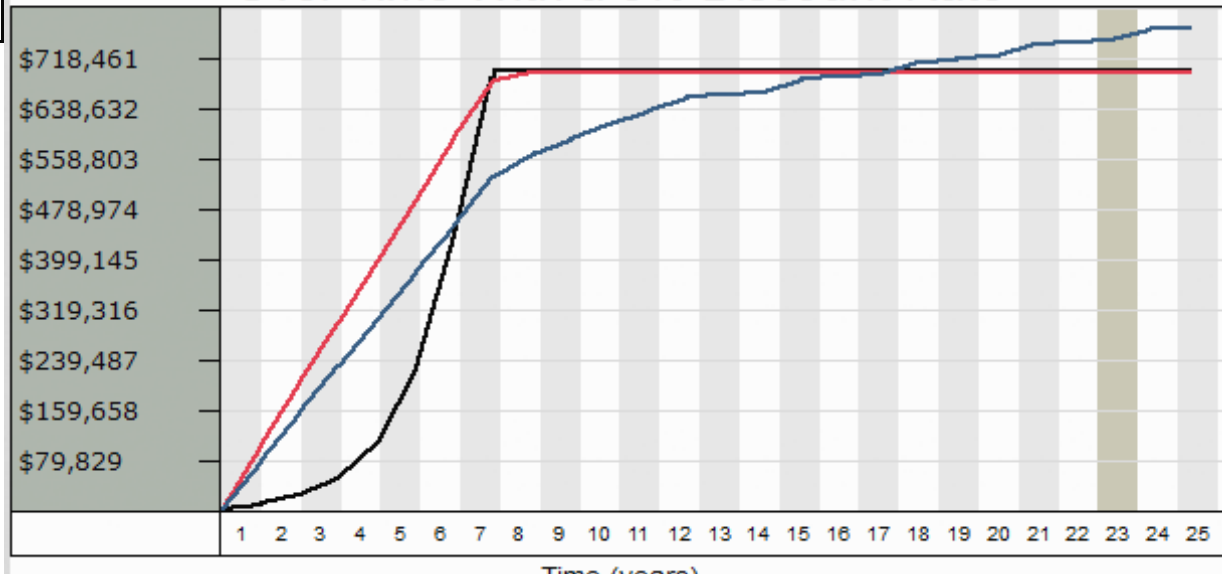


4 yr Election Cycle

Annual Cost Comparison in Today's Dollars Over Time With a 3% Discount Rate

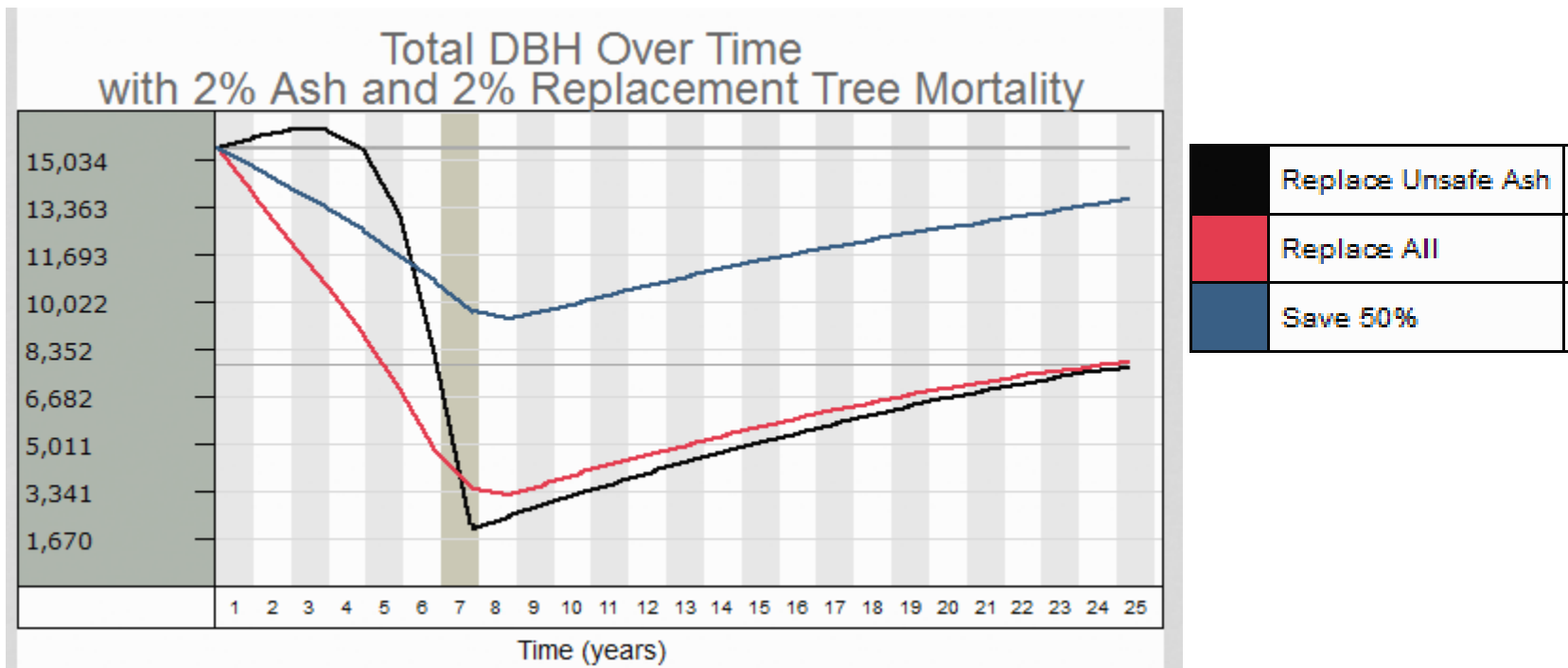


Cumulative Cost Comparison in Today's Dollars Over Time With a 3% Discount Rate



Relative Benefits in Canopy Size

-Treated forest is largest



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



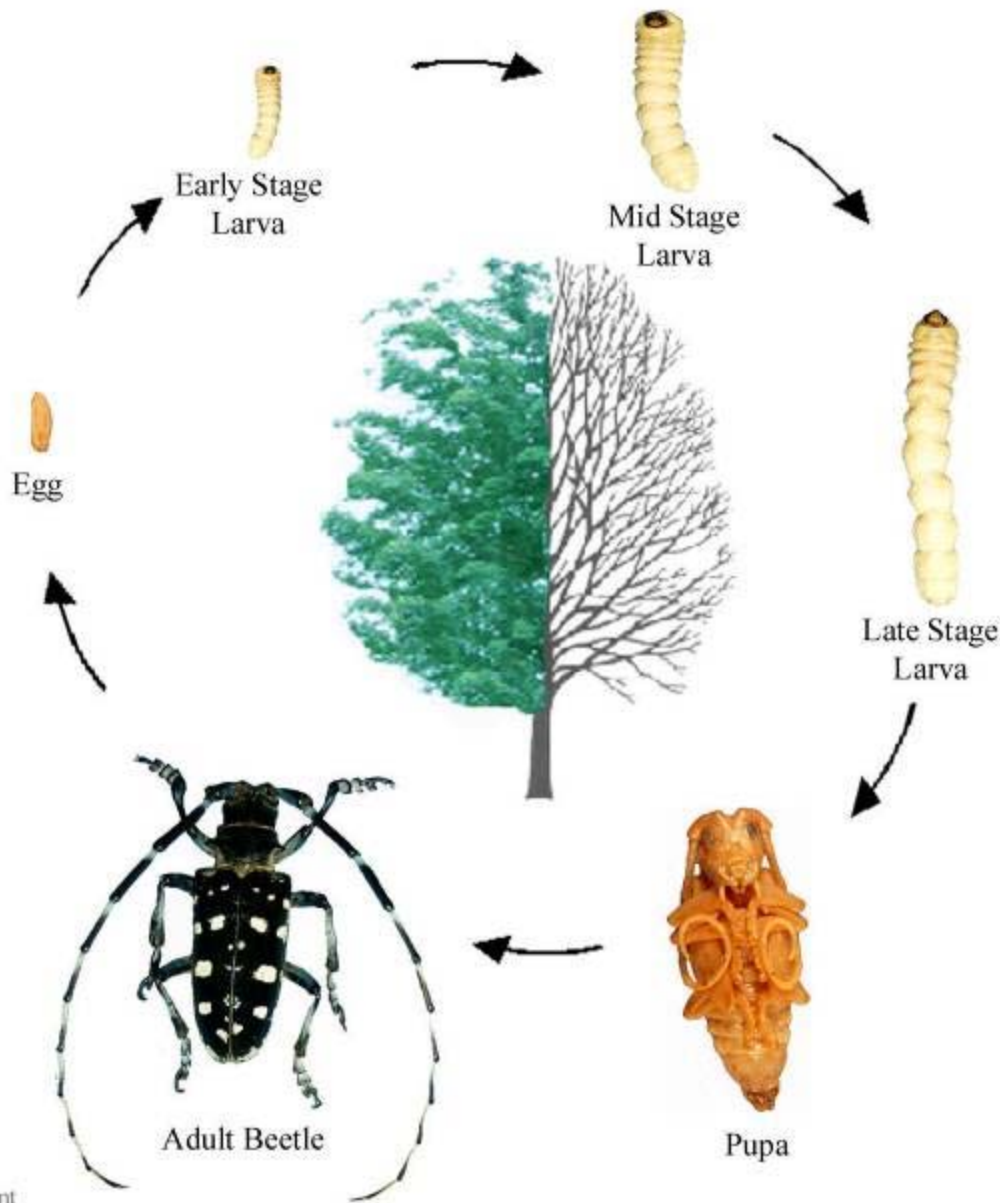
Adults and oviposition scars



Emergence holes



Adult emerging from tree



Larva in tree



Pupal chamber in tree

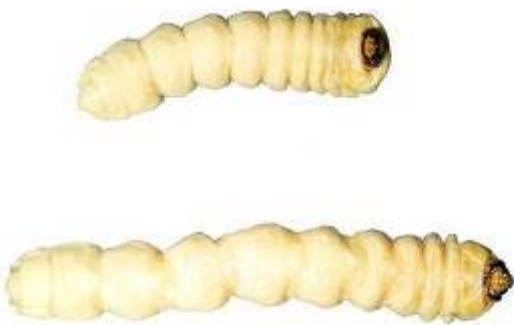
ALB Life Cycle – Egg and Larvae

- 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



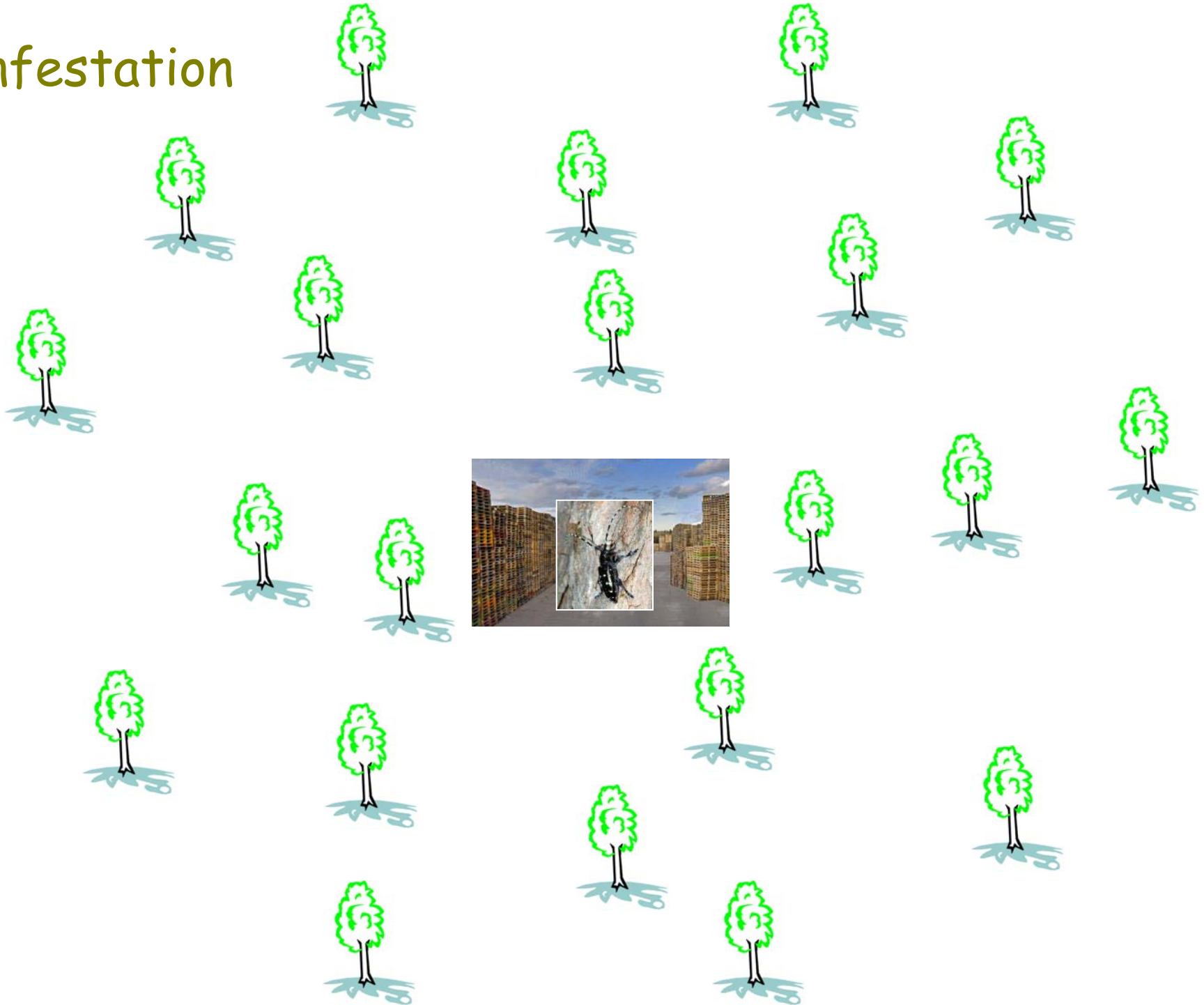
- Emerge late Spring thru late Summer
- Exit holes are approx. 3/8 to 5/8 inches in diameter
- Adults 1.5 – 2 inches in length

ALB lifecycle - Adults

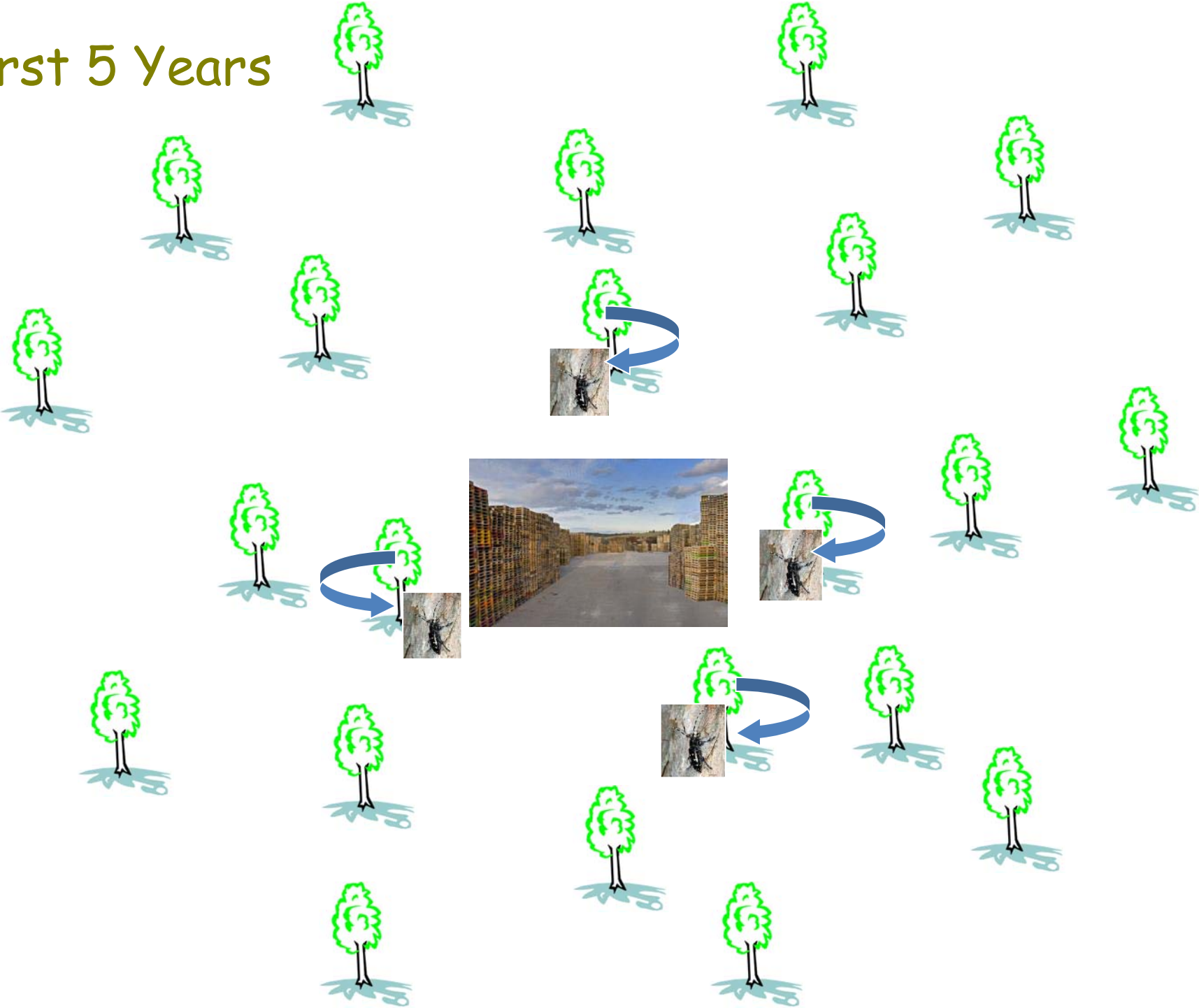
- Live for several weeks
- Can fly up to ½ mile, but often re-infest the same tree
- Feed on leaf midribs and mate
- Females lay between 35 to 90 eggs
- One generation per year



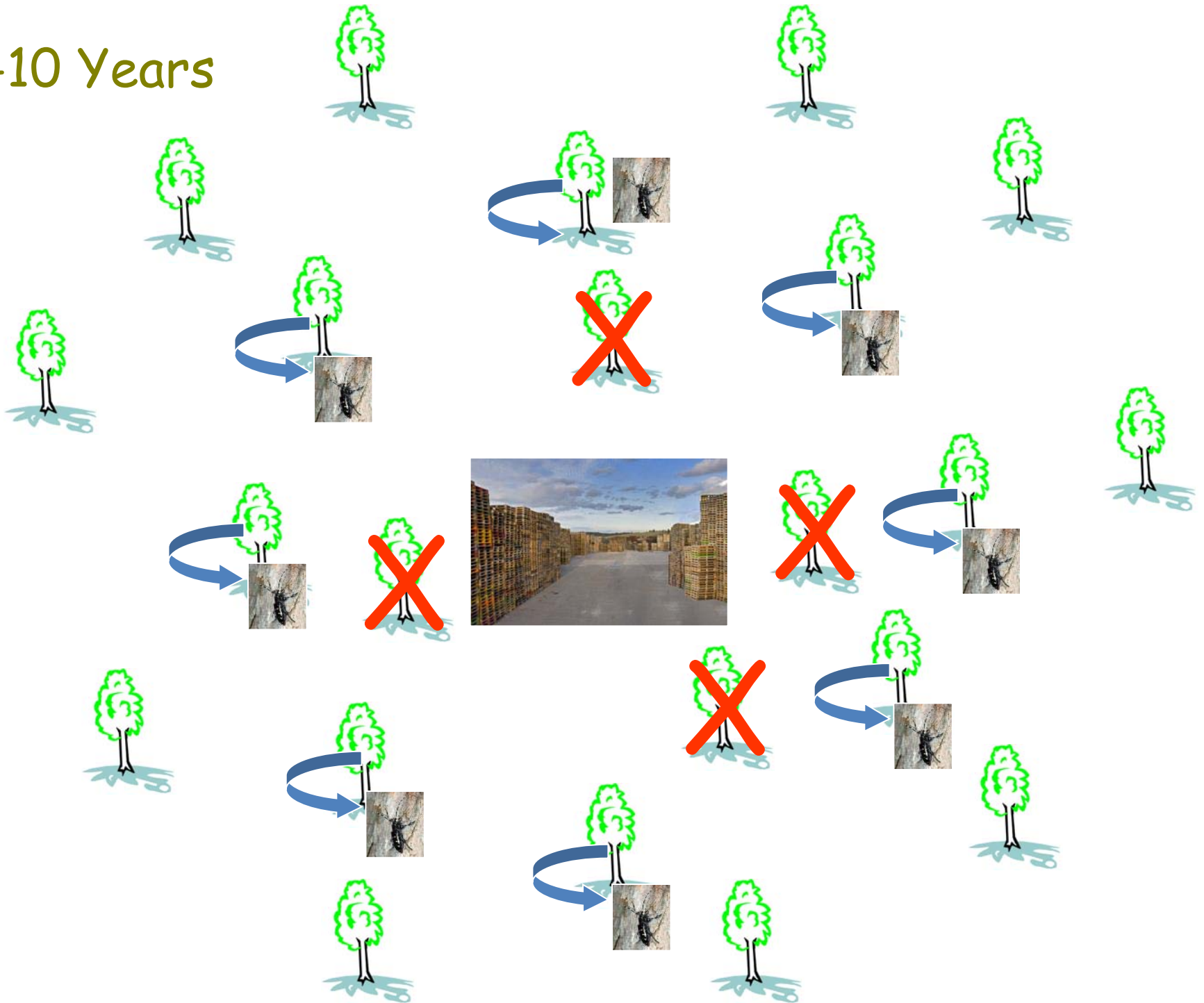
Infestation



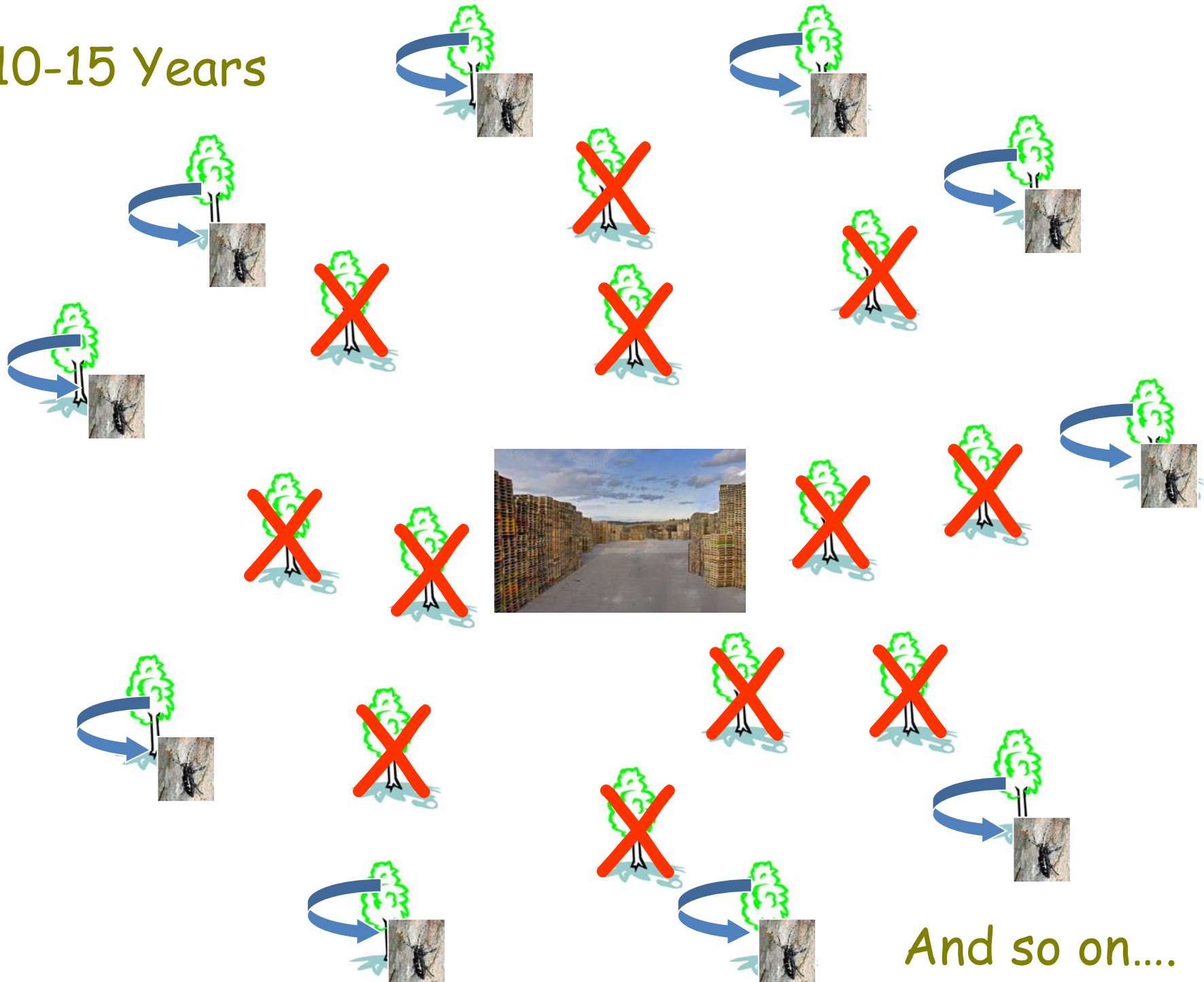
First 5 Years



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

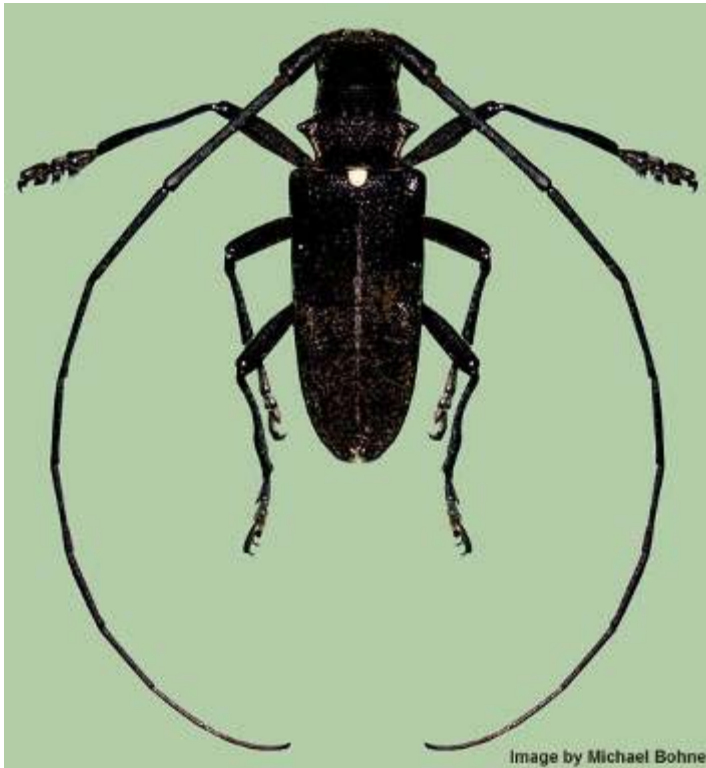


Sycamore/ London Plane Tree
(*Platanus* spp.)

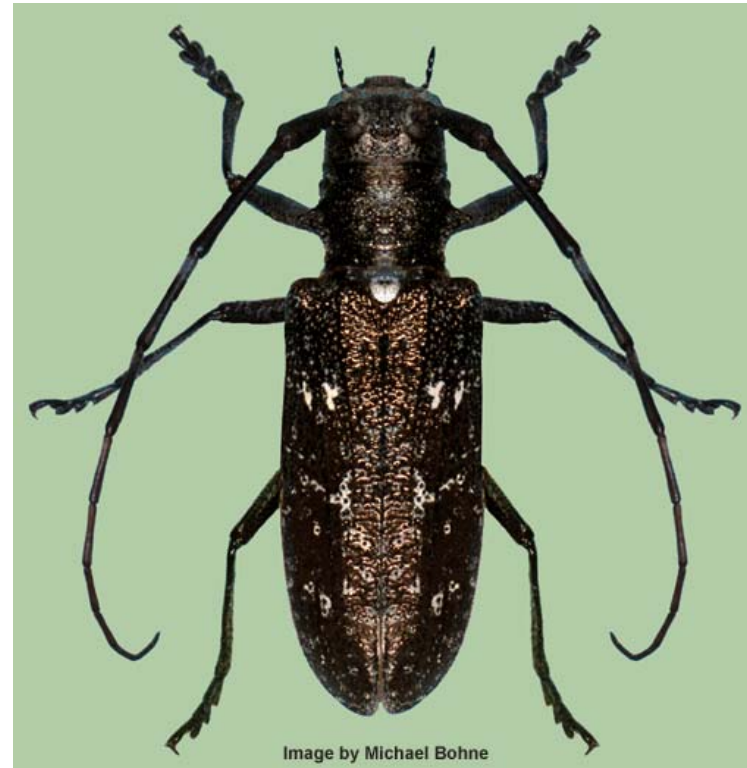


Poplar (*Populus* spp.)

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:

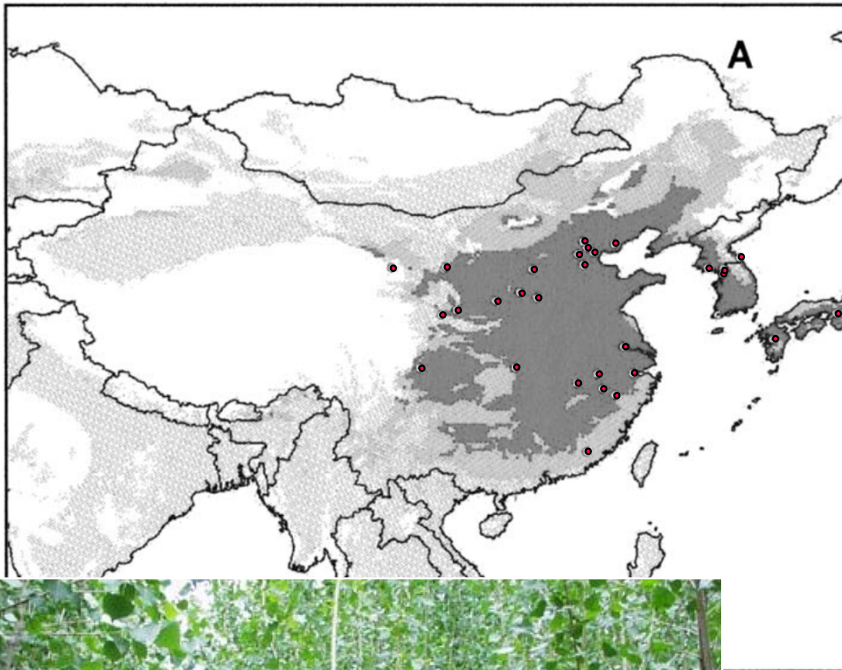


Sugar Maple Tap Holes





Where it Came From

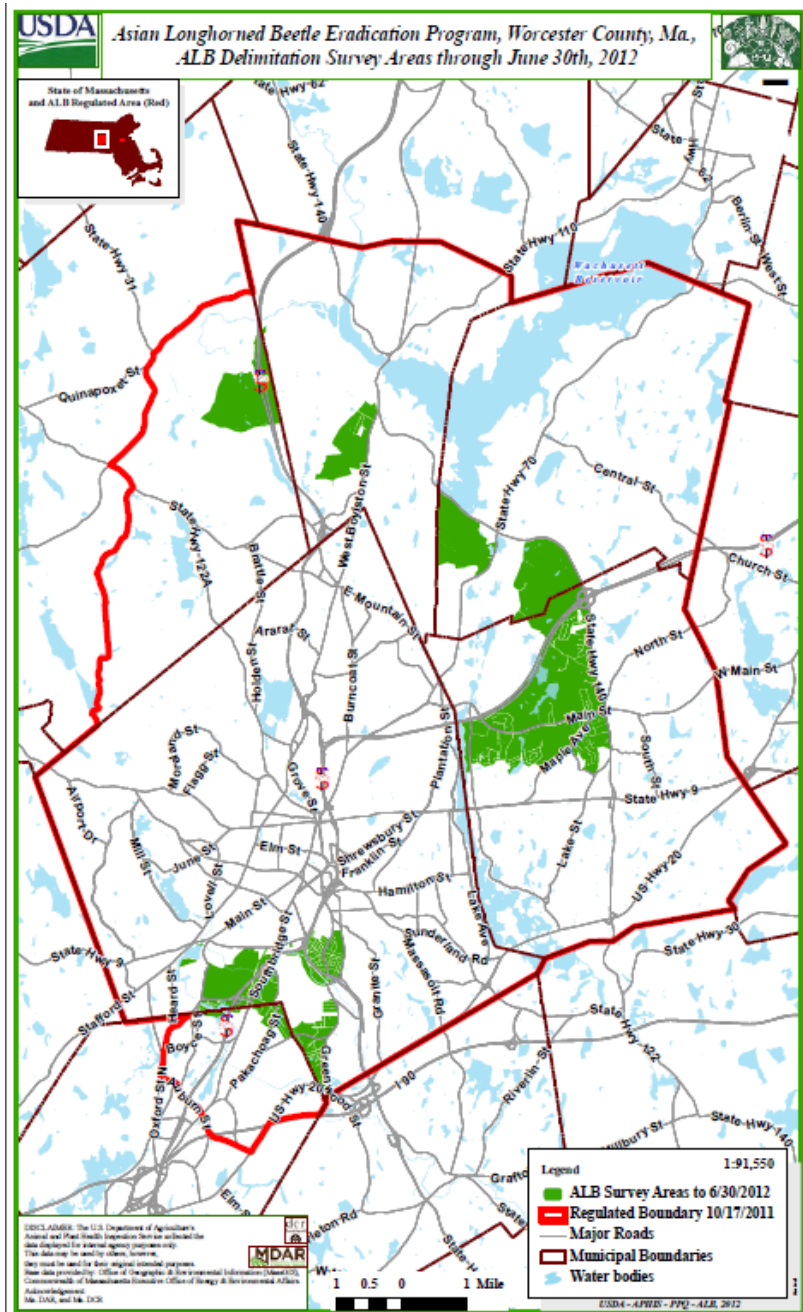


- 40% of poplar plantations damaged (ca. 2.3 million ha.)
- Infested 240 cities or counties in 5 provinces alone (230 thousand ha.)
- Estimated 50 million trees cut down over 3 years in Ningxia Province alone (1991-1993).
- Damaging from 21-43°N and 100-127° E (represents 4 climatic zones in China)

Infestations



- 1996 Brooklyn
- 1996 Amityville (declared free 2011)
- 1998 Chicago (declared free 2008)
- 1999-2000 Manhattan (declared free 2013)
- 2000 Queens (declared free 2019)
- 2002 Jersey City (declared free 2008)
- 2003 Toronto (declared free 2013)
- 2004 Carteret, NJ (declared free 2013)
- 2007 Prall's Island, NY (declared free 2013)
- 2008 Worcester
- 2010 Boston (declared free 2014)
- 2011 Clermont County Ohio

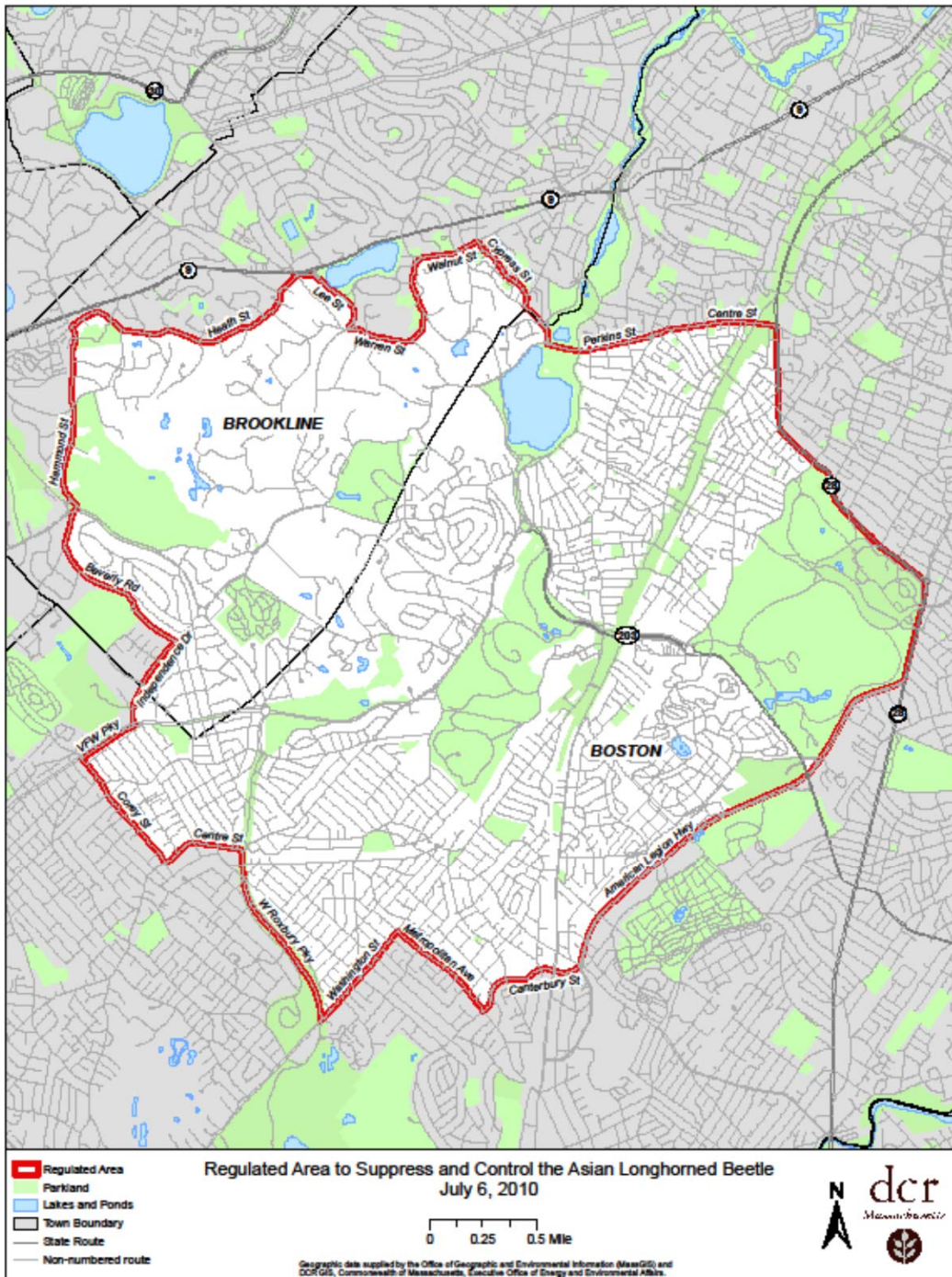


Worcester, MA 2008

- 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
- Declared free 2014









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, 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
August 2005



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