Insects that Feed on Trees

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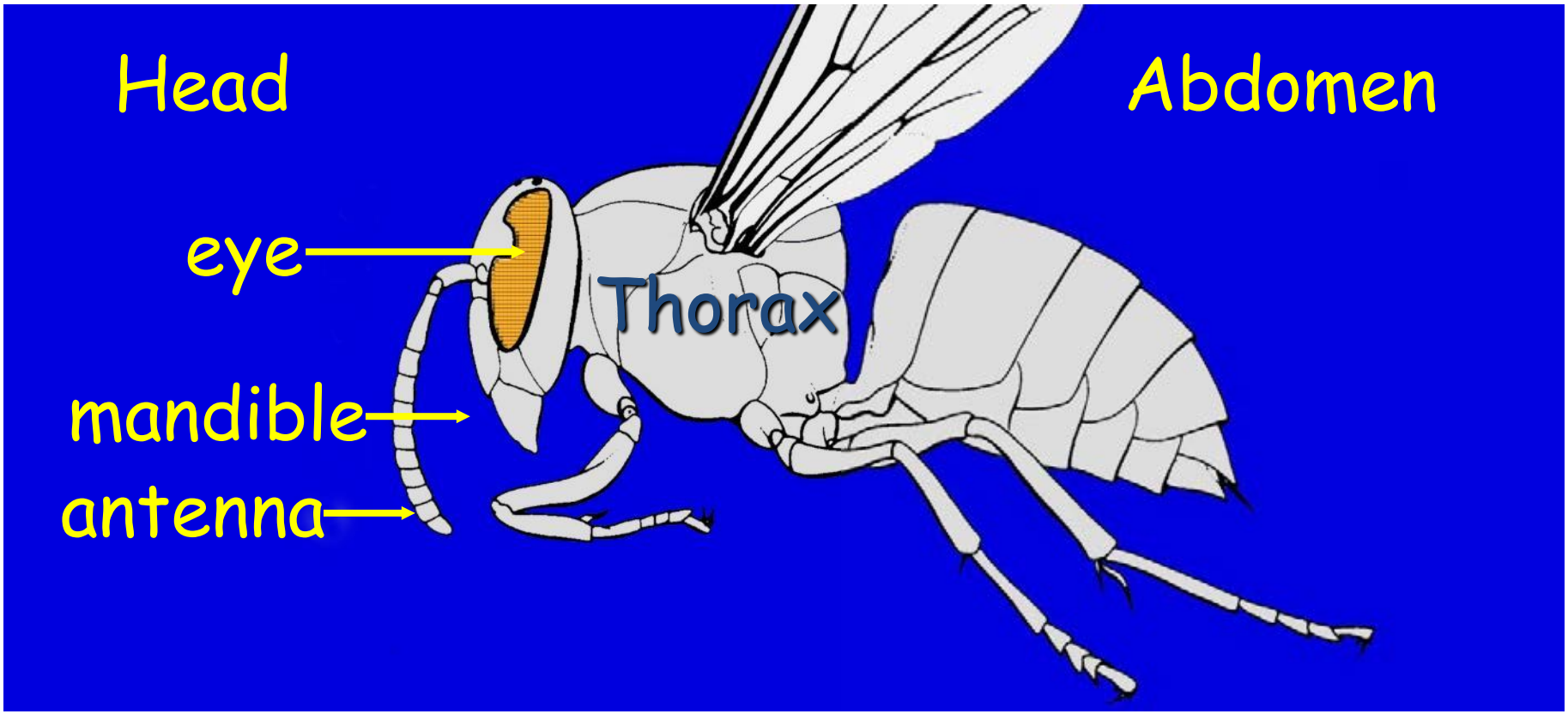
Insect Body Parts



Life Cycle of Insects

Incomplete metamorphosis

egg nymphs adult

Incomplete metamorphosis

Aphids

Adelgids

Plant bugs

Lace bugs

Complete Metamorphosis

Complete metamorphosis


Moths (Lepidoptera)

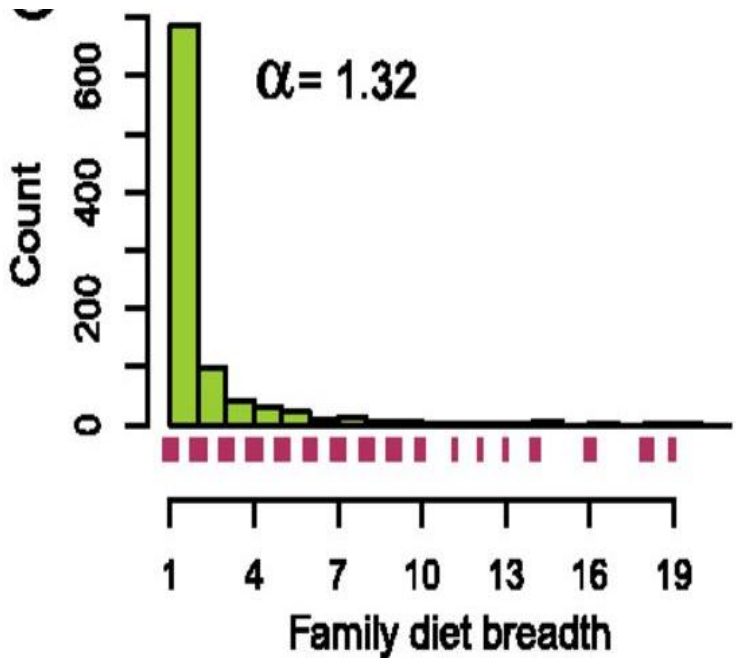

Beetles (Coleoptera)


Sawfly (Hymenoptera)


Fly (Diptera)

What Insects Eat, Host Range

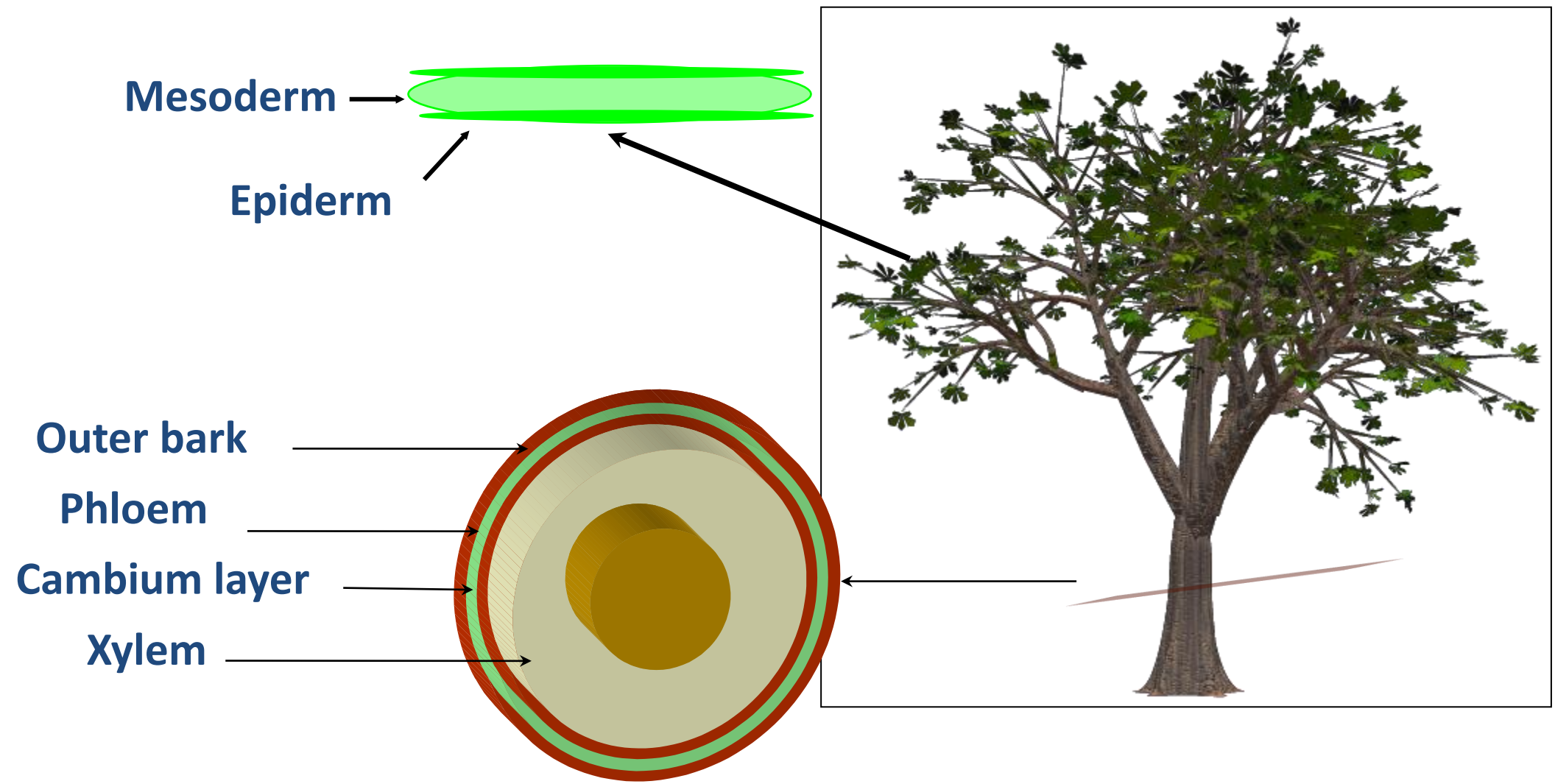
- Trees defend themselves
  - Chemical
  - Physical
- To feed on a tree, insects need to be adapted to that tree's defenses
- Most herbivorous insects are specialists
- So, if you know your tree, you have a great start on identifying your insect



Rickfels 2015

Edible Tree Parts

Edible Tree Parts (continued)



Layout of Talk

- For each insect
  - Show pictures of the life stages
  - Show pictures of damage
  - Discuss biology
  - Discuss management options

Insects That Suck

Damage Types

Form galls

Ingest sap > produce honeydew > sooty mold

Remove cell contents

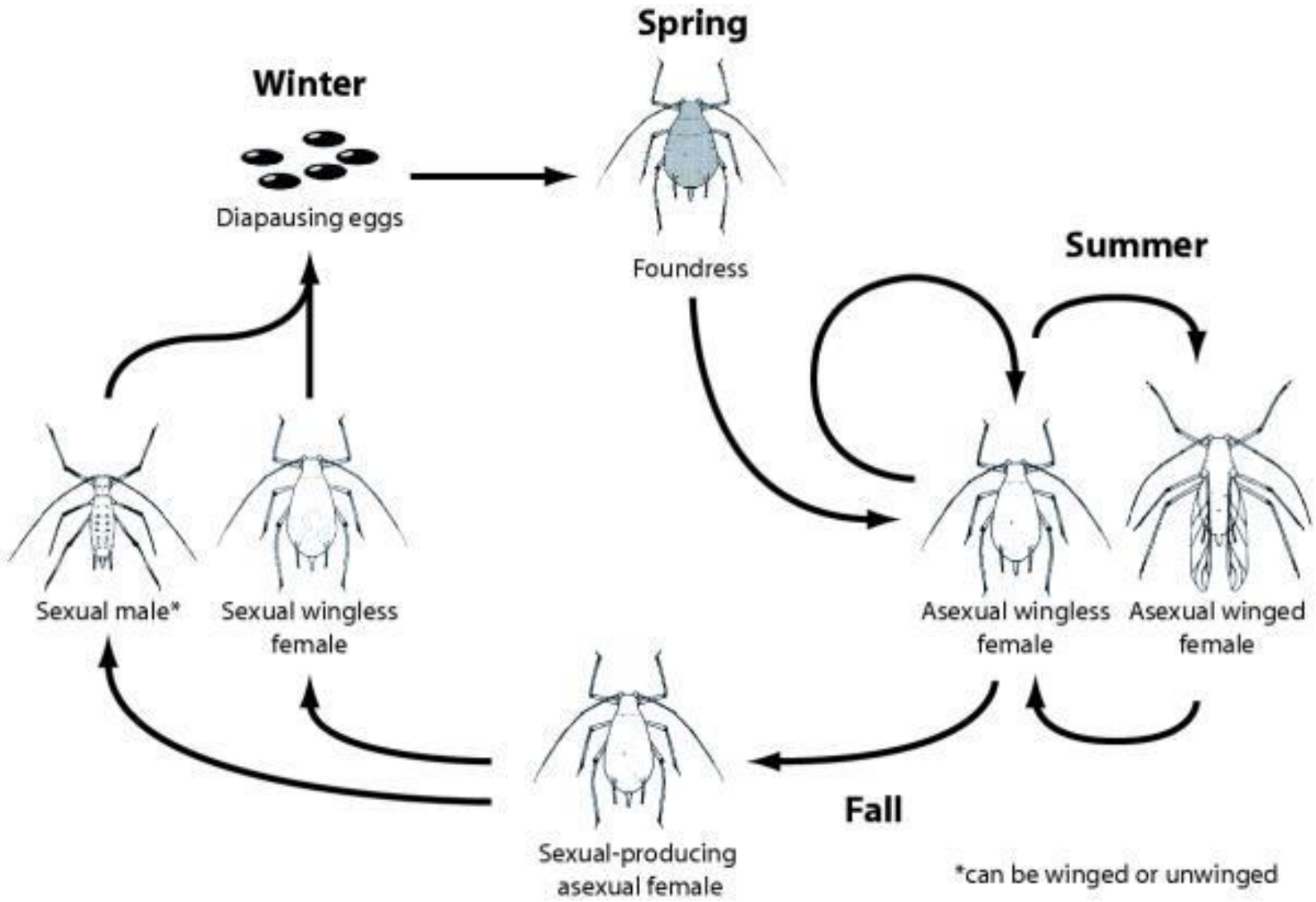
Inject toxins

Transmit pathogens

Aphids
Identifying Characteristics

Stylets

Aphids: Life Cycle



Wooly Beech Aphid

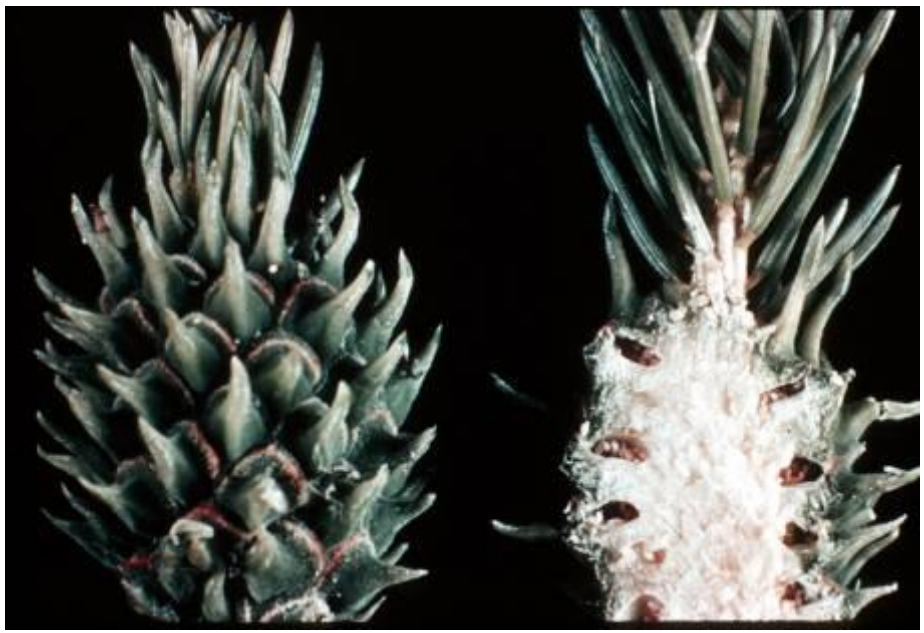
- Have a cottony waxy covering
- Live on underside of beech trees
- Main impact is honeydew production
- Seldom a problem- natural enemies keep in check

Aphid Management

- Usually not needed
- Natural Enemies
- Horticultural Oil
- Systemic insecticides
  - e.g. Acephate, Imidacloprid

Adelgids (Homopetera)

Originally all alternated between spruce and another conifer



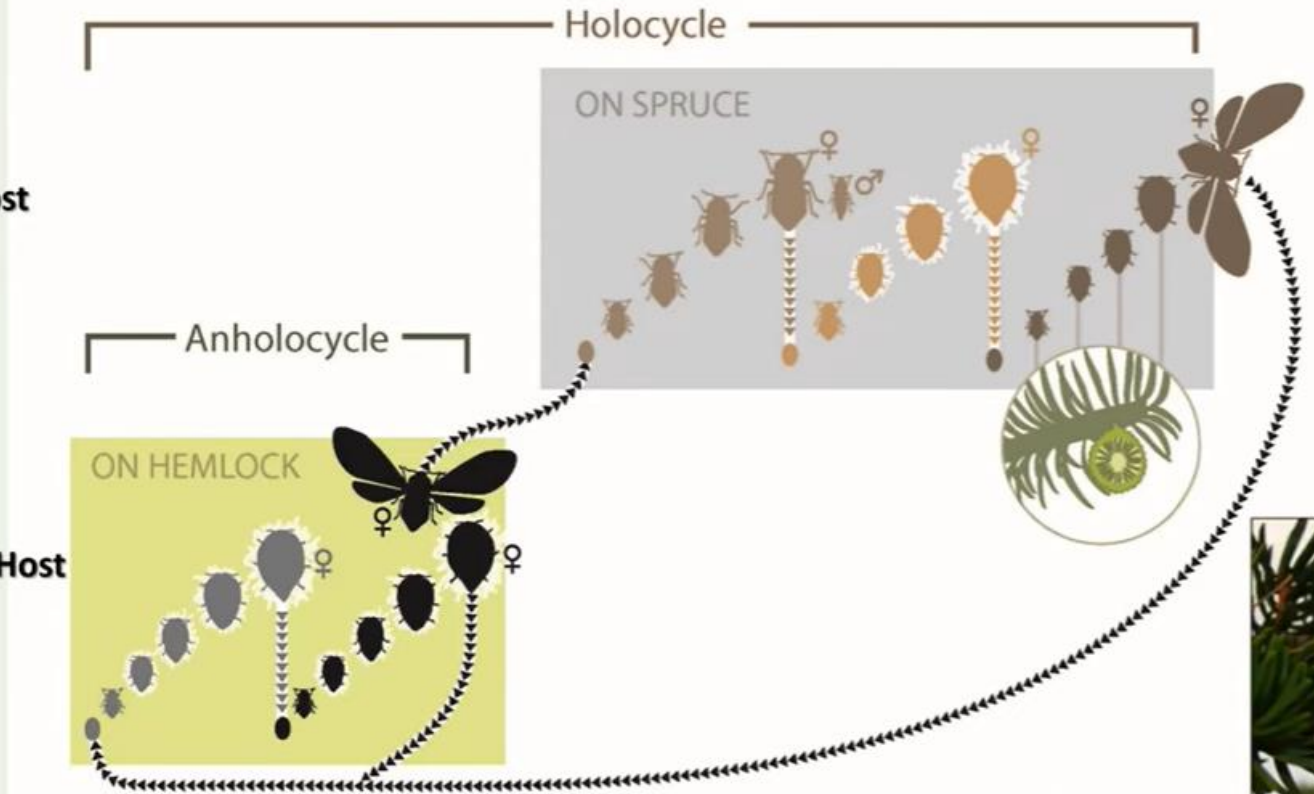
- On spruce form characteristic galls

- On alternate host generally have white, fluffy covering

HWA Life Cycle

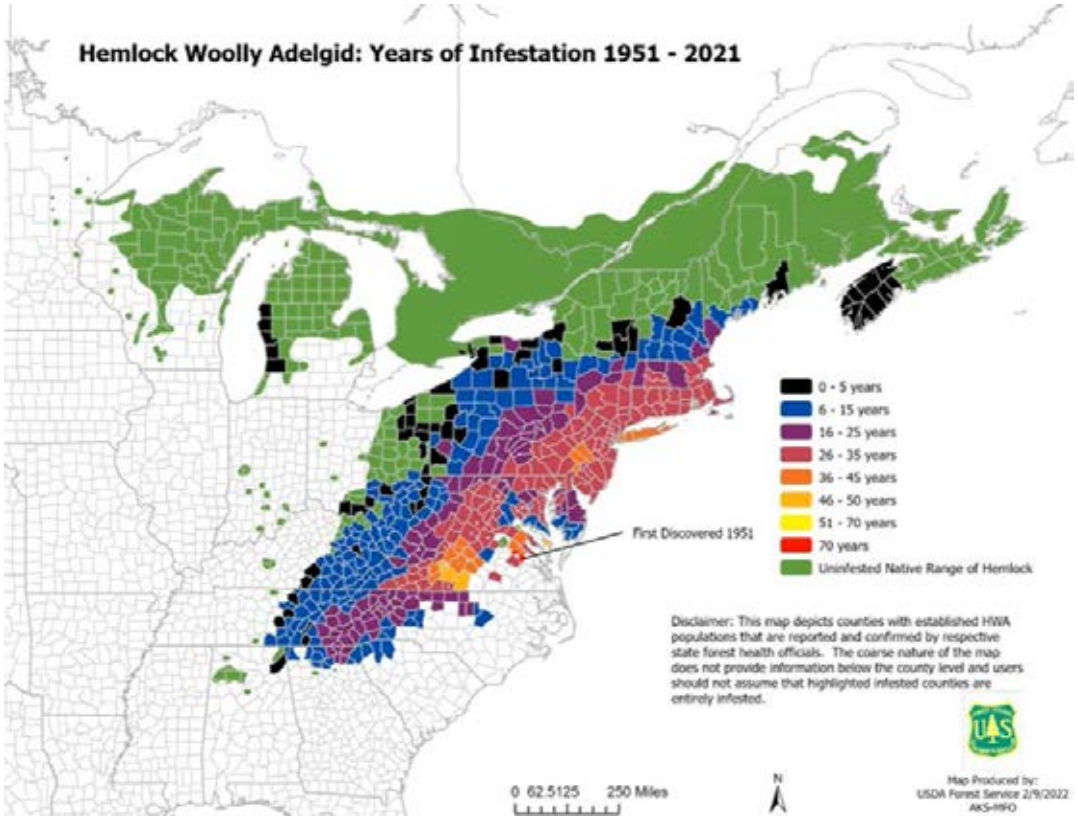
Spruce
Primary Host

Hemlock
Secondary Host



D'Amico and Havill, 2016

Hemlock woolly adelgid



- Native to Japan & maybe China – not a pest due to tree resistance and natural enemies
- Been in Western United States since 1924 - not a pest
- Damage noticed on East coast about 1951
- Destructive Pest of Eastern Hemlock and Carolina Hemlock

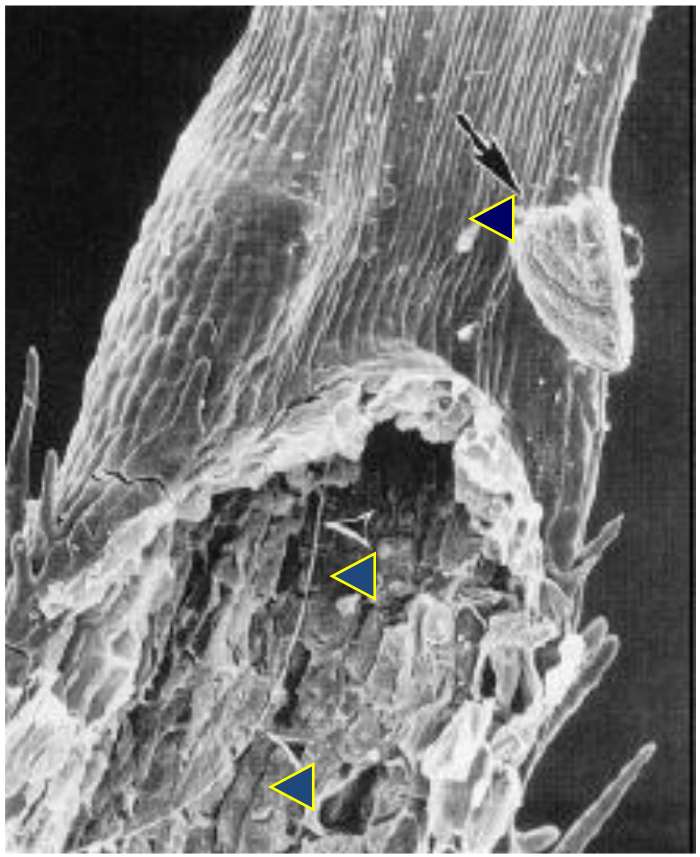
Hemlock woolly adelgid

Nymph with
‘wool’ removed

Egg Masses

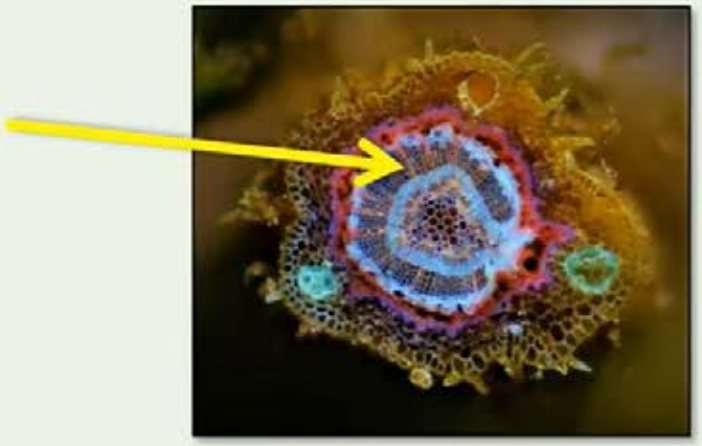
Hemlock wooly adelgid Feeding Site

Feeds in Xylem



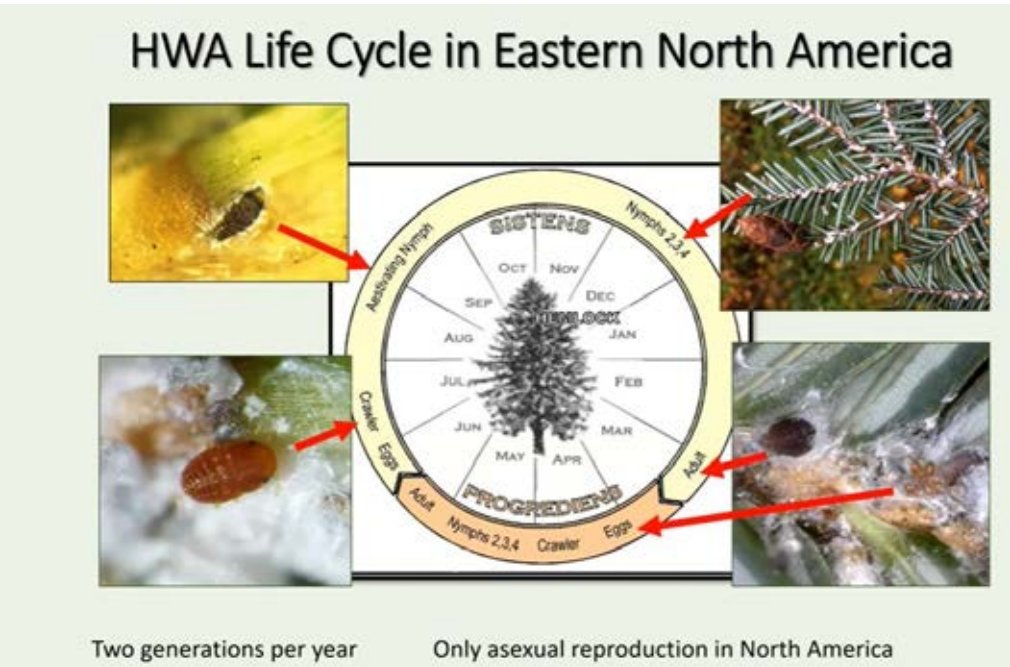
SEM's by Kathleen Shields, USFS

Impact on Eastern Hemlock



- Inserts mouthparts into TWIGS, usually near the base of needles, feeding on xylem ray parenchyma cells
- Feeding clogs conductive tissues in xylem, indirectly killing buds first, then the needles

Hemlock wooly adelgid Life Cycle



- Eggs laid in wooly sacs in March-May
- 1st generation matures, lays eggs in June
- 2nd generation nymphs crawl to base of needle, settle, enter dormancy until October
- 2nd generation matures over winter, lay eggs in March-May

Hemlock woolly adelgid

- Can kill trees in 1- 4 yrs.
- Systemic treatments (imidacloprid) most effective but can increase spider mite activity.
- Soil applications between late August and early December (before the soil is frozen) or from mid-March to mid-June.
- Horticultural Oil
  - – adults and eggs 3/15-4/30, all stages 6/1-6/15, mid July for dormant, mid-October for active nymphs

Hemlock woolly adelgid

Classical Biocontrol efforts for HWA

- 1992 *Sasajiscymnus tsugae* (Coleoptera: Coccinelliedae) from Japan
- 1995 *Scymnus spp*. (Cololeoptera: Coccinelliedae) from China
- 1997 *Laricobius nigrinus* (Coleoptera: Derodontidae) from Pacific Northwest
- 2005 *Laricobius osakensis* (Coleoptera: Derodontidae) from Japan
- 2008 *Leucotaraxis spp*. (Diptera: Chamaemyiidae) from West coast

adelgid (Homoptera)

Larva
Pseudoscymnus tsugae

Cooley spruce gall adelgid Two Hosts

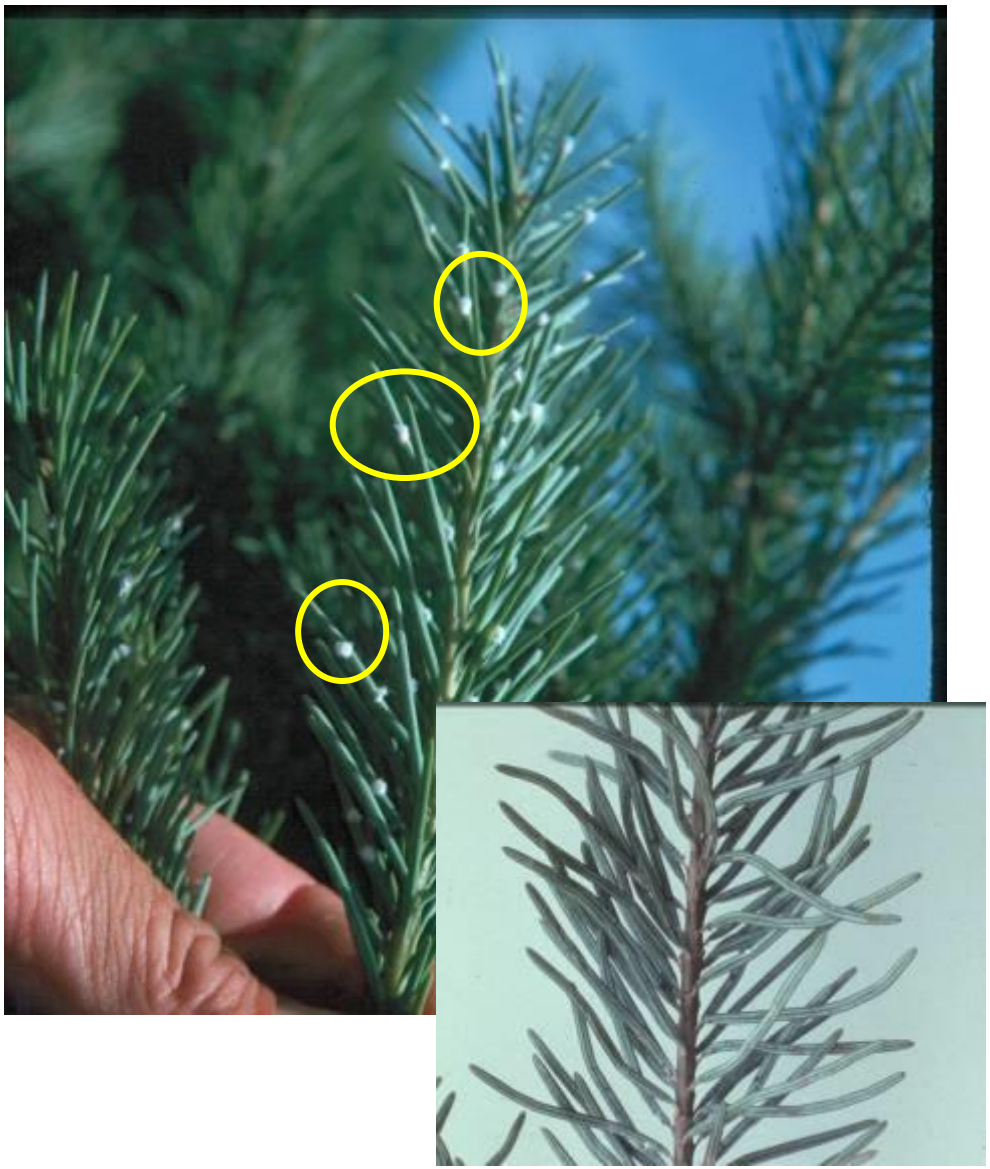
- ON SPRUCE
  - Immature females overwinter on twig terminals
  - Mature in April, lay eggs in white cottony masses on shoot terminals
  - Newly hatched nymphs cause galls to form on new growth
  - Live in galls till midsummer, galls dry and winged females emerge
  - Fly to another spruce OR to alternative hosts

Cooley spruce gall adelgid

Spruce Hosts – Blue Engelmann, and Norway

- Galls may disfigure trees
- Can prune off galls
- Chemical treatment for nymphs in early spring, or mid- late September e.g. horticultural oil, imidacloprid, bifenthrin

Cooley spruce gall adelgid

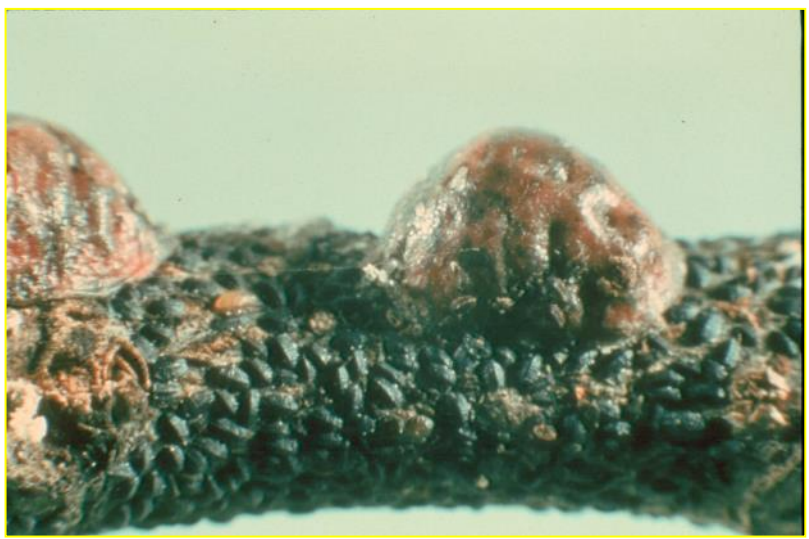


- Douglas Fir
- Winged females lay eggs which hatch to wooly adelgids
- Overwinter as immatures
- Cause distortion of needles/ needle drop/ unsightly
- Avoid planting near spruce (but can still cycle on each host)
- Horticultural Oil, bifenthrin, early May, July 26 – August 6

Scales: Homoptera

Soft Scales

- Have attached Soft Waxy Covers
- Suck Sap
- Produce Honeydew

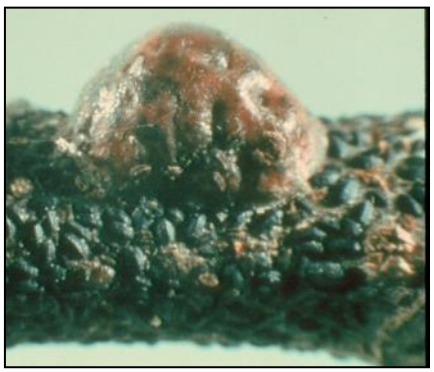


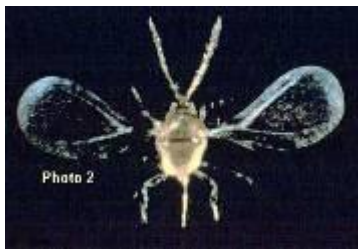
Hard Scales

- Live under Armored Waxy Covers
- Suck cell contents
- DON'T Produce Honeydew

Scale Life Cycle

Adult female





Adult male

Eggs laid under
Female's Scale

VUNERABLE STAGE

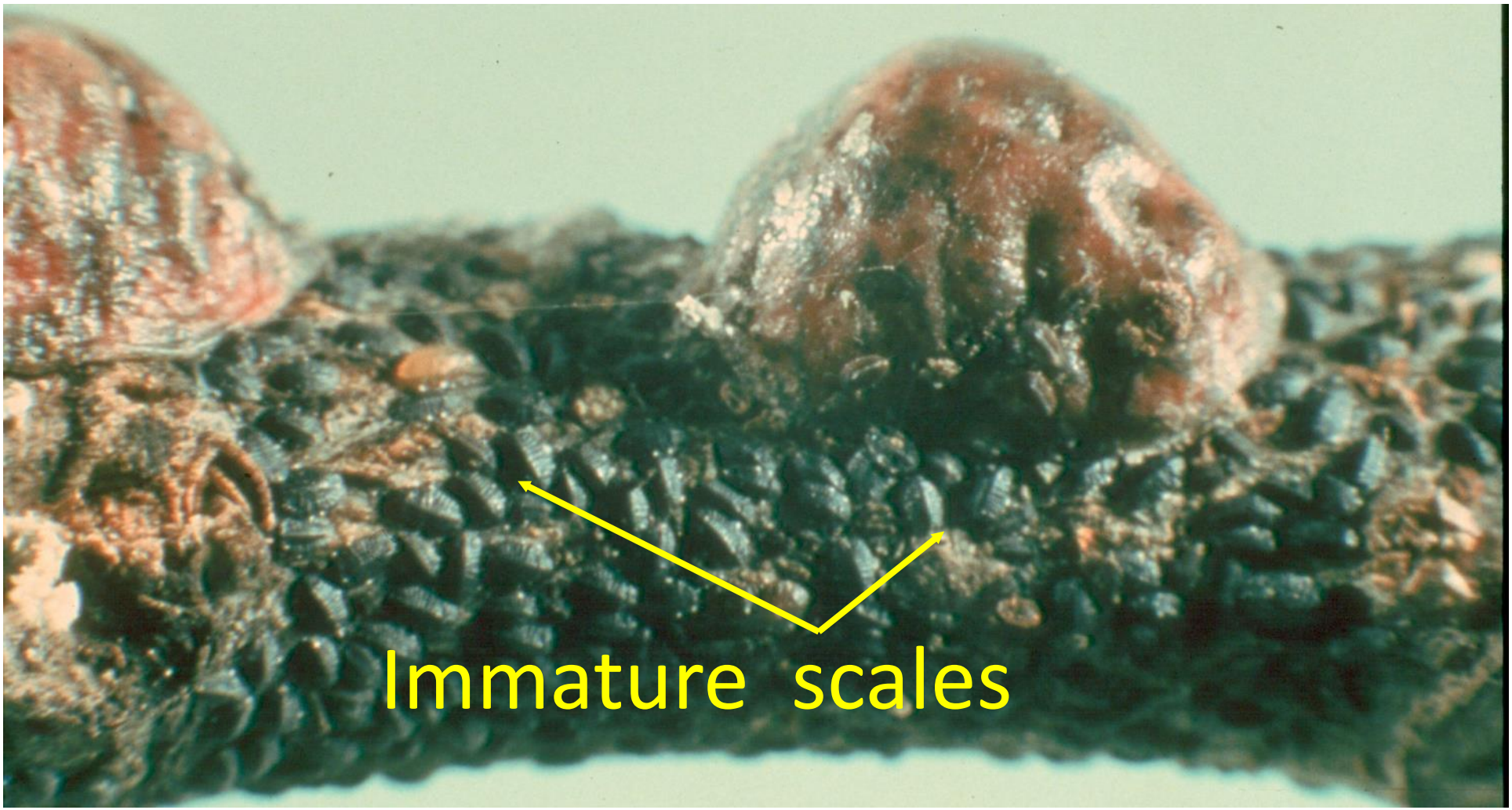
Immatures - Crawlers

Tuliptree scale

soft scale (Homoptera)

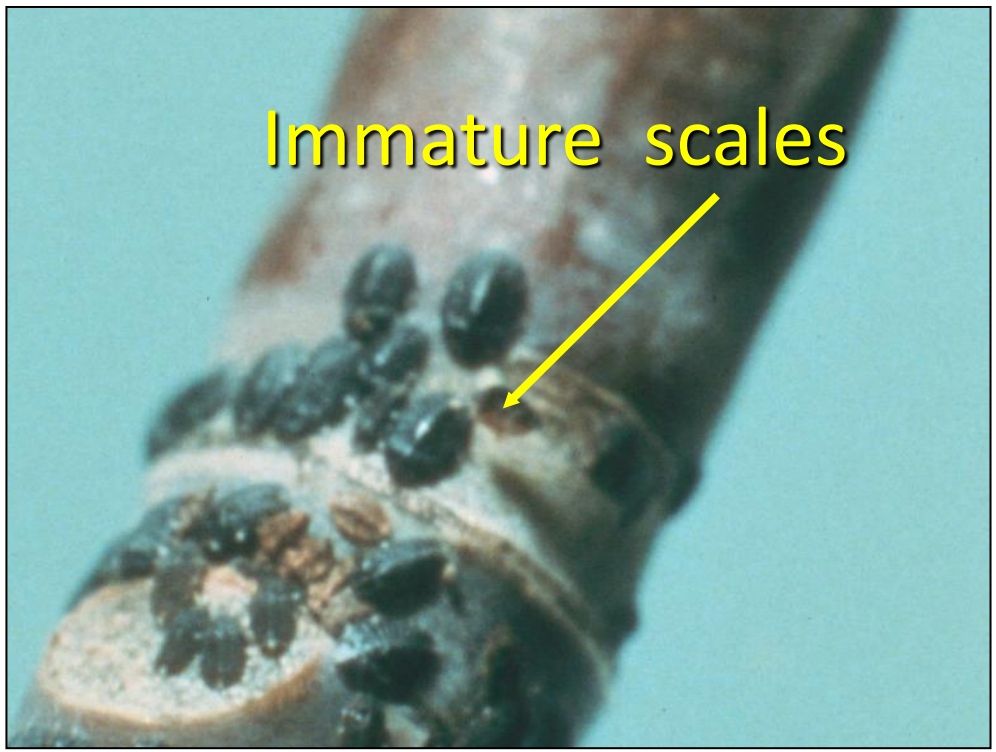
Tuliptree scale

soft scale (Homoptera)



Tuliptree scale

soft scale (Homoptera)



- Hosts – Tuliptree, Linden, catalpa, magnolia
- 1 Generation / yr – overwinter as crawlers
- Lots of honeydew → sooty mold
- May kill branch
- Often controlled by Natural Enemies
- Horticultural Oil in late March – early April

Beech scale

soft scale (Homoptera)

Scales

Spores

- Present on Trunk
- Allows Fungal Disease
- One generation / yr., crawlers overwinter
- Treat in Spring with horticultural oil
- Once diseased no treatment

Elongate hemlock scale

Armored Scale

- Introduced into New York in 1908
- Hosts- Hemlock, fir, spruce, pine
- 2 Generations / year overwinter as mature females
- All stages present through summer
- Yellowing, needle loss, death
- Horticultural Oil before bud break
- Foliar Sprays WHEN crawlers active – two peaks May and September
- Do not use nitrogen fertilizers

Scale Management

- Resistant Cultivars
- Natural Enemies: Parasitic Wasps, Ladybeetles
- Horticultural Oils
- Foliar/ Bark Sprays
- TIMING: Need to target Crawlers, adults resistant due to waxy covering
- Hard vs. Soft: Check labels!

  systemic insecticides only work on soft

Katherine Dugas, M.S. CAES

Spotted Lanternfly

- “New kid on the block” – found in southeastern PA in 2014
- Effective hitchhiker, moves through trade and travel
  - Egg masses like SM, well camouflaged
- 2020 found in Greenwich and West Haven
- Large planthopper, related to cicadas and aphids
  - Turgor-pressure feeder, sucks on sap, produces honeydew
- Preferred reproductive host is tree-of-heaven
- Threat to local agriculture, 65 known hosts
  - Large infestations in the fall create lots of honeydew, are a nuisance and can appear alarming

Spotted Lanternfly

- *Lycorma delicatula*
- Native to China, India, Vietnam
- Invasive species in Korea since 2006
- Found September 2014 in PA, first North American record

Lanternflies - Fulgoridae

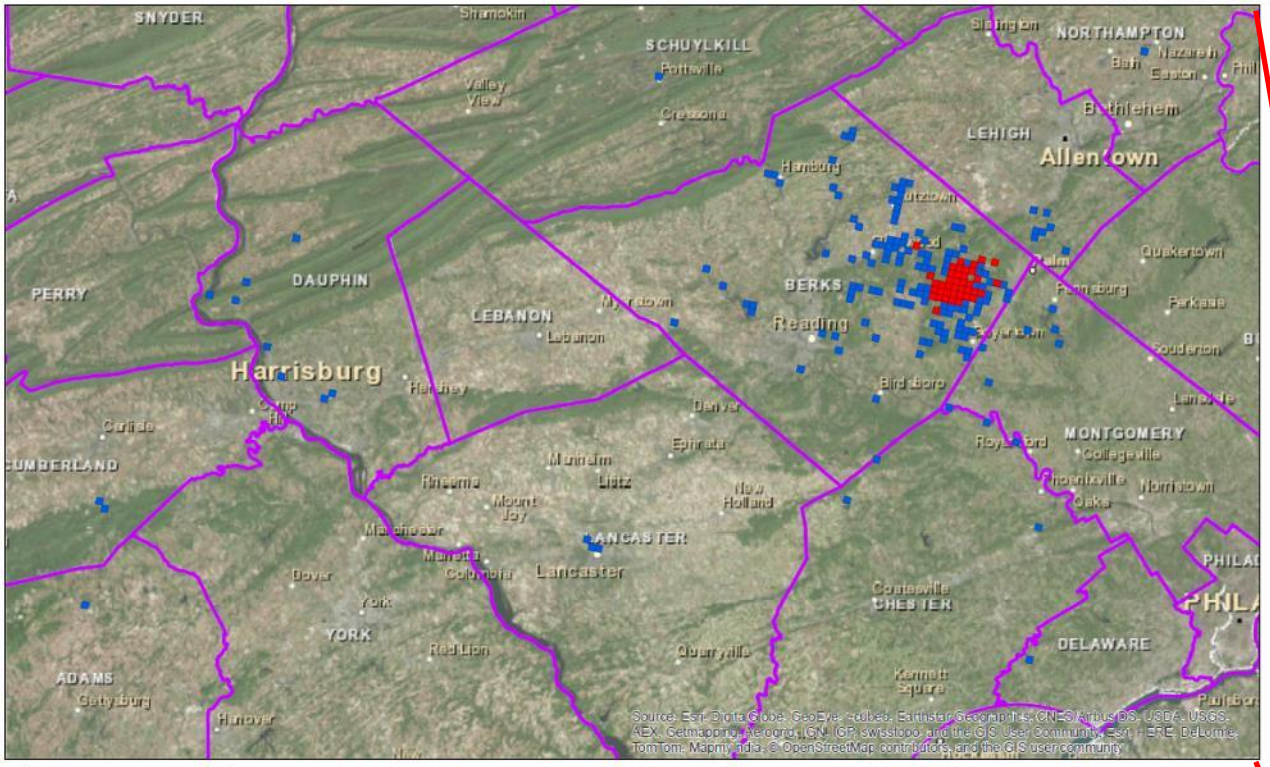
- Planthoppers – related to aphids, cicadas, and stink bugs
- Many are large and colorful, especially tropical species
- Named after the elongated head found in some species, which was once believed to be luminescent.

First Detection of Spotted Lanternfly: Berks County, PA

Late 2014

Lycorma Detection Survey

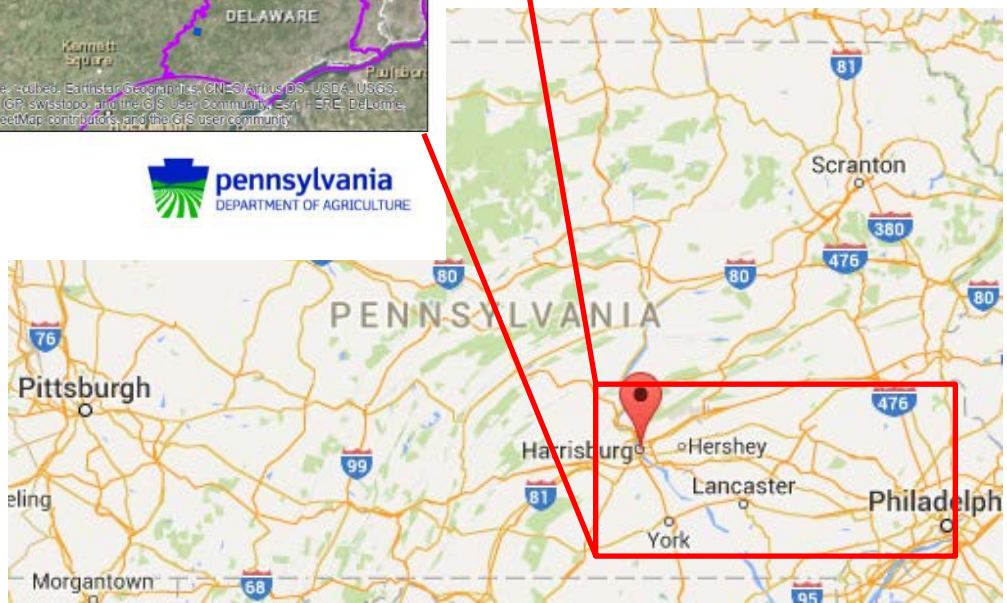
Results Through 15 December 2014



Survey Grids

- Surveyed - Positive
- Surveyed - Not Found

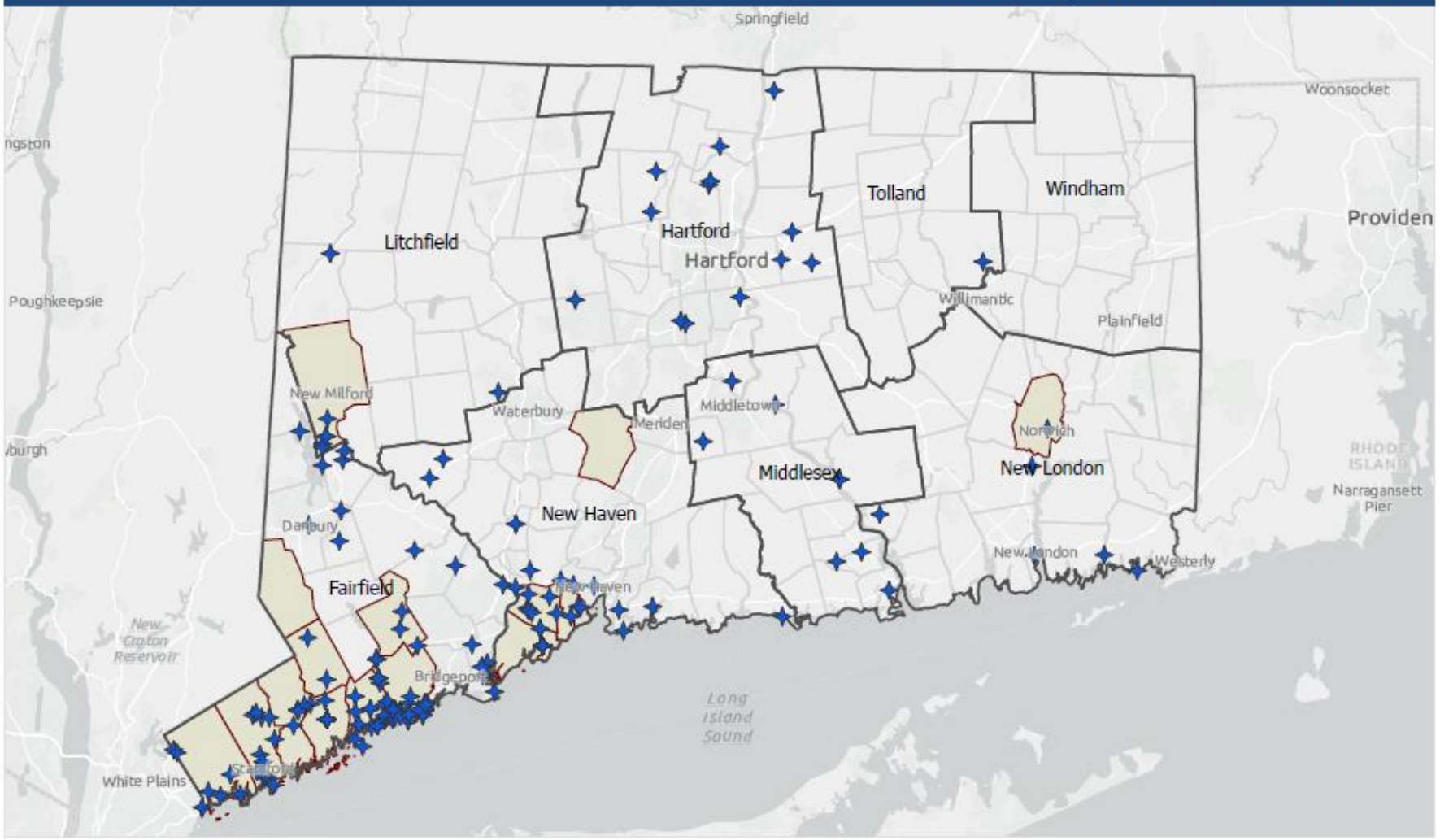
pennsylvania
DEPARTMENT OF AGRICULTURE



USDA United States Department of Agriculture

PPQ CT SPOTTED LANTERNFLY (LYCORMA DELICATULA) PROGRAM

CAES SLF Reports and State SLF Quarantine



CT County Boundary

CT Town Boundary

CT SLF Quarantine Towns

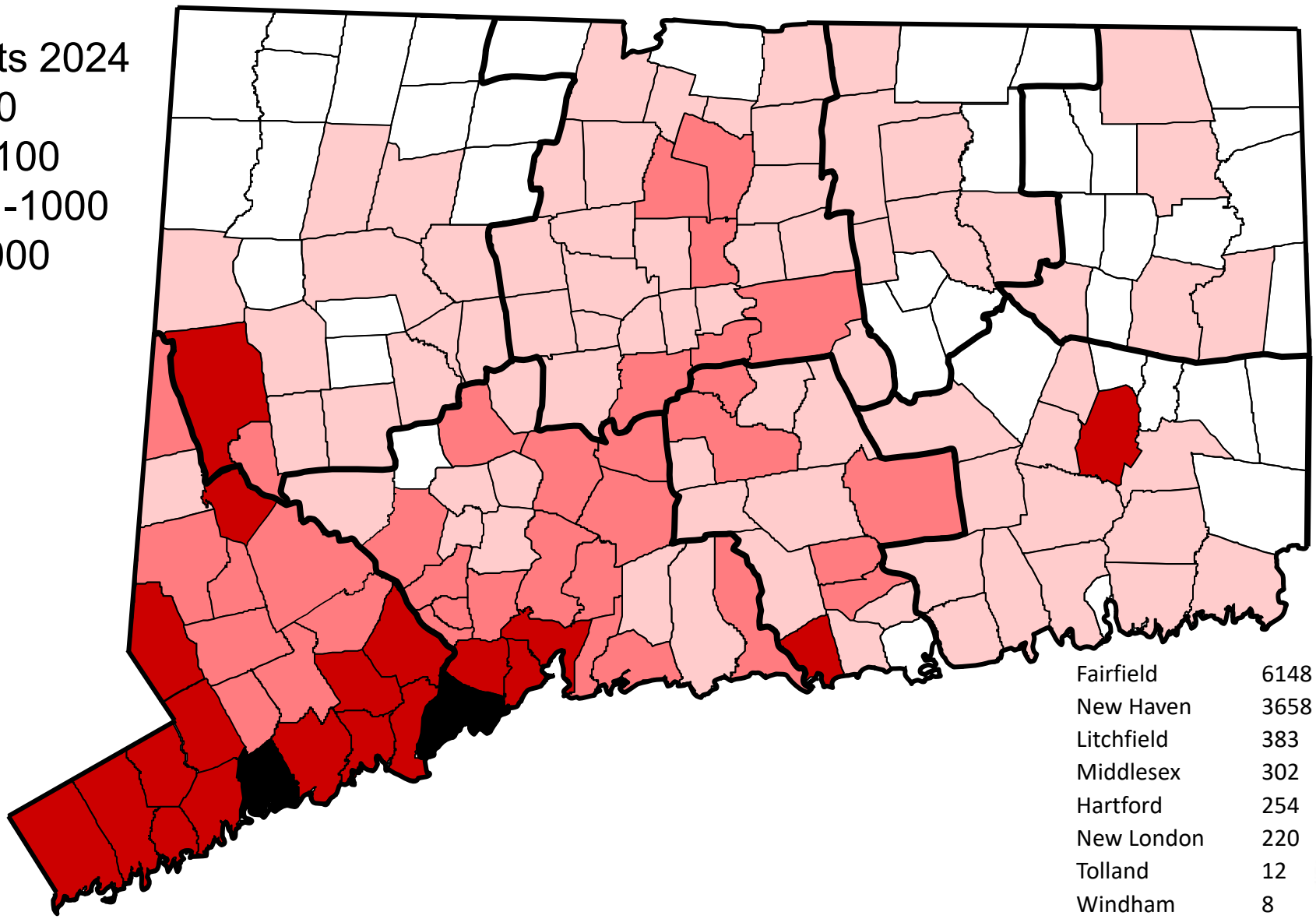
CAES SLF Reports (9/27/2022)

0 10 20 Miles

0 10 20 Kilometers

Date Created: 9/29/2022

USDA APHIS
97 Barnes Rd
Unit 20
Wallingford, CT 06492



Fairfield	6148
New Haven	3658
Litchfield	383
Middlesex	302
Hartford	254
New London	220
Tolland	12
Windham	8

CAES

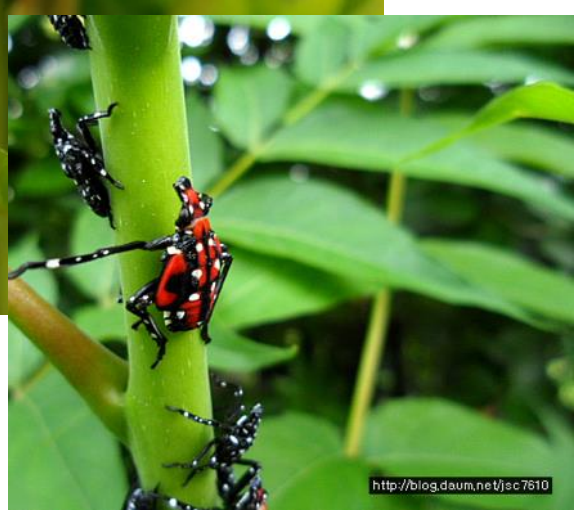
Spotted Lanternfly Hosts

They are phloem-feeders with piercing-sucking mouthparts; much like aphids

- stone fruit trees
- pine
- oak
- walnut
- poplar
- <u>tree of heaven (*A. altissima*) – preferred host</u>
- grape –Korean literature and PA have reported damage to vines, increased winter kill

Life Cycle

- Nymphs are black with white spots, later instars have red patches
- Nymphs feed on smaller plants and vines, moves to trees as they mature
- Feeding damage similar to aphids, honeydew can collect at plant base, large amounts from heavy infestations may produce fungal mats.



Lifecycle Timeline

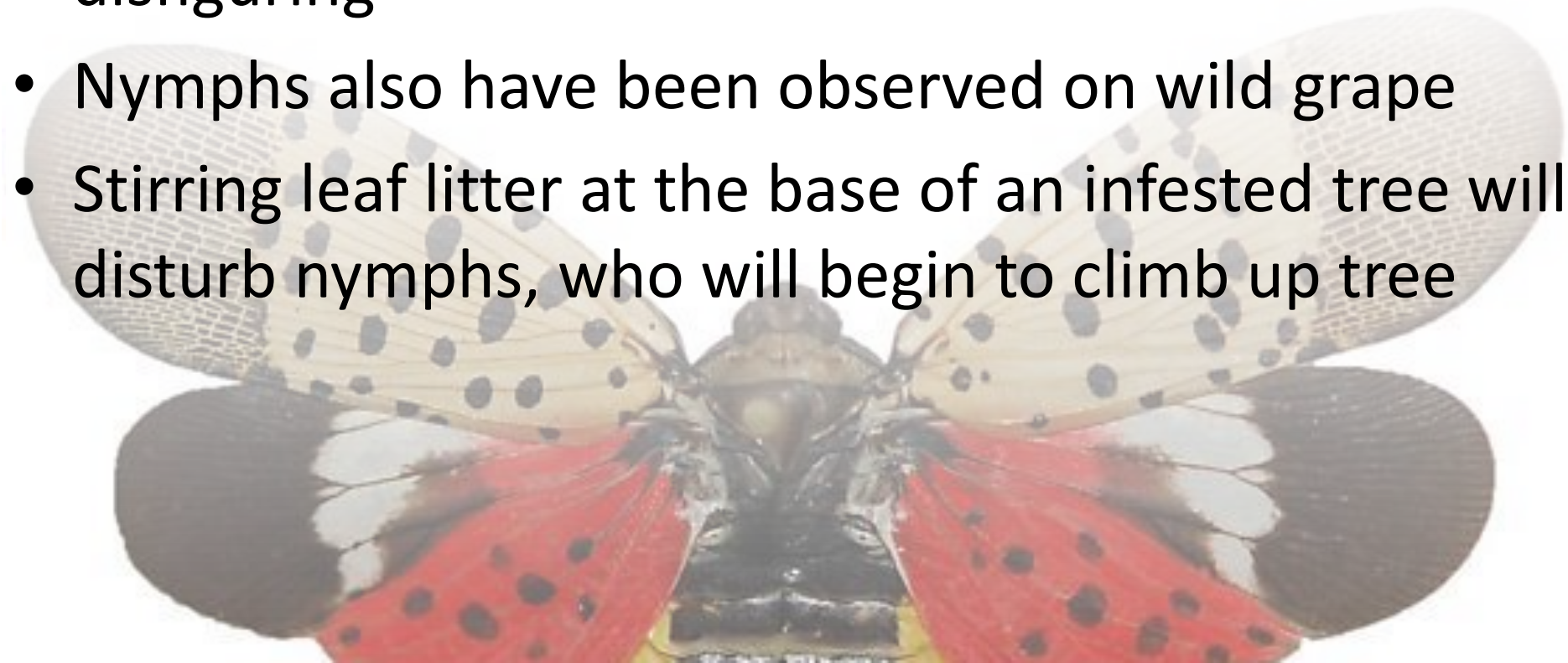
- November – April: Egg masses overwinter
- May: Nymphs emerge
- June – July: Nymphs develop, potential early adults
- August: Adults begin appearing
- September: Adults feed, disperse, mate
- October: Females oviposit egg masses

Life Cycle

- Adults could appear as early as July but start mostly in August
- Adults prefer Tree of Heaven as host for feeding, congregating and egg laying
- Adults are not strong fliers but are good jumpers – can travel!
- Egg masses are laid on under a waxy deposit – similar to gypsy moth but harder to spot!
- Egg masses may be laid on smooth barked trees or smooth vertical surfaces such as stonework – can be moved!

Observations from PA:

- Nymphs are feeding on the upper sides of leaves on oak and ailanthus, causing discoloration and disfiguring
- Nymphs also have been observed on wild grape
- Stirring leaf litter at the base of an infested tree will disturb nymphs, who will begin to climb up tree



Monitoring for Spotted Lanternfly

- Survey is visual; no lures currently available though potential attractant pheromone isolations are in progress
- Sticky bands/Tanglefoot have been used to trap and detect nymphs and adults
- Tree-of-Heaven is a preferred host; it may help in establishing new populations, so surveys should focus on areas with established *Ailanthus*.
- Egg masses laid on furniture or stonework (or vehicles!) could be moved and spread infestation in a similar way to gypsy moth

Insects That Chew


Moths (Lepidoptera)

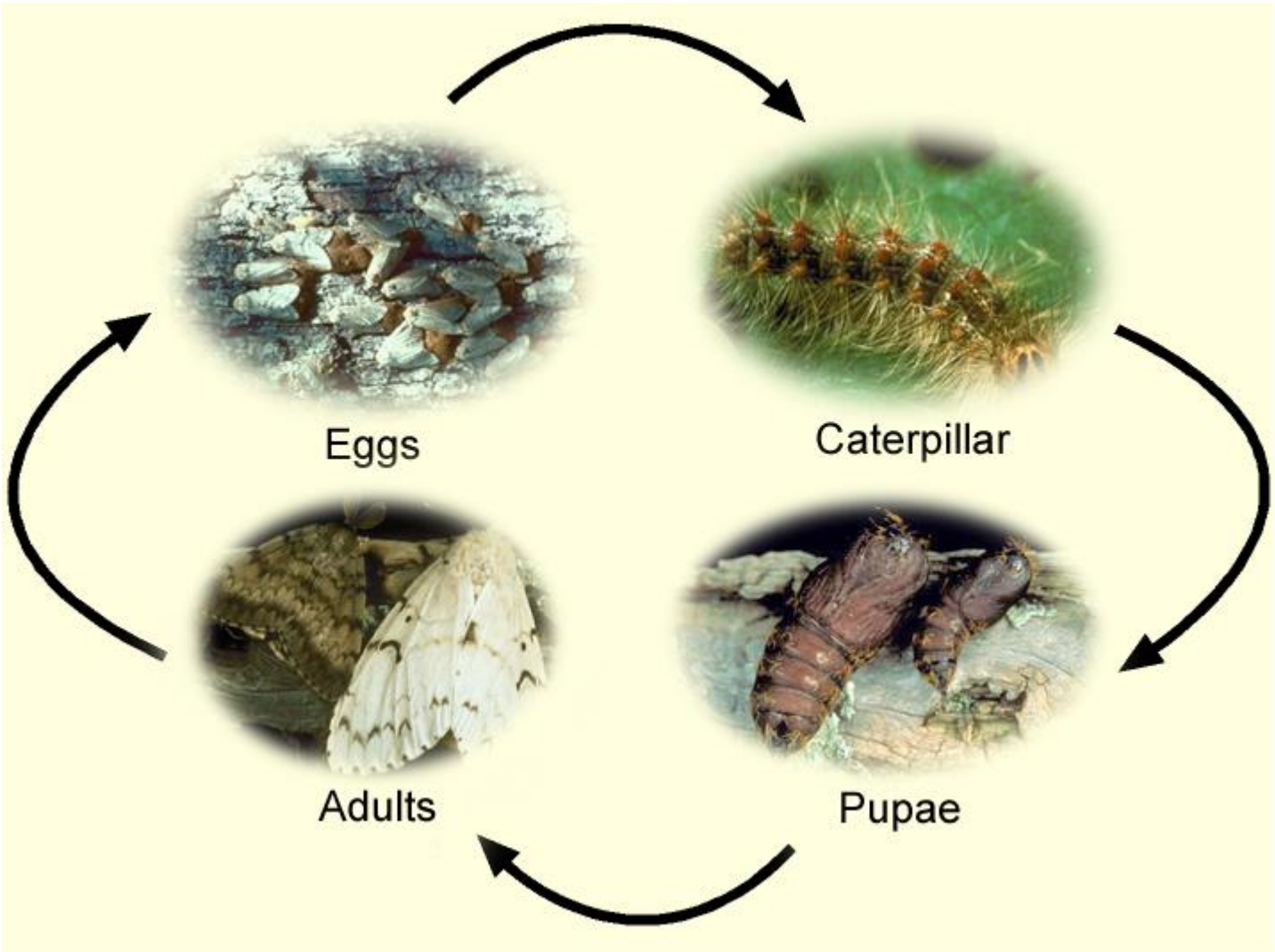

Beetles (Coleoptera)


Sawfly (Hymenoptera)

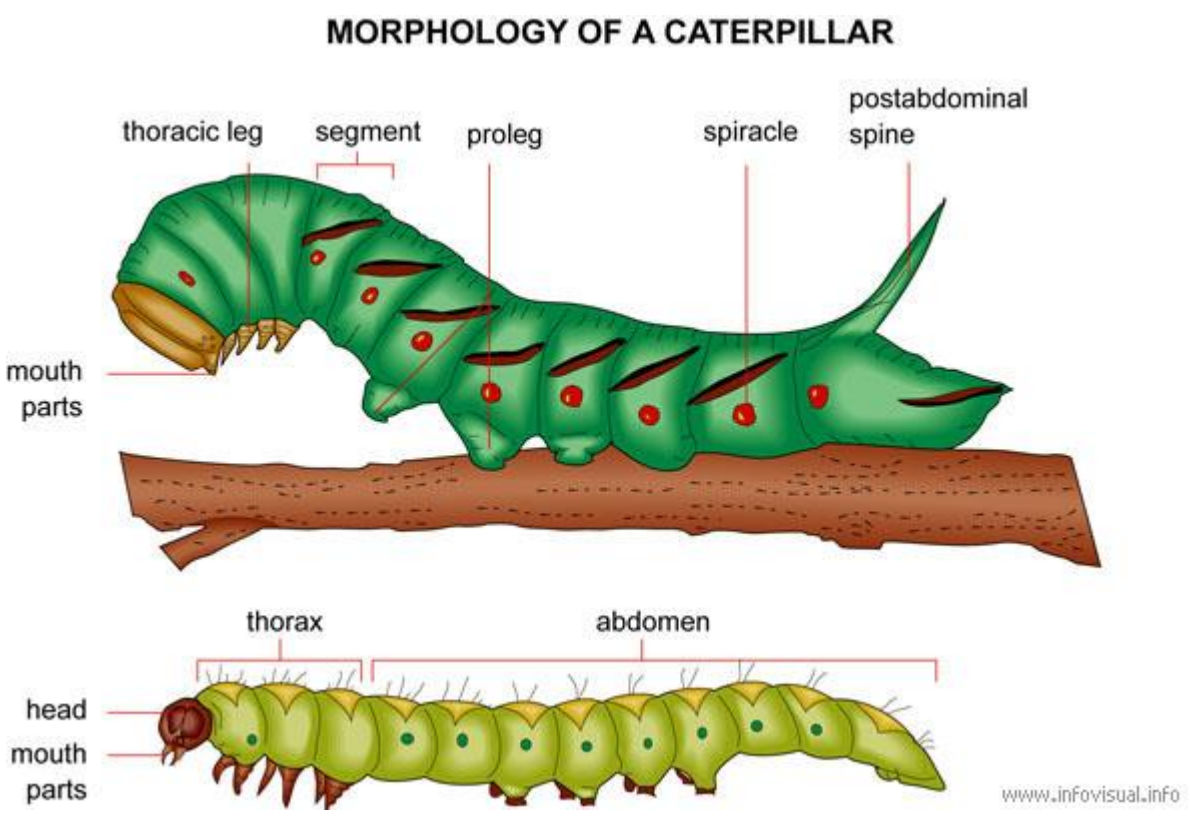

Fly (Diptera)

Moths: Lepidoptera

Moths Life Cycle

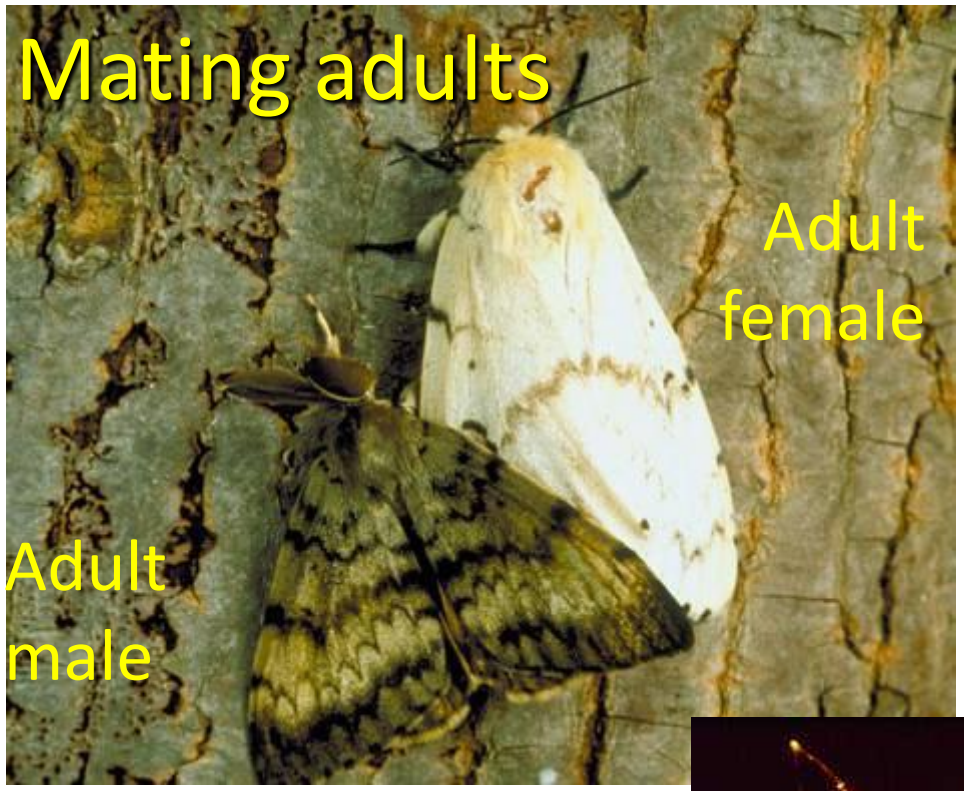


Caterpillars – Larval Moths

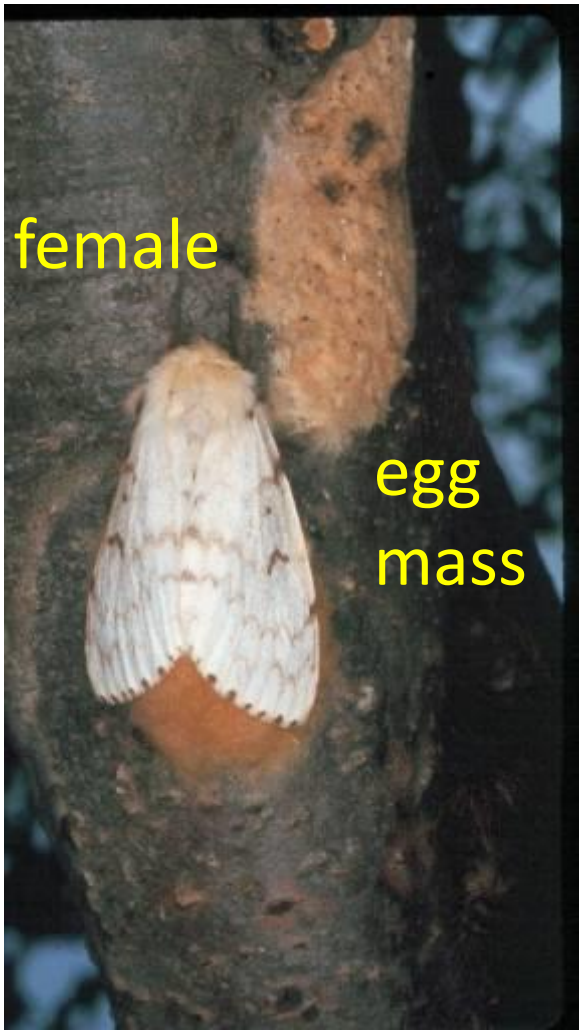


Gypsy moth

moth (Lepidoptera)



Adult male



Gypsy moth

moth (Lepidoptera)

Spongy moth

moth (Lepidoptera)

Winter in June

Favored Spongy Moth Host Trees

- Oaks, White Oak is most preferred
- Paper Birch
- Hophornbeam
- Basswood
- …. And when there is

an outbreak, anything it can get its mandibles on!

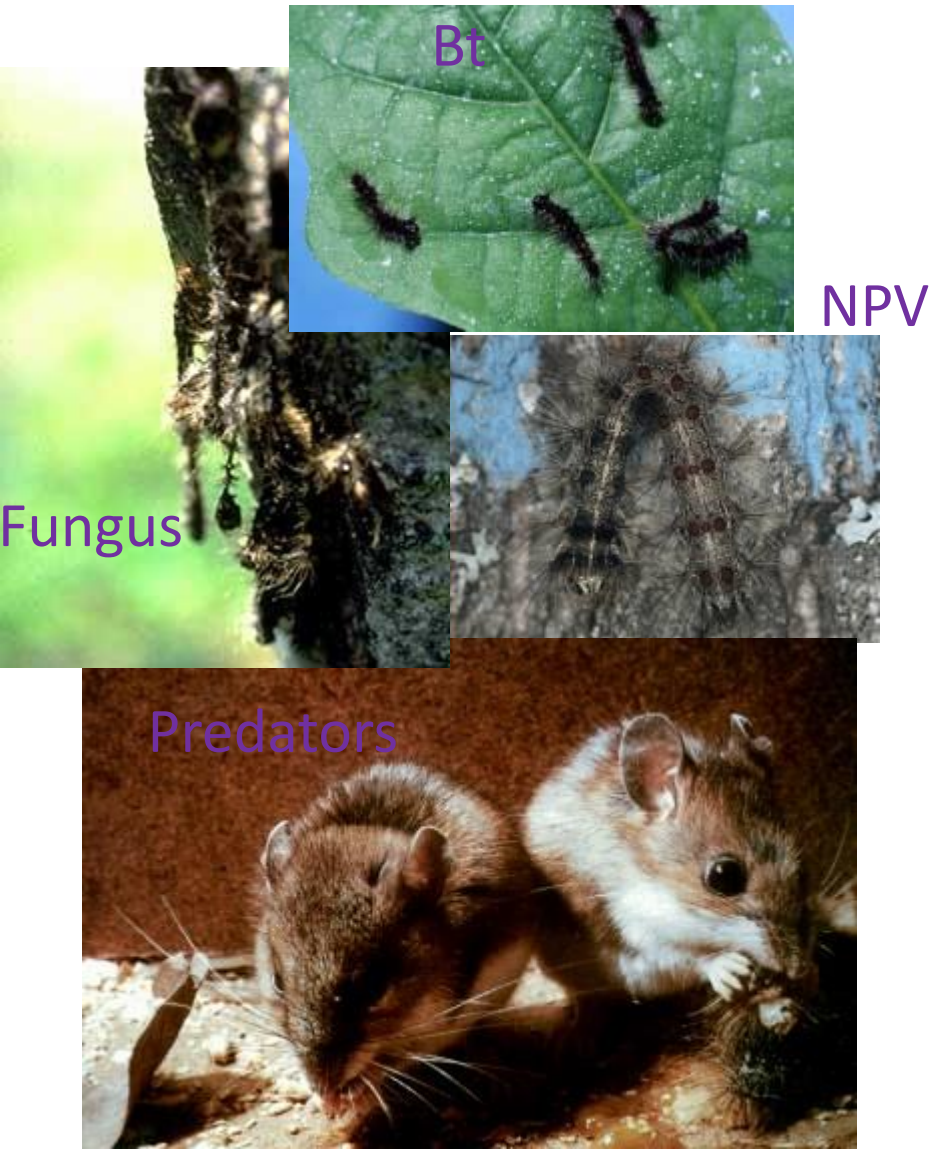
White Oak

Spongy moth

moth (Lepidoptera)

- One generation/ year
- Overwinter as eggs
- 1st instar is dispersal stage/ balloon
- Larvae eat at night, hide by day
- Larval feeding done by late June
- Females can’t fly (not true for Asian Gypsies)
- Males find females by sex pheromone

Spongy Moth Management

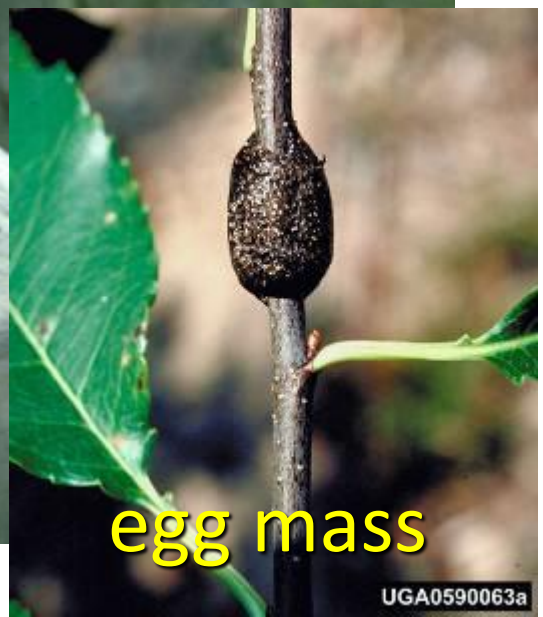


- Gypsy moth outbreaks in cycles.
- Outbreaks ended by natural enemies, viruses, FUNGUS, (epidemics) predators, parasitoids
- Area-wide management (forests): aerial spraying of virus or bacteria
- Specific trees protect with burlap bands, sprays: virus, conventional insecticides (lots)
- Target young caterpillars, older ones harder to kill

Eastern Tent Caterpillar

moth (Lepidoptera)

mature larva



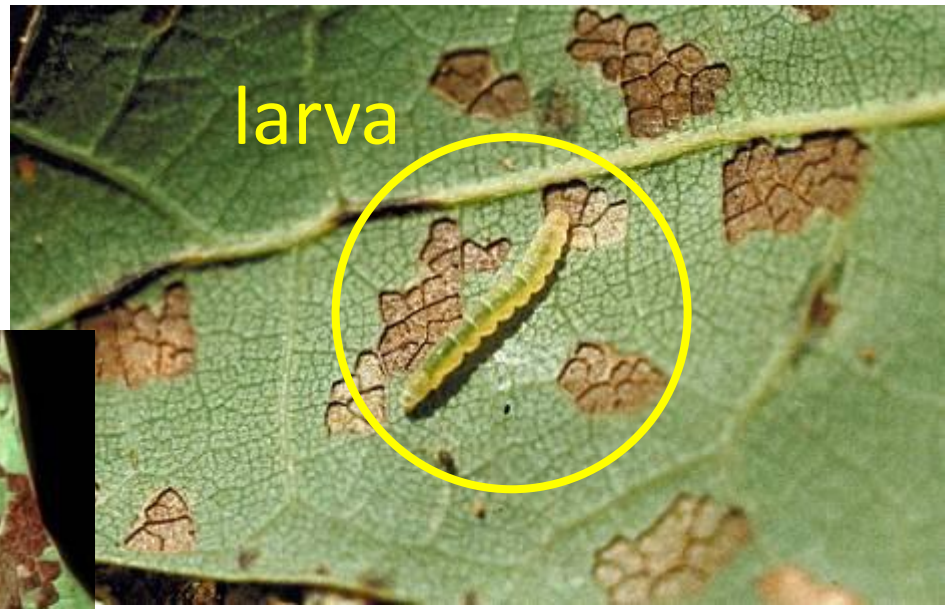
Eastern Tent Worm Management

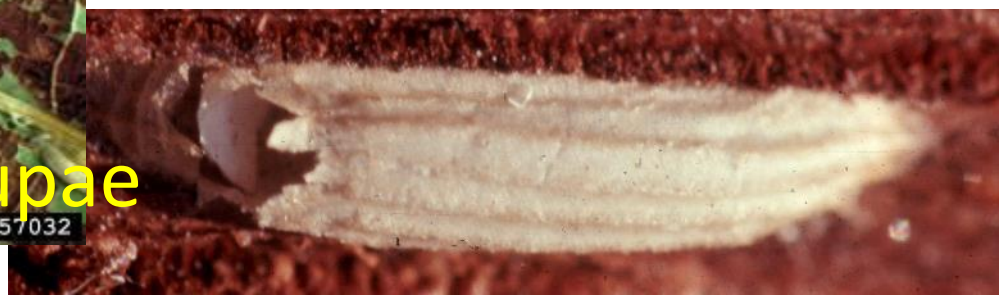
- Hosts – wild cherry, apple, elm maple, others
- Hatch in early spring/ timed to wild cherry
- Feed during day/ in tents at night
- One generation / yr.
- Can remove egg masses

Oak skeletonizer

moth (Lepidoptera)

adult

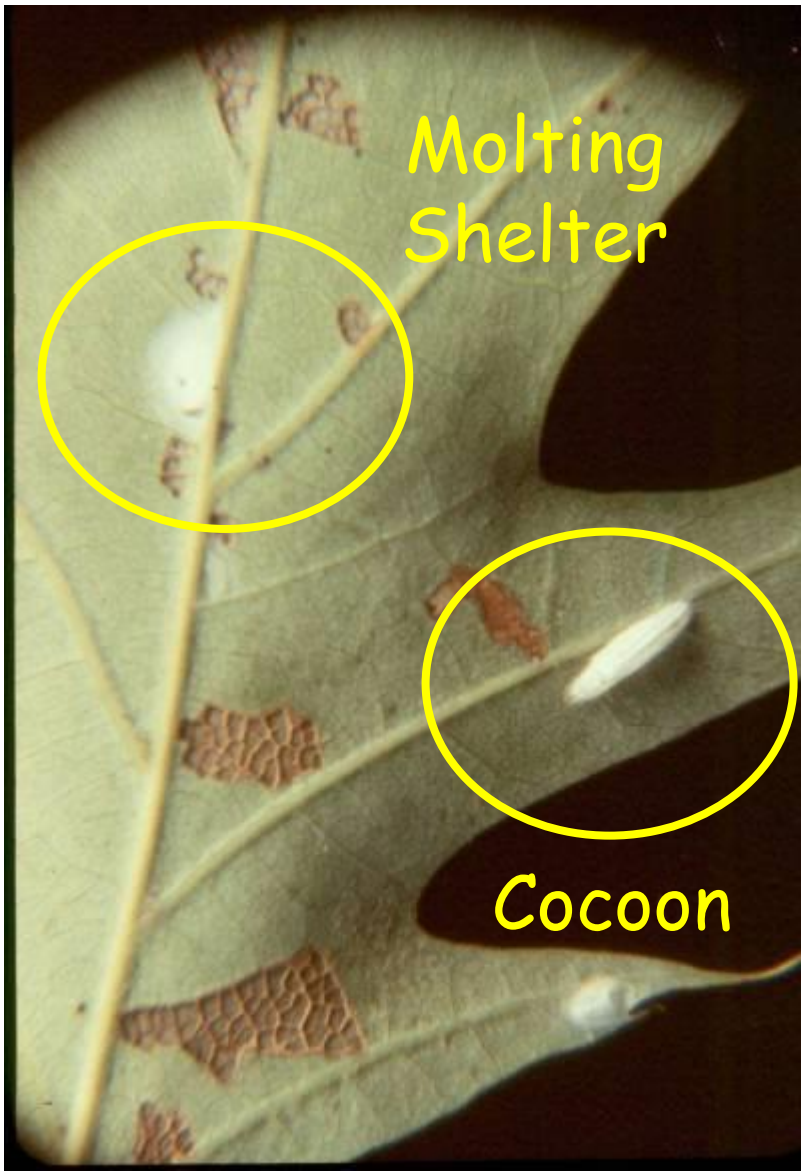




Oak skeletonizer

moth (Lepidoptera)

Oak Skeletonizer Management



- Hosts – Oaks
- 2 gens. / yr. Larvae active 6/4-20 & 8/7-24
- Occasionally high enough levels to be damaging –usually a nuisance due to larvae dropping on silk, and numerous cocoons
- If necessary, spray when large numbers of young larvae

Arborvitae leafminer

moth (Lepidoptera)

egg

Arborvitae leafminer

moth (Lepidoptera)

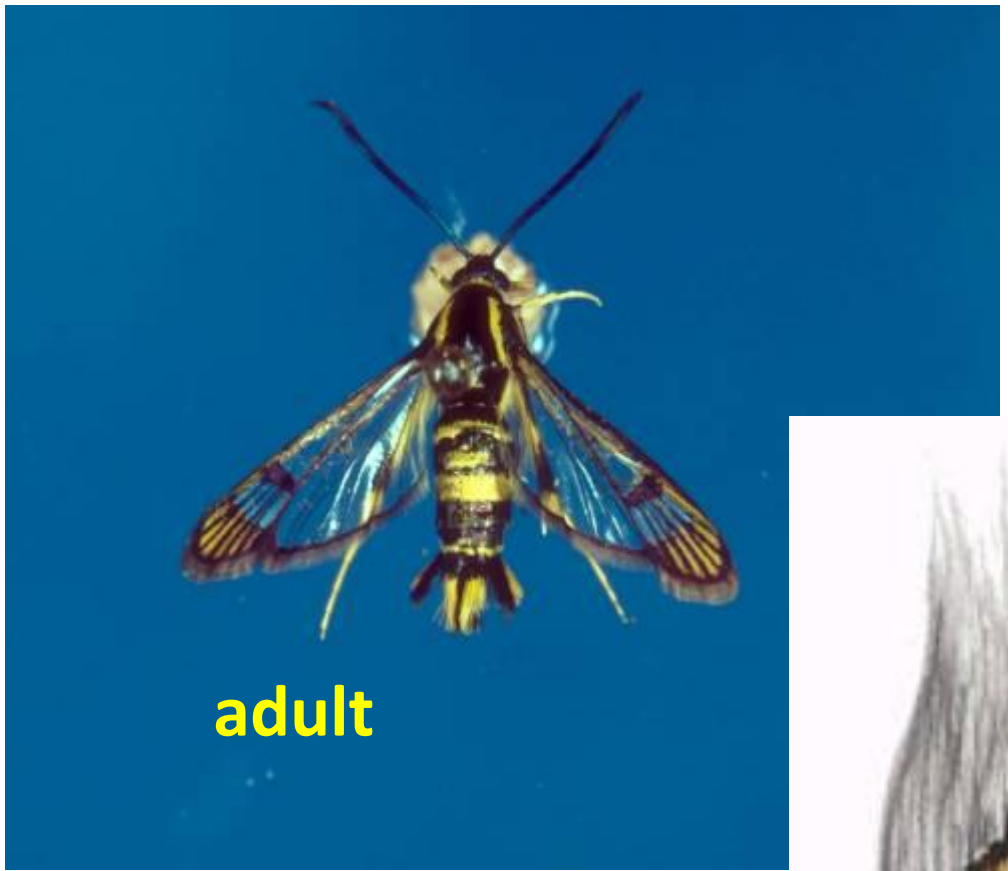
Damage
(Mined needles)

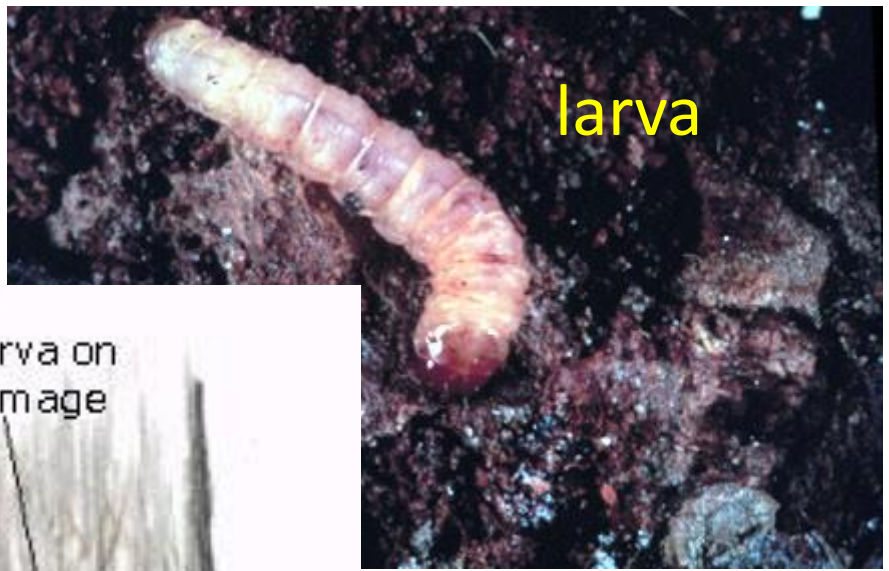
Arborvitae Leafminer Management

- Host – Arborvitae
- Moth – mid May to June
- Larvae – mid June / overwinter as larvae
- Damage on tips of twigs
- Usually only aesthetic damage
- Trim and discard brown tips
- If needed – overwintering larvae treat 5/10-22, adults 6/10-20, summer larvae - 8/7-16 imidicloprid, acephate for adults

Dogwood borer

moth (Lepidoptera)





Dogwood borer

moth (Lepidoptera)

Dogwood Borer Management

- Hosts – Flowering dogwood, apple, mountain ash, oak, other deciduous trees
- Larvae feed on cambium, girdle tree
- Adults emerge mid May. Peak is late June – mid July.
- Monitor adults with pheromone traps
- Larvae can only get in wounds or cracks: Avoid bark damage
- Control : one bark drench 14 days after 1st adult caught e.g. permethrin

Sawflies (Hymenoptera)

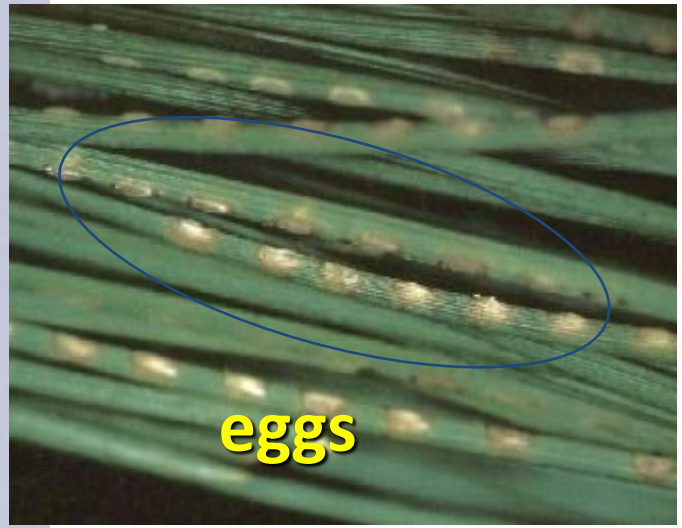
Sawfly (Hymenoptera)

DEFOLIATOR

European Pine Sawfly & Redheaded Pine Sawfly sawfly

(Hymenoptera)

adult



larvae

DEFOLIATOR

European Pine Sawfly & Red Headed Pine Sawfly sawfly (Hymenoptera)

European Pine Sawfly

sawfly (Hymenoptera)

- Hosts- Pines
- One generation per year
- Eggs Overwinter
- Hatch in late April
- Feed gregariously on older needles till mid May
- Trees < 15 ft most at risk
- Feed from top to bottom of tree

Redheaded Pine Sawfly

sawfly (Hymenoptera)

- Hosts – Pines
- One generation per year
- Overwinter in cocoons in ground
- Trees < 15 ft most at risk
- Larvae feed gregariously in June

European Pine & Redheaded Pine Sawfly Management

- Scout pine trees beginning late-April to mid-May
- Infestations sporadic/ lots of Natural Enemies
- Spot treatment often adequate

Holly Leafminer

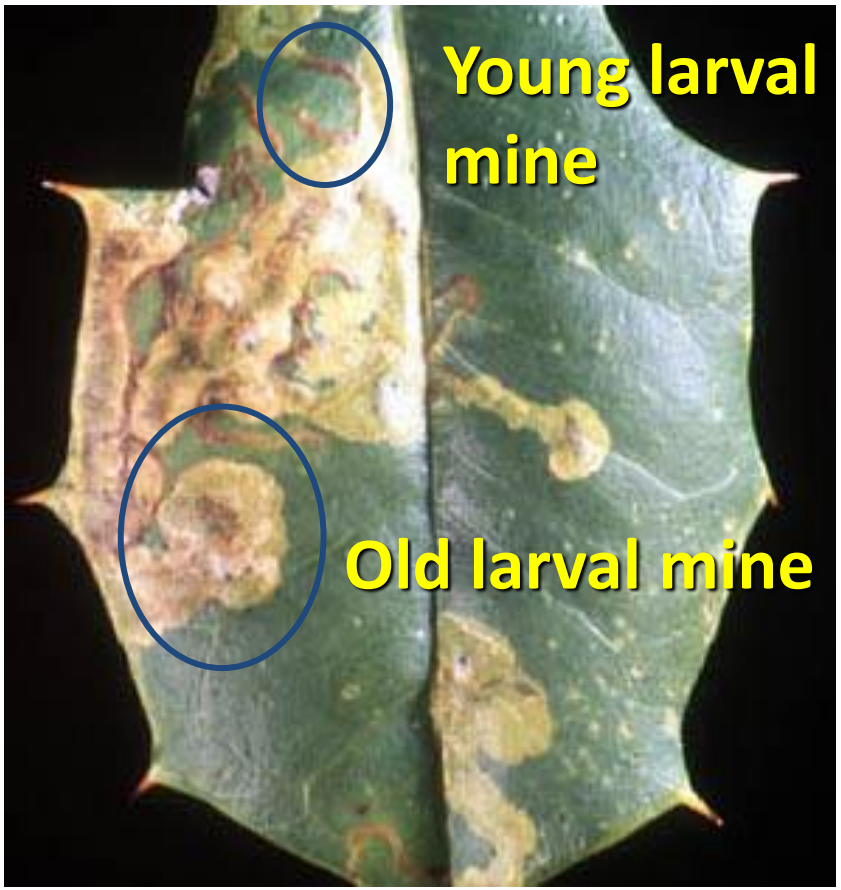
fly (Diptera)

Holly Leafminer

fly (Diptera)

Holly leafminer

fly (Diptera)



- Hosts – Holly
- Adults appear mid-to-late May
- Maggots yellow
- Maggots overwinter in mine, can see now
- One generation per year

Holly Leafminer Management

- Damage mainly aesthetic, in heavy infestations may lose leaves
- Lays eggs only American Holly
- Gather and destroy dropped leaves w/ mines
- Soil treatment with systemic between 5/14-24
- Foliar spray for adults 5/21-6/5, must cover tops and bottoms of the leaves. Can fine tune timing by looking for oviposition/ feeding scars

Beetles (Coleoptera)

Beetle Grubs (larvae) (Coleoptera)

Black vine weevil

beetle (Coleoptera)

- Intro 1910 CT
- Hosts – Taxus, hemlock, rhododendron, azalea, mountain laurel
- One generation/ year
- Adults feed on leaves at night, hide in leaf litter by day
- Can’t fly, so move in pots
- Larvae overwinter in soil, feed on roots in spring

Black Vine Weevil Management

- Larval damage in spring most serious
- Monitor for adults by creating hiding space on ground with burlap, then look during day
- Goal: prevent egg laying. Control adults between 6/10-20, 3 weeks after first seeing adults
- Larvae may be controlled by entomophathogenic nematodes in soil drench, most effective in pots Rich Cowles

White Pine Weevil

beetle (Coleoptera)

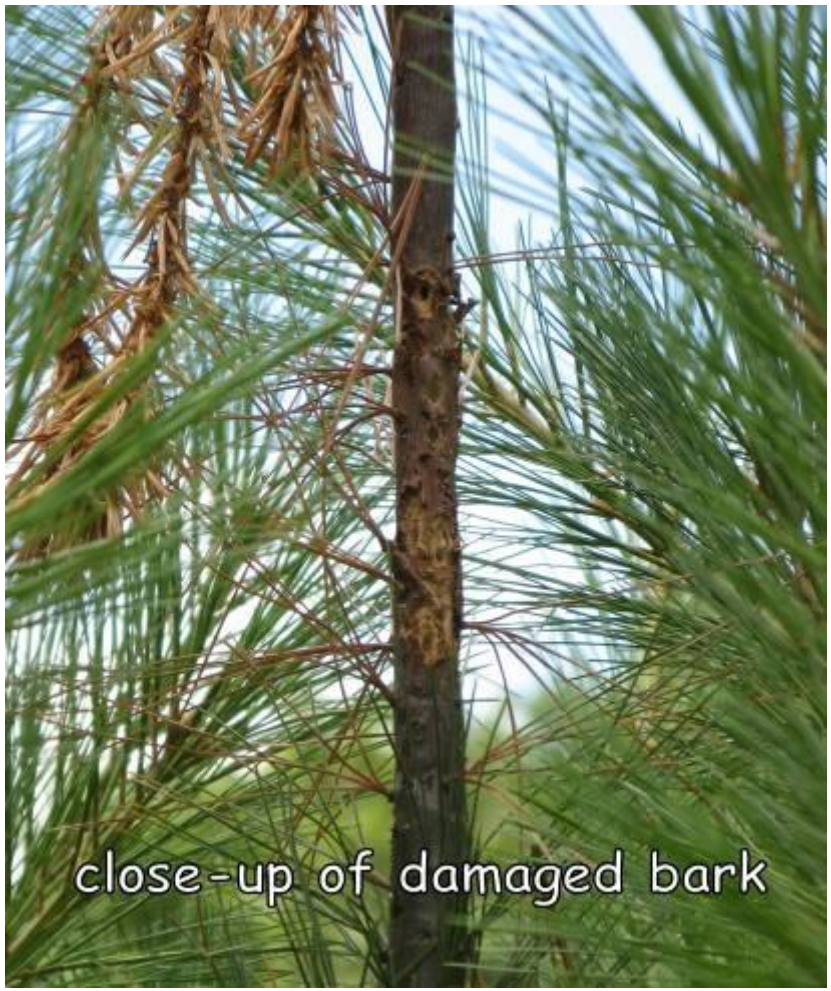
adult

White Pine Weevil

beetle (Coleoptera)

White Pine Weevil

beetle (Coleoptera)



- Hosts – Pines, spruces
- One generation / yr.
- Adults overwinter in ground litter
- Adults emerge April 1 – 20
- Feed in leader, leave tiny holes, resin drops
- Eggs laid in leader
- Larvae tunnel and feed in leader

White Pine Weevil Management

- Trees < 15 ft. most susceptible
- Larvae girdle leader, leading to stunted growth and distorted growth forms
- Cut out and destroy infested leader before late June/ prune all but 1 live lateral shoot
- If spray, between April 1 and April 20, targets adults

White Pine Weevil Management

- Trees < 15 ft. most susceptible
- Larvae girdle leader, leading to stunted growth and distorted growth forms
- Cut out and destroy infested leader before late June
- If spray, between April 1 and April 20, targets adults

Bronze Birch Borer

beetle (Coleoptera)

Bronze Birch Borer

beetle (Coleoptera)

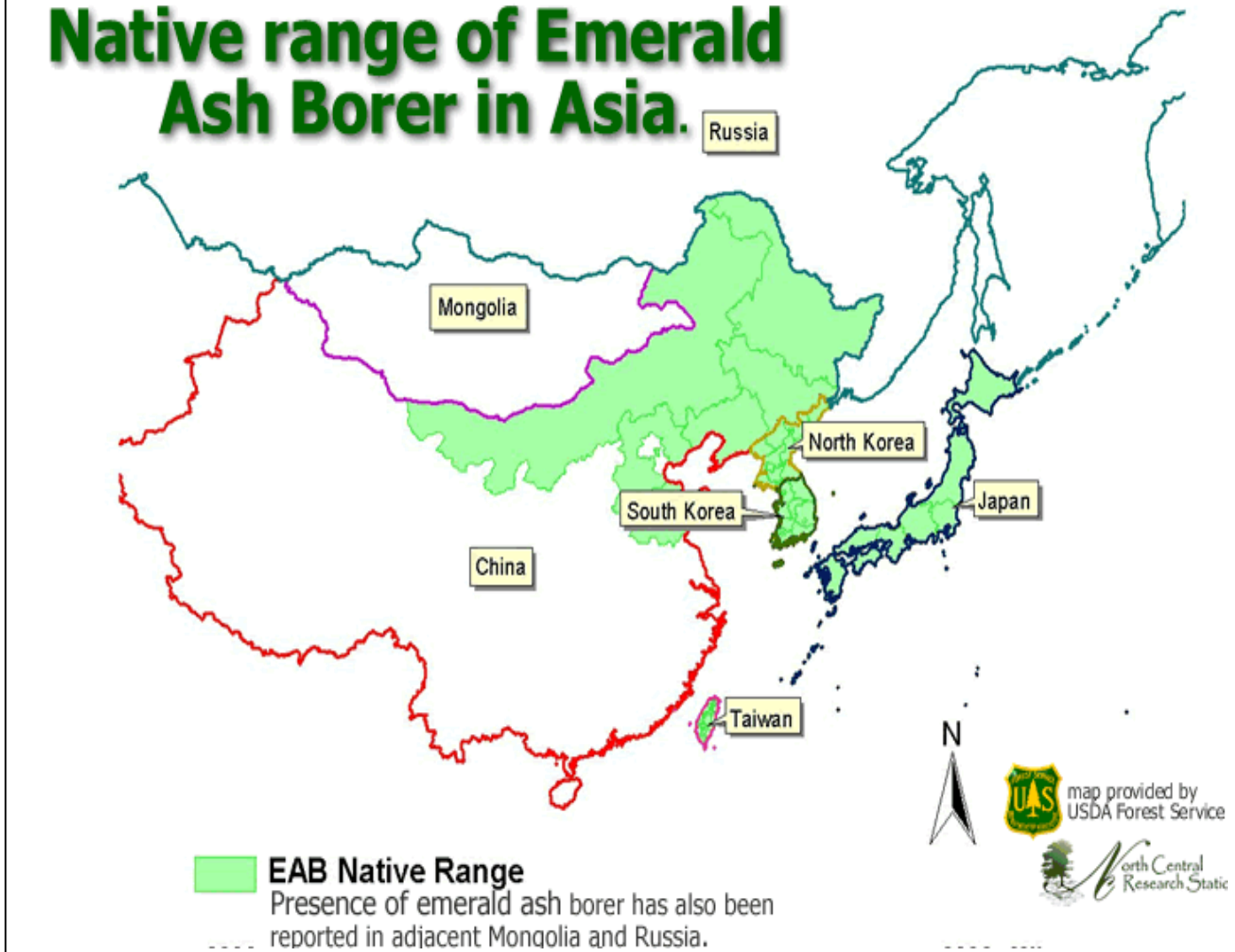
- Hosts – Birch, paper, white, grey, Jacquemontii
- Adults emerge early June – August, most in June
- Lay eggs in crevices of bark
- Larvae tunnel in phloem / cambium
- Overwinter as larvae in tree

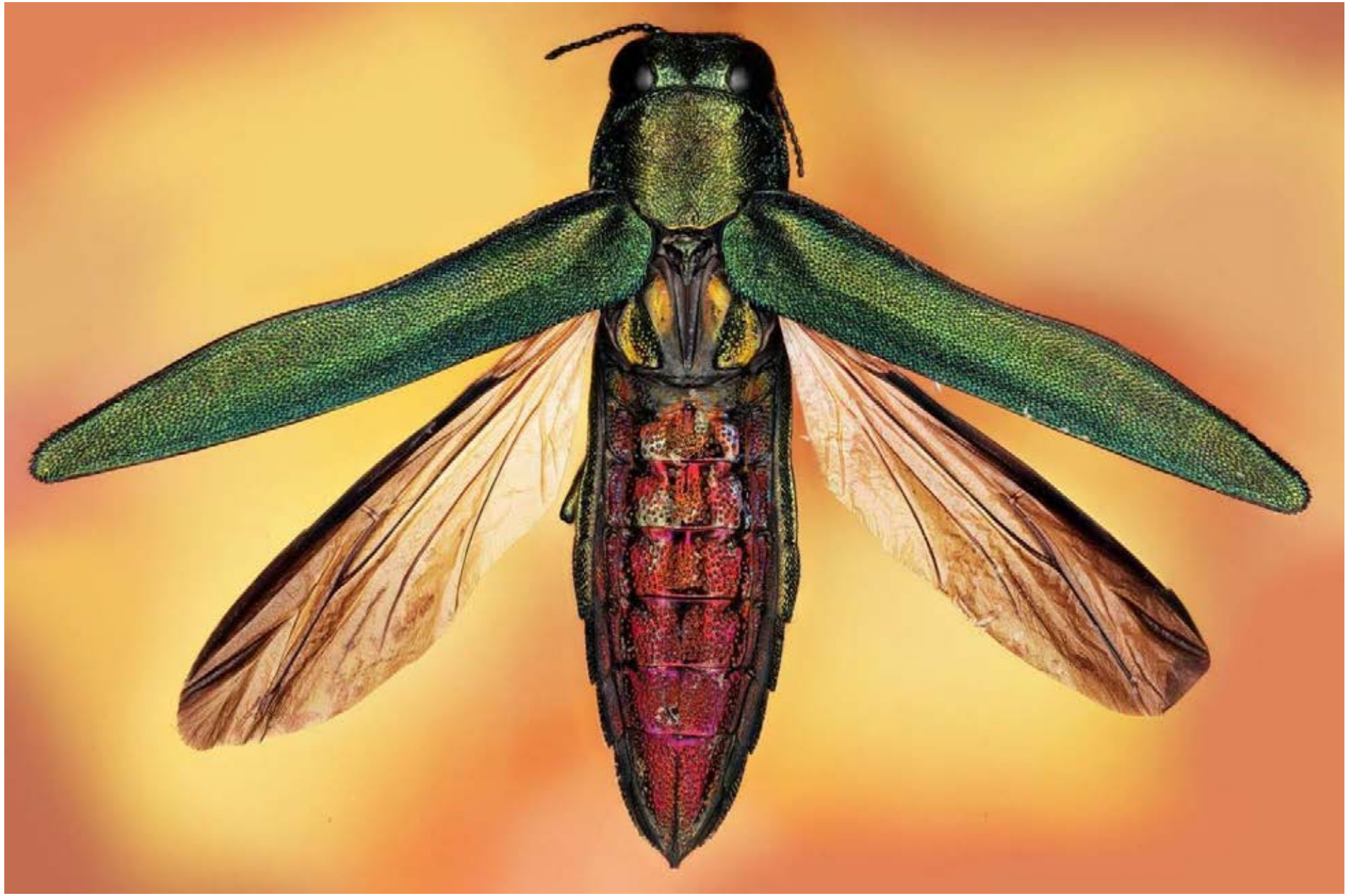
Bronze Birch Borer Management

- Resistant Cultivars –, non-native birches more susceptible, native species/ cultivars preferable e.g. Heritage
- TLC – watering, fertilizer, limit wounding: stressed trees are susceptible, healthy trees resist
- Systemic insecticides: e.g. Imidacloprid, Dinotefuran

The Emerald Ash Borer *Agrilus planipennis*

Native range of Emerald Ash Borer in Asia.





Host Trees

- All Ashes: *Fraxinus* spp.
- Not Mountain Ash
- Not Prickly Ash

How to Identify Ash Trees


*Paul Wray, Iowa State University

Authors: Kimberly Rebek
and Mary Wilson

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Not all Ash is Equal

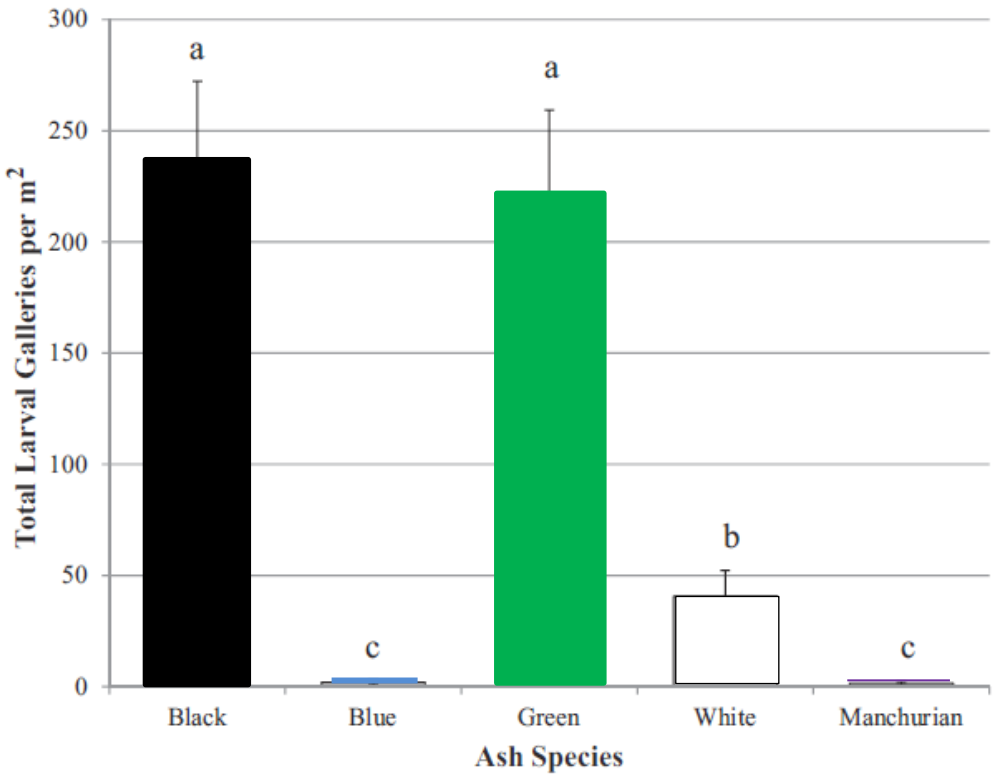

Fig. 3. Mean (± SE) number of *Agrilus planipennis* larval galleries per square meter of debarked phloem on black, blue, green, white, or Manchurian ash trees harvested in 2011 ($N = 21$ trees per species). Letters indicate differences among species ($\alpha = 0.05$).

Tanis & McCullough 2015

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White fringetree, *Chionanthus virginicus* L. (Oleaceae)

Courtesy of Dan Herms, Ohio Agricultural Research and Development Center, Wooster, Ohio

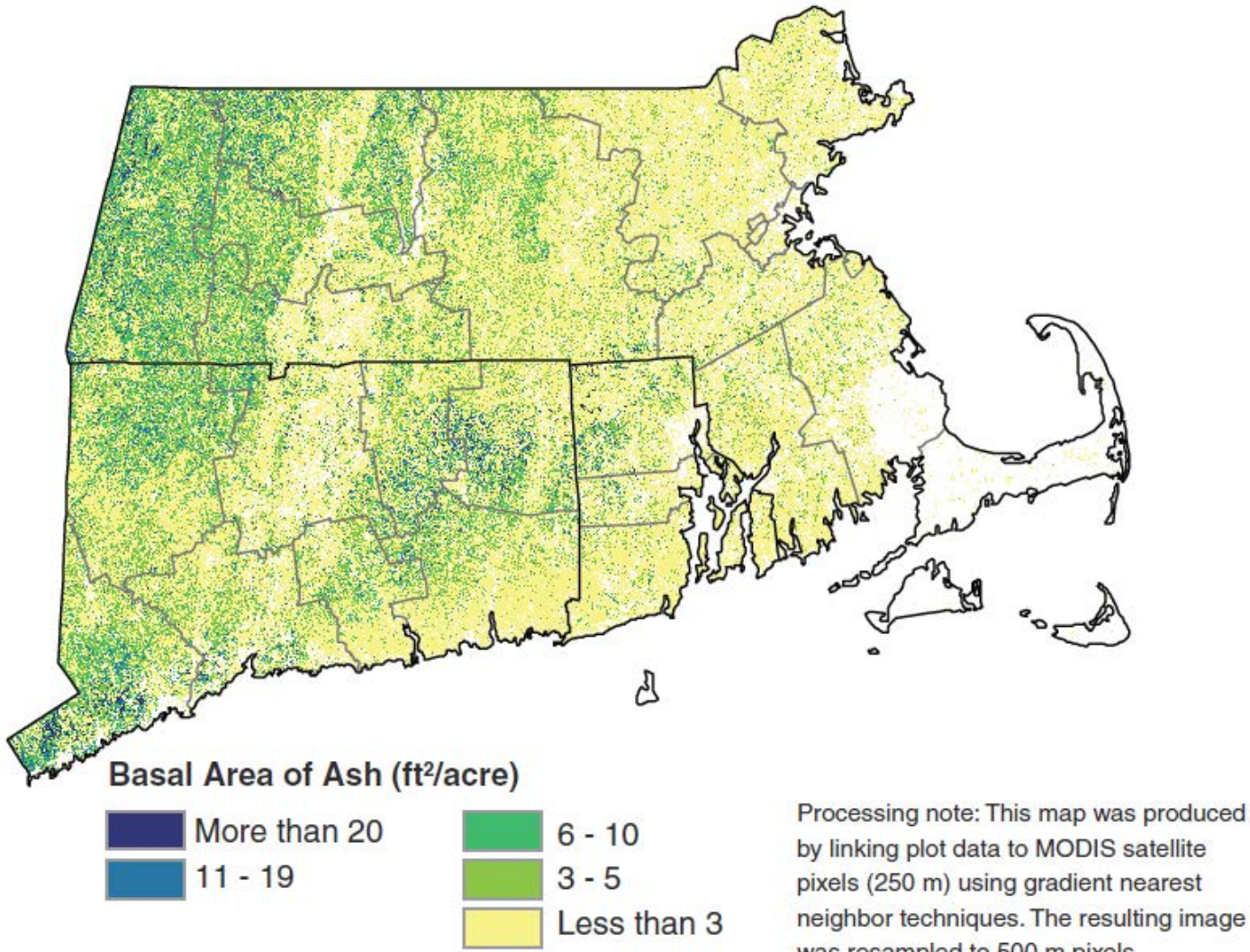

Figure 35.—Distribution of ash species on forest land, Southern New England, 2007.

NRS-55 USDA FS NRS 2011

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Mating and Eggs

Larvae (immatures)

Adults

Pupae

Biology

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

Biology

- 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/ phloem
- Feed through summer

Serpentine Galleries

- All stages eat the phloem, cambium and score the outer layer of sapwood
- Kills tree by girdling it

Biology

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


Photo by David Cappaert. Reprinted with permission.


Photo by Deborah Miller, USDA Forest Service. Reprinted with permission.

- Pupate and develop starting in spring

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Mating and Eggs

Larvae (immatures)

Adults

Pupae

Death of an Ash Tree

1 2 3 4 5

Ash canopy health condition rating scale

Smith (2006)

CAES

dead and dying ash

Prospec

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Branch Die-Back, Bristol

Picture courtesy of Chris Donnelly DEEP

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Dead Neighborhood Trees in Middletown, CT

Cassandra Day / Hearst Connecticut Media

4/23/2019

Dieback

Hamden

Prospect

Dead Ash, Thomaston

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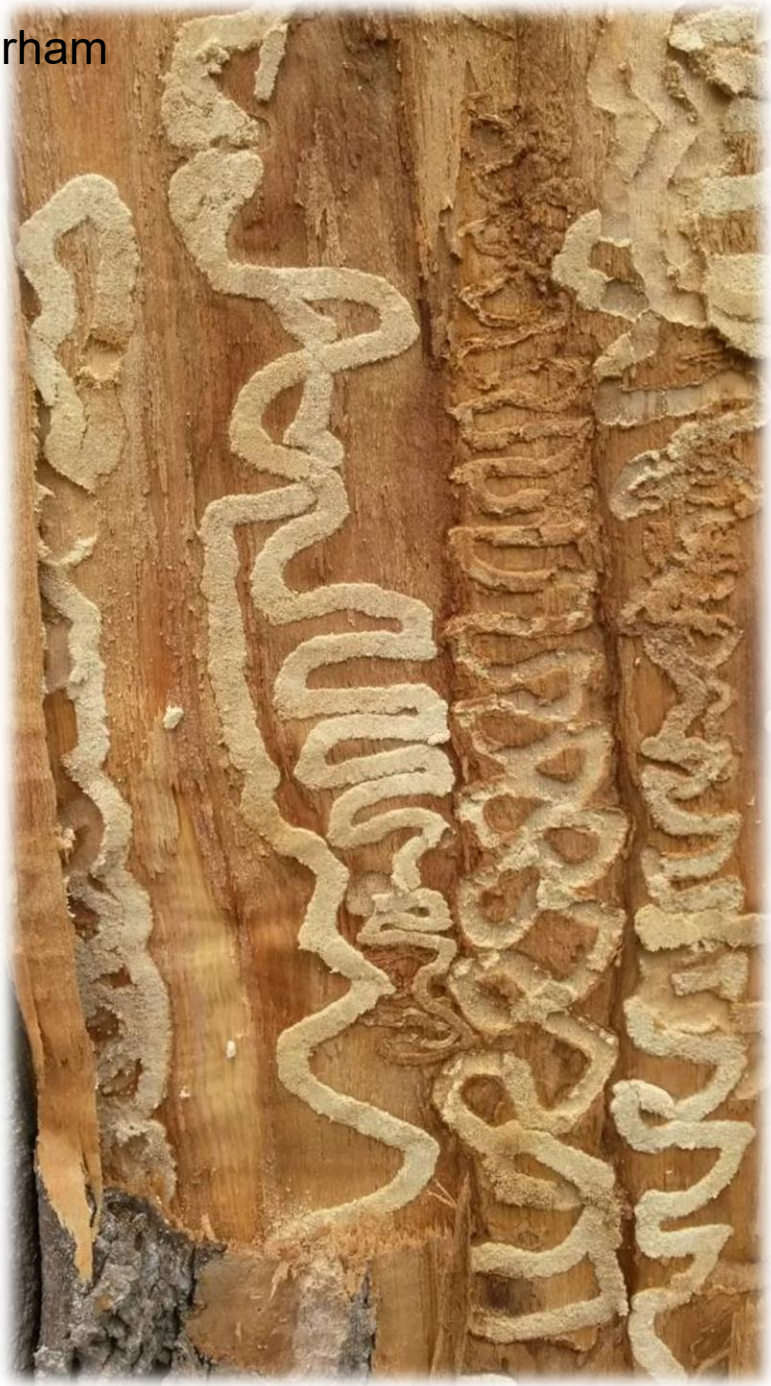
Tunnels

Hamden

Durham



Woodpecker damage

Waterbury

Southbury

Middlebury

Bethany 2016

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Tree Death and Shedding

Falling tree kills woman, seriously injures Horlick High School teacher in Caledonia

Jacquelyn Abad WDJT –Milwaukee

Posted: Oct 22, 2018 10:13 CDT

Loss of life and limb: Michigan's weakened trees pose deadly threat

John Barnes, Special to The Detroit News Published 11:01 p.m. ET Oct. 27, 2018

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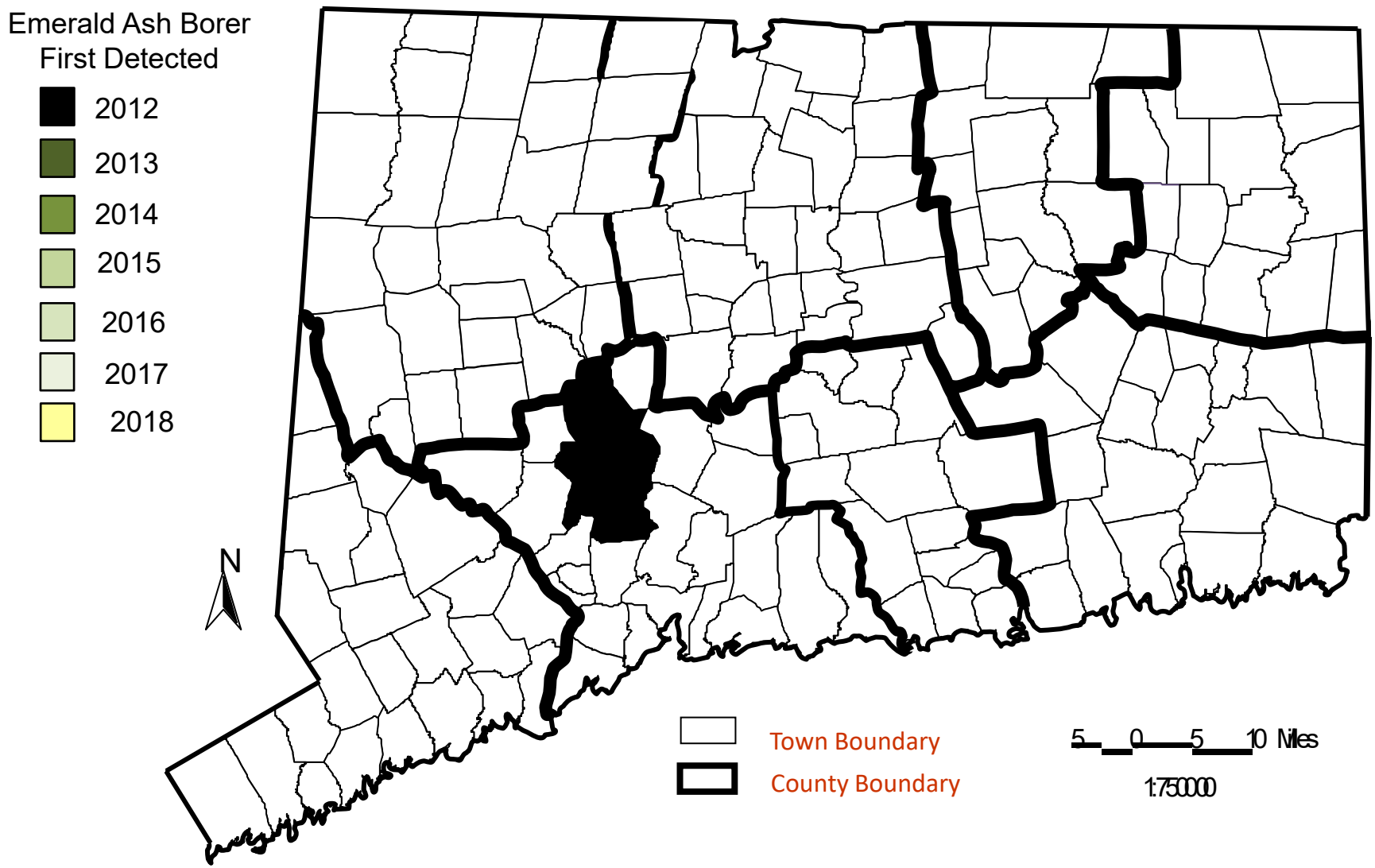
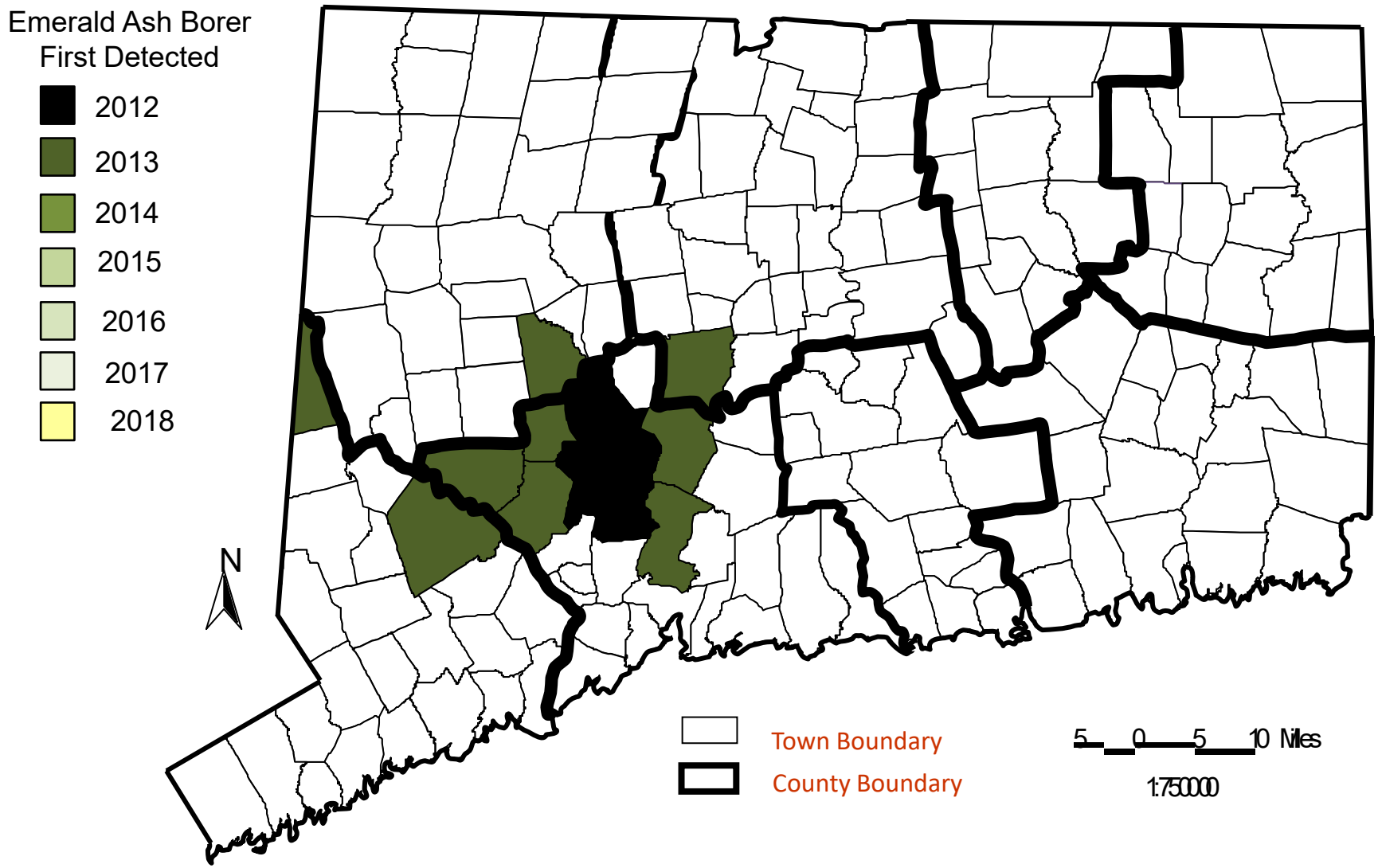

Emerald Ash Borer
First Detected
2012
2013
2014
2015
2016
2017
2018
N
Town Boundary
County Boundary
5 0 5 10 Miles
1:75000

2012

CAES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2013

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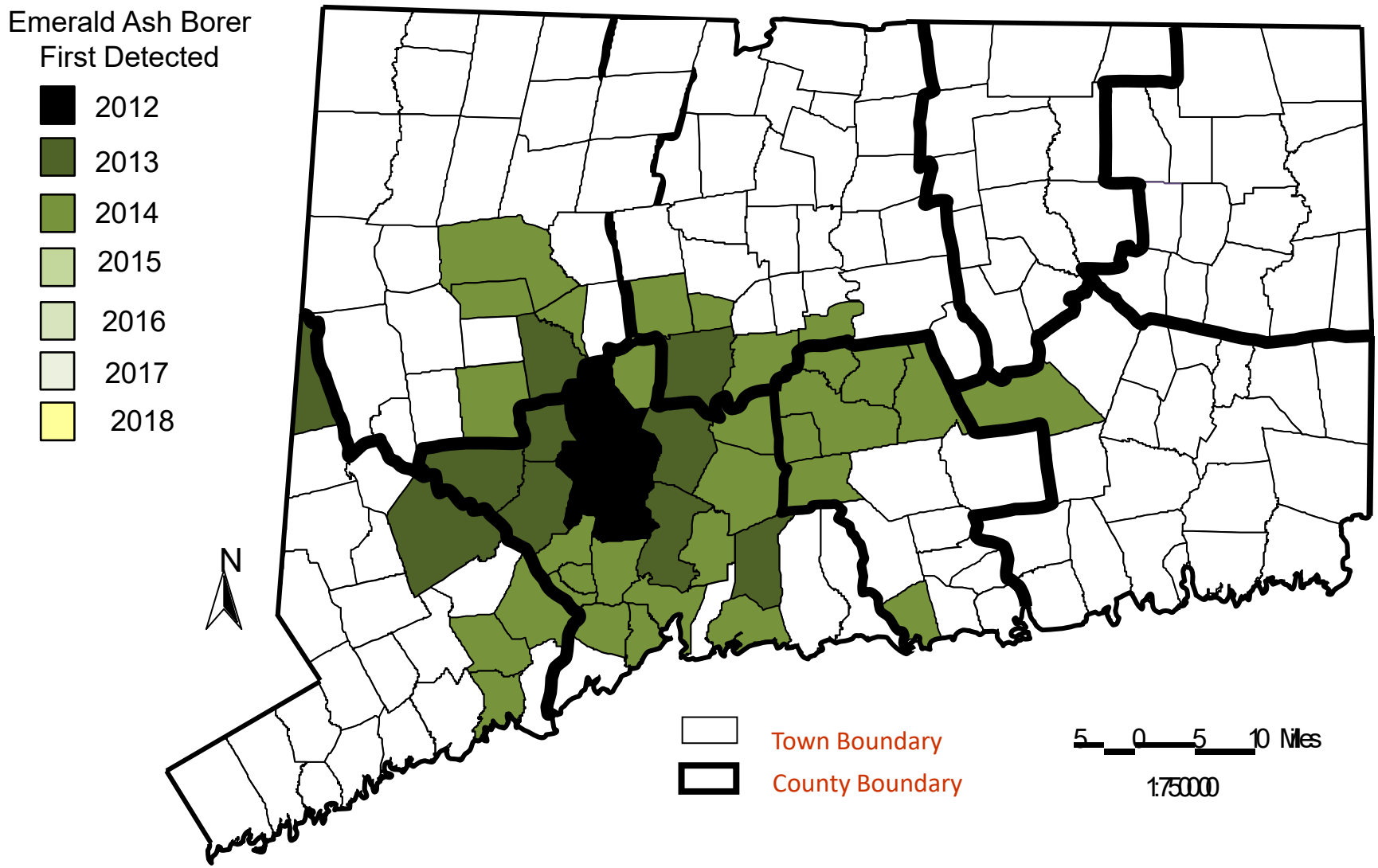
Emerald Ash Borer
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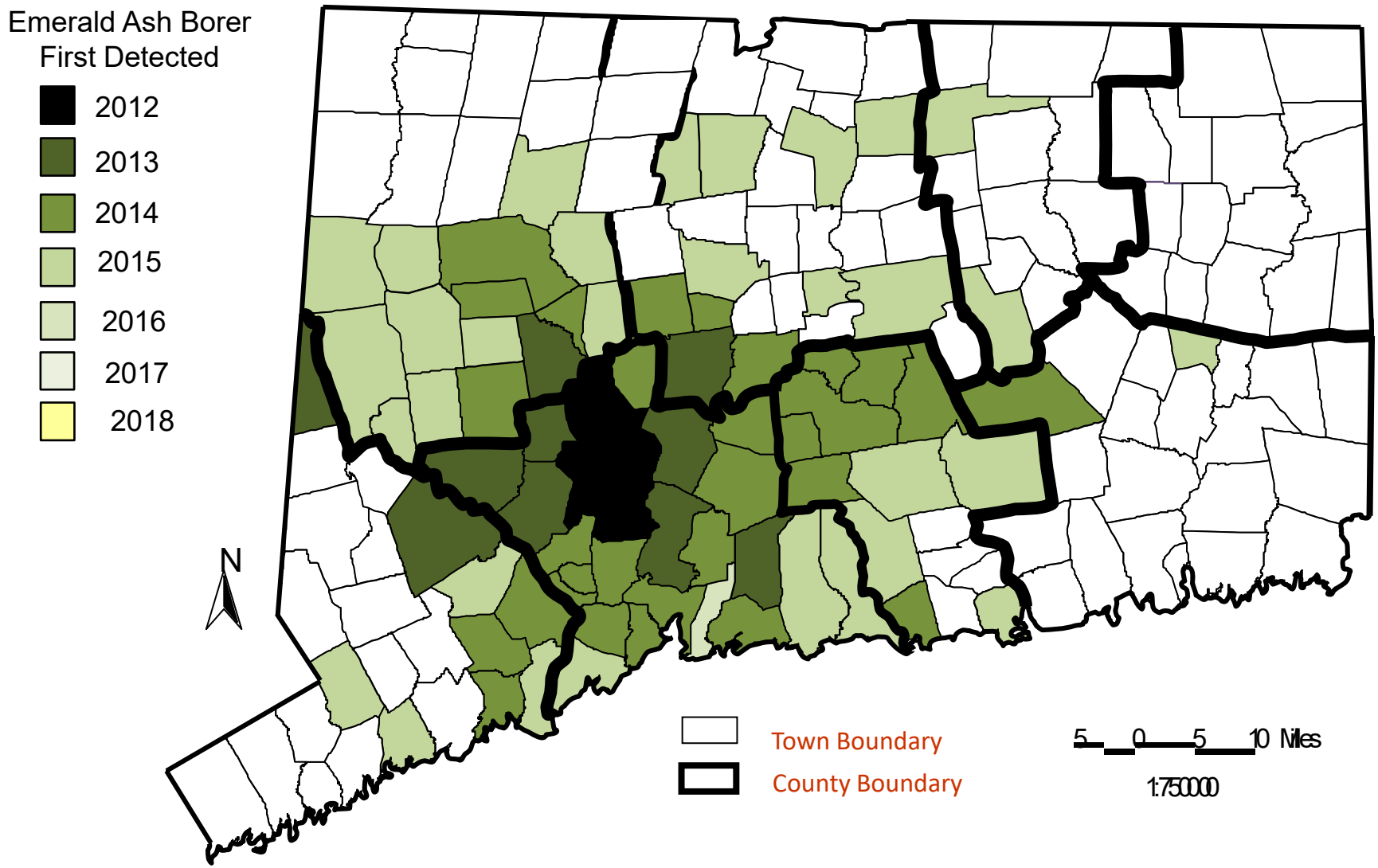
2014

CAES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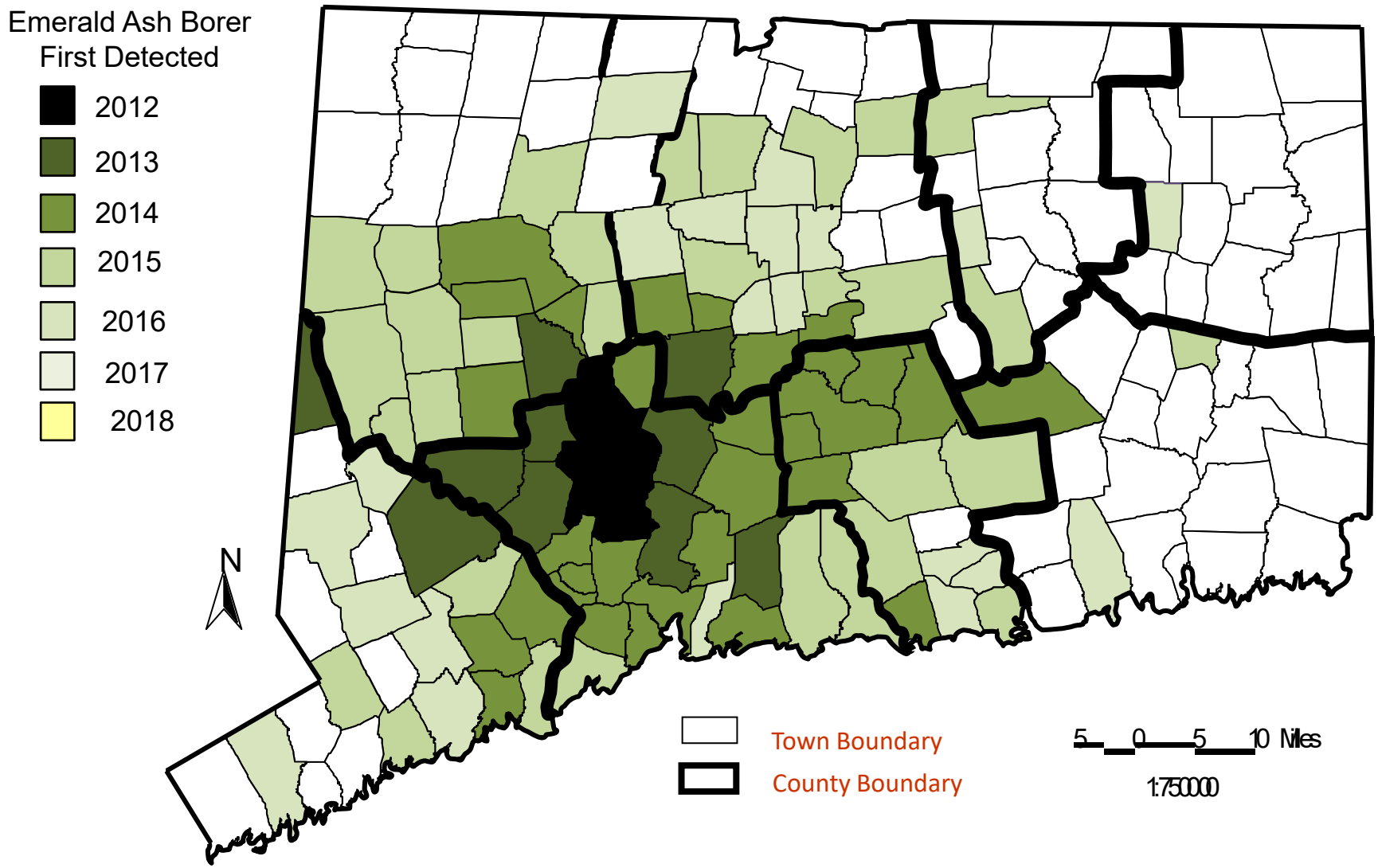
Emerald Ash Borer
First Detected
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2016

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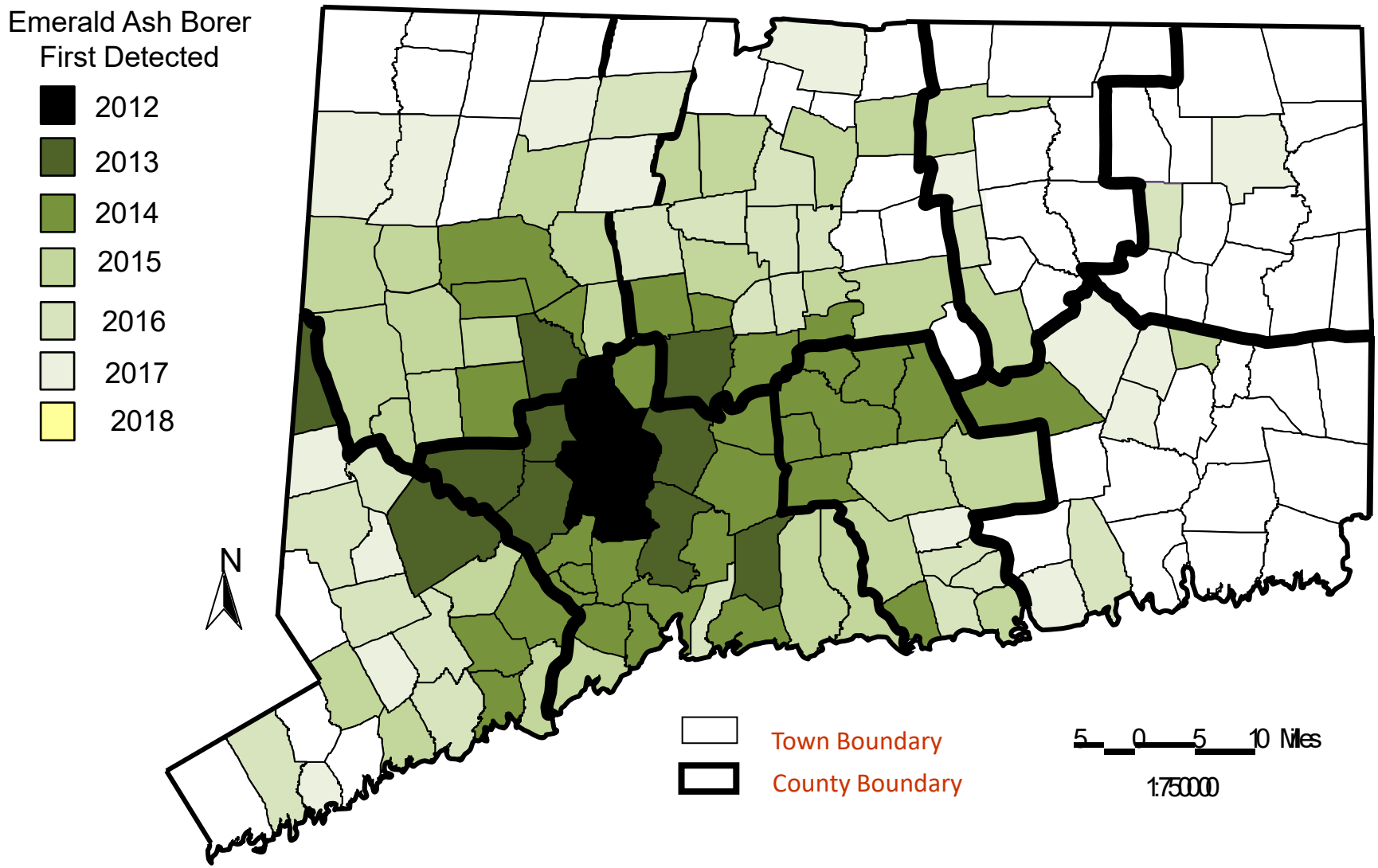
Emerald Ash Borer
First Detected
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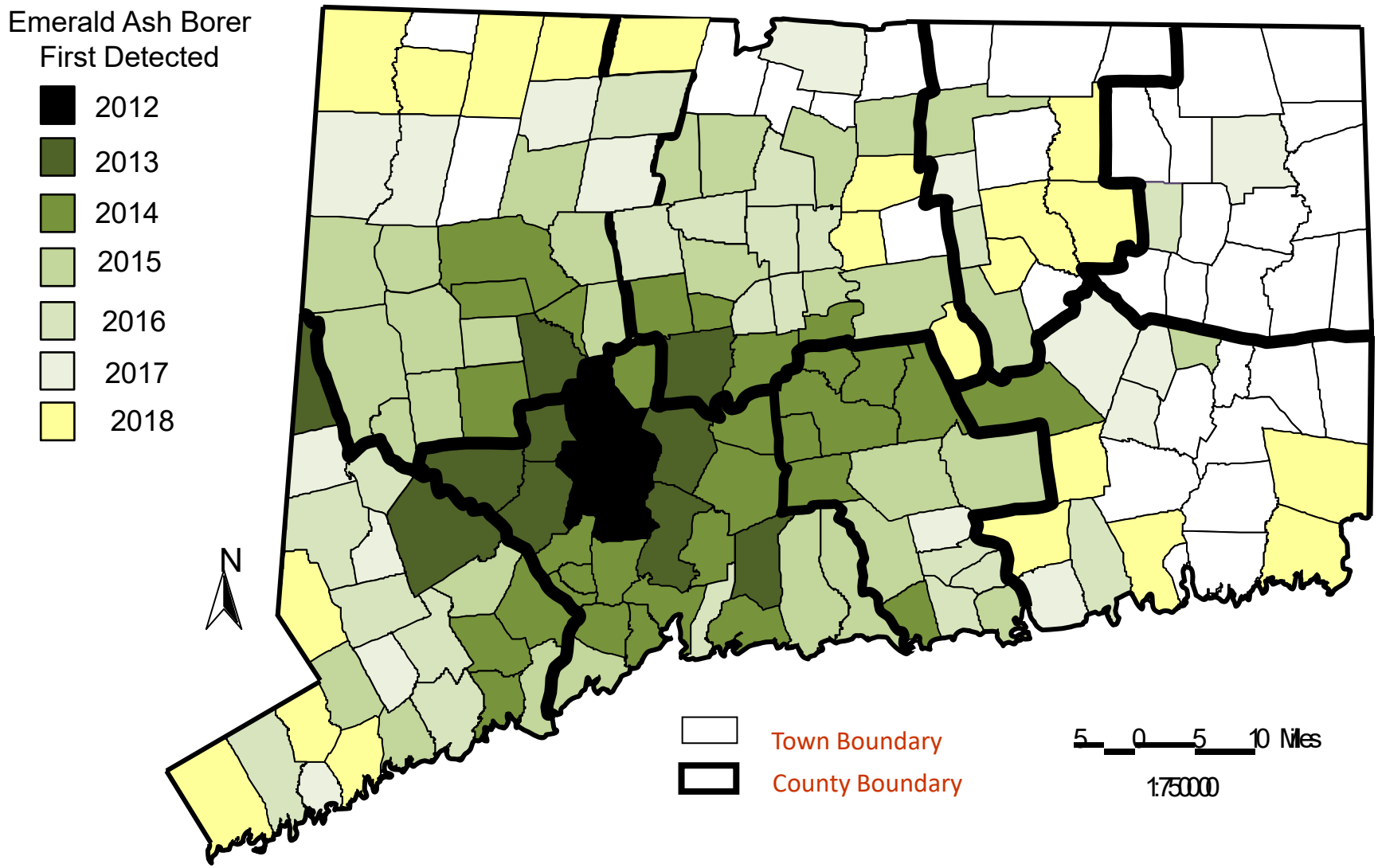
2017

CAES


Emerald Ash Borer
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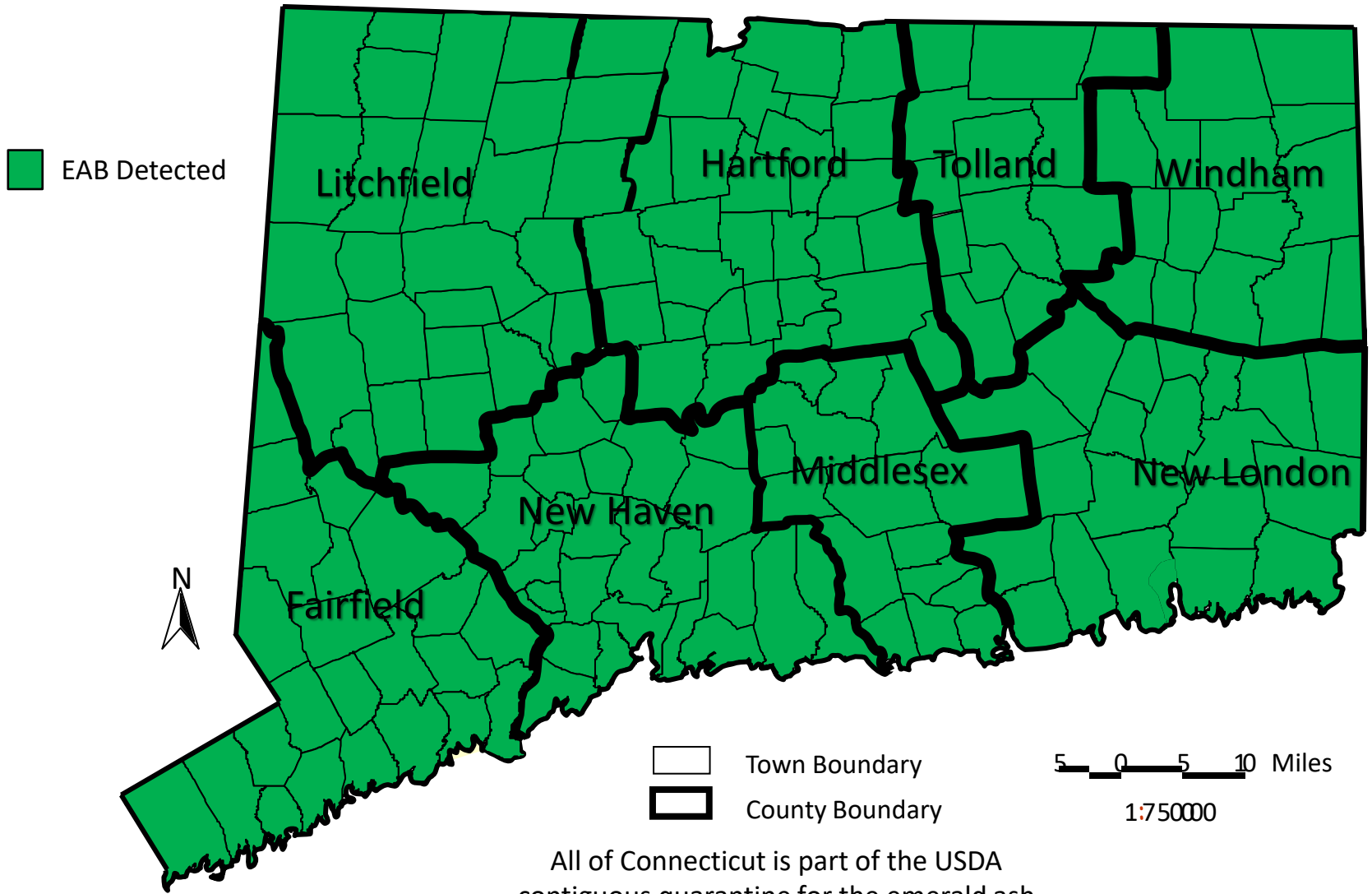
2018

CAES



All of Connecticut is part of the USDA contiguous quarantine for the emerald ash borer. EAB detections by town shown

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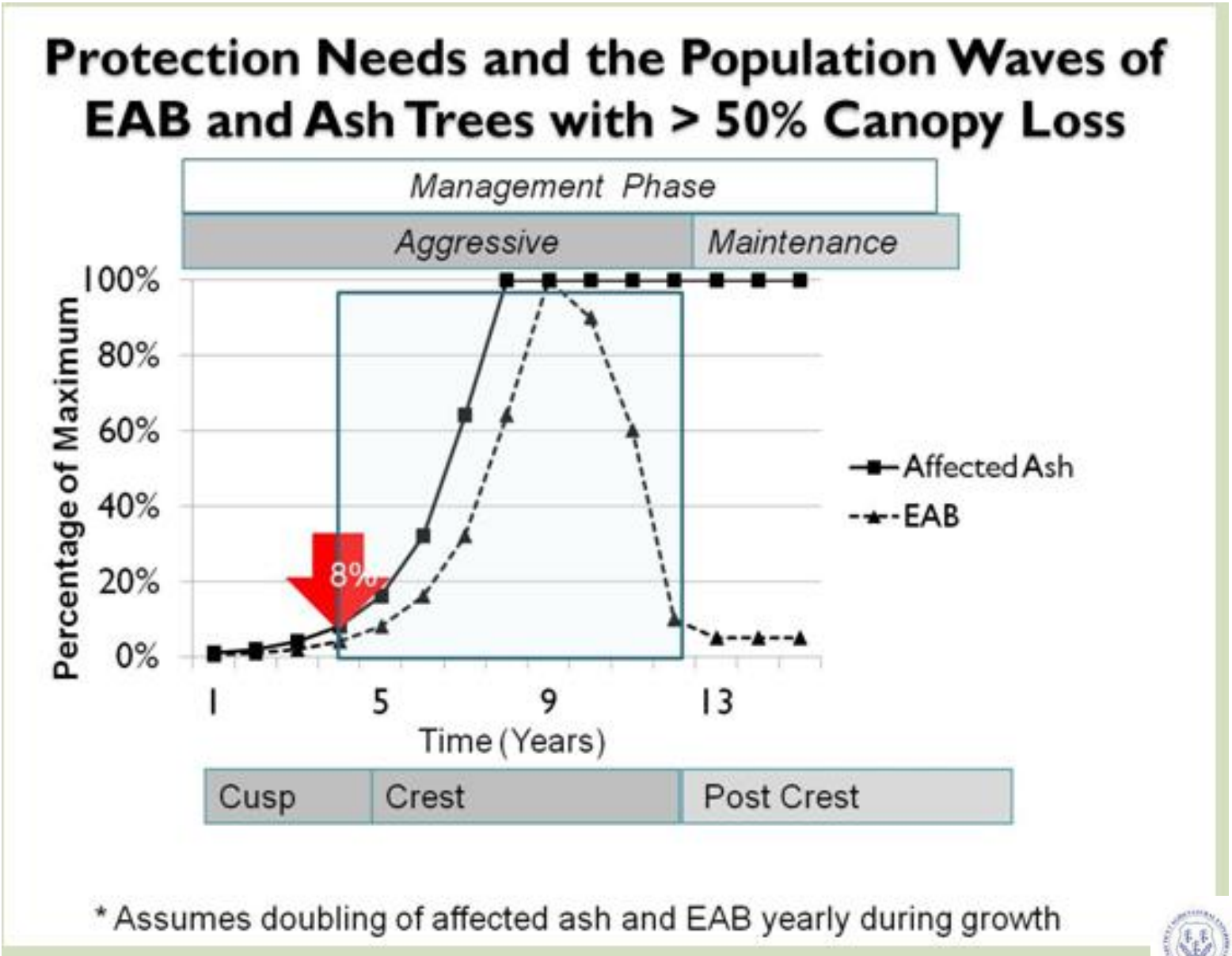
The Connecticut Agricultural Experiment Station
Putting Science to Work for Society since 1875

The Destruction Wave



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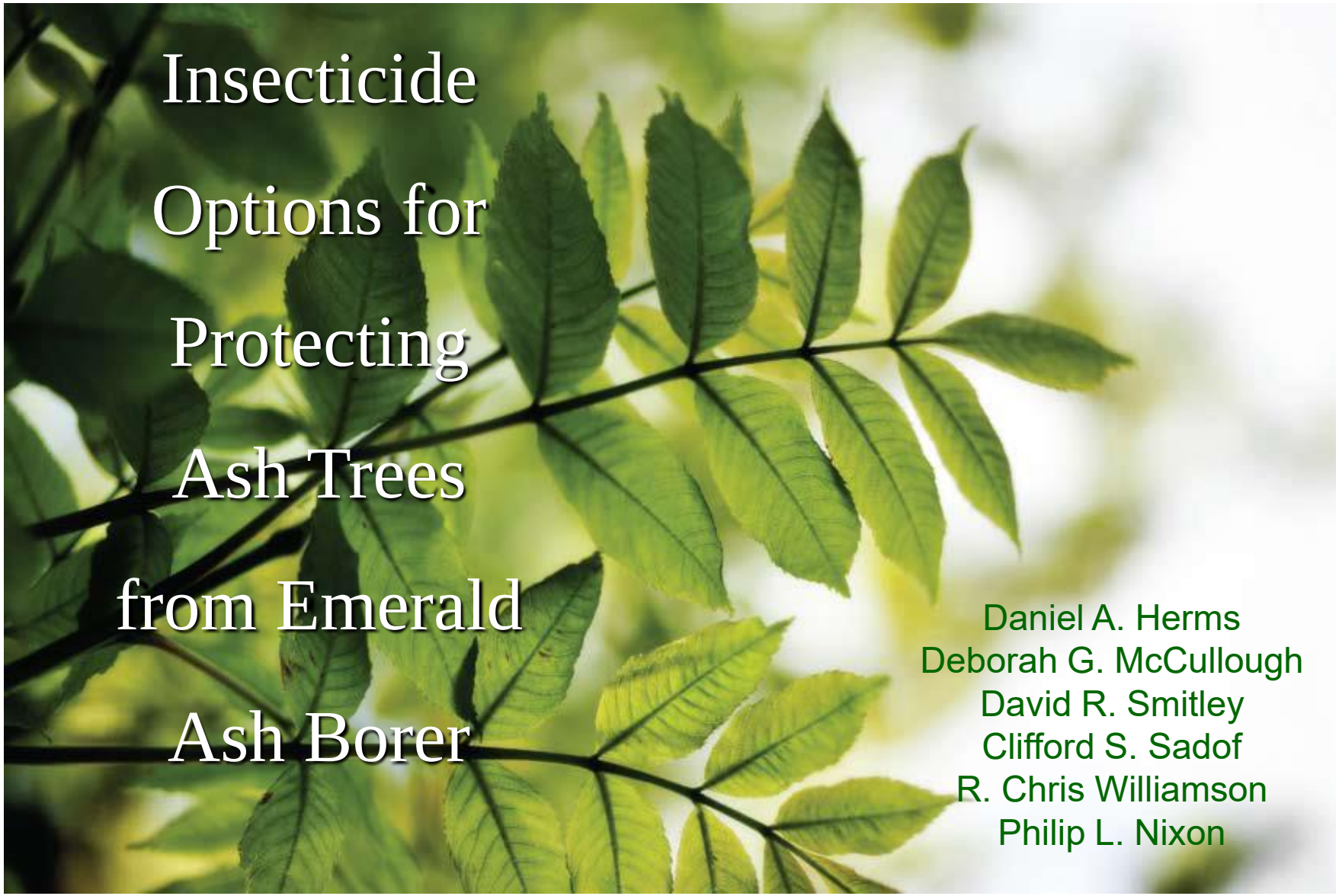

Insecticide Options for Protecting Ash Trees from Emerald Ash Borer

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)
Azadiractan	Early Summer	Will last up to two years, is considered to be ‘organic’

[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

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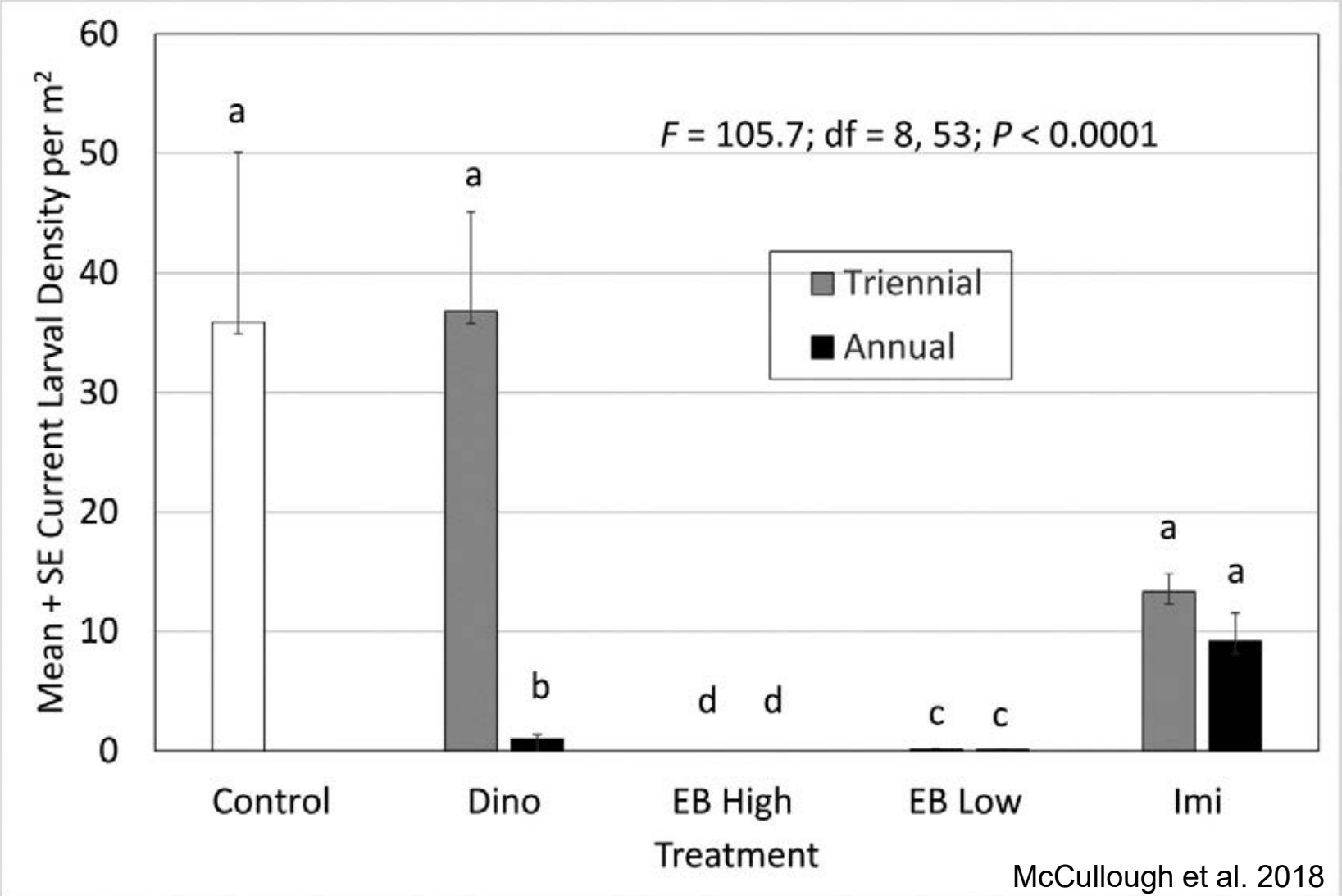

EAB larval density in trees treated with systemic insecticides annually or triennially in mid-June from 2008-2013, felled in 2013

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Benefits of Protecting Ash in Town

- Declining, dying and dead trees reduce property values
- Become hazard trees that must be removed
- Less disruptive than removing large trees
- Retains ecological services such as stormwater uptake
- Predictable treatment cost and scheduling

McCullough 2019

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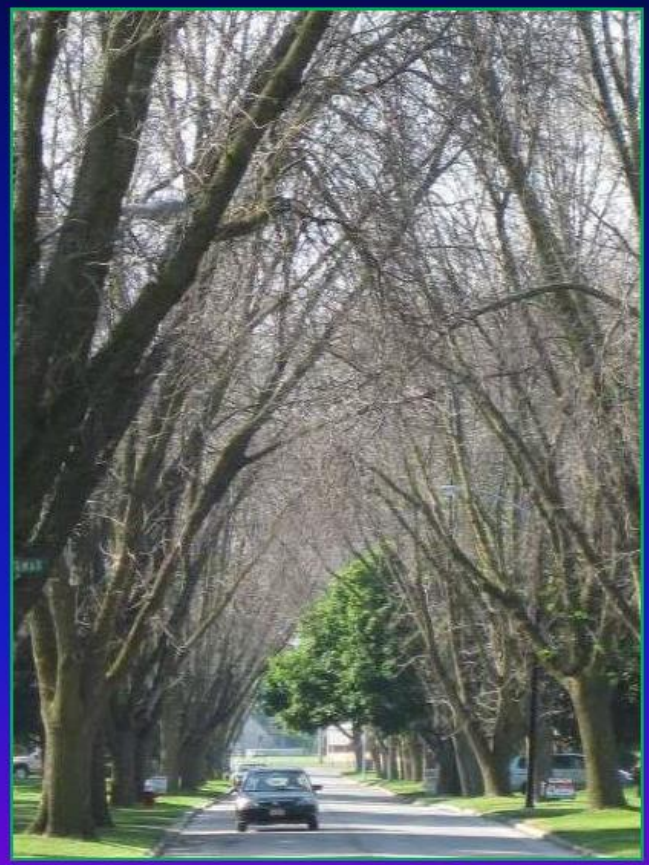
Toledo, Ohio – BEFORE & AFTER

June 2006



August 2009

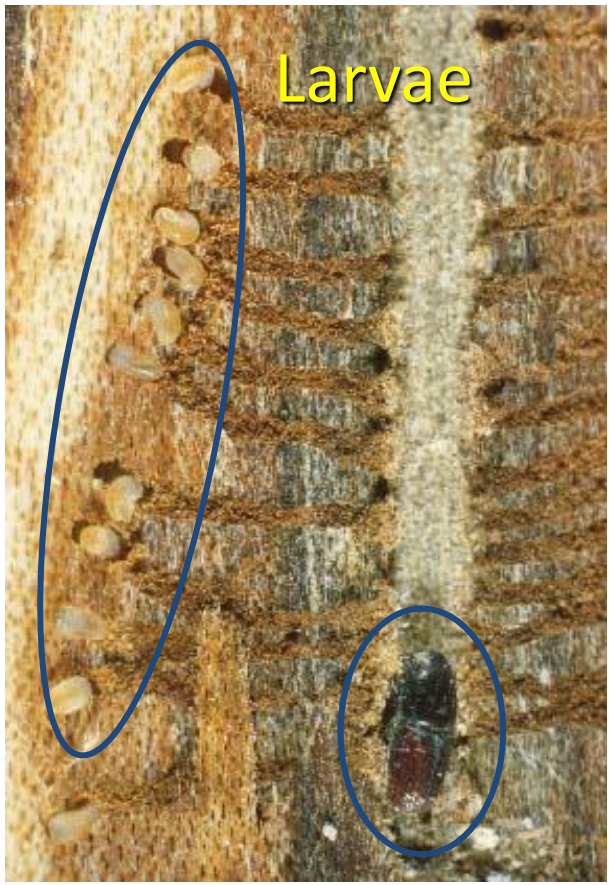
Courtesy of Dr. Dan Herms

THE OHIO STATE UNIVERSITY

Elm Bark Beetles

beetle (Coleoptera)

Native elm bark beetle

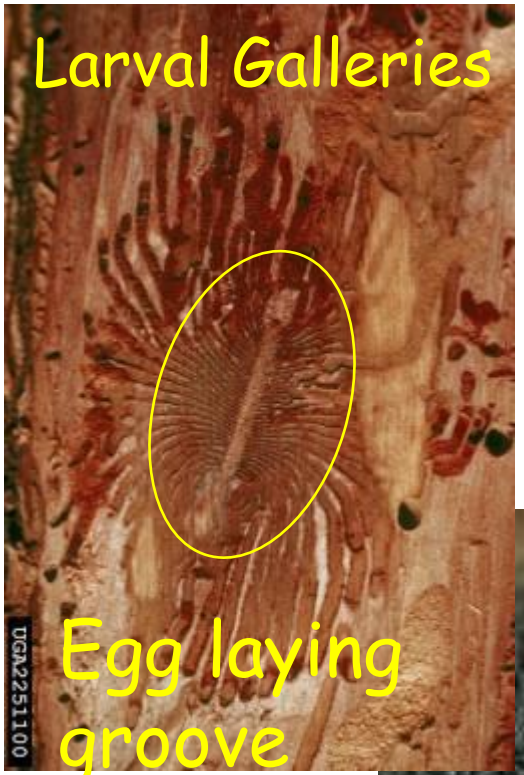


Adult female

BORER

Elm Bark Beetles

beetle (Coleoptera)



Adult Damage on Twig

Elm Bark Beetles

beetle (Coleoptera)

- Hosts – Elms
- 2-3 generations/ yr
- European EBB overwinter as larvae in tree
- Native EBB adults bore into bark at base of tree to overwinter
- Adults emerge in April & feed on twigs
- Females bore into bark and lay eggs
- Larvae create tunnels
- When emerge leave ‘shot gun’ holes
- Primary importance is as vector of Dutch Elm Disease

BORER

Elm Bark Beetle and Dutch Elm Disease

- Disease is a Fungus
- Fungus is vectored by the beetle
- Most often spread by adult feeding on thin barked branches; so first damage shows on flagged branches
- Can spread between trees via root grafts

EBB & Dutch Elm Disease Management

- Plant resistant cultivars
- Best management is pruning of infested branches and sanitation/ removed material must be destroyed
- Spray in April to control adults
- Can control over-wintering Native EBB adults by a bark drench spray between late August and mid-September

Asian Longhorned Beetle

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Talk Outline

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

Fengler CAES

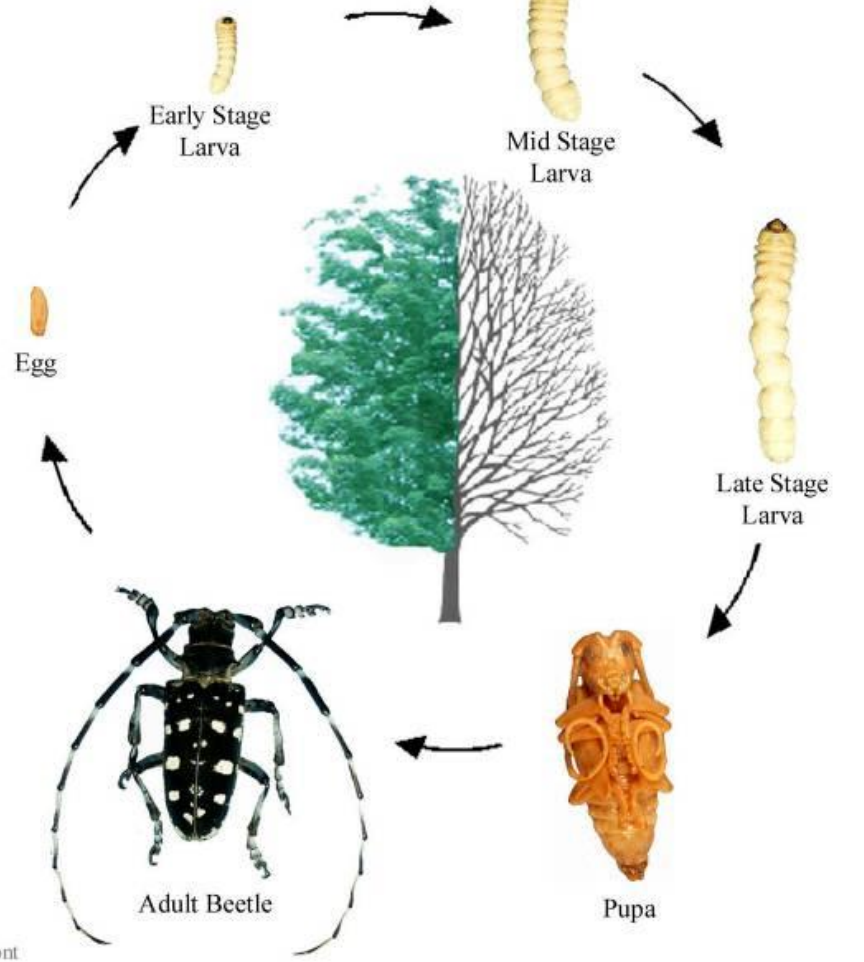
Asian Longhorned Beetle

Asian Longhorned Beetle Lifecycle

Adults and ovipostion scars

Emergence holes

Adult emerging from tree



Larva in tree

Pupal chamber in tree

Diagram by Michael Bohne

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ALB Life Cycle – Egg and Larvae

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

yer

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
- Mark recapture 98% recovered with 920 m of release (0.5 miles).
- Males moved 6X further than females.
- USDA quarantine is 2,400m (1.5miles)
- Feed on leaf midribs and mate
- Females lay between 35 to 90 eggs
- One generation per year

Host Range of ALB

Maple, Box Elder

(*Acer* spp.)

Horse Chestnut/
Buckeye

(*Aesculus* spp.)

Host Range of ALB

Birch

(*Betuala* spp.)

Willow

(*Salix* spp.)

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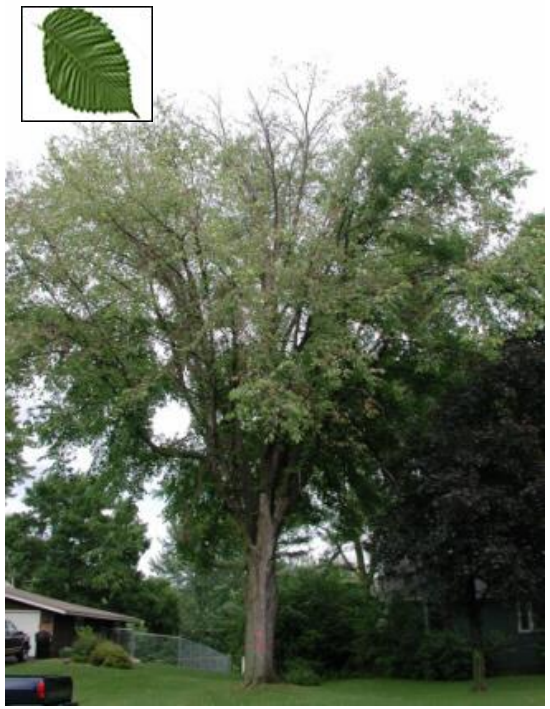
Host Range of ALB



Elm (*Ulmus* spp.)

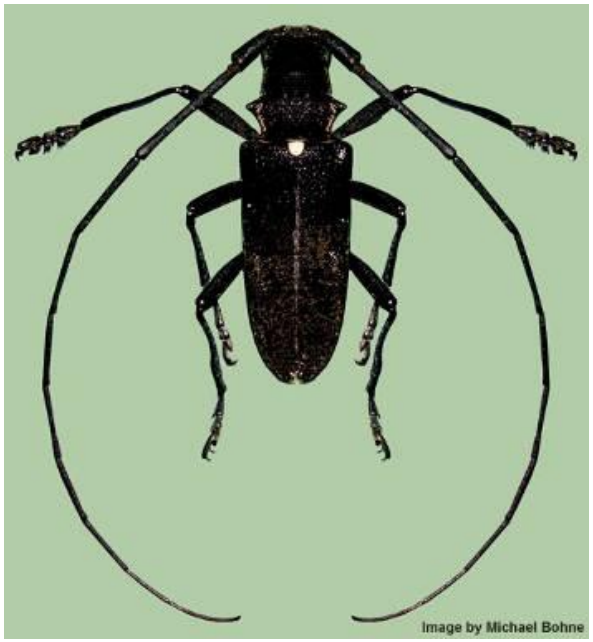
Ash (*Fraxinus* spp.)

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

ALB

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

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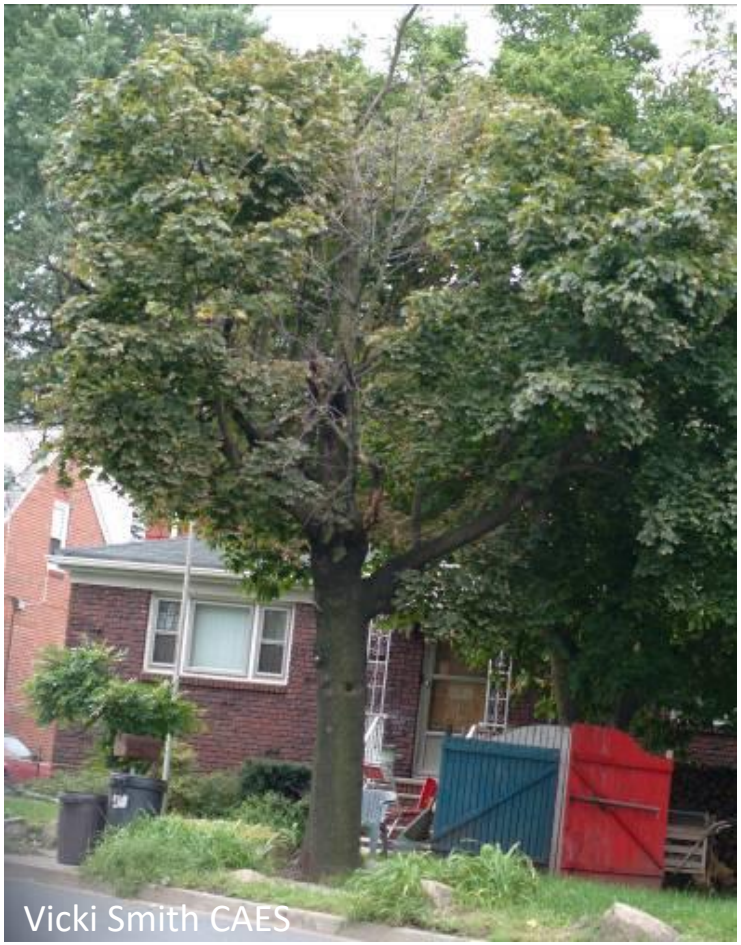
Early fall coloration:

Vicki Smith CAES

Branch Die-Back



Chewed out midrib:

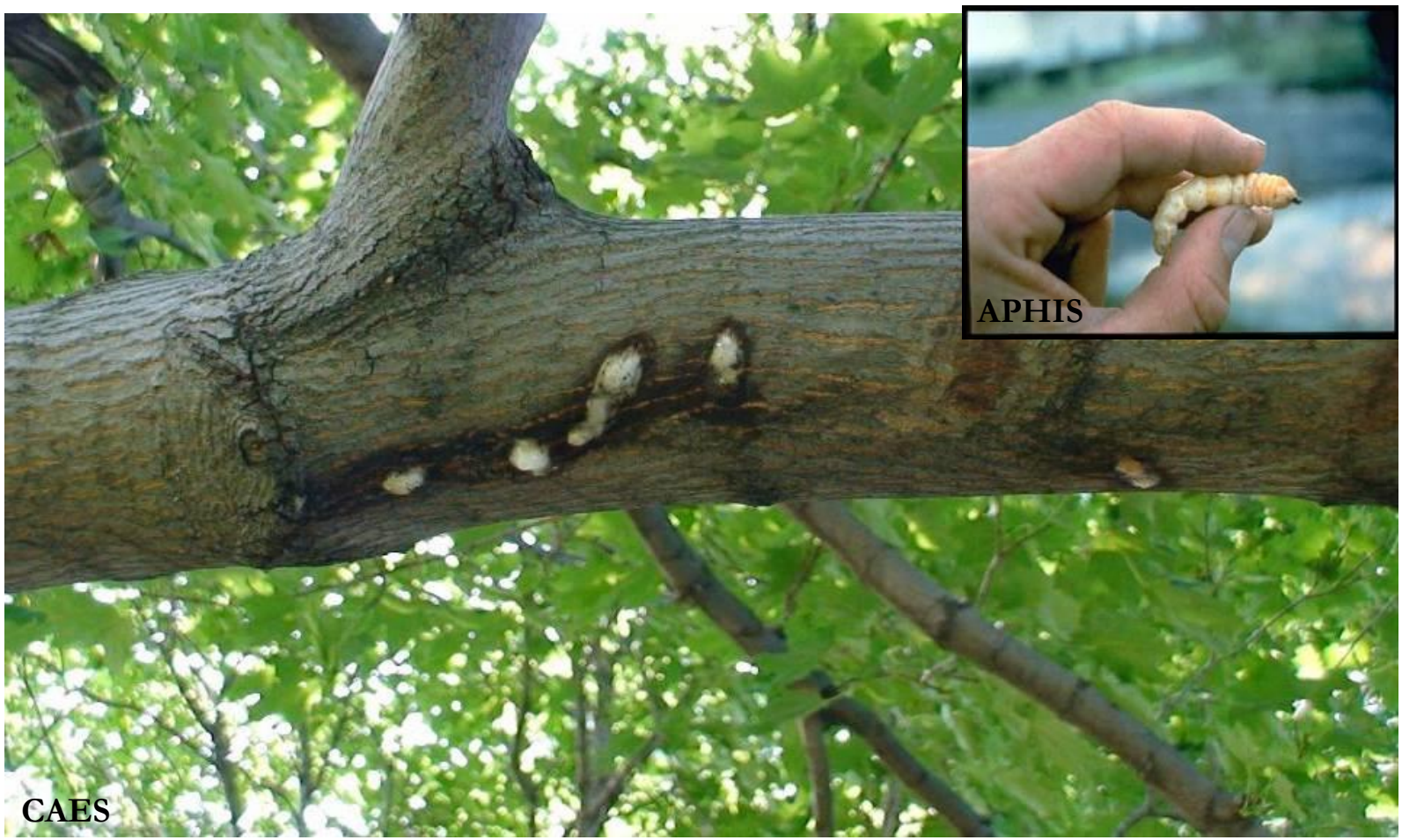
Sawdust at base of trees:

Sawdust at base of trees:

Egg laying sites:

Egg laying sites:

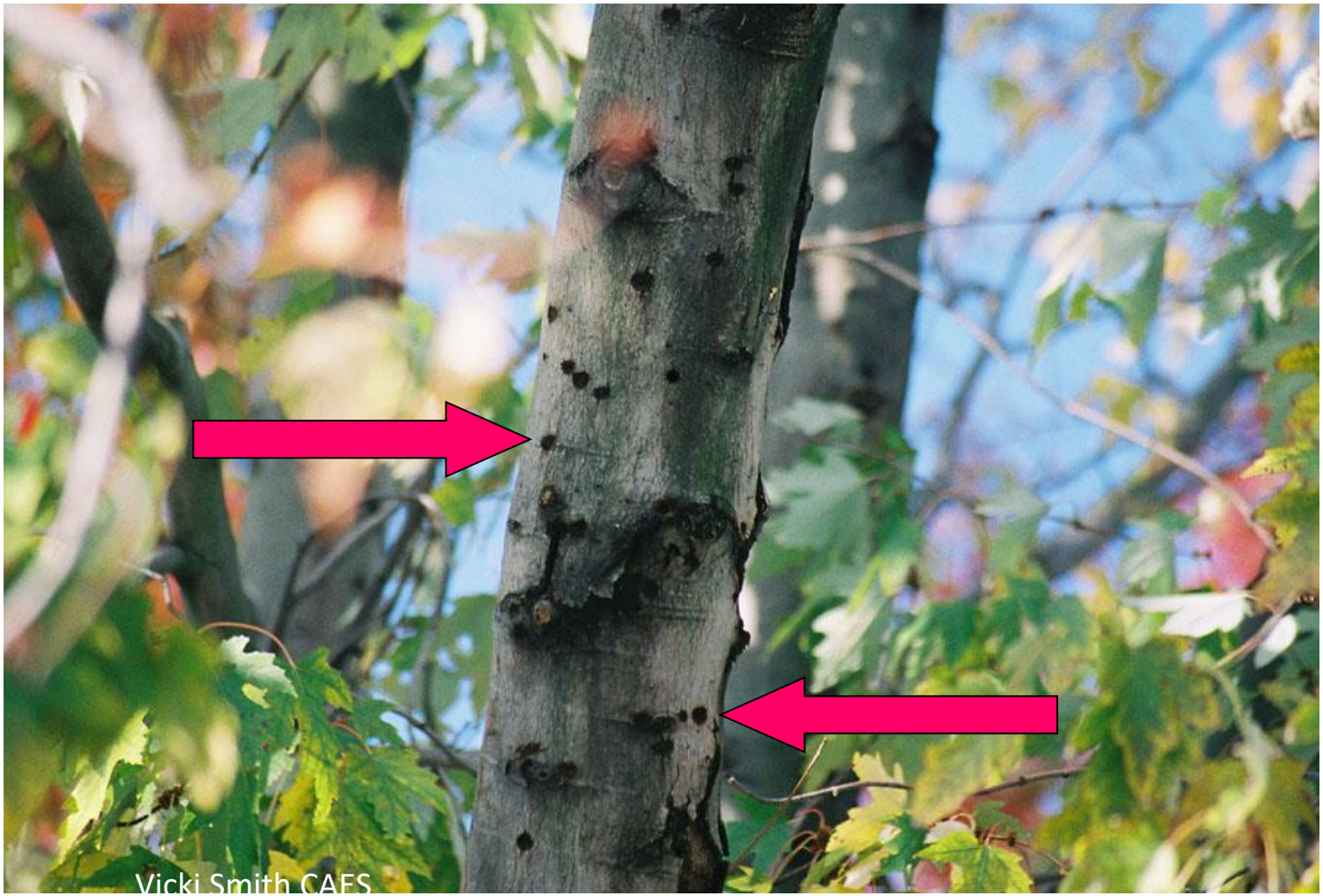
Oozing sap



Larval activity:

Exit holes:

Exit holes:



Exit holes:

Sap sucker damage:

Sugar Maple Tap Holes

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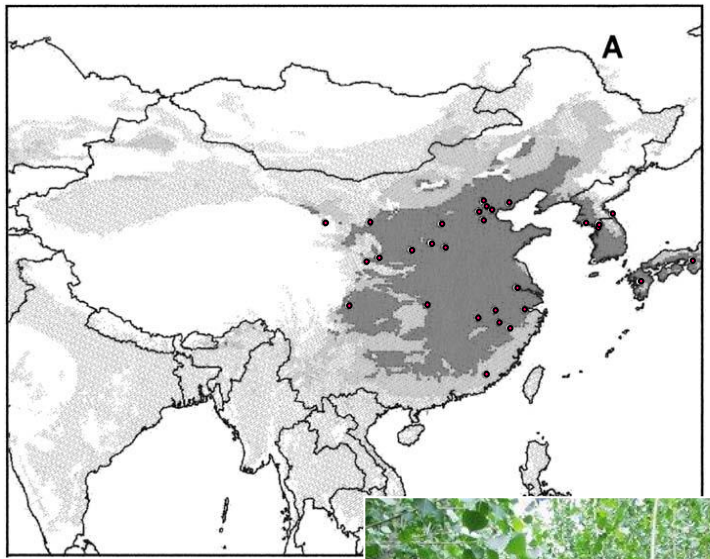
Where it Came From



- 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)

Peterson et al. 2004

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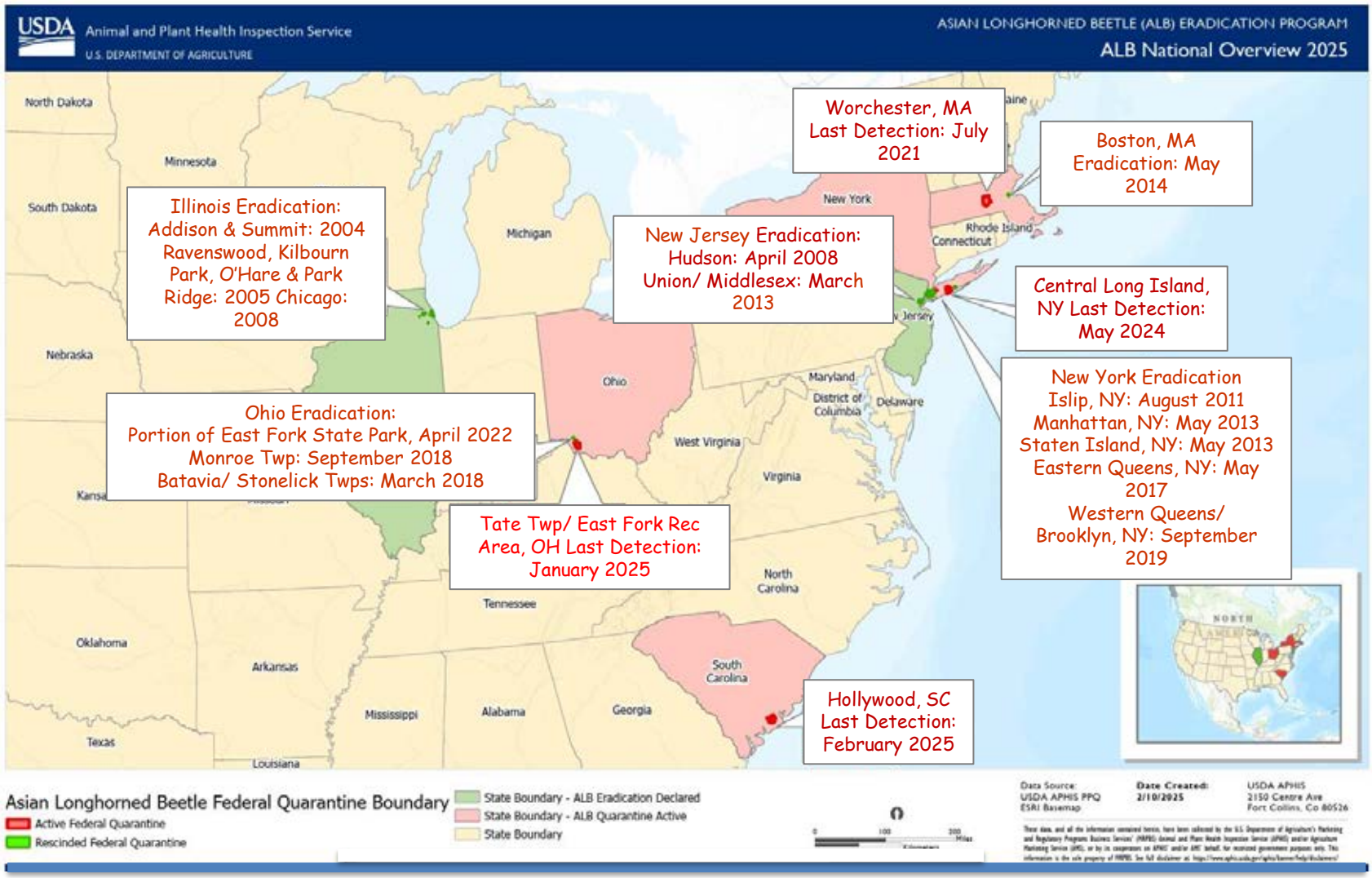
USDA
Animal and Plant Health Inspection Service
U.S. DEPARTMENT OF AGRICULTURE
ASIAN LONGHORNED BEETLE (ALB) ERADICATION PROGRAM
ALB National Overview 2025
Worchester, MA
Last Detection: July 2021
Boston, MA
Eradication: May 2014
Illinois Eradication:
Addison & Summit: 2004
Ravenswood, Kilbourn Park, O'Hare & Park Ridge: 2005 Chicago: 2008
New Jersey Eradication:
Hudson: April 2008
Union/ Middlesex: March 2013
Central Long Island, NY Last Detection: May 2024
New York Eradication
Islip, NY: August 2011
Manhattan, NY: May 2013
Staten Island, NY: May 2013
Eastern Queens, NY: May 2017
Western Queens/ Brooklyn, NY: September 2019
Ohio Eradication:
Portion of East Fork State Park, April 2022
Monroe Twp: September 2018
Batavia/ Stonelick Twps: March 2018
Tate Twp/ East Fork Rec Area, OH Last Detection: January 2025
Hollywood, SC
Last Detection: February 2025
North Dakota
Minnesota
South Dakota
Nebraska
Michigan
New York
Rhode Island
Connecticut
Ohio
Maryland
District of Columbia
Delaware
West Virginia
Virginia
North Carolina
Tennessee
Oklahoma
Arkansas
Mississippi
Alabama
Georgia
South Carolina
Texas
Louisiana
Asian Longhorned Beetle Federal Quarantine Boundary
Active Federal Quarantine
Rescinded Federal Quarantine
State Boundary - ALB Eradication Declared
State Boundary - ALB Quarantine Active
State Boundary
Data Source:
USDA APHIS PPQ
ESRI Basemap
Date Created:
2/10/2025
USDA APHIS
2150 Centre Ave
Fort Collins, Co 80526

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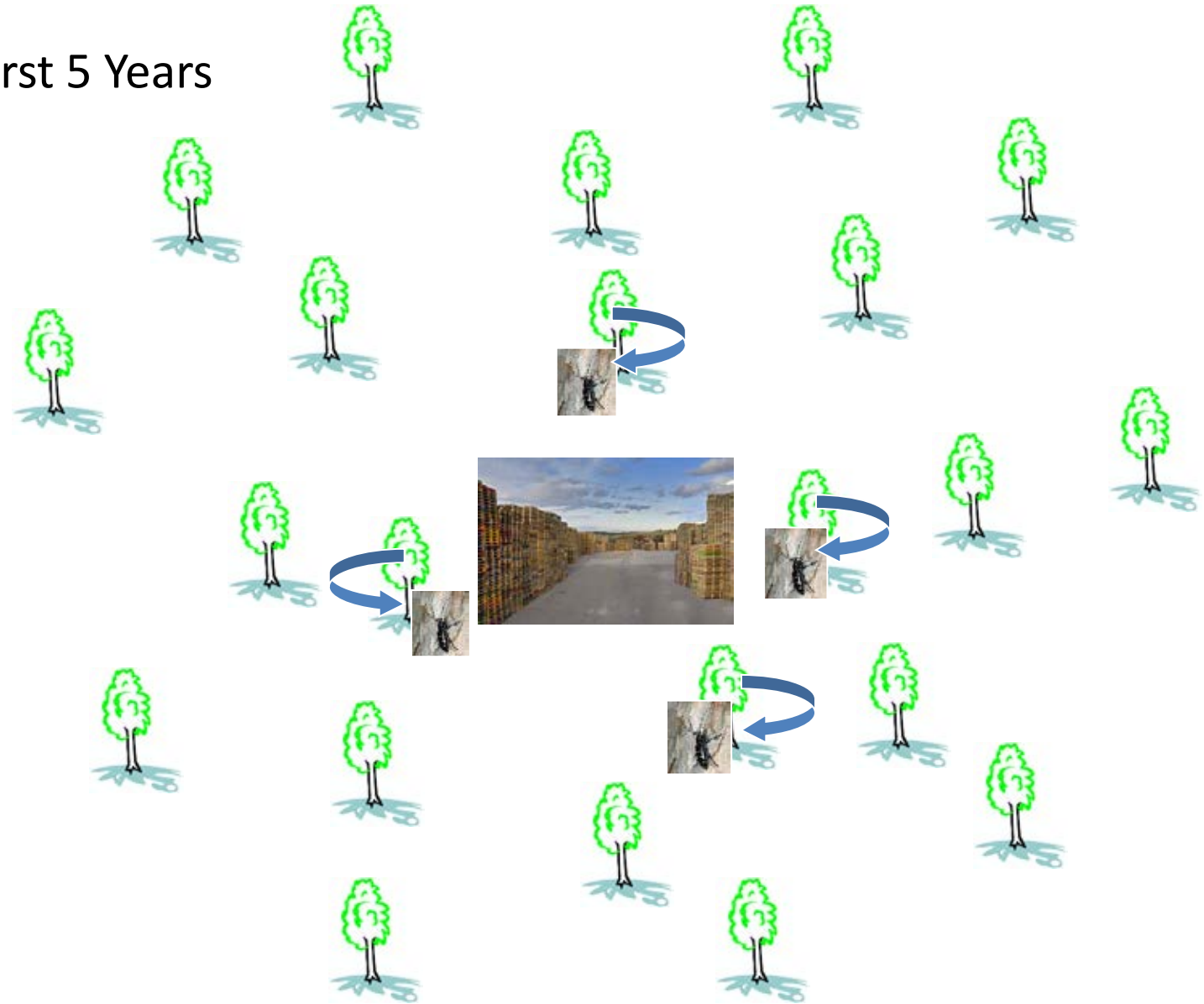
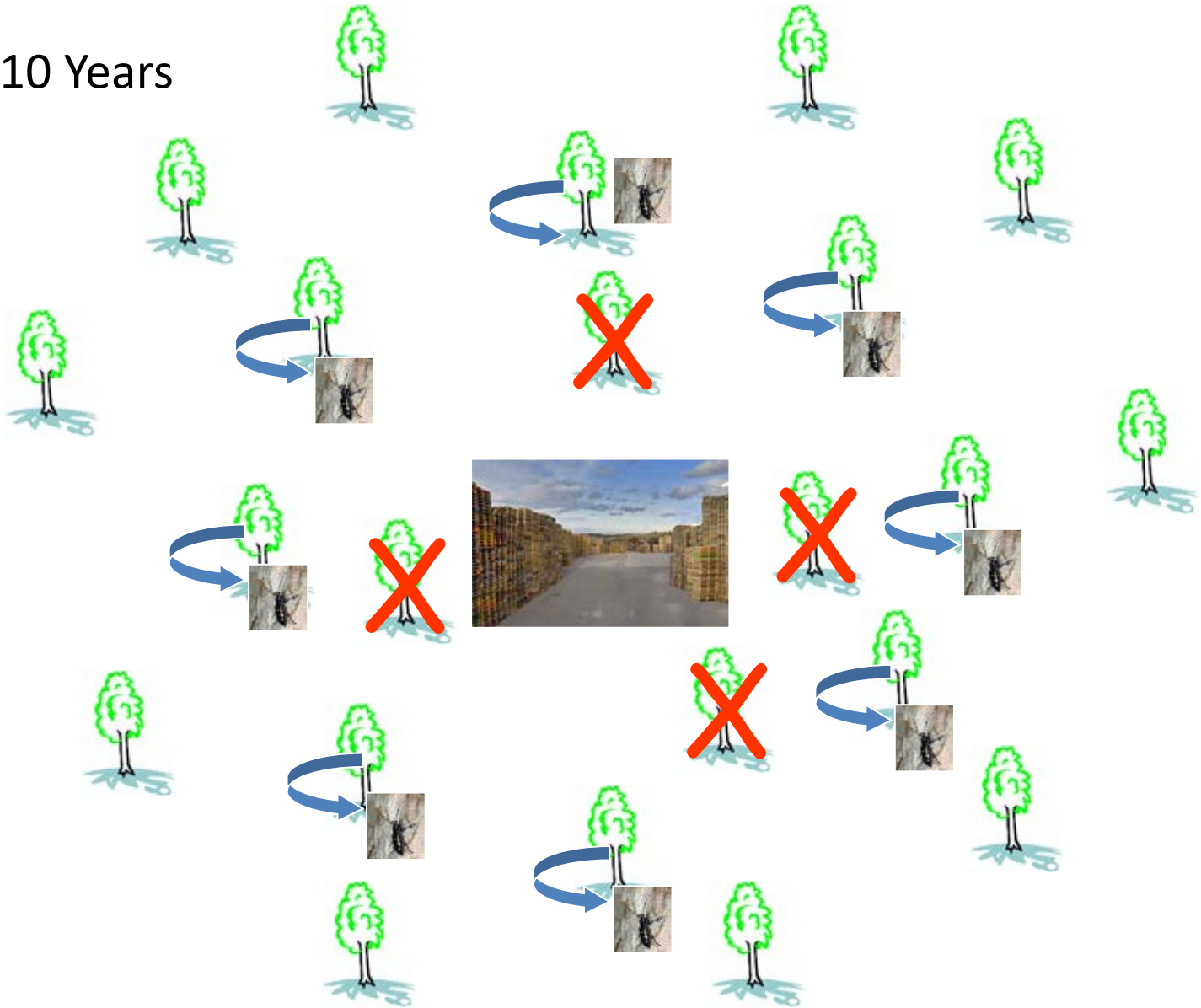
Infestation

First 5 Years



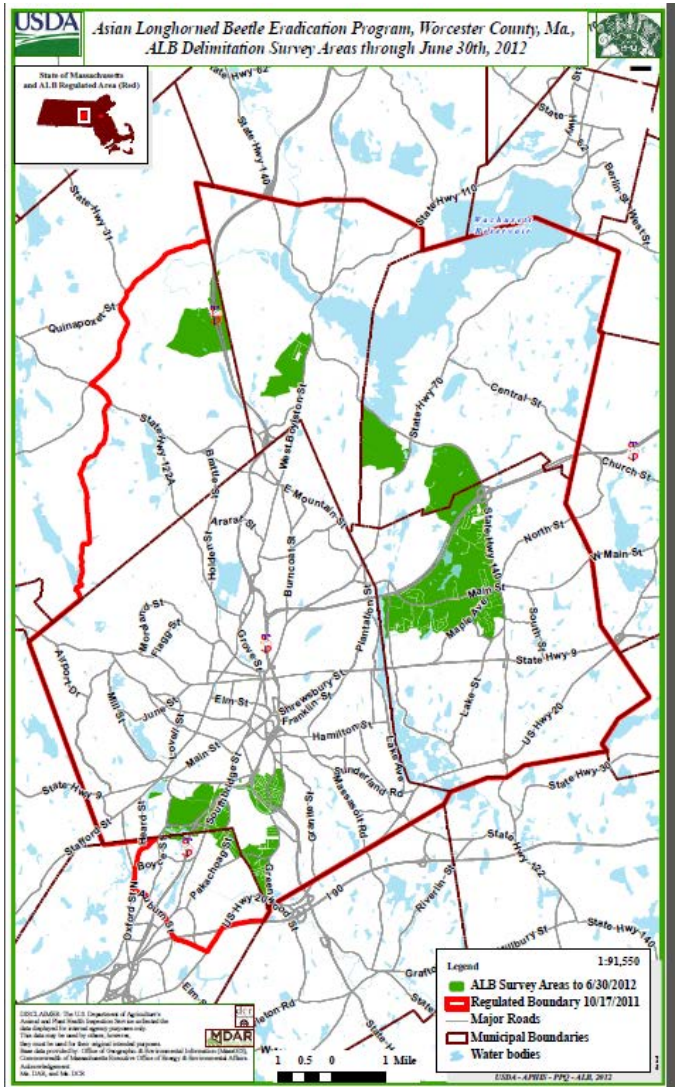
5-10 Years



10-15 Years

And so on….

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

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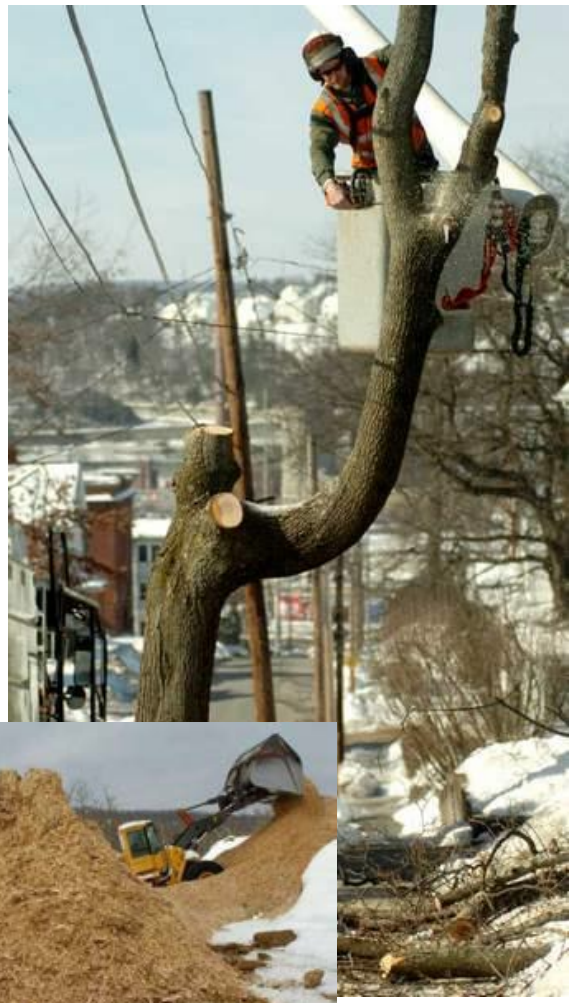
ALB traps



Tree cutting in Worcester

Chips sent to power plant

(T&G Staff Photos / RICK CINCLAIR)

What Happens When ALB is Detected

- It's a federal case, overseen by USDA APHIS
- Delimitation surveys happen
- Quarantines set
- Compliance agreements with arborists, nurseries, firewood dealers, electric companies, etc.
- All known infested trees removed and chipped. High risk trees removed and chipped
- Annual intensive surveys, including tree climbers, and trapping
- Eradication declared 4 years after last detection

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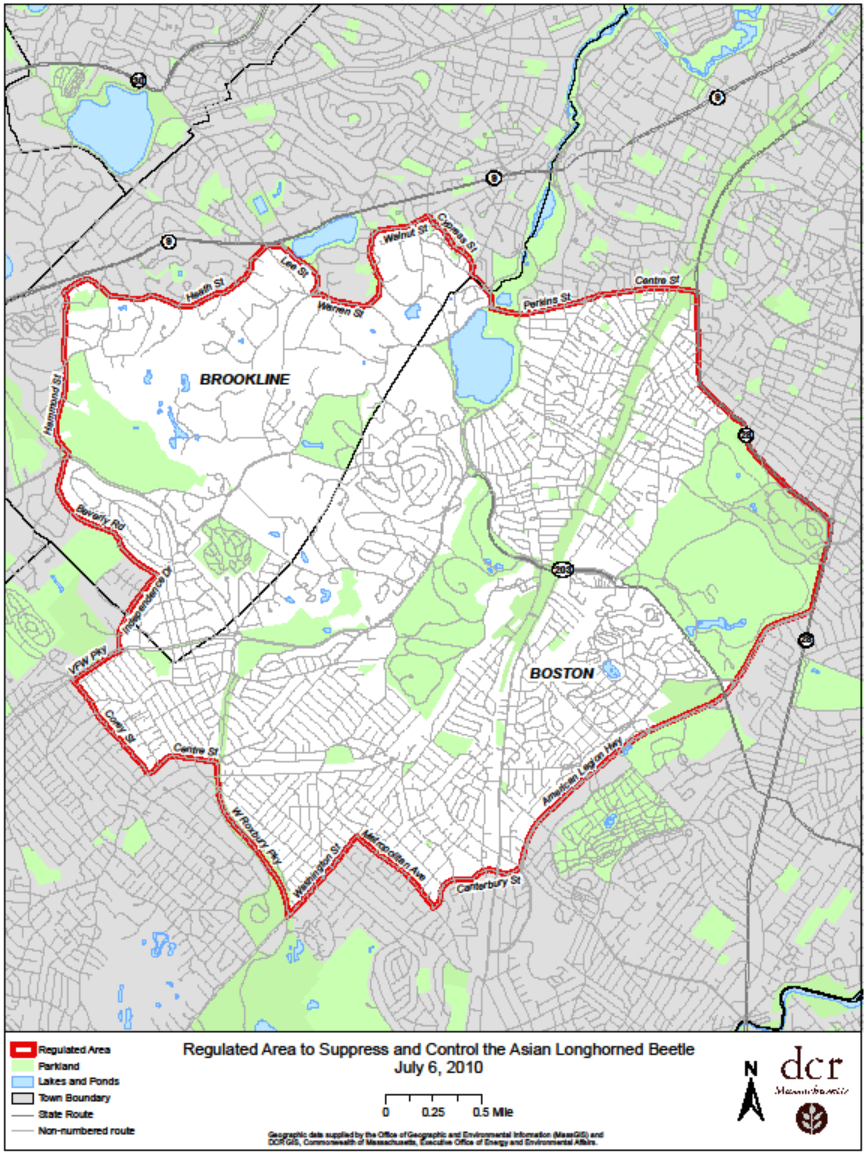

Boston, MA 2010

- Discovered July 2, 2010 @ Jamaica Plains
- Regulated area 10 square miles
- 6 infested trees found by arborist!
- So far only trees found
- Surveyed about 56 K trees in area
- Declared free 2014

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ALB Ohio 2011

Regulated Area: 49 sq. miles* in Clermont County

Tate and Williamsburg Townships

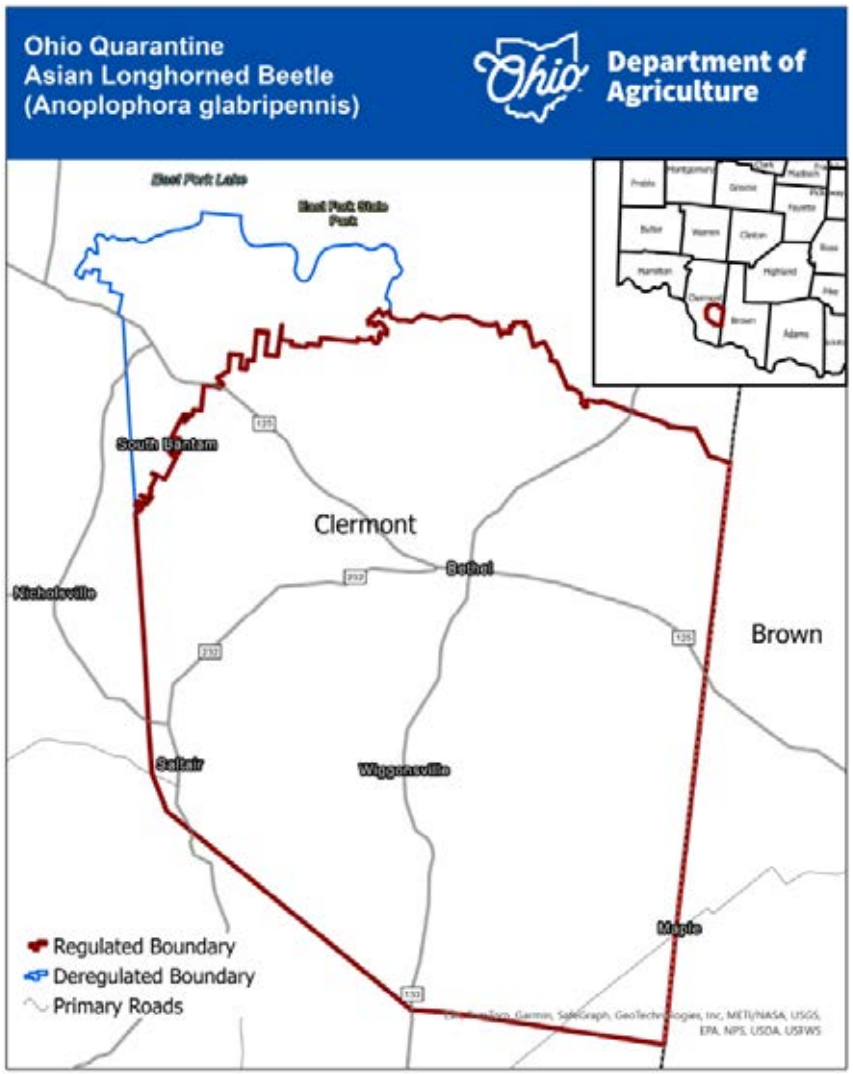
Infested Trees: 21,756

Removals: 117,550

21,695 Infested, 95,855 High-Risk Hosts

Surveys: 4,376,449

* Monroe Township was eradicated in September 2018, resulting in a reduction of the regulated area by .5 sq. [illegible] onelick and Batavia Townships were eradicated [illegible] 2018, resulting in a reduction of the regulated area by 5 sq. miles.



ALB South Carolina 2020

ALB by the Numbers – 2025 ALB Stats as of 12/05/2025

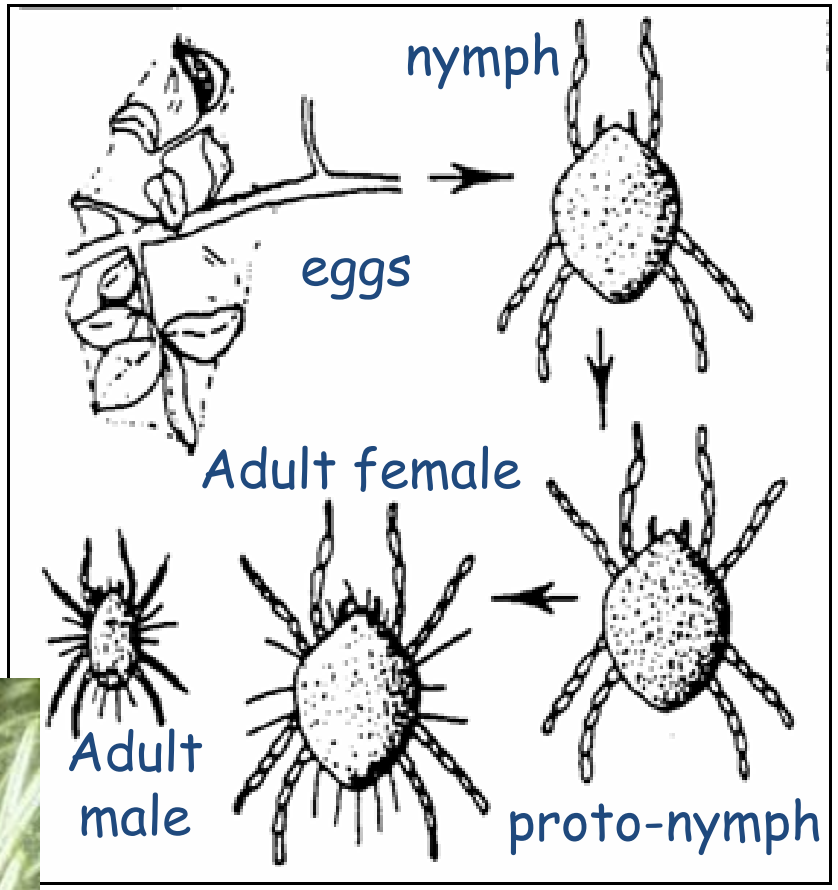
- Tree Surveys: 566,357
- Infested Detections: 12,816
- Infested Removals: 7,853
- High Risk Removals: 20,860

- House with discovery had found lots of construction, lots of SW packing also an RV park near discovery site
- Most material, infested are maple 98% almost all red
- Popular, birch aspen, elm willow
- Genetics match Ohio, but could be from, Asia or Europe.

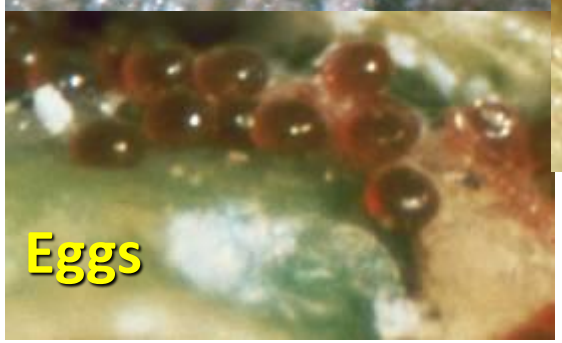
What can you do?

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

Spider Mites



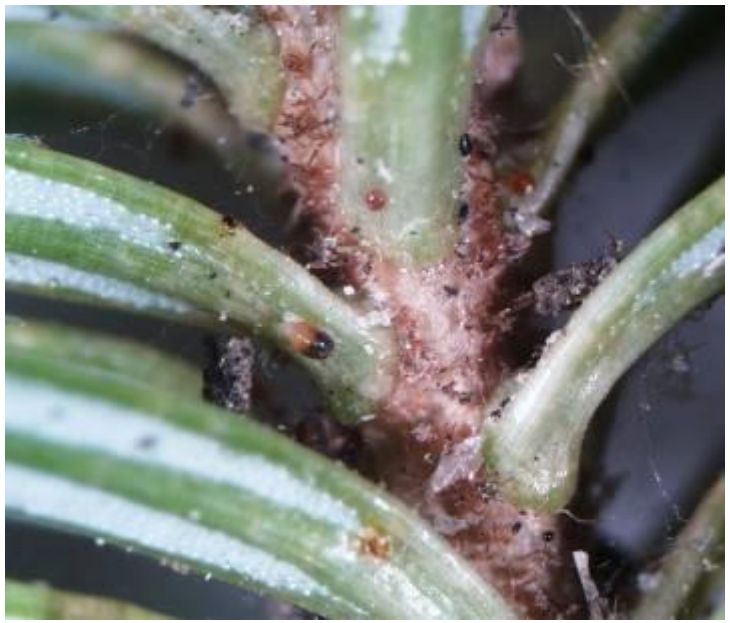
Spruce Spider Mite



Webbing

Spruce Spider Mite

Spruce Spider Mite



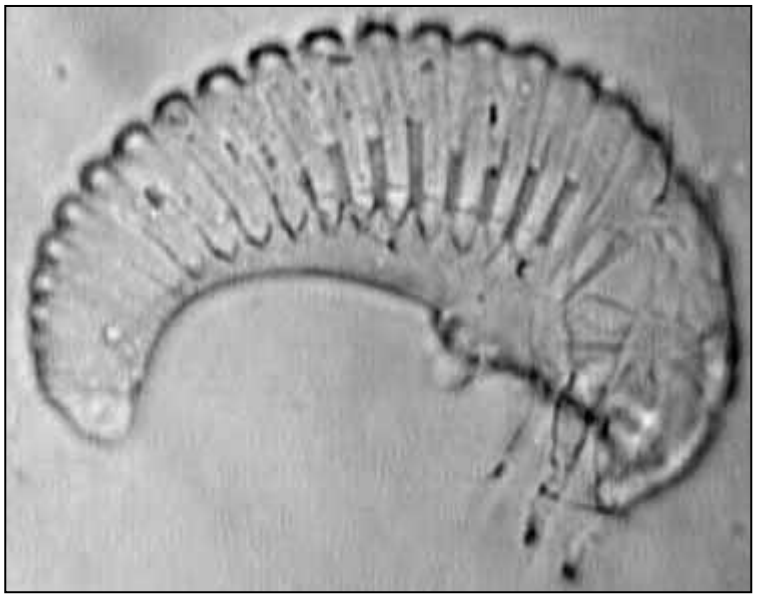
- Hosts – Spruce, arborvitae, hemlock, pine, juniper, Cedar, Doug. Fir, etc.
- Overwinter as eggs, hatch in April
- Several generations/ year
- Prefer older needles
- Most active in spring and fall

Spruce Spider Mite Management

- Infested plants, dull, lack vigor
- Monitor by looking for eggs in April (or winter), active forms in May & September
- Jar limbs over white surface to dislodge active forms for counting
- If necessary dormant horticultural oil in April, summer oil in summer

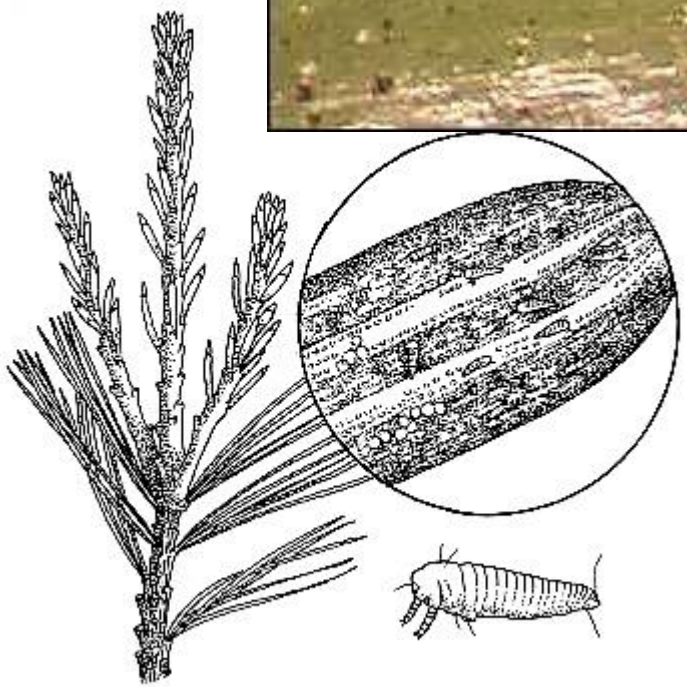
Eriophyid mite

mite



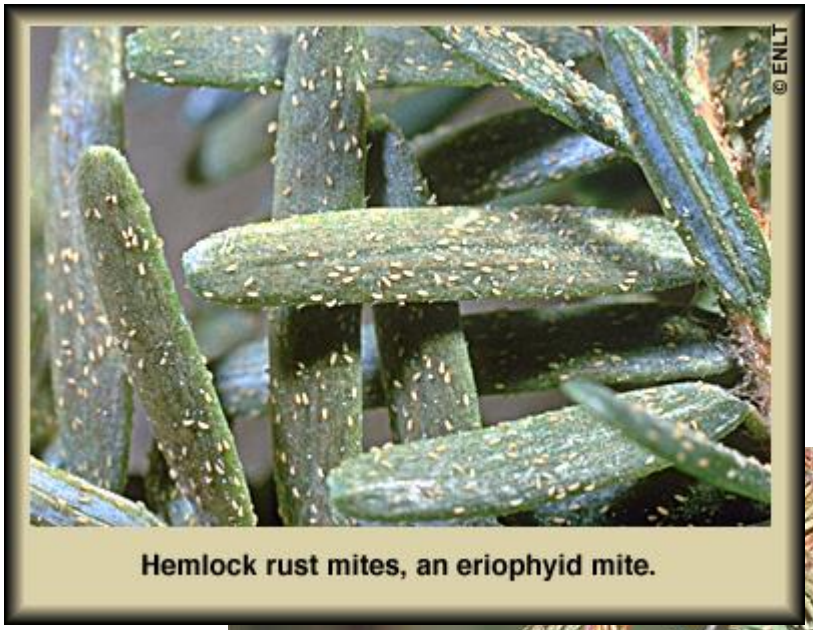
Only 2 legs

Wedge Shaped

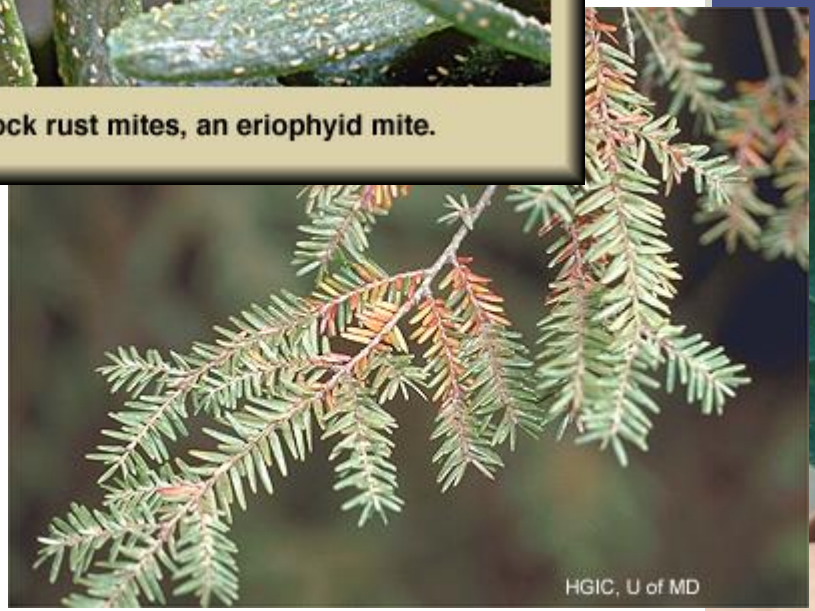


Eriophyid Mite

mite



Hemlock rust mites, an eriophyid mite.



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Eriophyid mite

- Hemlock rust mite of most concern – also attacks fir and spruce
- Causes yellow or brown russeting
- Most damage in spring
- Horticultural oil can be used to control

General Rules of Insect Management

- Appropriate tree placement and resistant cultivars
- Maintain tree health! Healthy trees are more able to resist attacks, and to tolerate any damage.
- Monitor trees for pests, visual assessment, counts, traps (sticky traps, band traps, pheromone traps)
- Rely on natural enemies when possible
- If necessary use insecticides. Always use the insecticide with the least potential for damaging natural enemies, people, pets, ground water and the environment.

Complete List of Insects for Test

https://portal.ct.gov/DEEP/Pesticides/Arborist/Commercial-Arborist-License

Category	Species to Know
Aphids and Adelgids	• Cooley spruce gall adelgid • Eastern spruce gall adelgid • Hemlock Woolly adelgid • Pine bark aphid • Woolly beech aphid
Bark Beetles and Borers	• Black vine weevil • Bronze birch borer • Dogwood borer • Elm bark beetle • European pine shoot moth • Pine root collar weevil • Two-lined chestnut borer • White pine weevil
Caterpillars and Loopers	• Cankerworms • Eastern tent caterpillar • Fall webworm • Forest Tent Caterpillar • Spongy (gypsy) moth • Oak leaf tier • Oak leaf roller
Leaf Miners	• Arborvitae leaf miner • Birch leaf miner • Holly leaf miner
Mites	• Spruce spider mite • Two-spotted spider mite
Sawflies	• European sawfly • Mountain ash sawfly • Pine false webworm • Pine sawflies • Redheaded sawfly
Scales	• Beech bark scale • Euonymous scale • European elm scale • Elongate hemlock scale • Magnolia scale • Oystershell scale • Pine needle scale • Tulip tree scale • White prunicola scale
Skeletonizers	• Birch skeletonizer • Elm leaf beetle • Oak leaf skeletonizer

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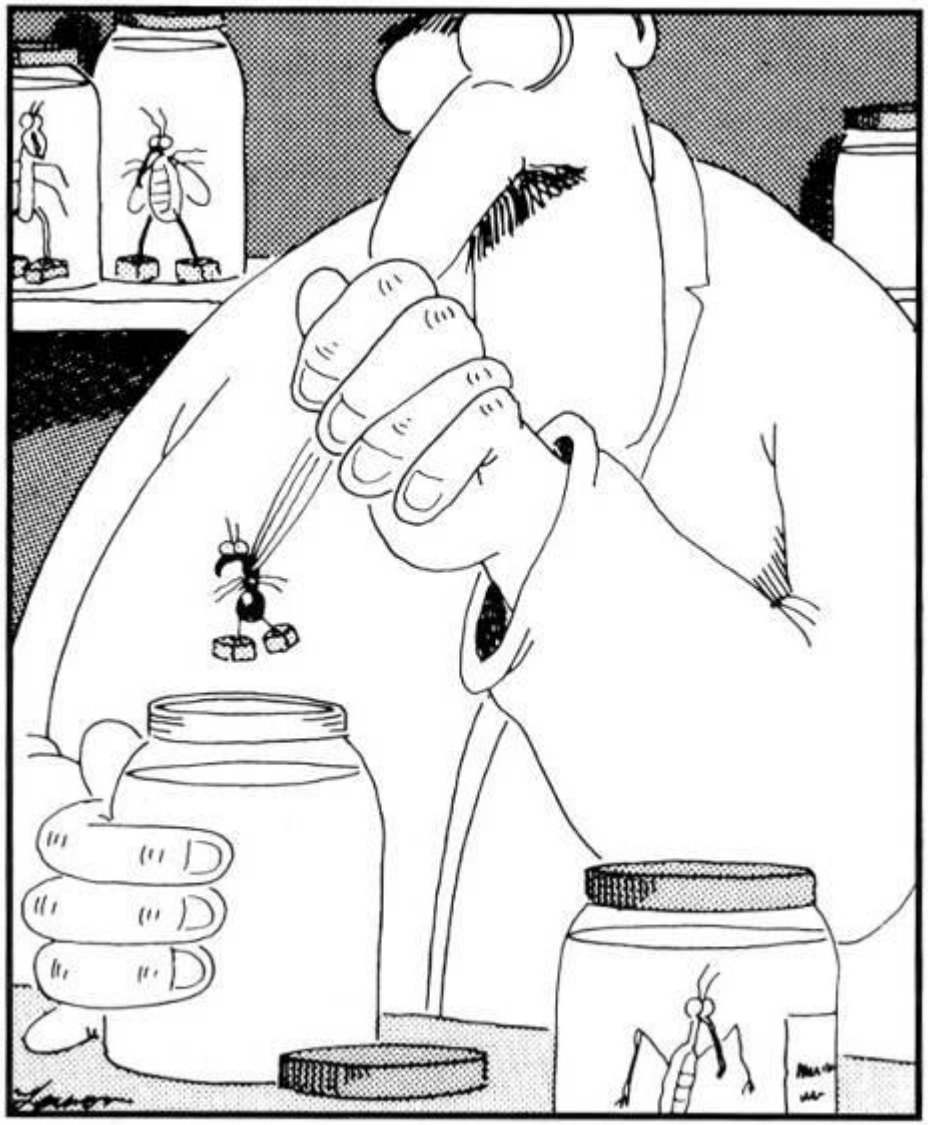
Additional Resources

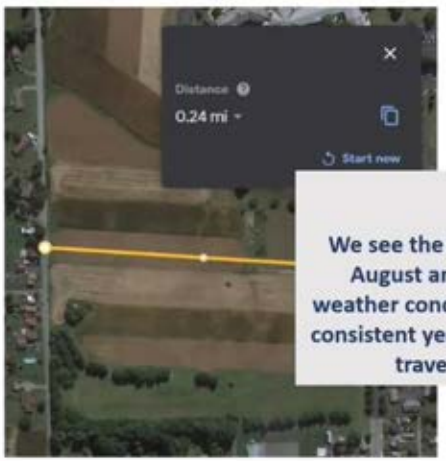
- Insects that Feed on Trees and Shrubs. Johnson and Lyon. Cornell University Press
- The ‘Blue Books’ Guide to Management for CT Insects and Diseases.
- Integrated Pest management for insects and related pests on ornamental plants: a guide for arborists and grounds keepers. UConn, Cooperative Extension Service



Scenes from the entomology underworld

The End

Are SLF Capable of Flying Long Distan



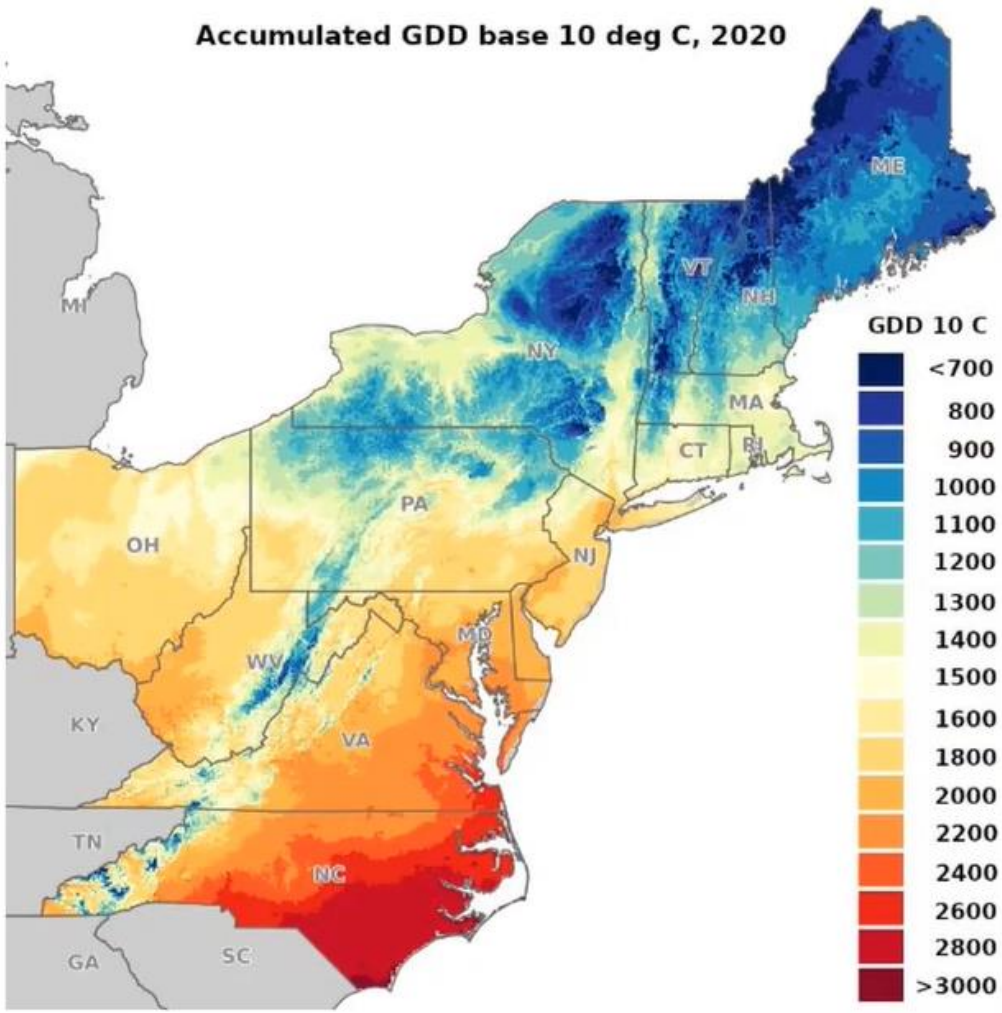
Yes!!!

We see the biggest dispersal flights in late August and through September when weather conditions are good. Judging by the consistent yearly spread, I believe individuals travel ~7.5-10 miles per year.

PennState

Extension.PSU.EDU/SLF

Slide Courtesy of Dr. Dennis Calvin



SLF and the Intertie of Different Landsca

PennState

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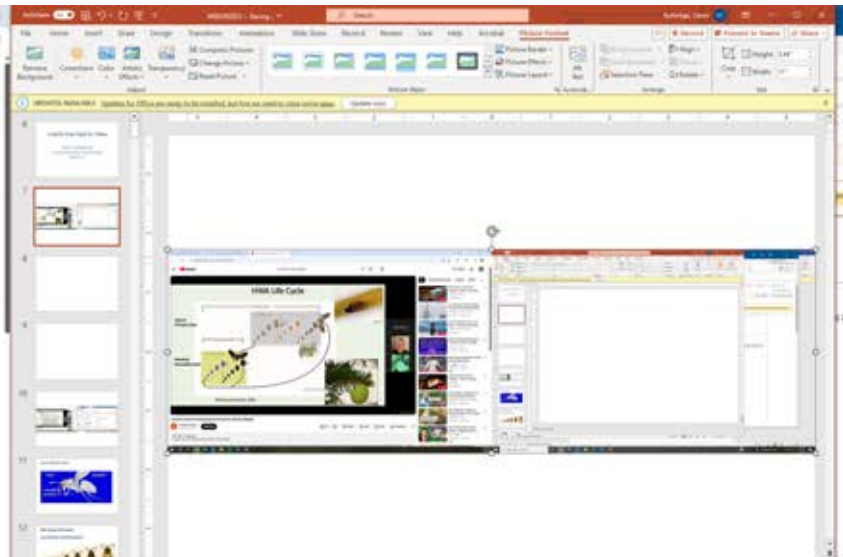
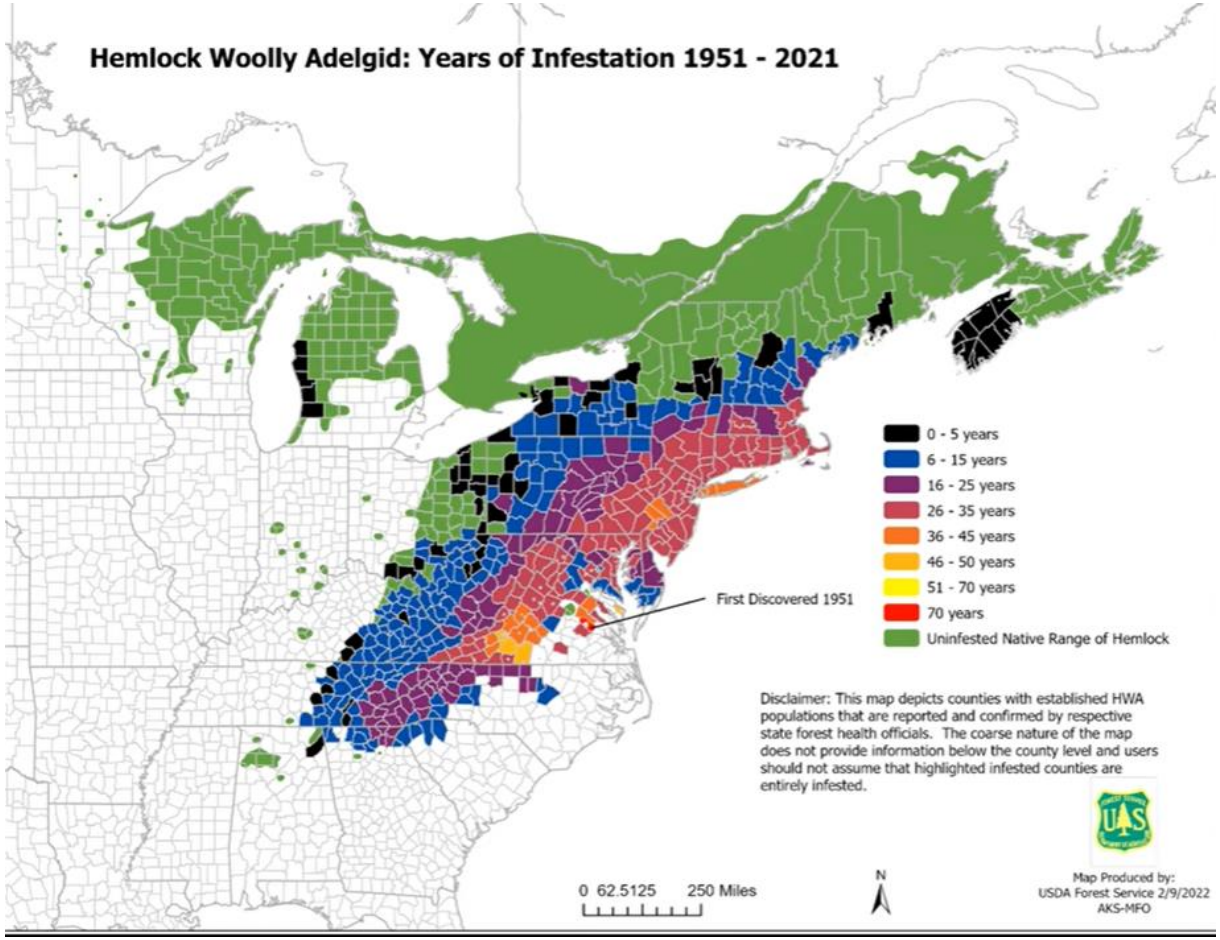
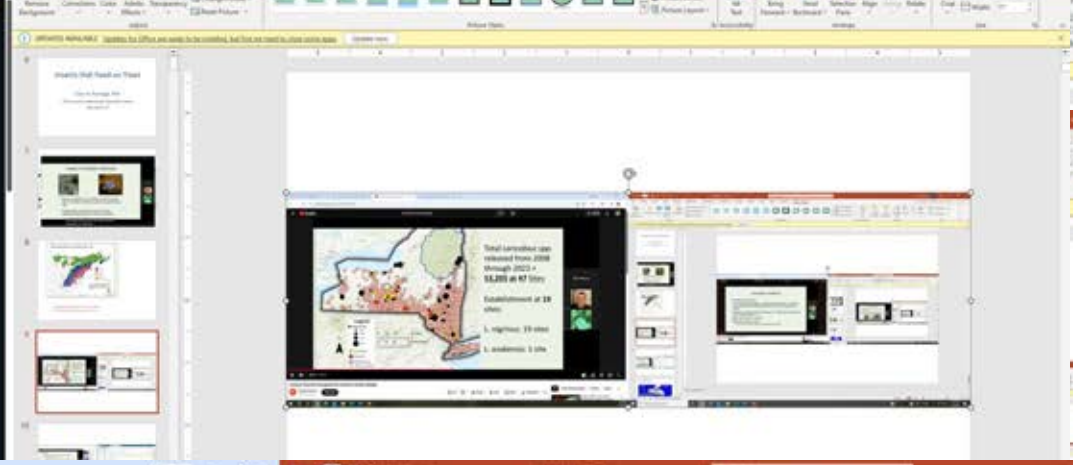
hemlock woolly adelgid
HWA Life Cycle in Eastern North America
Two generations per year
Only asexual reproduction in North America

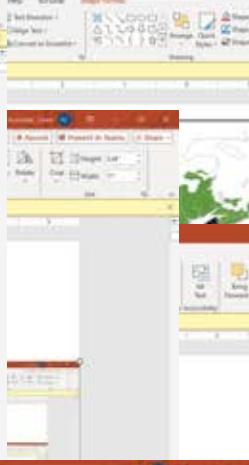

HWA Life Cycle

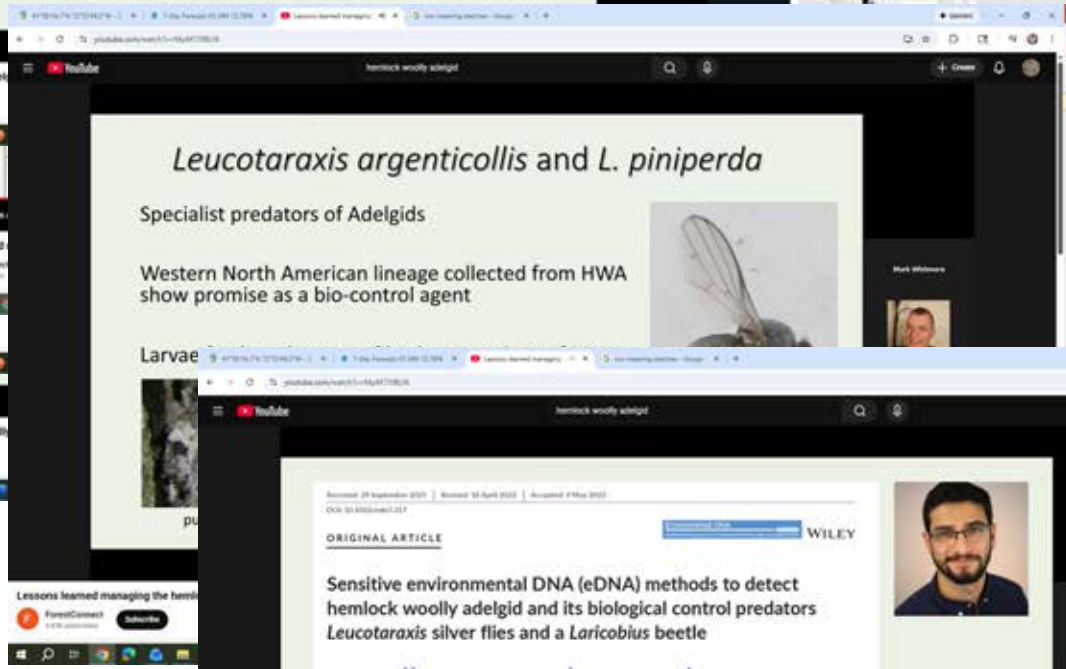


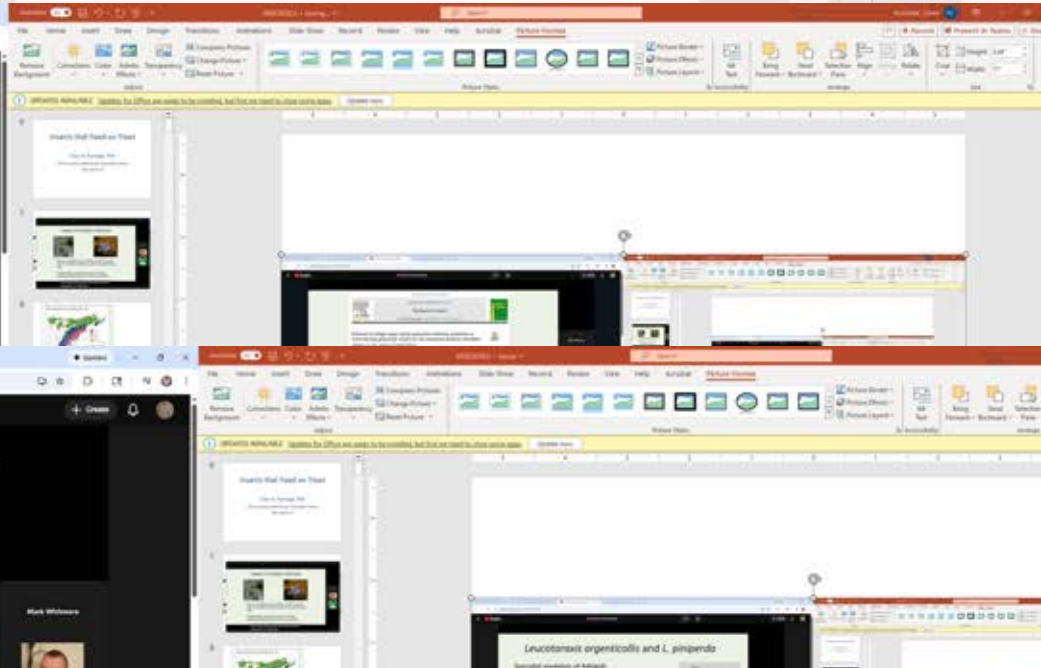
Probably introduced at turn of century
first noticing that damage trees in 51

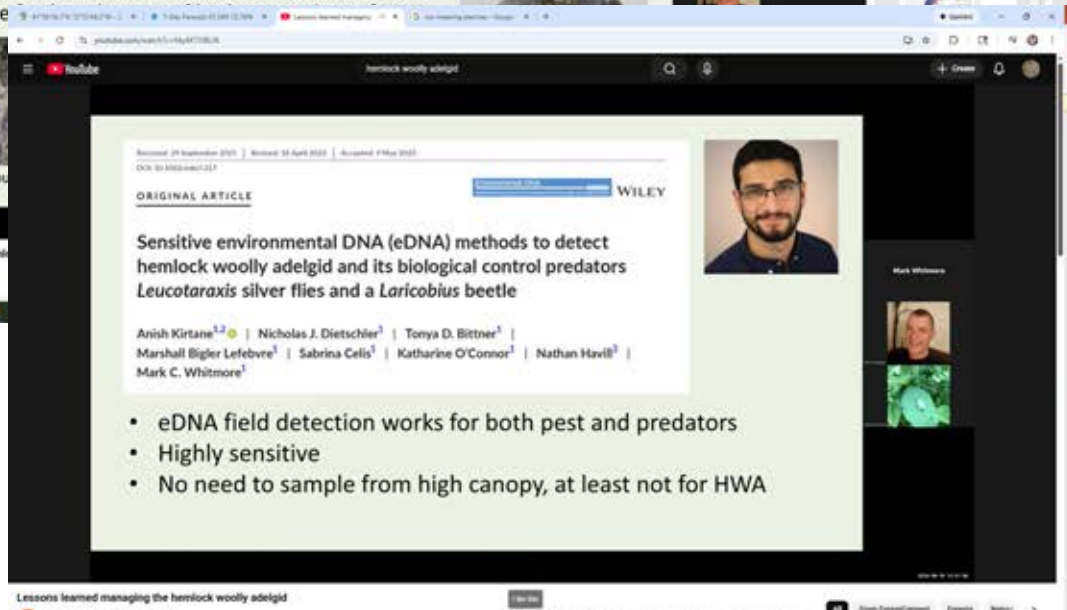

Biological Control
Mark Whitmore

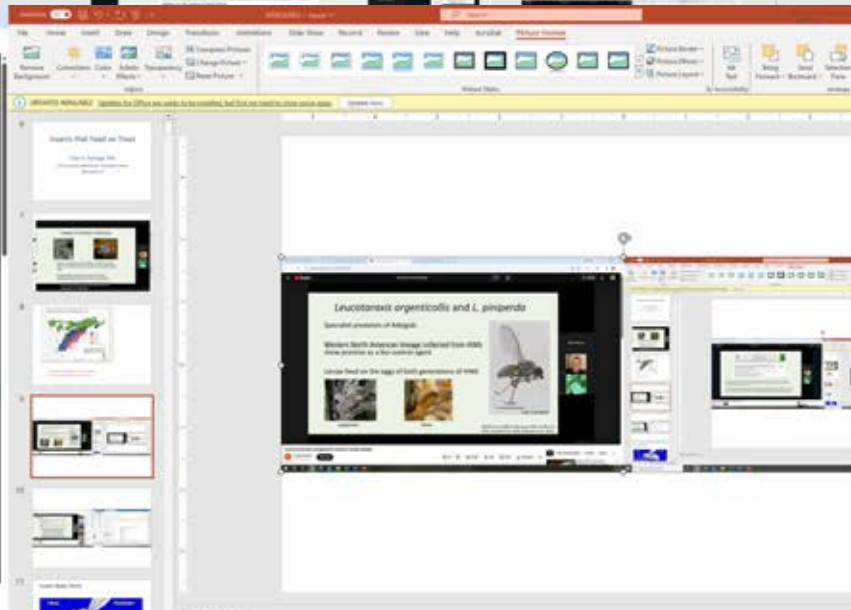


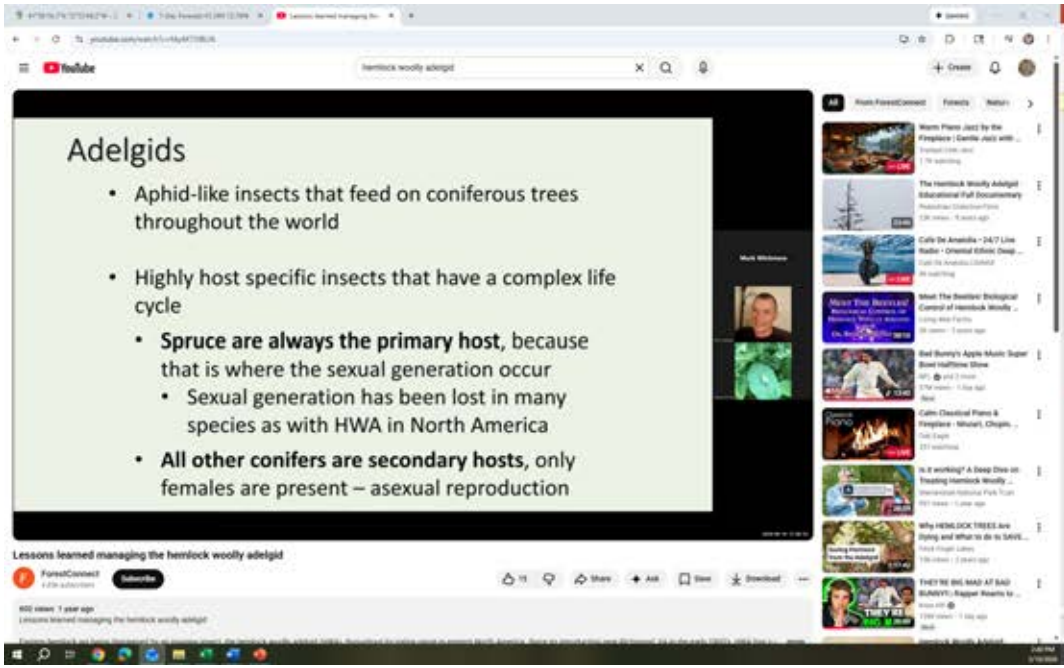


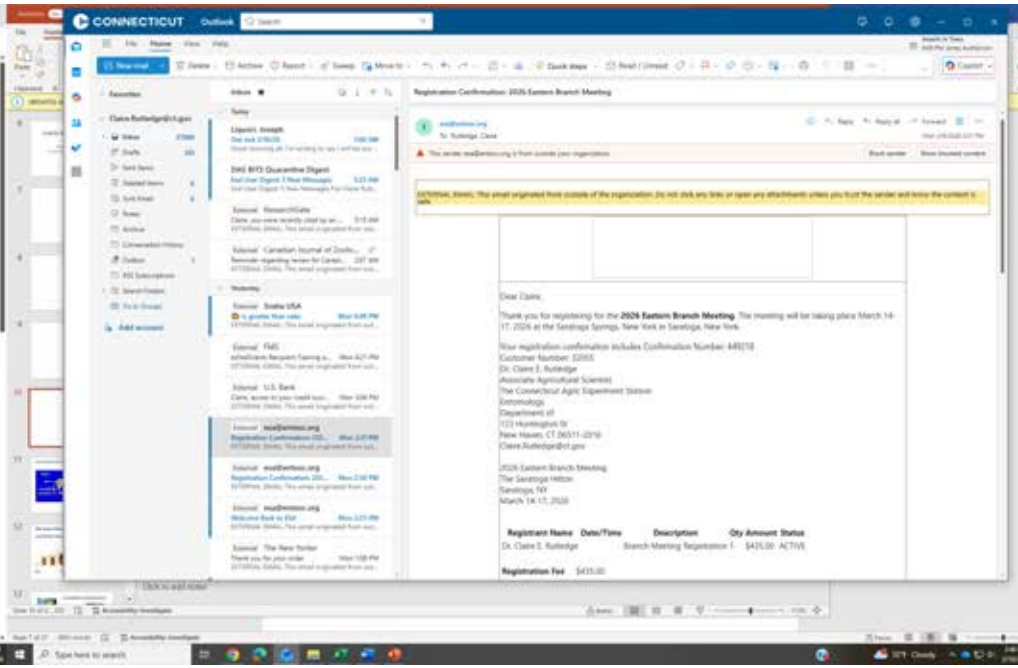

Leucotaraxis argenticollis and L. piniperda
Specialist predators of Adelgids
Western North American lineage collected from HWA show promise as a bio-control agent
Larvae
Mark Whitmore
Lessons learned managing the hemlock woolly adelgid
ForestConnect




ORIGINAL ARTICLE
WILEY
Sensitive environmental DNA (eDNA) methods to detect hemlock woolly adelgid and its biological control predators Leucotaraxis silver flies and a Laricobius beetle
Anish Kirtane | Nicholas J. Dietschler | Tonya D. Bittner | Marshall Bigler Lefebvre | Sabrina Celis | Katharine O'Connor | Nathan Havill | Mark C. Whitmore
• eDNA field detection works for both pest and predators
• Highly sensitive
• No need to sample from high canopy, at least not for HWA
Mark Whitmore
Lessons learned managing the hemlock woolly adelgid




Adelgids
• Aphid-like insects that feed on coniferous trees throughout the world
• Highly host specific insects that have a complex life cycle
• Spruce are always the primary host, because that is where the sexual generation occur
• Sexual generation has been lost in many species as with HWA in North America
• All other conifers are secondary hosts, only females are present – asexual reproduction
Lessons learned managing the hemlock woolly adelgid
ForestConnect
Subscribe


CONNECTICUT
Outlook
Registration Confirmation: 2026 Eastern Branch Meeting