An Overview of Insect Pest Priorities for NJ's Urban and Rural Forests

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Spotted Lanternfly

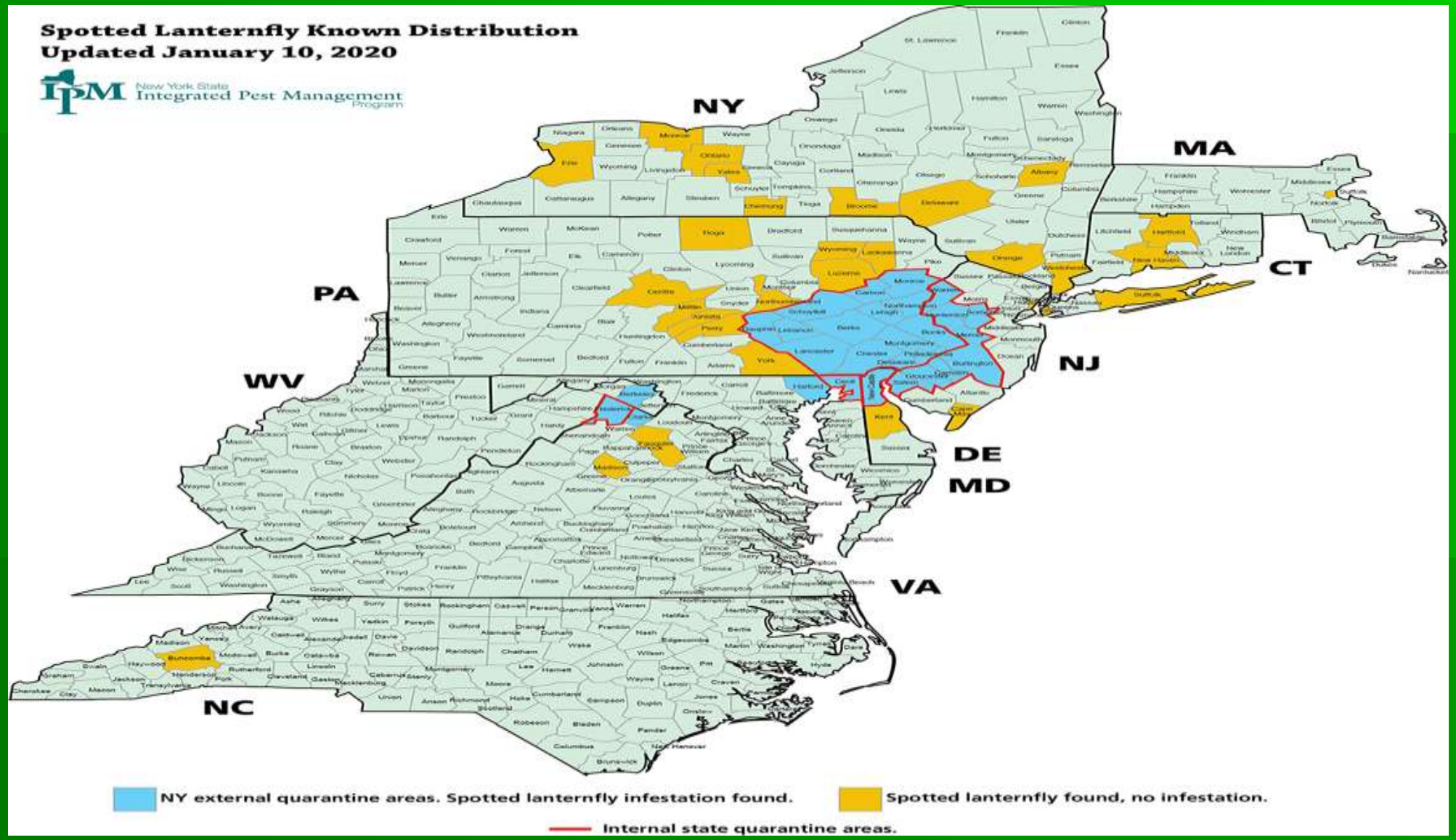
Lycorma delicatula

- The Spotted Lanternfly is a planthopper from Asia, specifically found in China, India, Vietnam, South Korea*, Japan* and USA*.
- It belongs to the family Fulgoridae in the order Hemiptera (true bugs).
- Most hemipterans feed on plants, using their sucking and piercing mouthparts to extract plant sap.

Distribution

- Found in Berks County in Pennsylvania Fall 2014, at a stone importer prompting the immediate quarantine of Pike and District townships. Port of NY?
- The initial introduction is believed to have been in 2012.
- As of 2020 there are 14 counties under quarantine in PA for SLF.
- August 2 , NJ added 4 more counties totaling 8.
- Currently in 5 states and detected in another 3.

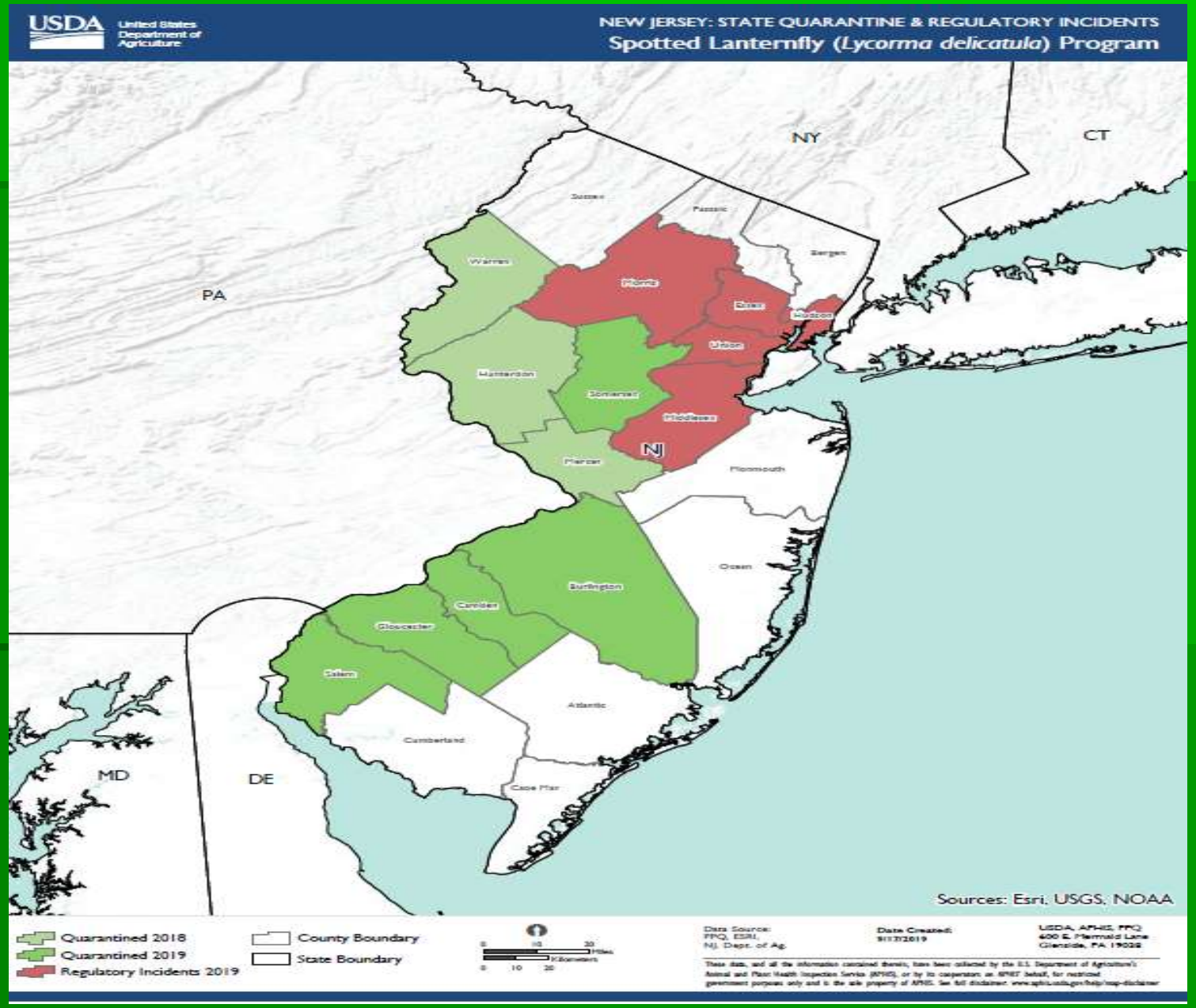
Distribution: SLF US



NJ SLF Quarantine

- Warren County
- Hunterdon County
- Mercer County
- Somerset County
- Burlington County
- Camden County
- Salem County
- Gloucester County

- Inspect, Inspect, Inspect!
- Commercial Permits
- Property Access (Survey)



NJ Survey & Treatment

- **The treatment areas include private/ state/county lands, farms and RR.**
- **Retreatment from 2018/2019 of farms and other treated lands.**
- **Total Properties in Project:** 119,134
- **Total Acres in Project:** 425,006
- **Total Properties Treated (2019)**: 420 total, 13,861 Acres

How Does Quarantine Impact NJ?

- Limited movement of articles from inside the quarantine to outside the quarantine.
- This includes ANY means of conveyance!

NJ Permits

REGULATED ARTICLES

- Any living life stage of SLF.
- Landscaping, remodeling and construction waste.
- Firewood of any species.
- Packing materials (e.g., wood pallets, crates, boxes)
- All plants and plant parts including logs, stumps and any tree parts.
- Outdoor household articles like RVs, boats, lawn mowers, chairs, grills, tarps, tile, stone, deck boards, and trucks or other vehicles not stored indoors.
- Anything!

Lifecycle: Adults

Approx. 1 inch in length

Adults

- The forewing is gray with black spots of varying sizes and the wing tips have black spots outlined in gray.
- Hind wings have contrasting patches of red and black with a white band.
- The legs and head are black, and the abdomen is yellow with black bands.

Adults

- Adults often cluster in groups to feed, mate and lay eggs.

- Life cycle is univoltine
  (one generation per year)

- Spotted lanternfly overwinters as eggs.

- Egg laying begins in September and continues up through the onset of winter, until a hard killing frost.

Adults

- Adult feeding on soybean as well as other vegetable crops.

- Adults have poor muscle strength in their mouth parts so they choose individual hosts based on turgor pressure.

Egg Masses

- Egg masses contain 30-50 eggs in 4-7 vertical rows.
- Females can lay up to 2 eggs masses.
- An egg mass is approx. 1 inch in size.
- Eggs hatch intermittently to increase survival of the nymphs.

Lifecycle: Nymphs

Nymphs

- There are four nymphal instars.
- 1st instar - April to June
- 2nd & 3th - June to July
- 4th instar - July to Sept
- The first 3 instars are black with white spots and wingless.
- The fourth instar has red wing pads and upper body.
- Nymphs spread from the initial site by crawling and feeding on woody and non-woody plants.

Nymphs

- Nymphs have a much wider host range compared to the adults.
- They “hop” to avoid prey or capture.
- Like the adults prefer to feed in groups.
- Feed on the phloem with sucking mouthparts.
- Stores bitter chemicals from TOH feeding in its body to make it unpalatable to predators during the 4th instar.

Hosts

- Spotted lanternfly feeds on a variety of host plants including fruit trees, ornamental trees, woody trees, vegetables, herbs, grains and vines.

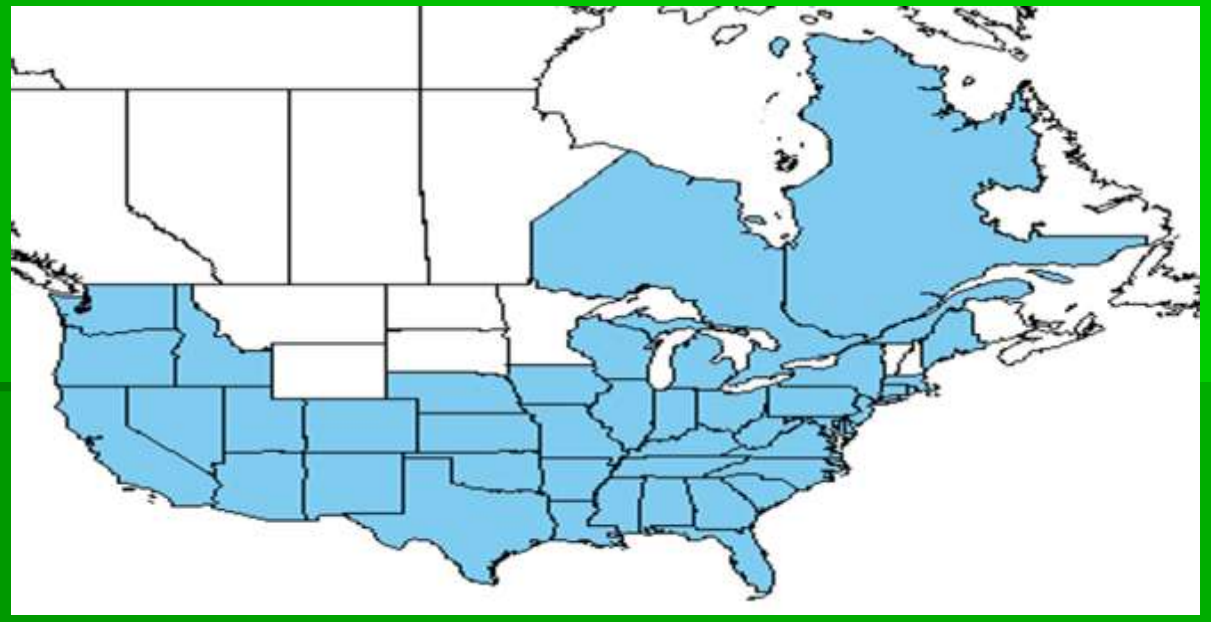
- 135+ species of woody and herbaceous plants.

**SLF CAN complete development and reproduce without tree of heaven!

Hosts

- Tree-of-heaven, *Ailanthus altissma*, which contains high concentrations of cytotoxic alkaloids, is one of the favorite hosts.

- Korean Evodia contain toxic secondary metabolites as well.



Tree of Heaven Distribution-USDA PLANTS Database

Hosts

- Spotted lanternfly shows a strong preference to both wild and cultivated grapes.

Hosts

Host	Nymphs			Adults		
	May	June	July	August	September	October
Rose (cultivated, multiflora, etc.)	■	■				
Grape (wild and cultivated)	■	■	■	■	■	■
Tree-of-heaven	■	■	■	■	■	■
Black walnut, butternut		■	■			
River birch			■	■	■	■
Willow			■	■	■	■
Sumac			■	■	■	■
Silver/red maple				■	■	■

Damage

Due to the sugar content of the liquid, plant parts covered with spotted lanternfly excretion harbor mold growth, which could hinder plant growth or even cause death. The largest colonies can produce large fungal mats at the base of tree.

Control

- Neonicotinoids, pyrethrins, and organophosphates are among the chemical insecticides effective against spotted lanternfly.

- **93/7% Control**

Bio-Control

Parasitoid encyrtid wasp, *Ooencyrtus kuvanae,* which was brought in from Asia in 1909 to control gypsy moth was found parasitizing SLF eggs in PA in 2017.

Parasitoid eupelmid wasp, *Anastatus orientalis* is reported to parasitize up to 30-40% of spotted lanternfly eggs in South Korea.

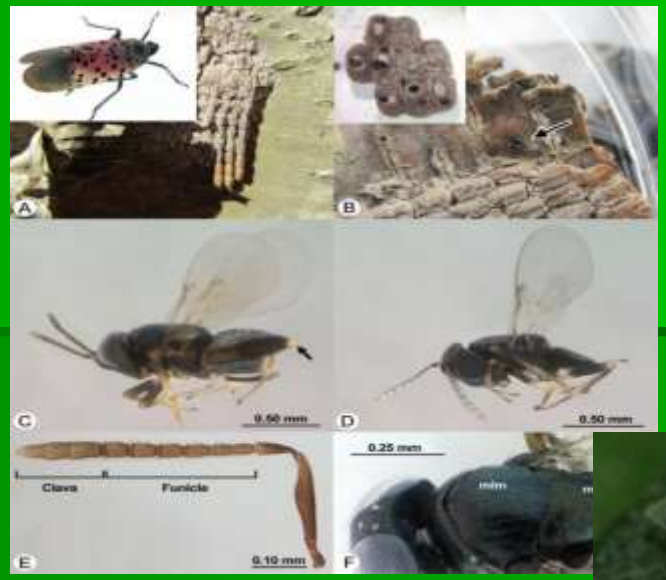
Parasitoid dryinid wasp, *Dryinus sinicus* is reported to parasitize spotted lanternfly nymphs in China.

Bio-Control

The difficulty in biocontrol is rearing SLF in the lab.

*Green Lacewing (*Chrysoperla rufilabris*) may be a native predator of the eggs, but further study is required.

Wheel bugs?



Liu & Mottern (2017) showing *Ooencyrtus kuvanae*

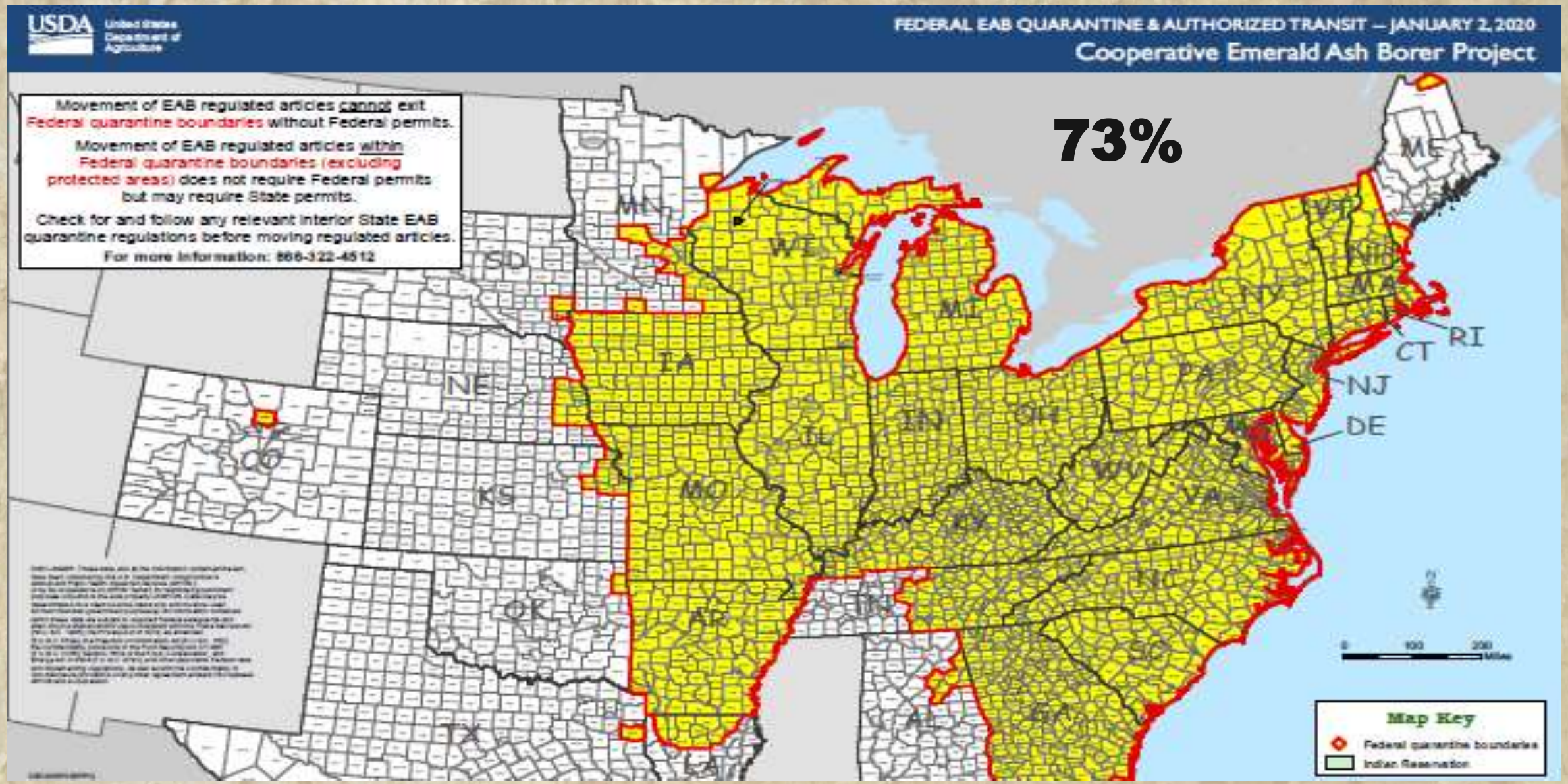
Bio-Pesticides
Entomopathogenic Fungus

- *Beauveria bassiana*
  (Aprehend, Botaniguard)
- *Batkoa major*
- Infects through the cuticle

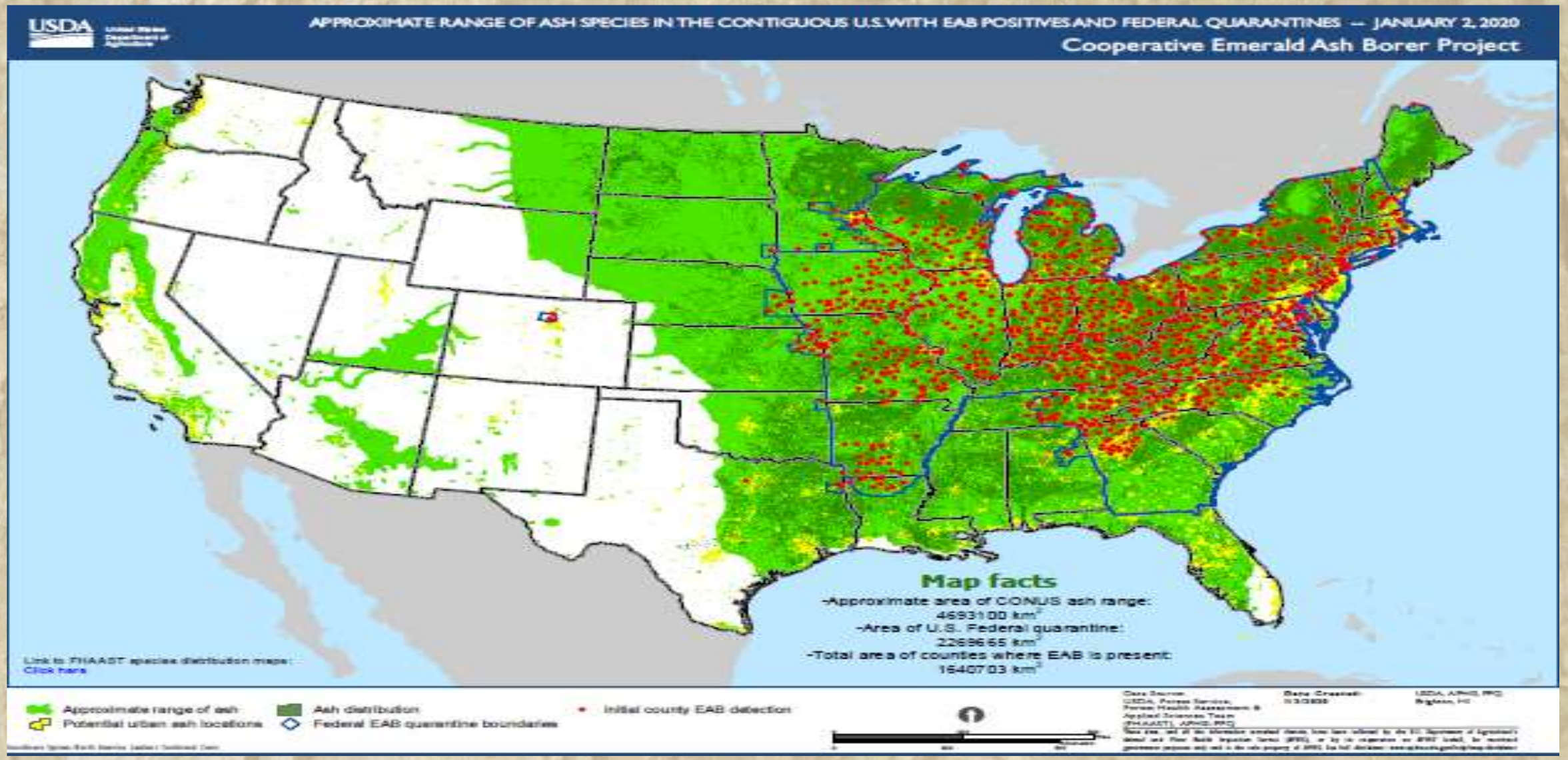
Endosymbionts

- There are three known “gut” bacteria that are only found in SLF.
- They have evolved three separate organs in the female.
- Their role is to process the sugary sap in to amino acids.
- The bacteria pass from mother to egg through a currently unknown mechanism.

NA EAB Infestations: 35 States 5 Canadian Provinces



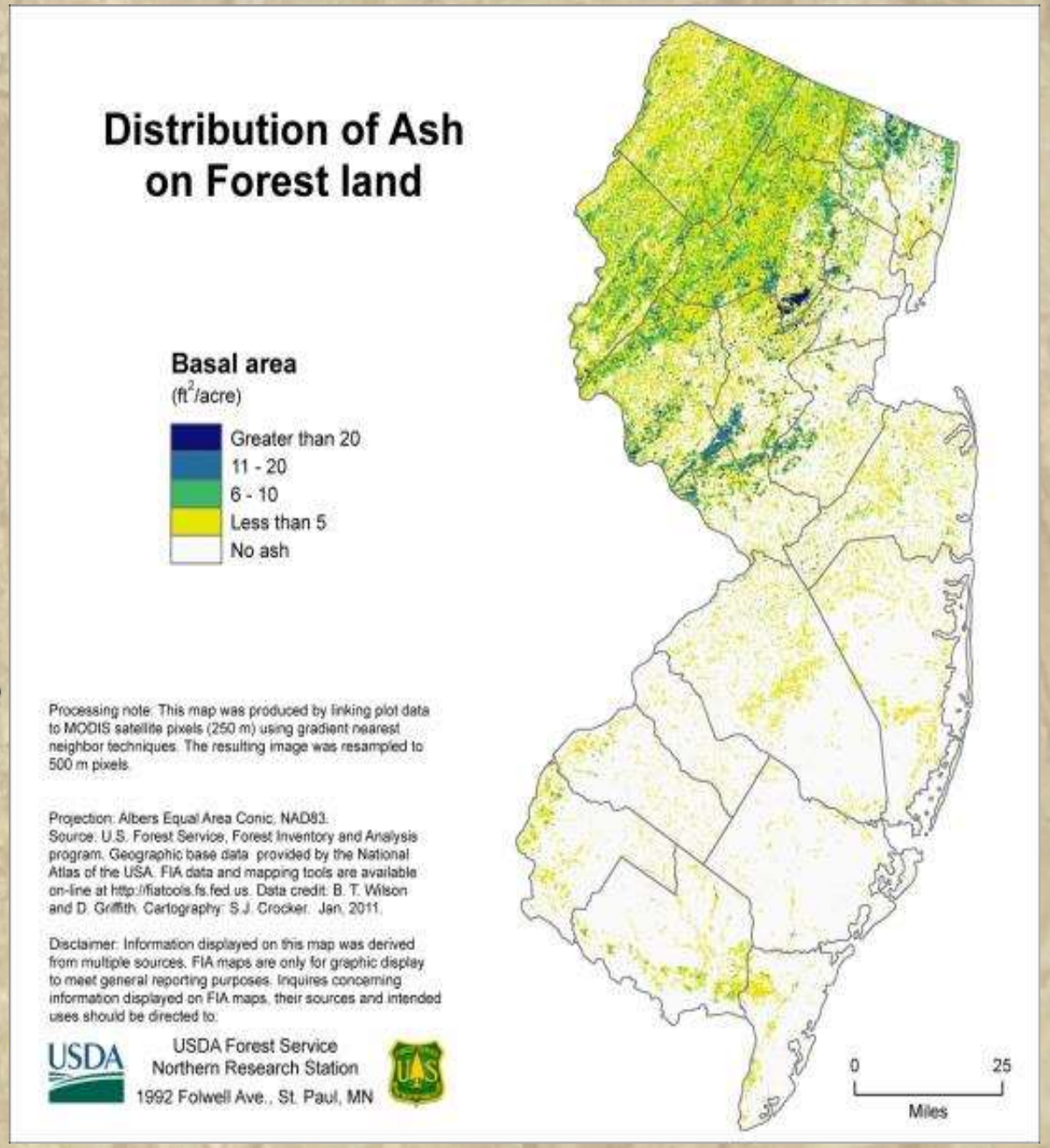
US Ash Distribution



EAB Threatens 7.5 Billion Ash Trees in North America

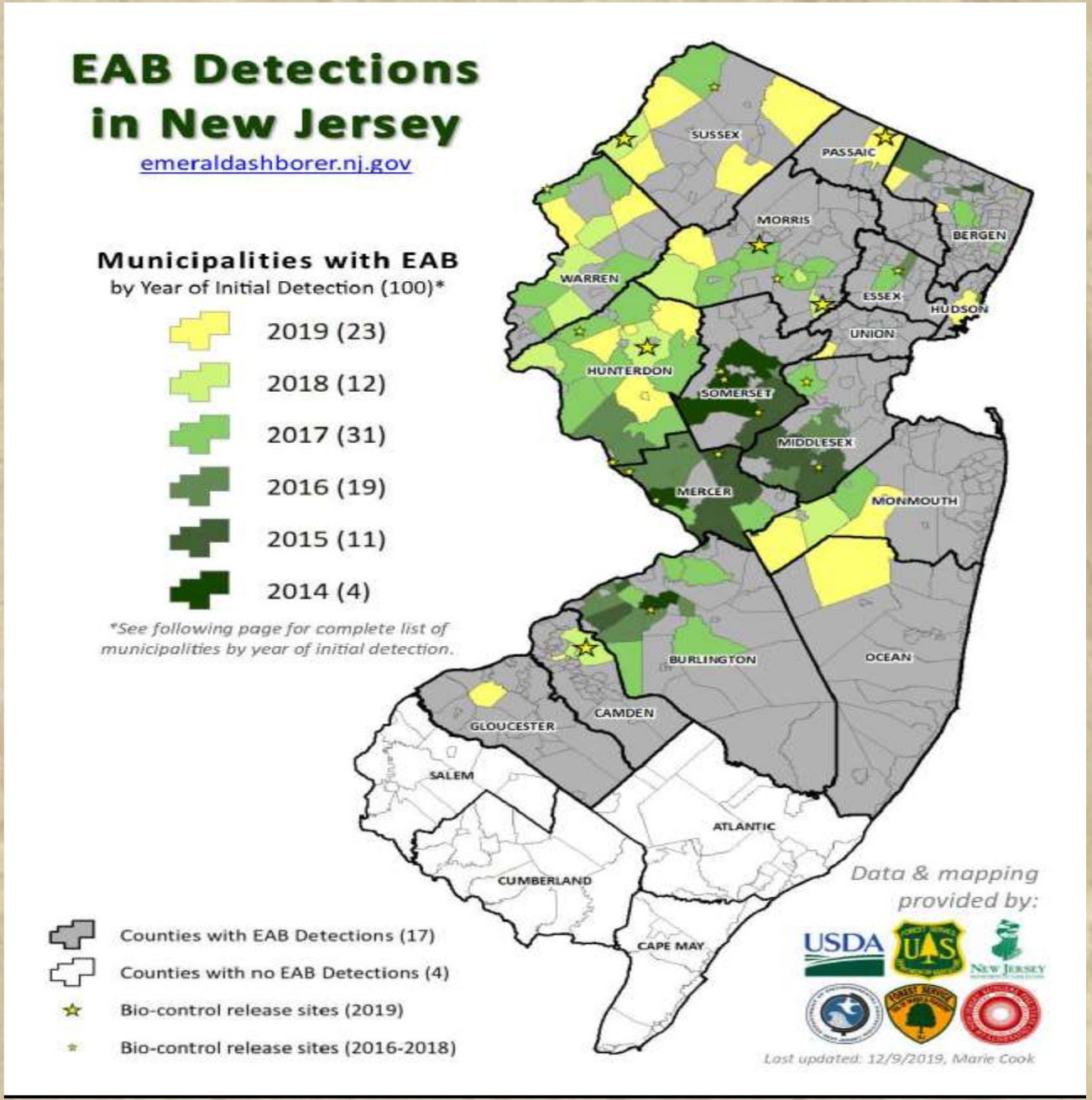
NJ Ash Distribution

- **NJ has over 24 million ash trees in forests, NOT including all the planted street, park and homeowner trees.**
- **Green, White, Black and Pumpkin Ash are found in NJ.**
- **Ash was a commonly planted landscape tree in the 70s-90s in in new developments and retirement communities.**



NJ EAB

- 17 Confirmed Counties
- 4 Unconfirmed Counties
- 100+ Municipalities



EAB Damage

D-Shaped Exit Holes

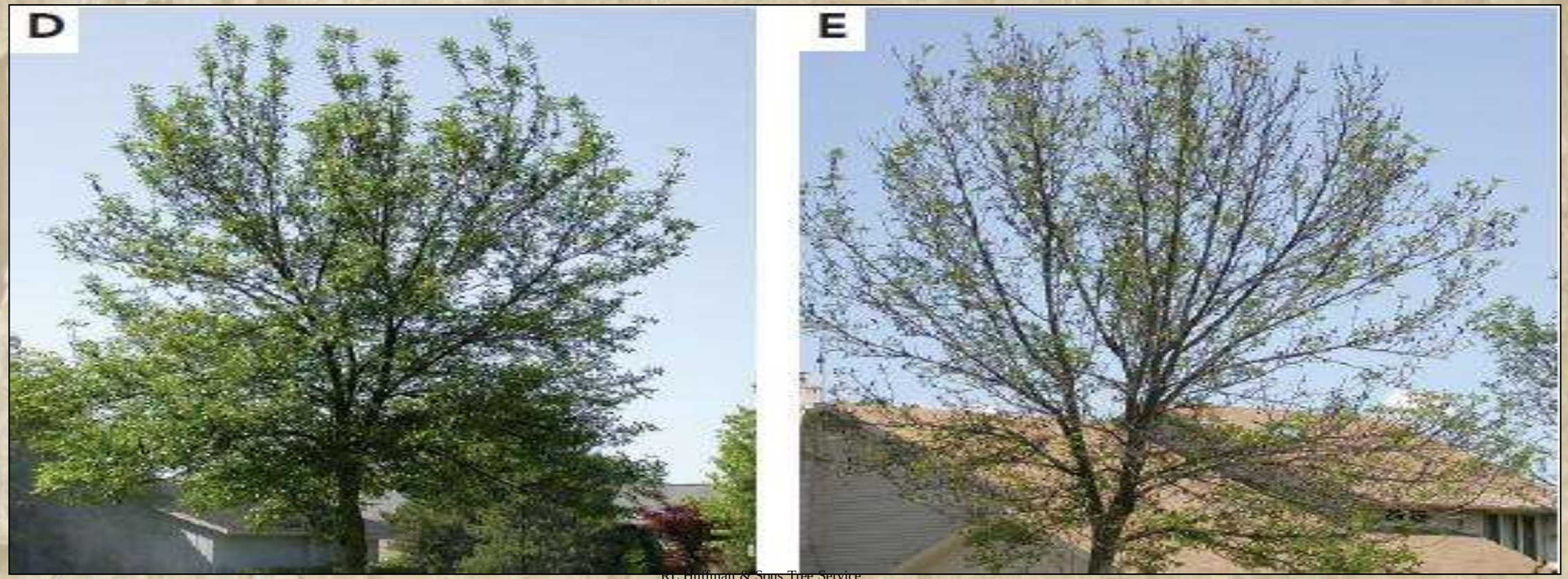
Bark Cracks

S-shaped larval galleries

Charles Flower

www.emeraldashborer.nj.gov

Crown Dieback

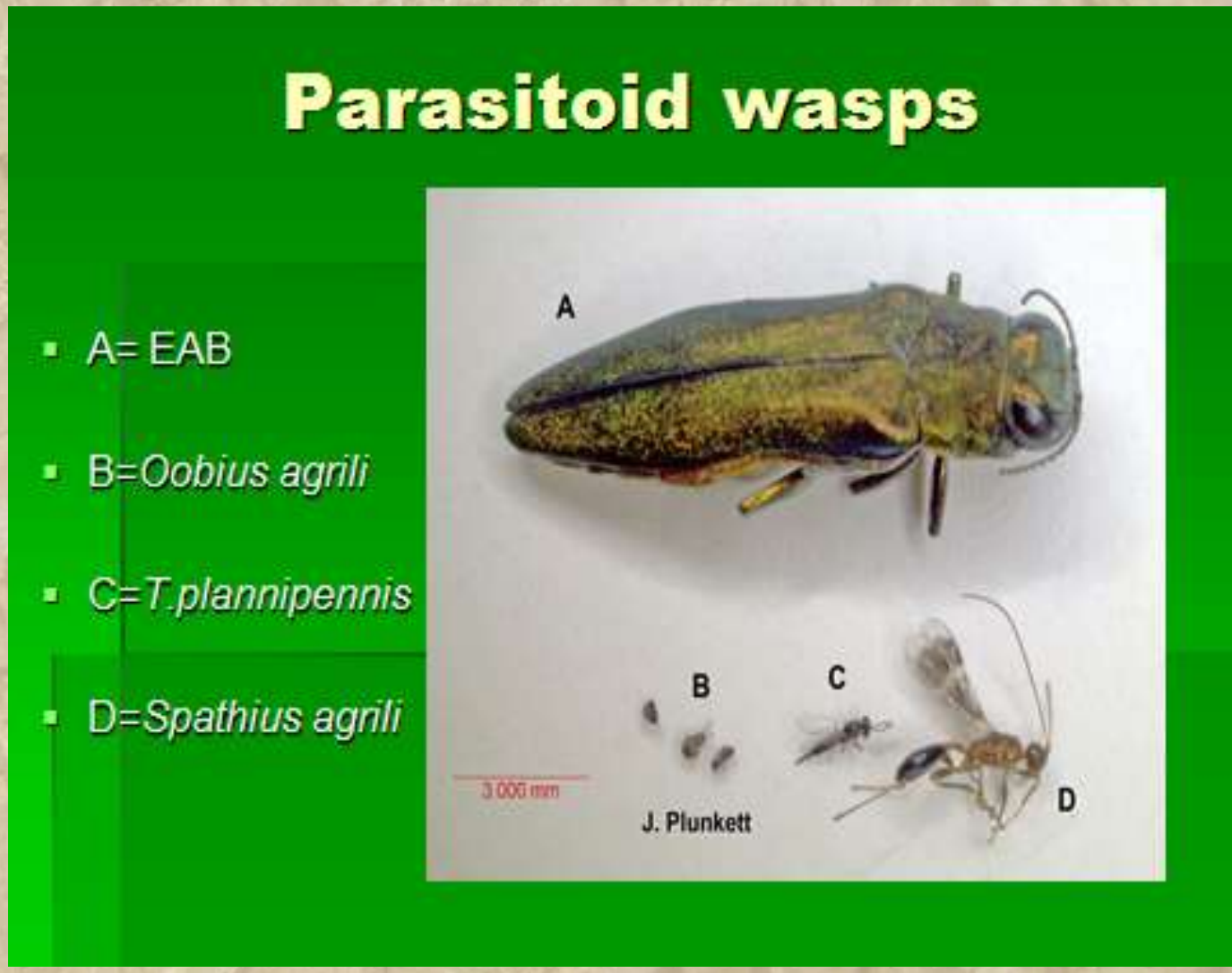


RL Huffman & Sons Tree Service

- **Feeding and damage begins in the upper canopy.**
- **30% crown loss is the tipping point for tree survival**
- **Tree mortality in 6-8 years depending on size and vigor.**
- **Over 99.7% tree mortality from untreated EAB infestation.**

EAB Bio-Control

- The USDA APHIS PPQ Biological Control Production Facility in Brighton, MI
- 4 non-native wasp spp (Stingless parasitoids)
  - *Oobius agrili*
    - *Egg parasitoid*
  - Tetrastichus plannipennis
    - Larval parasitoid <10DBH
  - *Spathius agrili**
    - Larval parasitoid >10DBH
  - *Spathius galinea**
    - Larval parasitoid >10DBH
      - * 40th Latitude



Crazy Snake Worm

- ***Amynthas agrestis***
- ***Amynthas tokioensis***
- ***Metaphire hilgendorfi***
- **Parthenogenic**
- **Complete lifecycle in 60 days**
- **Higher density than European EW**
- **Prefer grassland prairie habitats**

- Asian crazy worms—also known as Alabama jumpers or Jersey wrigglers for their speed and snakelike agility—first turned up in the United States more than a century ago when they were accidentally imported with ornamental plants.
- But their real damage occurs when the worms or their cocoons spread from home gardens into the wild.
- Asian worms eat up all the leaf litter and other organic matter they can find, leaving no nutrients for the forest's plants to consume.

- Their “poop,” called castings, contains calcium carbonate, and in great enough amounts it can change the chemistry of the soil, making it more alkaline and less welcoming to certain kinds of plants, such as azaleas and oaks.
- Leaf litter declined by 95 percent in forested study areas, and the Asian worms left behind residue that was almost pebbly in consistency -- grainy little balls of dirt that may make it hard for the seeds of native plants to germinate.

Crazy Snake Worm

- Crazy snake worms also cycle nutrients so quickly and so superficially—aboveground, not below—that erosion and rain often wash away all the good stuff before the plants can make use of it.
- This is especially problematic for ecosystems in areas of the Northeast and upper Midwest, where glaciers once scoured the land.
- For tens of thousands of years, forests there evolved in the absence of worms.

Crazy Snake Worm

- Native wildlife species take a hit from the activity of crazy snake worms.
- Seedlings and wildflowers have a tough time taking root in the depleted, dry, and loose soil the worms create.
- Invasive weeds choke out wildflowers and other natives while altering the soil's moisture and pH content—more transformations to which native species will have to adjust.
- The resulting absence of vegetation can not only exacerbate erosion but also rob ground-nesting birds, salamanders, and insects of hiding places. *Millipedes

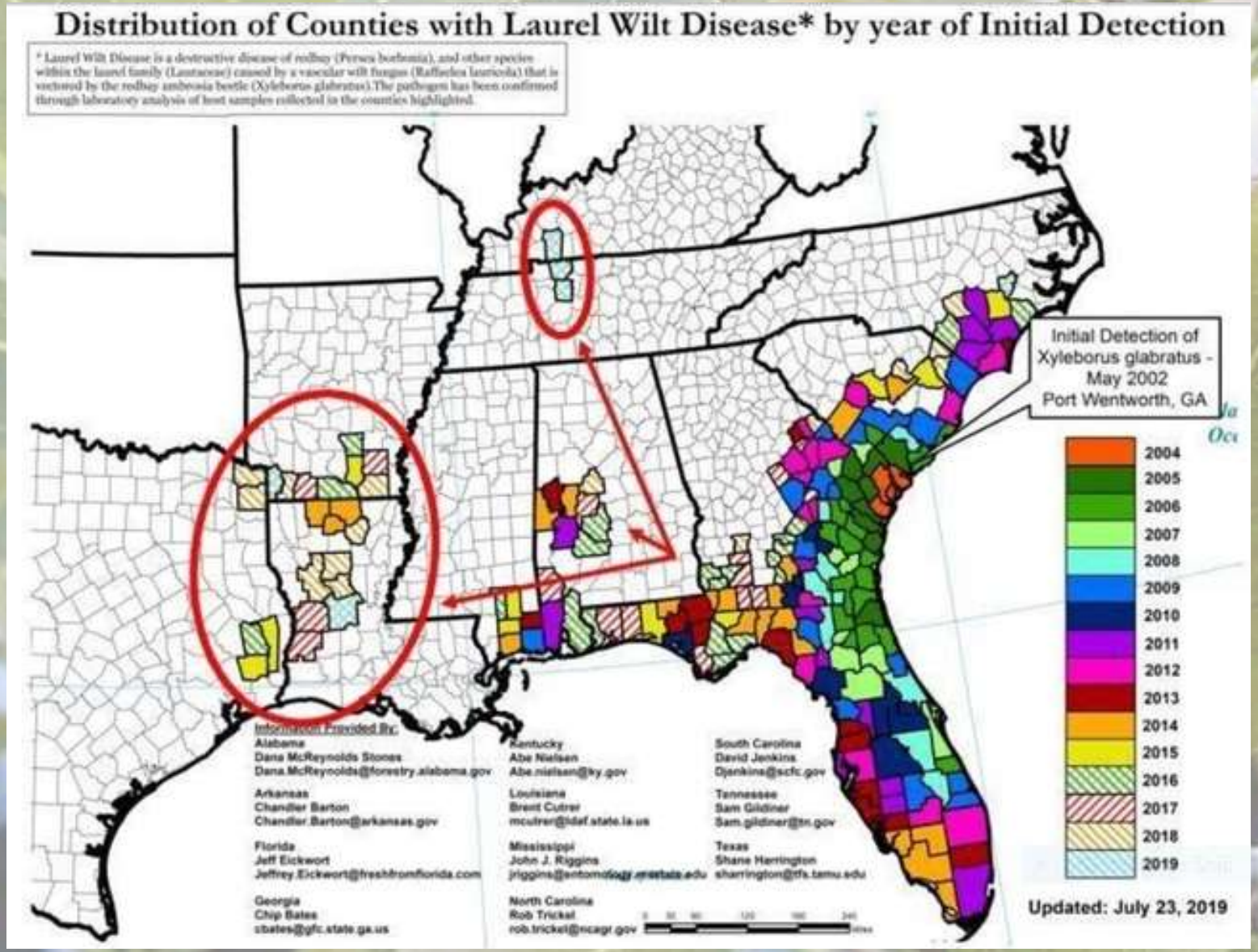
Control?

- There are no approved pesticides for worms (and spraying every inch of forest is out of the question in any event).
- The egg casings of crazy snake worms are also capable of surviving temperatures as low as –12 degrees Fahrenheit.
- A 2015 study found that prescribed burns don't effectively kill off many adult worms—though they did reduce the number of cocoons that hatched later.
- Fire, the researchers suggest, might also indirectly kill many surviving hatchlings simply by burning up the soil nutrients they rely on for food.

Redbay Ambrosia Beetle/Laurel Wilt Disease

Xyleborus glabratus

Raffaelea lauricola



Redbay Ambrosia Beetle

- Xyleborus glabratus is native to India, Japan, Myanmar and Taiwan (Rabaglia 2008).
- In the U.S., Xyleborus glabratus was first detected in a survey trap near Port Wentworth, Georgia in 2002 (Rabaglia 2008).
- The pest continues to expand rapidly to new areas posing a threat to redbay and avocado trees in the U.S. and in the countries of Central and South America.

Laurel Wilt Disease

- Vascular disease that is caused by the fungal symbiont *Raffaelea lauricola*, which is transmitted by the invasive redbay ambrosia beetle, *Xyleborus glabratus.*

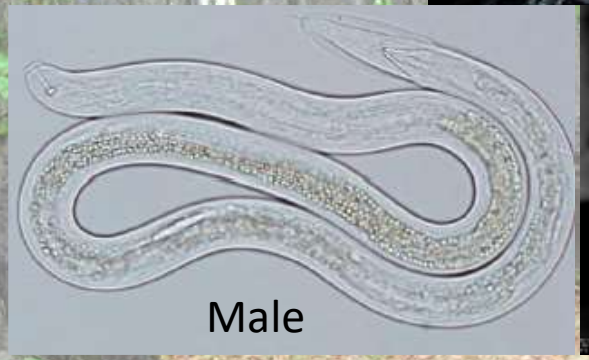
- The disease affects and kills members of the Laurel family (*Lauraceae*).

- The complex is considered a very high risk invasive disease pest complex having potential equal to that of Dutch elm disease or chestnut blight (Global Invasive Species Database 2010).

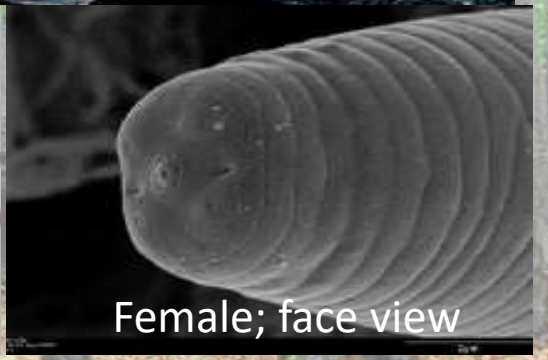
Beech Leaf Disease (BLD)

Photos by Dr. Lynn Carta, USDA ARS

- Bacterial disease?
- Possibly vectored by a nematode.
- Nematode possibly vectored by birds.
- •No definitive causal agent identified, but growing evidence nematode Litylenchus crenatae may be involved.
- •L. crenatae recently described on Japanese beech in Japan (Kanzaki et al. 2019 – Nematology 21(1), 5-22)



Male



Female; face view

Possible Mite Association

Mite harboring many nematodes from PA BLD samples

Some Eryiophidmites may cause leaf galls such as genera *Aceria*or *Eriophyes*

Images: Mihail Kantor and Zafar Handoo

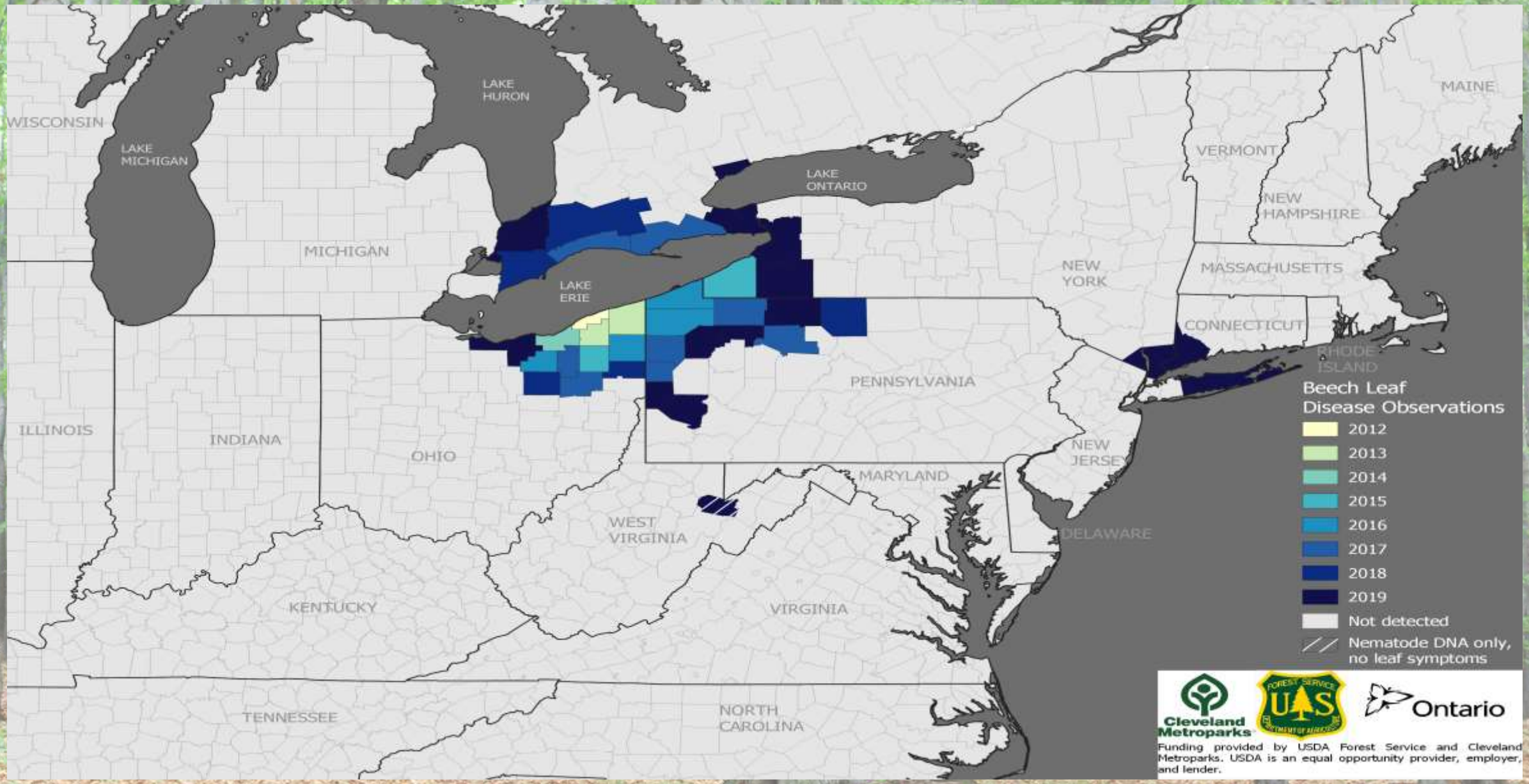
Possible nematode egg

Erineum patch (eriophyid mite, *Acalitus gaferinea)*

Photographer Nigel Cattlin80112232 Beech erineum gall mite (*Eriophesnervisequusfagineus*) red galls on a beech leaf

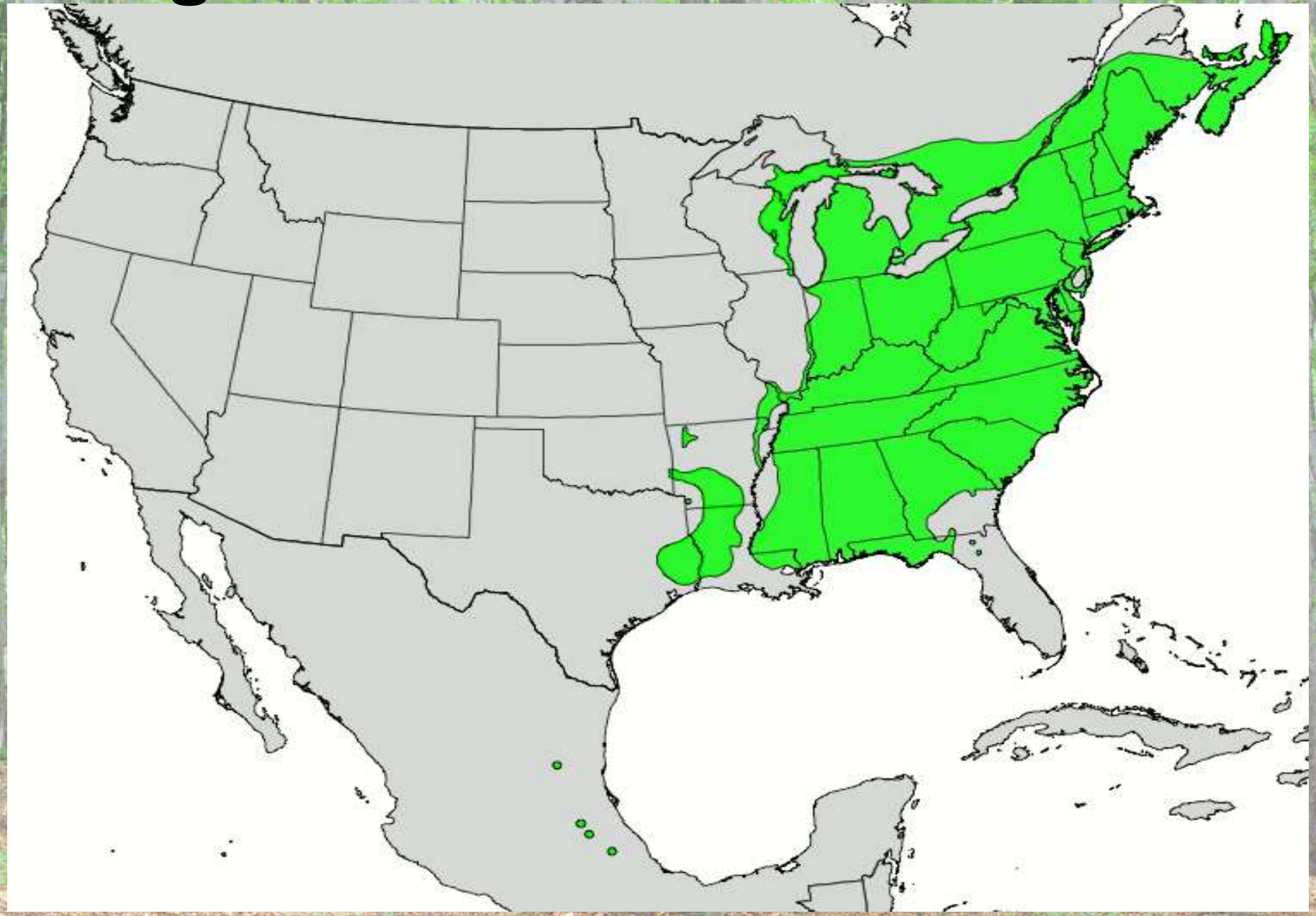
*Fagus orientalis*LIPSKY, OrientbucheFilzrasen, wie: *Acerianervisequafaginea*(NAL.) (Acar.) GallmilbeB:

Where has BLD been documented?



Funding provided by USDA Forest Service and Cleveland Metroparks. USDA is an equal opportunity provider, employer, and lender.

Range of Beech in North America



2011

2016

Photos: Cleveland Metroparks

- **Causing widespread mortality of American beech understory.**
- **Canopy trees severely impacted.**

What Does BLD Look Like?

Striped Lleave
More severely striped leaves
Reduced leaf-out and branch diebacks
Late flush of non-symptomatic leaves

Questions?

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