Beech Leaf Disease

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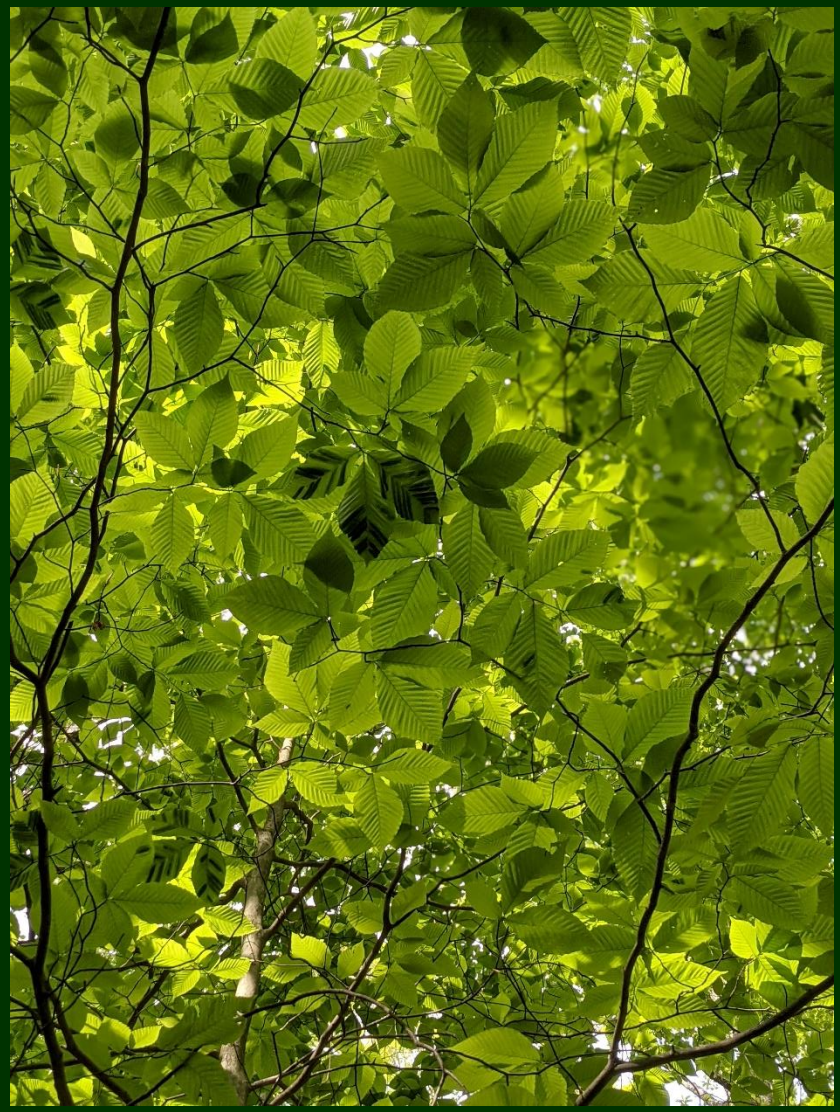
Beech Leaf Disease

First identified in Ohio in 2012

Affects American, European, Oriental beeches:

Fagus grandifolia
F. sylvatica
F. orientalis



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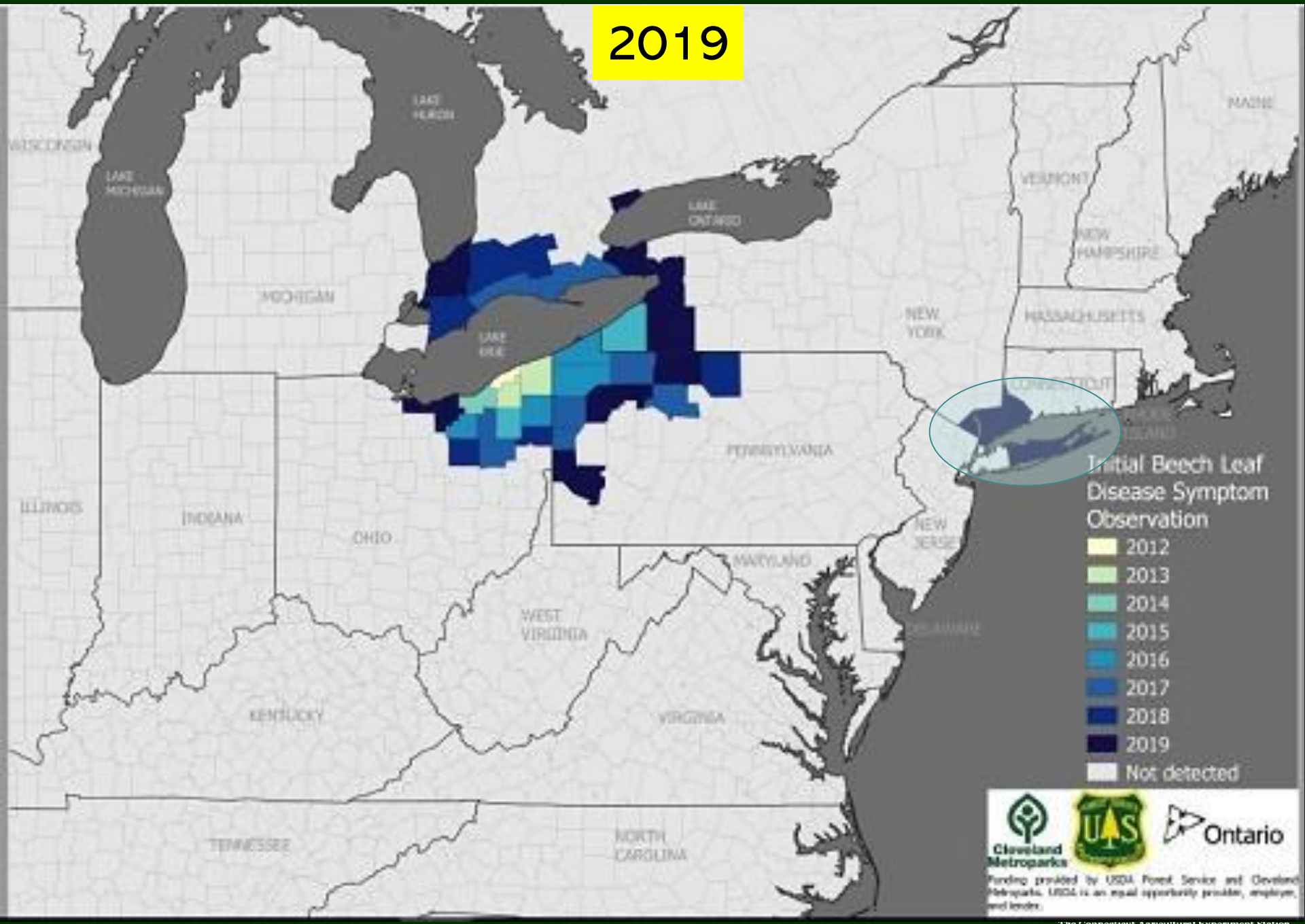
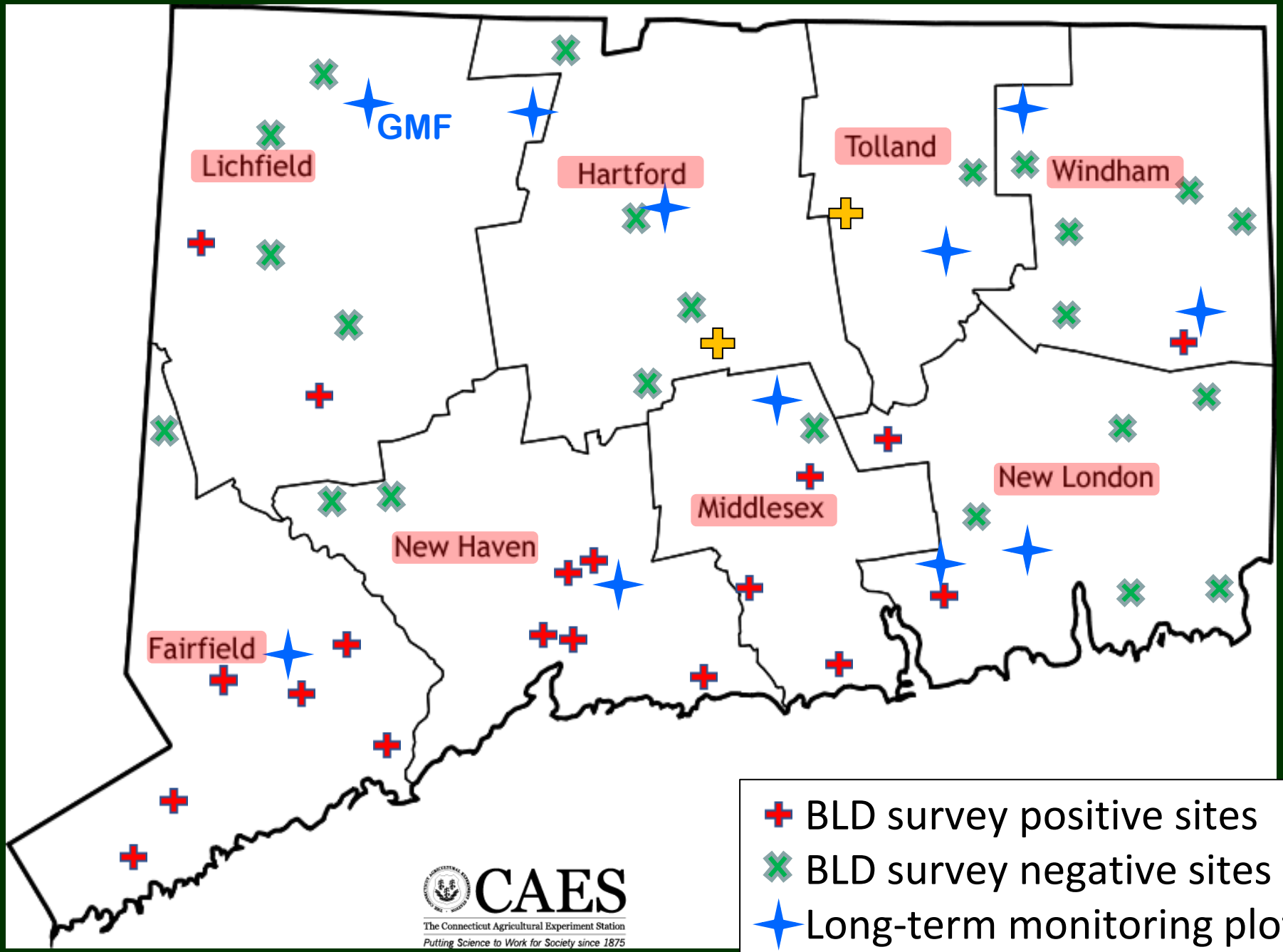

2019
Initial Beech Leaf Disease Symptom Observation
2012
2013
2014
2015
2016
2017
2018
2019
Not detected
Cleveland Metroparks
Ontario
LAKE MICHIGAN
LAKE HURON
LAKE ERIE
LAKE ONTARIO
MICHIGAN
WISCONSIN
ILLINOIS
INDIANA
OHIO
PENNSYLVANIA
NEW YORK
MAINE
VERMONT
NEW HAMPSHIRE
MASSACHUSETTS
NEW JERSEY
MARYLAND
WEST VIRGINIA
KENTUCKY
VIRGINIA
TENNESSEE
NORTH CAROLINA

Beech Leaf Disease

2020 Fieldwork

USFS Region 9 Emerging Pest Funding:

- Distribution surveys;
- 11 long-term monitoring plots in CT.


GMF
Lichfield
Hartford
Tolland
Windham
Middlesex
New London
New Haven
Fairfield
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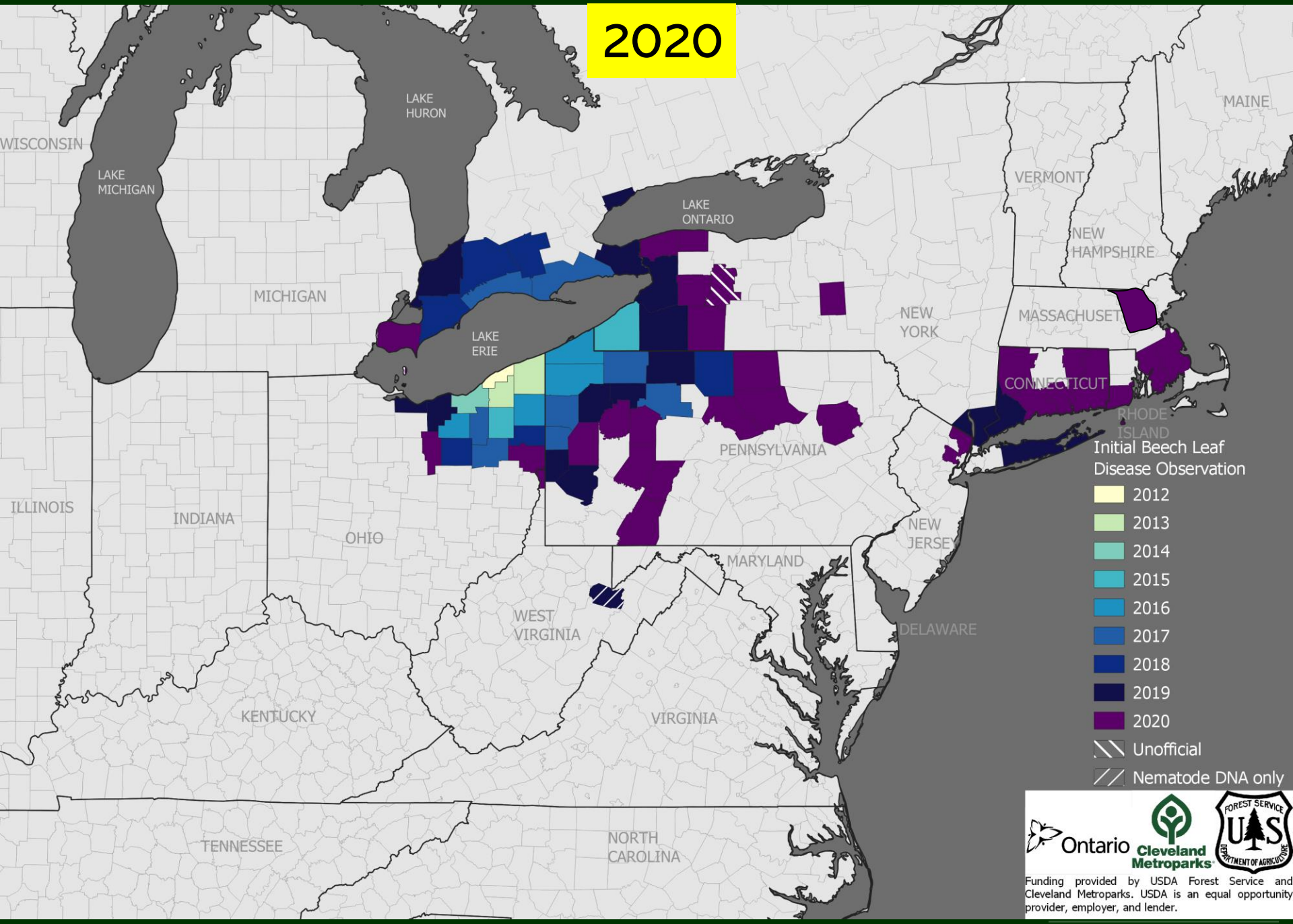
BLD survey positive sites
BLD survey negative sites
Long-term monitoring plots



Ontario Cleveland Metroparks FOREST SERVICE USDA DEPARTMENT OF AGRICULTURE

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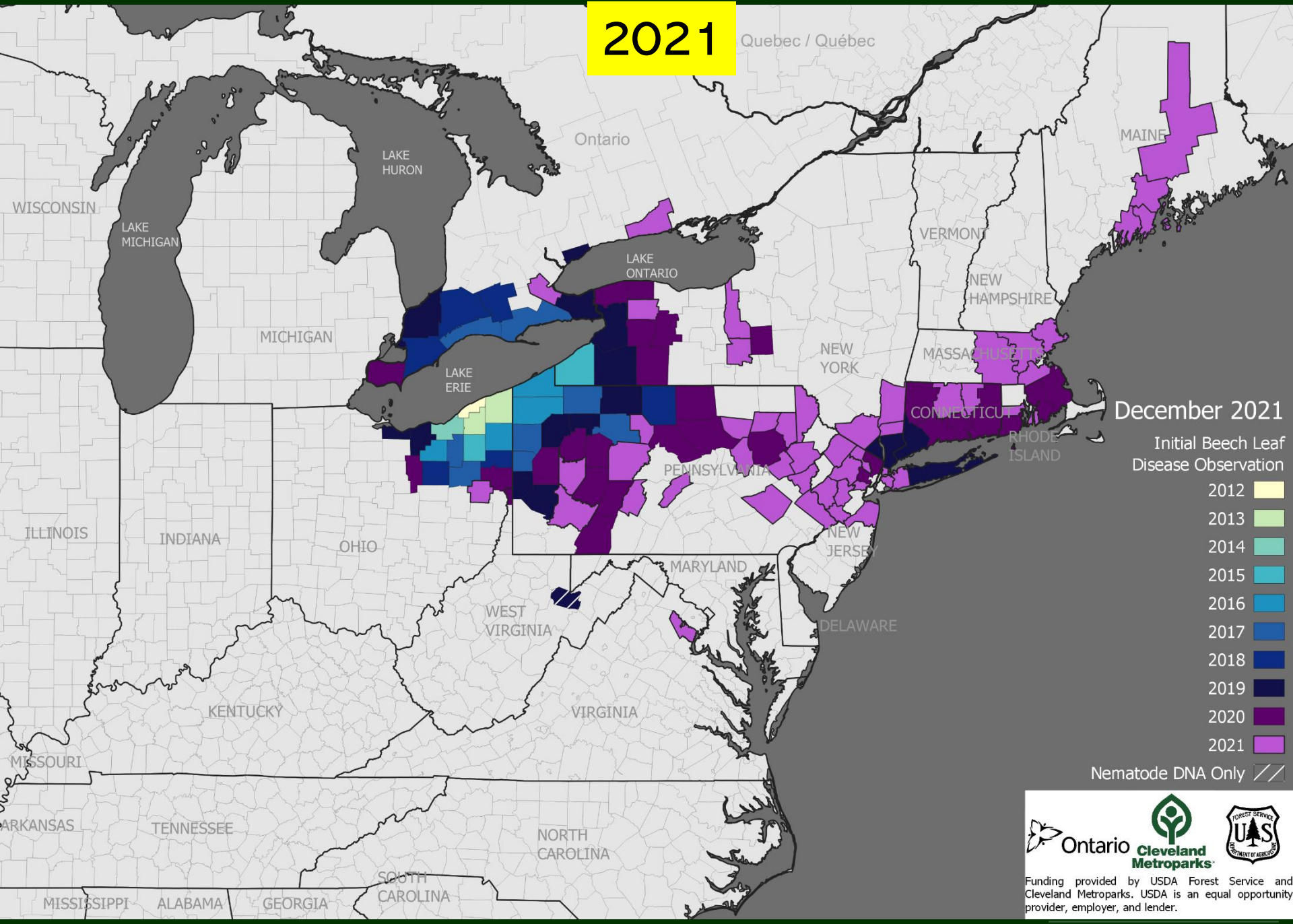

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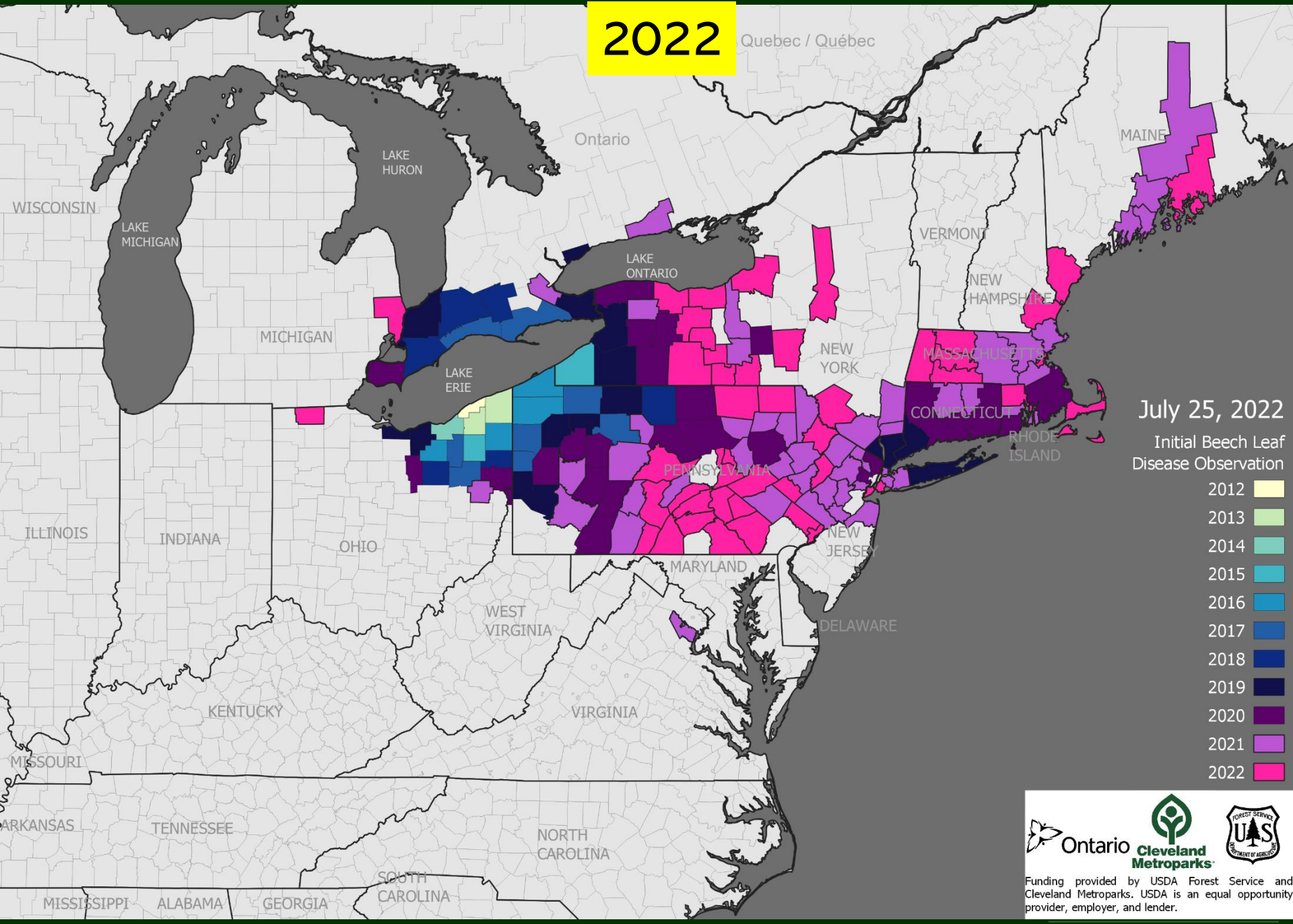

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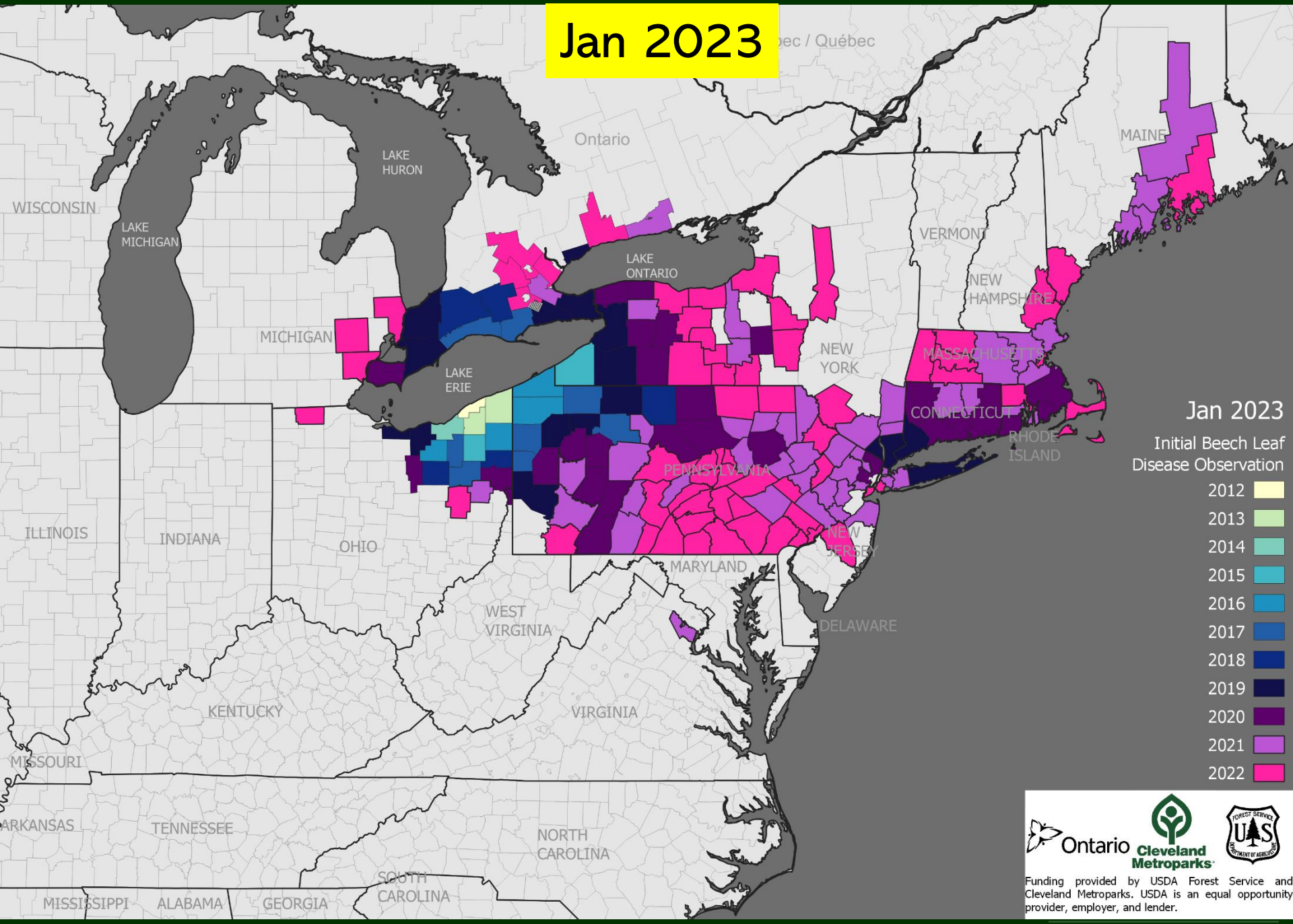

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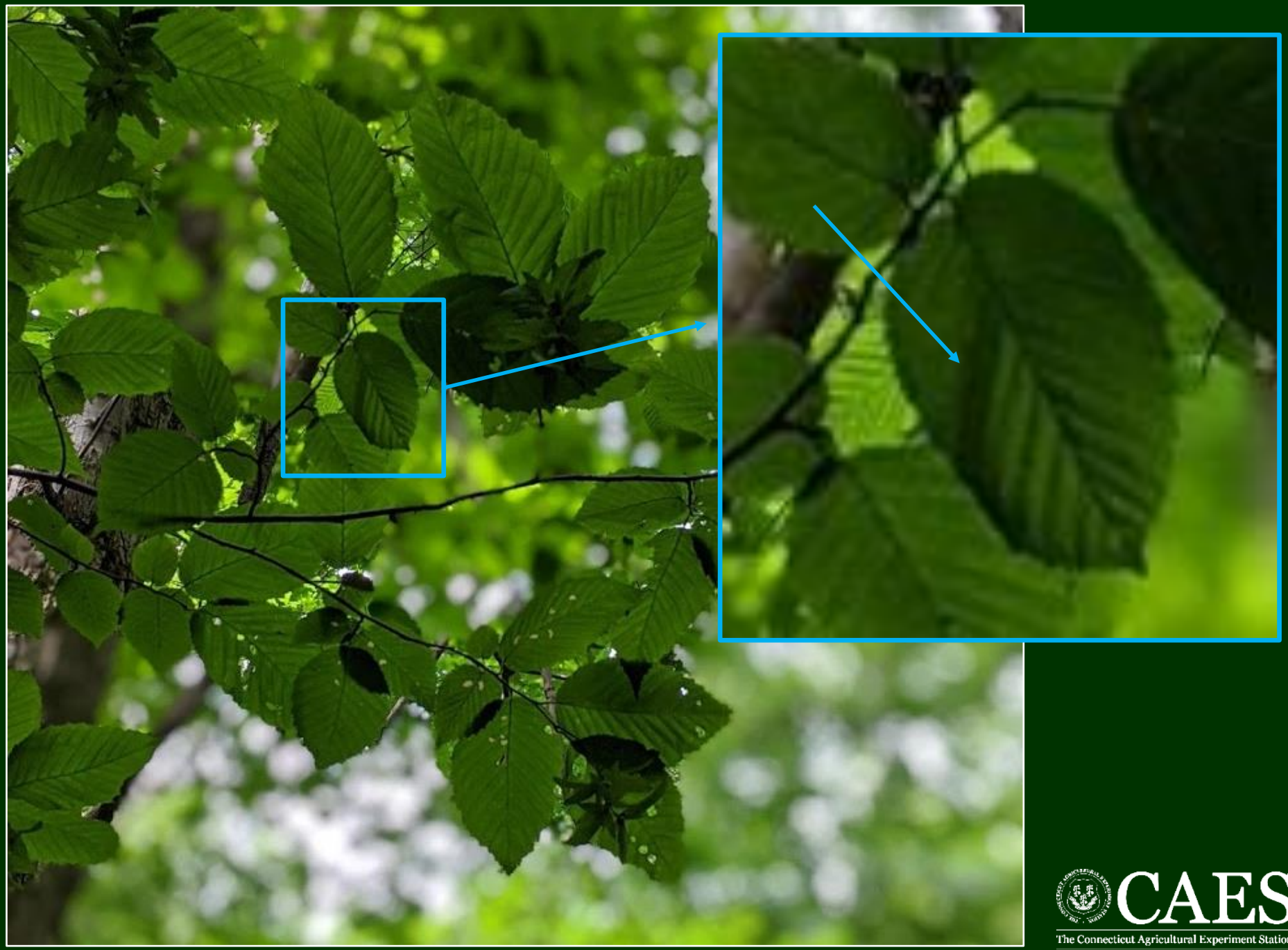

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Beech Leaf Disease

Disease Progression

Early season:

- Leaves emerge fully symptomatic
- Darkened bands, hypertrophy
- No new symptoms appear during growing season

Beech Leaf Disease

Disease Progression

Late season:

- Banding darkens, thickens, hardens

Beech Leaf Disease

Disease Progression

Subsequent seasons:

- Aborted bud development
- Thinning of canopy
- Mortality in 2-5 yrs in *some* diseased saplings

Beech Leaf Disease

Disease Progression:
2022

West Rock Ridge State Park
New Haven/Hamden

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Beech Leaf Disease

Disease Progression:
2022

The 2022 BLD Hell-scape

West Rock Ridge State Park
New Haven/Hamden

Spring, 2022

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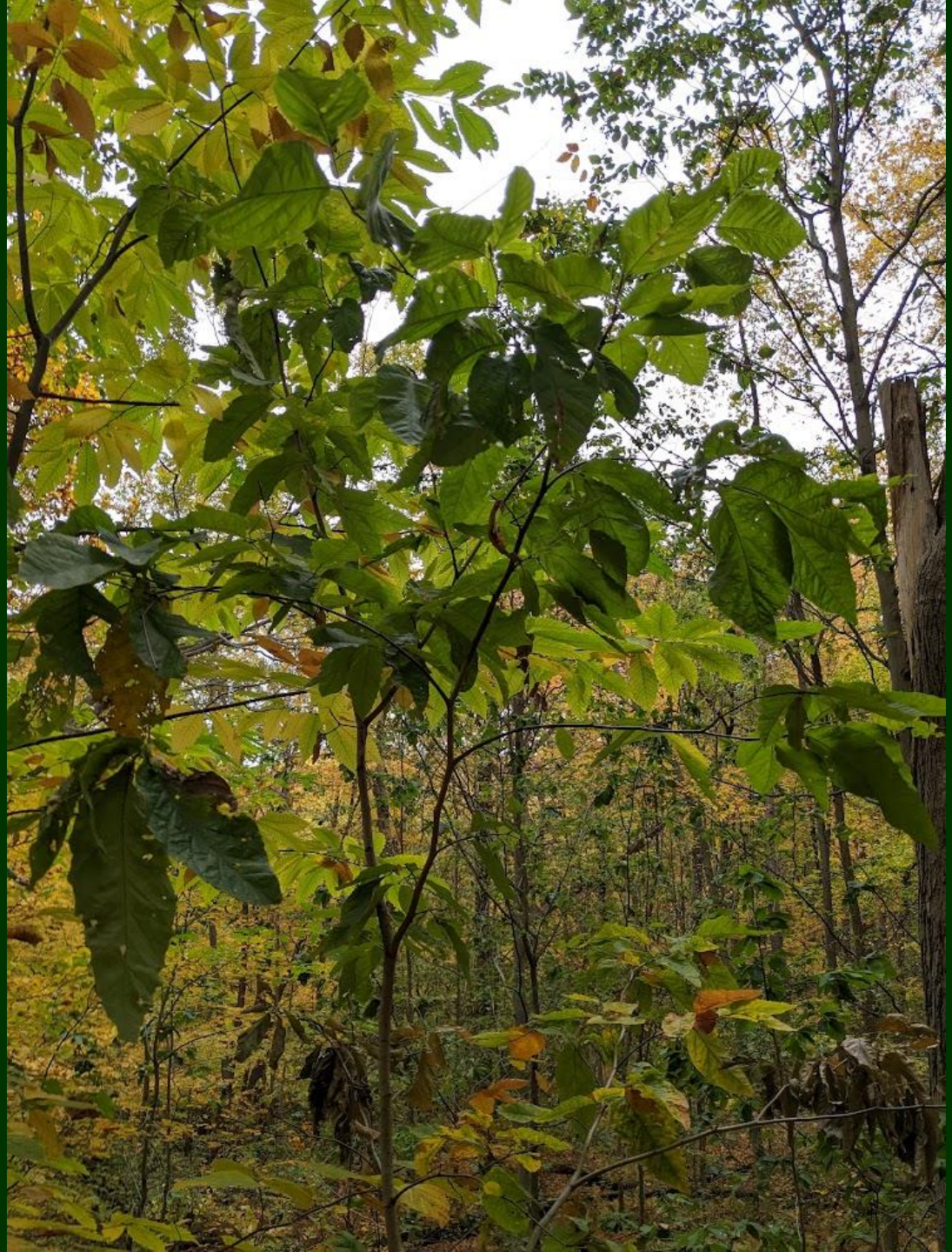
Secondary leaf flush, spring

Secondary leaf flush,

October



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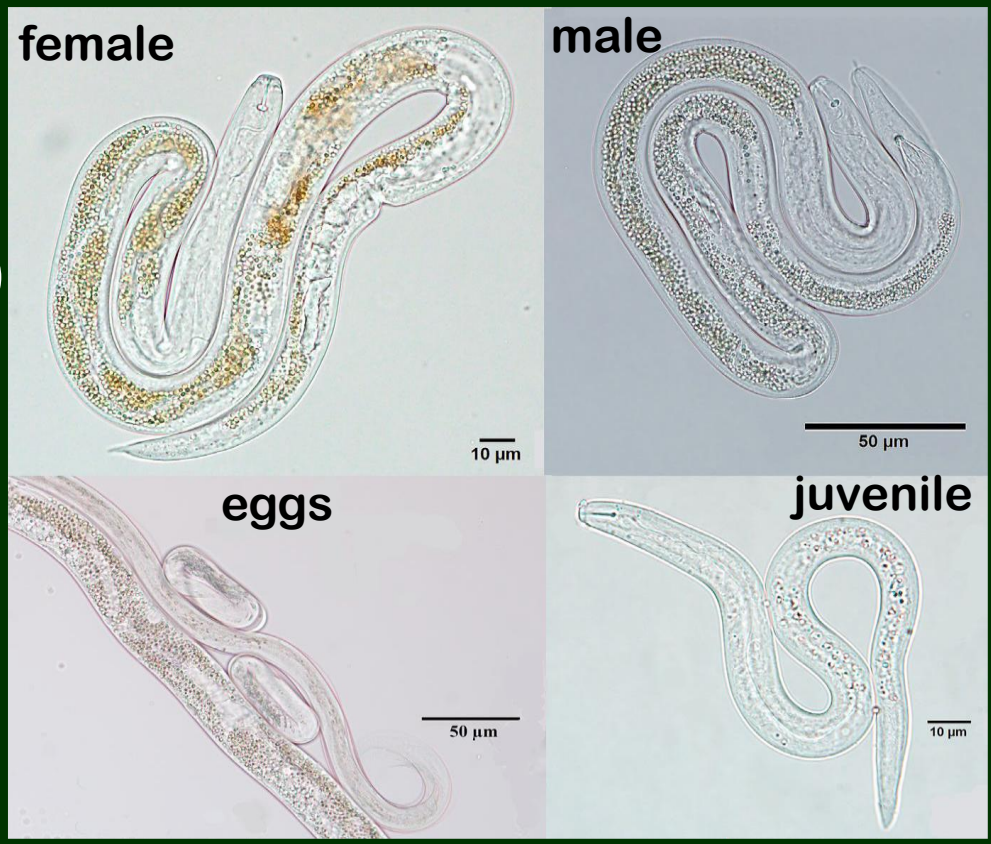
Beech Leaf Disease

Nematode:

- *Litylenchus crenatae* , subspecies *mccannii* (***Lcm***)
  - Confirmed and proven as causal in 2019

- *Litylenchus crenatae* , subspecies *crenatae* (***Lcc***)
  - **Known only in Japan, on Japanese beech (*F. crenata*)**
  - **“blister galls” on foliage**
  - **No documented mortality**



Carta et al. 2020
Forest Pathology 50(2)

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Foliar nematodes

- Require water films to move outside of leaf;
- In presence of water, juveniles and adults will exit/enter through leaf stomata;
- Any “wet event” will trigger egress of nematodes from leaves;
  - More “wet events” = more opportunities for nematodes to exit leaves.

Beech Leaf Disease

Transmission (vectors) of BLD nematode:

Little is known

Local movement via rain splash?

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Beech Leaf Disease

Intermediate- and long-distance transmission:

- Vectors: insects, mites, birds, mammals?
  - passage through bird gut?
    - Overwintering birds – e.g., finches – regularly feed on beech buds
- Nurseries (European beech)

Beech Leaf Disease

Life cycle of BLD nematode

Spring, bud-break through early summer:

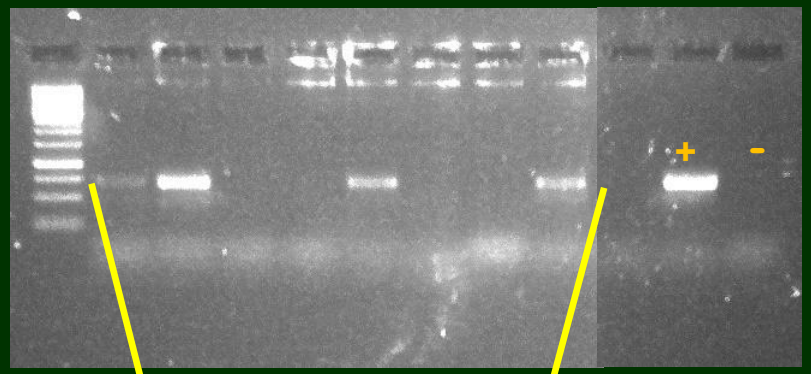
- None (or few) nematodes directly observed in symptomatic leaves;

- DNA signal confirms presence of the nematode:
  - eggs?
  - recalcitrant juveniles/adults?

Distribution of BLD nematode in early-season symptomatic tissue

- eggs?

CO-1 PCR



Beech Leaf Disease

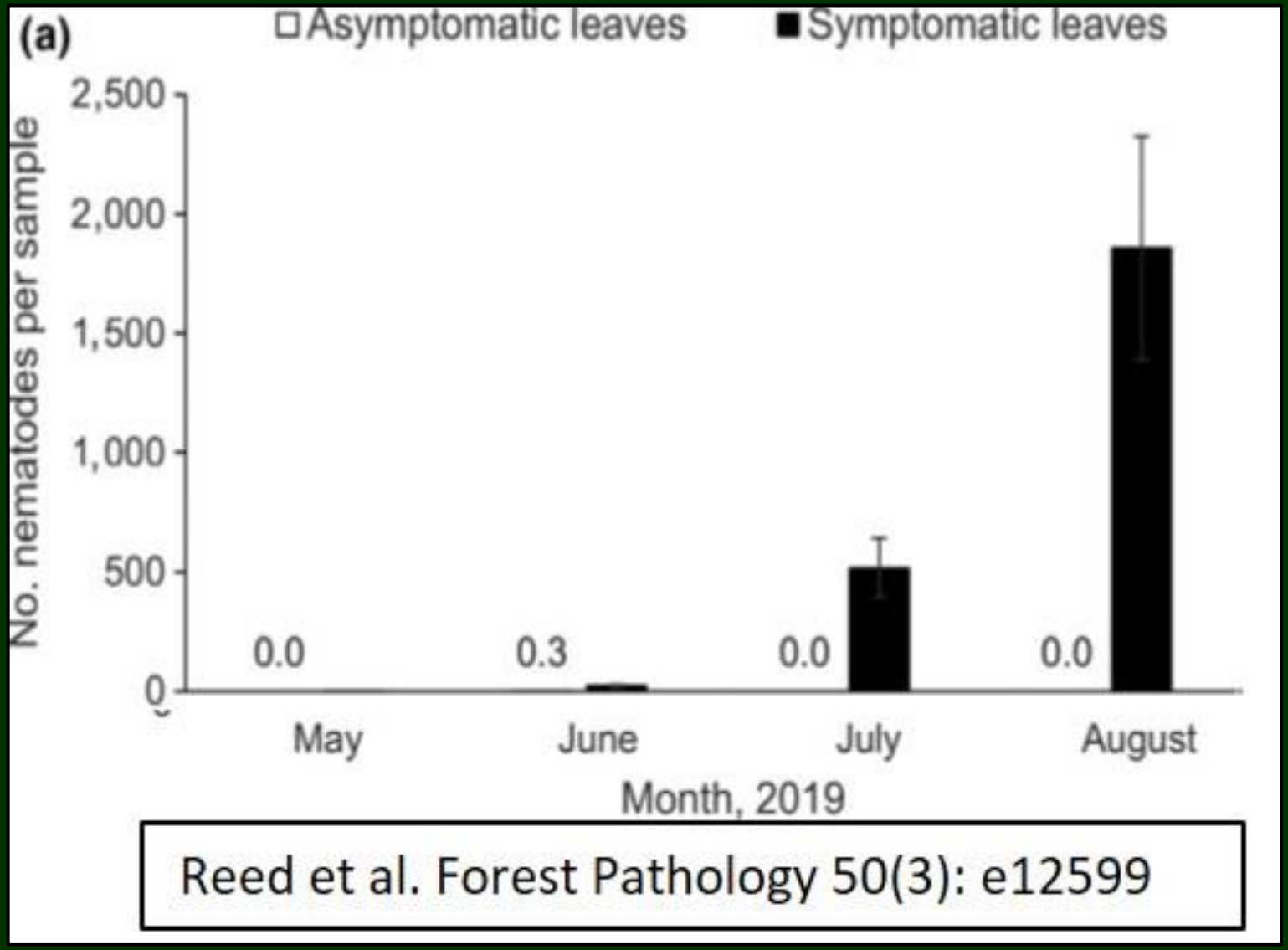
Life cycle of BLD nematode

Late summer to fall:

- Population densities of juveniles and adults increase dramatically through autumn
- Nematodes migrate from leaves to buds

Winter:

- Nematodes – juveniles, adults, eggs -- overwinter in buds
- Damage leaf primordia (Dr. Paulo Vieira, USDA-ARS).

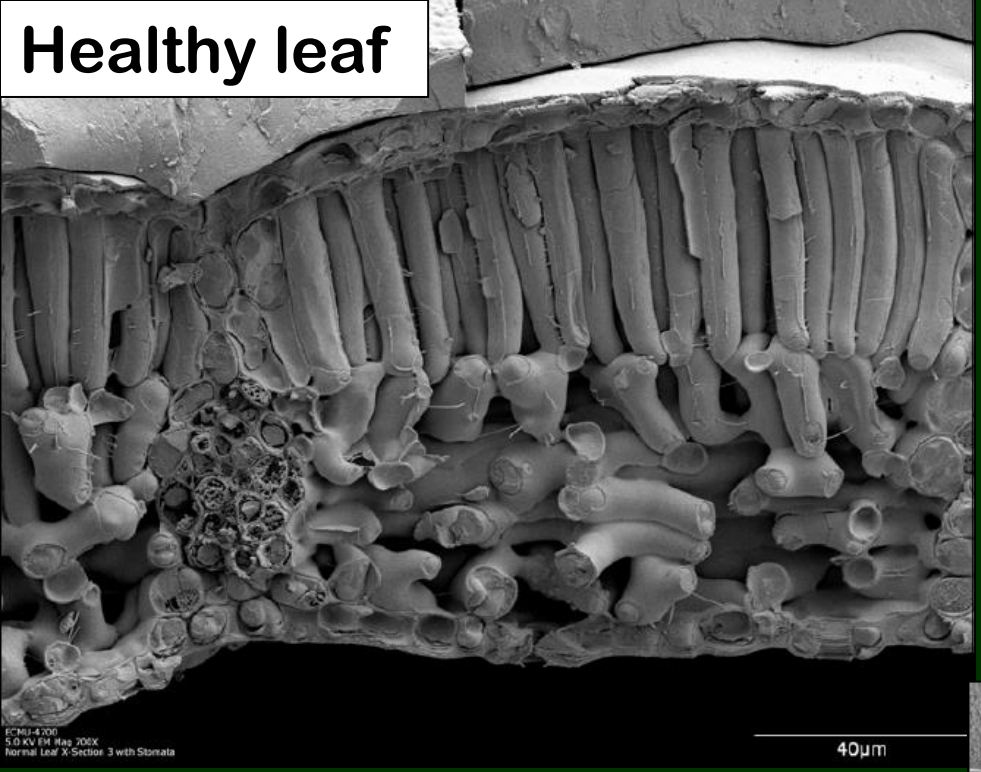


Reed et al. Forest Pathology 50(3): e12599

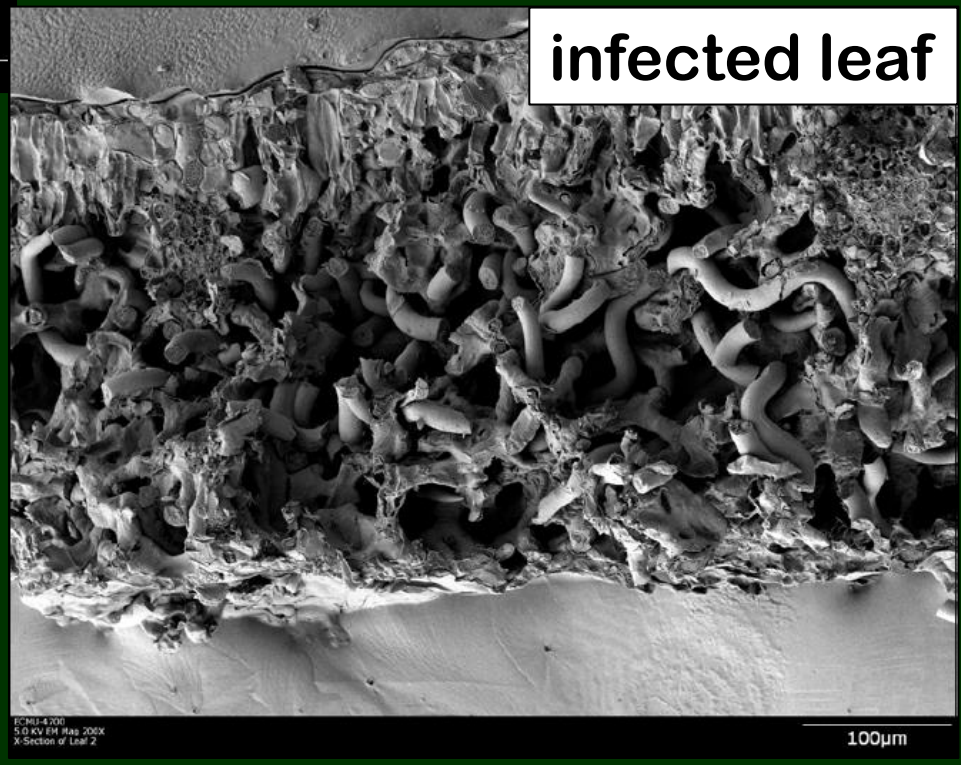
Bud infestation by Lcm in autumn is variable

Bud infestation by Lcm in autumn is variable

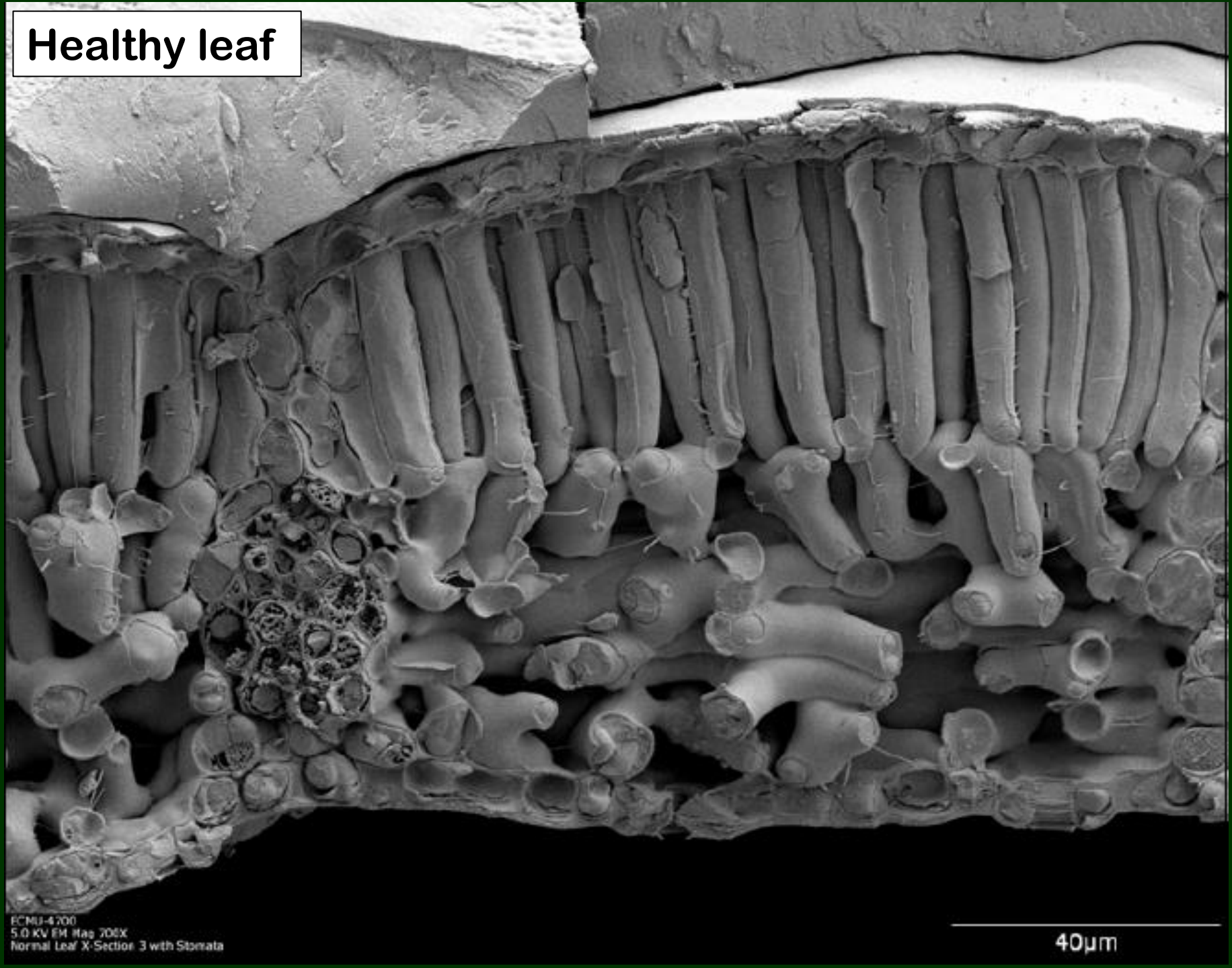
Symptoms correlate with bud leaf-cohorts

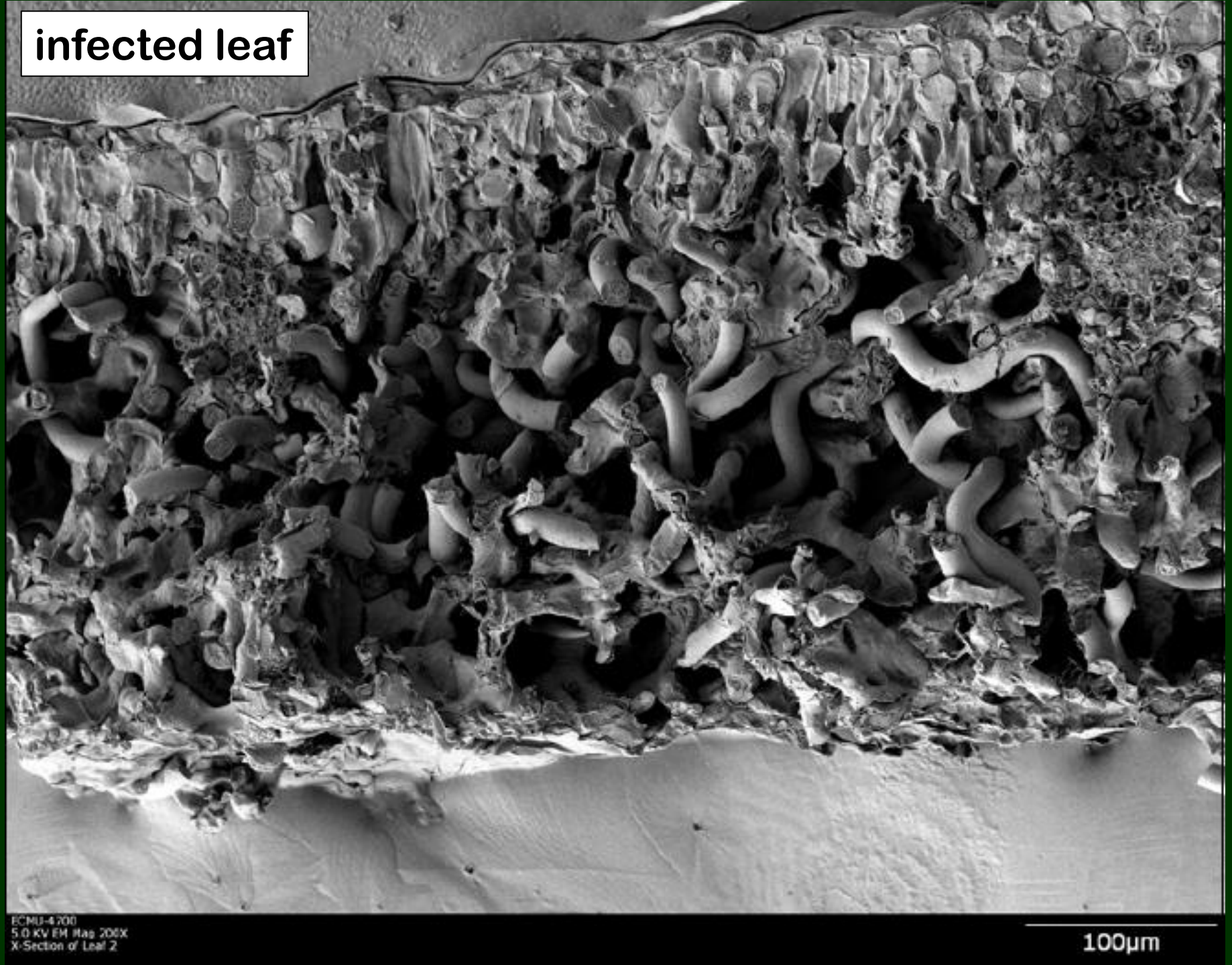


Beech leaves, in cross-section, late season



Electron micrograph images:
Gary Bauchan, Lynn Carta
USDA-ARS


Healthy leaf
ECNU-4700
5.0 KV EM Mag 700X
Normal Leaf X-Section 3 with Stomata
40µm


infected leaf
ECMU-4200
5.0 KV EM Mag 200X
X-Section of Leaf 2
100µm

Lcm nematodes in leaf tissue, late autumn

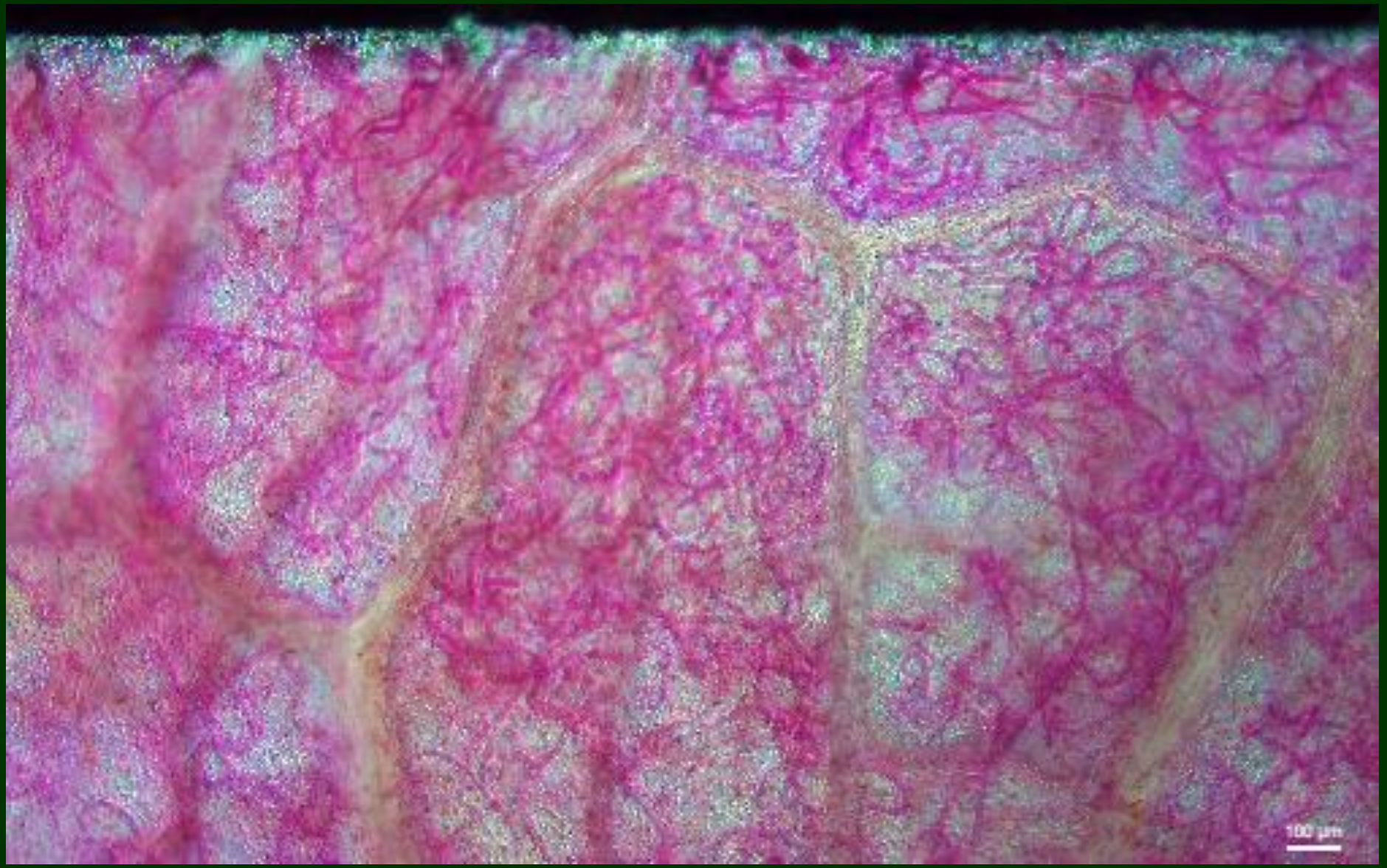


Image: Paulo Vieira, USDA-ARS

Lcm eggs in bud scale, late autumn

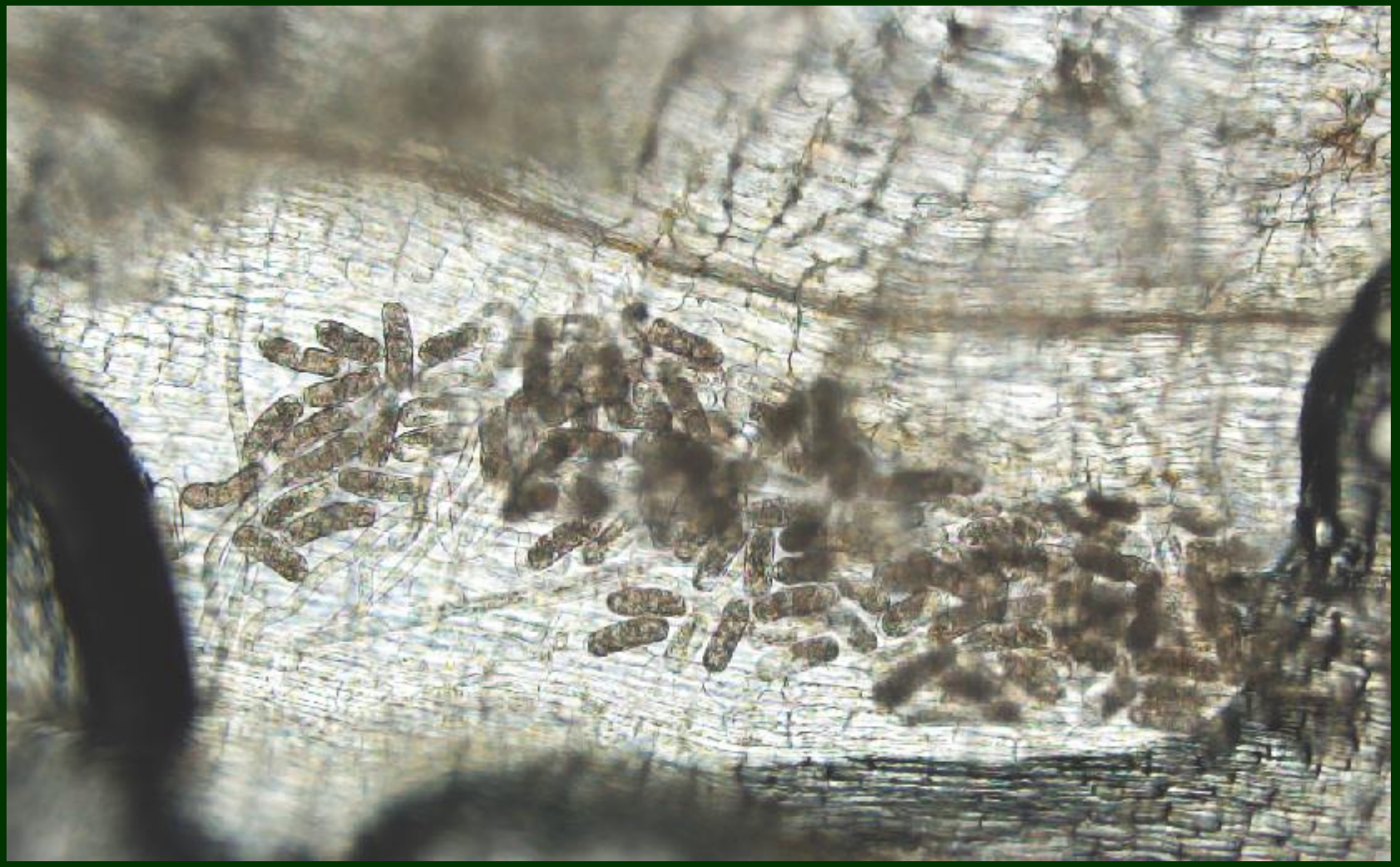


Image: Paulo Vieira, USDA-ARS

More information:

- CAES BLD Fact Sheet
  - https://portal.ct.gov/CAES/PDIO/Alerts
- USFS Bulletin R9–PR–001–21
  - http://www.dontmovefirewood.org/wp-content/uploads/2019/02/Beech-Leaf-Disease-Pest-Alert.pdf

QUESTIONS?

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