INSECTS AND DISEASE: Strategic approaches to managing threats

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STRATEGIC APPROACH?

- Advance planning on how to respond to a new plant pest or pathogen
- Consider resources/tools available
- Prioritize your responses based on past experience and future needs

WHAT IS THE "BEST CASE" SCENARIO WHEN A NEW PEST OR PLANT DISEASE SHOWS UP?

- Complete preparation
  - Have all the background info
  - Know exactly what to look for, and where
  - Have all the tools available to get rid of it

WHAT IS THE "BEST CASE" SCENARIO WHEN A NEW PEST OR PLANT DISEASE SHOWS UP?

- It dies off (and you probably never even knew it was there)

REALITY:

- Most new pest and pathogen introductions fail
- There is a constant pressure of new introductions, through a variety of vectors

HOW DO INVASIVE PESTS AND PATHOGENS GET HERE?

- Contaminants of imported plant material
  - International
  - Interstate
- Hitchhikers
  - In cargo
    - In/on packing material (crates, pallets, spools, etc.)
  - On vehicles
  - On animals
- Weather events
  - Hurricanes
  - Floods

WHO IS WORKING TO PREVENT PLANT PESTS AND PATHOGENS FROM BECOMING ESTABLISHED?

- Federal government
  - Dept. of Homeland Security
    - USDA
      - APHIS (Animal and Plant Health Inspection Service)
        - Plant Protection & Quarantine (PPQ)
        - Center for Plant Health Science & Technology (CPHST)
      - US Forest Service
    - Customs & Border Protection
- State government
  - State agricultural departments
  - State forestry departments

THE ROLE OF THE CAPS PROGRAM

- Cooperative Agricultural Pest Survey (CAPS) is a partnership between states and the USDA to detect and monitor exotic pests
- CAPS targets High Priority introduced pests and pathogens
  - Species of regulatory significance (could negatively impact agricultural commodities, or the natural environment)
  - Species that aren't established in Massachusetts (and maybe have never been found in the US!)
- CAPS is proactive: work includes surveys, trapping, site inspections, outreach

WHY HAVE A STRATEGIC APPROACH?

- Resources are limited
- Time is also limited
- A proactive response is better than a reactive response
  - Goal: Survey for pests and pathogens to find them early, or ensure they are not here at all
- Discover missing tools and plug the holes
- You may need to choose your battles

PEST/PATHOGEN RESPONSE TOOLKIT

1. Background research
   - What pests and pathogens are at risk of showing up in Massachusetts?
   - Which of these species have the greatest potential to establish here?
   - Which of these species have the potential to cause the most harm if they do establish?
     - Ecological harm
     - Economic harm
   - Will we be able to eradicate or manage these species if they do show up here?
   - Can we identify pathways of introduction that are most likely to bring new pests and pathogens to our state?

SAMPLE PRIORITY PEST/PATHOGEN LIST

Scientific Name	Common Name	Organism Type
Anoplophora glabripennis	Asian longhorned beetle	insect
Phytophthora ramorum	Sudden oak death	pathogen
Agrilus planipennis	Emerald ash borer	insect
Agrilus biguttatus, A. coxalis auroguttatus, A. sulcicollis	Oak splendor beetle, Goldspotted oak borer, Jewel beetle (exotic Agrilus spp.)	insect
Anoplophora chinensis	Rough shouldered longhorned beetle	insect
Potyvirus sp.	Plum pox virus	pathogen
Candidatus *Phytoplasma* spp. *(mali, pyri, prunorum, australiense*, etc.*)*	Apple proliferation, pear decline, European stone fruit yellows, Australian grapevine yellows, etc.	pathogen
Lymantria sp. *(dispar asiatica, mathura, albescens, monacha, postalba, umbrosa)*	Gypsy moths	insect
Thaumatotibia leucotreta	False codling moth	insect
Archips xylosteanus	Variegated golden tortrix	insect
Adoxophyes orana	Summer fruit tortrix moth	insect
Epiphyas postvittana	Light brown apple moth	insect
Lobesia botrana	European grape vine moth	insect
Platypus quercivorus	Oak ambrosia beetle	insect
Lycorma delicatula	Spotted lanternfly	Insect

PEST/PATHOGEN RESPONSE TOOLKIT

1. Background research – The Hard Questions
   - How easy would it be to find these pests and pathogens before they become established?
     - Can they be identified by sight?
     - Do we need to do genetic testing to confirm?
     - Are there traps/lures available?
   - How do we prioritize the hunt for new pests/ pathogens with limited time and money?

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PEST/PATHOGEN RESPONSE TOOLKIT

2. Set up surveys/monitoring
   - Target highest priority pests/pathogens and their pathways
   - If resources are limited, set up rotating schedule of targets
   - Federal resources often working in parallel to create/improve survey methods

PEST/PATHOGEN RESPONSE TOOLKIT

3. Outreach and Education
   - Provide trainings, educational materials to stakeholders
   - Encourage people to report any suspicious pests or damage to plants
   - Time and again, this has been shown to be a key way of identifying new pest/pathogen arrivals in our state

PEST/PATHOGEN RESPONSE TOOLKIT

4. If pest or pathogen is found, determine feasible outcome(s)
   - Can it be eradicated?
   - Does it need to be managed?
   - Can you reasonably acquire the resources/ tools needed to deal with this pest/ pathogen?
   - Make sure you are getting feedback from all stakeholders

PEST/PATHOGEN RESPONSE TOOLKIT

5. Develop additional survey/monitoring/ management tools as needed/feasible
   - Traps and lures for pests
   - Protocols for detecting plant pathogens
   - Development of biological controls, when feasible
   - Happening mainly at the federal level, though DCR and MDAR assist with research

CASE STUDY #1: ALB

Asian Longhorned Beetle

(*Anoplophora glabripennis*)

WHAT IS THE ASIAN LONGHORNED BEETLE?

- An introduced pest, native to Asia
- Longhorned beetle, Cerambycidae family
  - Scientific Name: *Anoplophora glabripennis*
- Wood-boring pest that attacks hardwood trees (primarily maple)
- Discovered in Worcester, MA in 2008
- Currently under eradication

ALB HOST TREES

- Maple**
- Horsechestnut*
- Elm*
- Willow*
- Birch*
- Sycamore/Plane tree
- Mountain Ash
- Hackberry
- Ash
- Poplar/Cottonwood
- Mimosa
- Katsura
- Golden Rain Tree

**, * preferred

ALB ACTIVITY PRE-2008

- EDUCATION (presentations, distribution of educational materials, how to report finds)
- Response to reports
  - 1 infested bonsai maple around 2002, no infestation found
  - Look-alike insects
- Surveys?
  - No traps/lures available
  - Visual surveys with no geographical target = too resource intensive

…BUT IT SHOWED UP ANYWAY

ALB ACTIVITY POST-2008

- EDUCATION (presentations, distribution of educational materials)
- Response to reports
- Volunteer and train-the-trainer trainings, including surveys in high-risk areas

ALB ACTIVITY POST-2008

- ALB Cooperative Eradication Program created
- Emergency funding received to survey, treat trees, plant replacement trees
- Surveys
  - Visual surveys (ground, tree climbers)
  - Trap/lure development with USFS
  - Identification of potential vectors of spread
- Quarantine/compliance training to enforce quarantine
- Goal: eradication

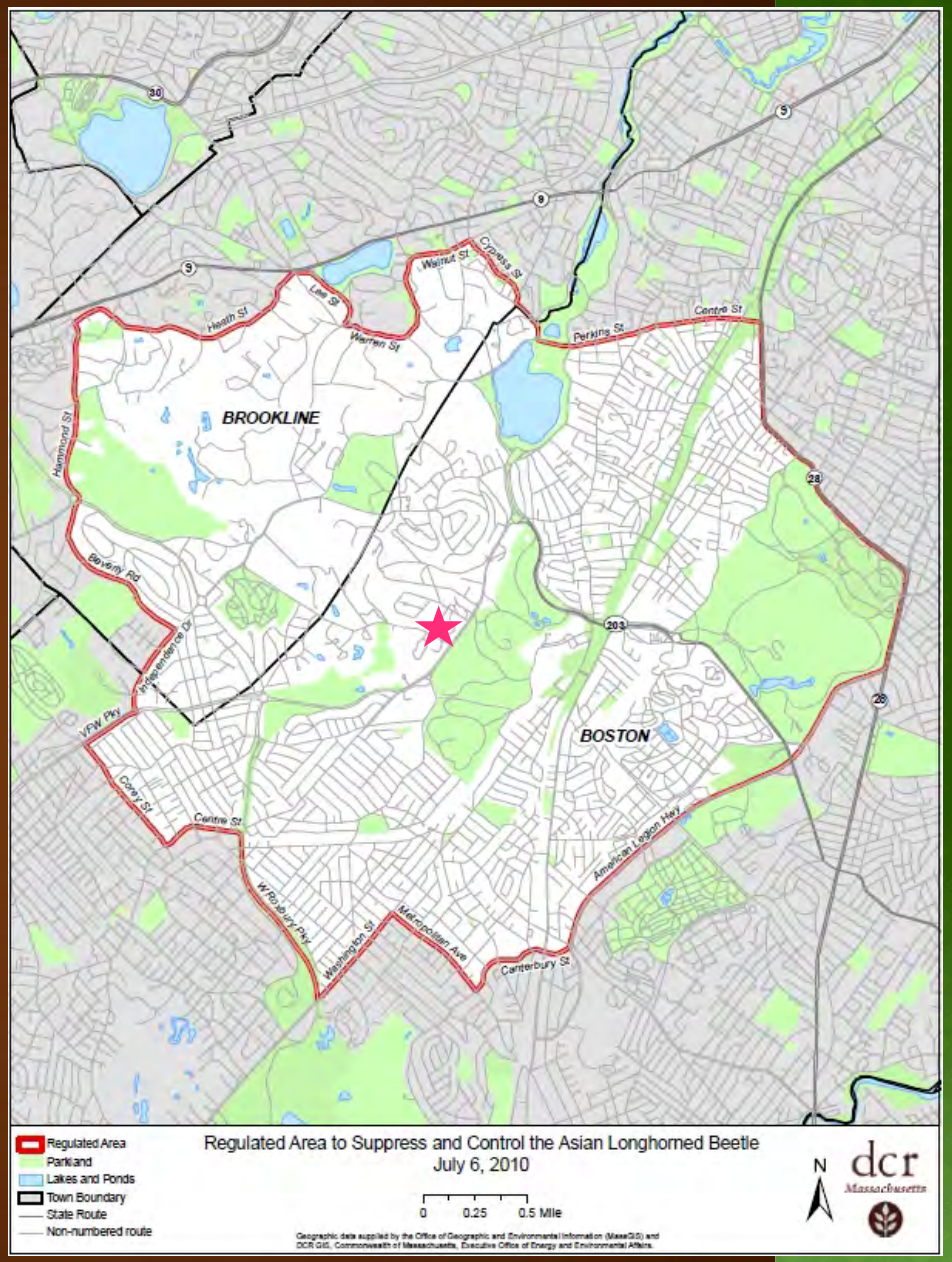
ALB IN BOSTON

- Infestation discovered July 2010
  - Reported by groundskeeper at Faulkner Hospital that received training on ALB
  - Only 6 trees found so far
  - Infestation only a few years old

Photos by DCR/USDA

ALB IN BOSTON

- Officials designated a **10 square mile regulated area** in a **1.5mile radius around the infestation**
- Regulated area include Boston and part of Brookline
- Over 75,000+ trees checked
- **DECLARED ERADICATED 2014**



CASE STUDY #2:

EAB

Emerald Ash Borer

(*Agrilus planipennis*)

EAB: TREE DAMAGE

- Tunnels beneath bark
- Distinct, S-shaped paths
- Larval galleries filled with frass
- D-shaped exit holes

Photos: David R. McKay, Nate Seigert (USFS), James W. Smith, USDA APHIS PPQ, Bugwood.org

EAB ACTIVITY PRE-2012

- EDUCATION (presentations, distribution of educational materials)
- Response to reports
  - Look-alike insects, tree damage
- Surveys
  - Trap and lure available
  - USDA/USFS funded trapping, majority performed by DCR
    - Funding for trapping disappeared as EAB spread through Mass.

EAB SURVEY

- Sticky traps with lures to attract EAB

"Barney" traps

Photo from Bob the Wikipedian

EAB: TREE DAMAGE

- Increased woodpecker damage (“Blonding”)
- Bark splitting

EAB ACTIVITY 2012-2015

- EDUCATION (presentations, distribution of educational materials)
  - Public meetings
- Response to reports
- Trapping surveys

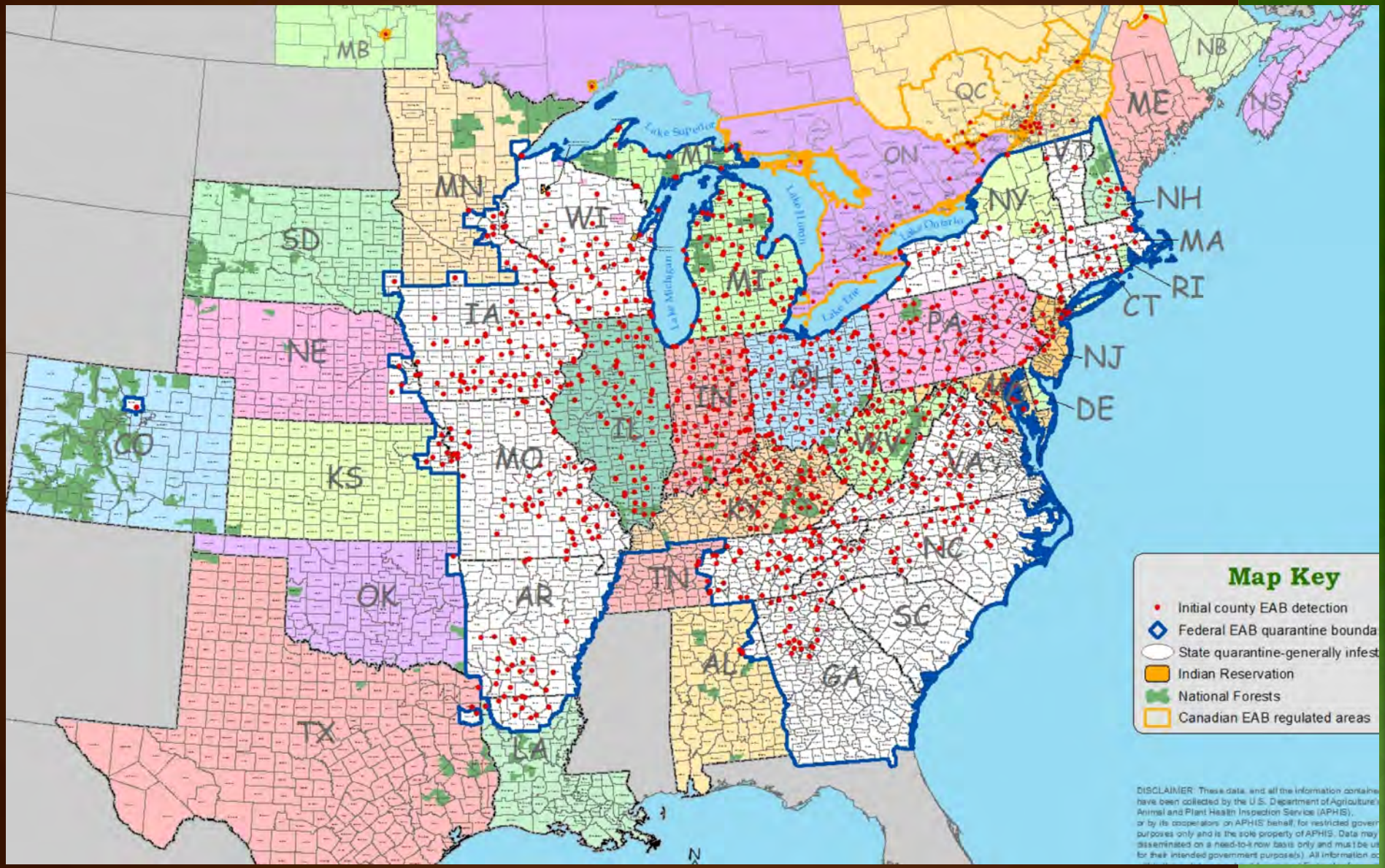
EAB ACTIVITY POST-2015

- EDUCATION (presentations, distribution of educational materials)
  - Trainings, action kits geared towards empowering municipalities to take the lead
- Response to reports
  - Many are positive
- Surveys
  - Eventually, just to confirm new towns or sight new biocontrol release locations
- Biocontrol releases

EAB ACTIVITY POST-2015

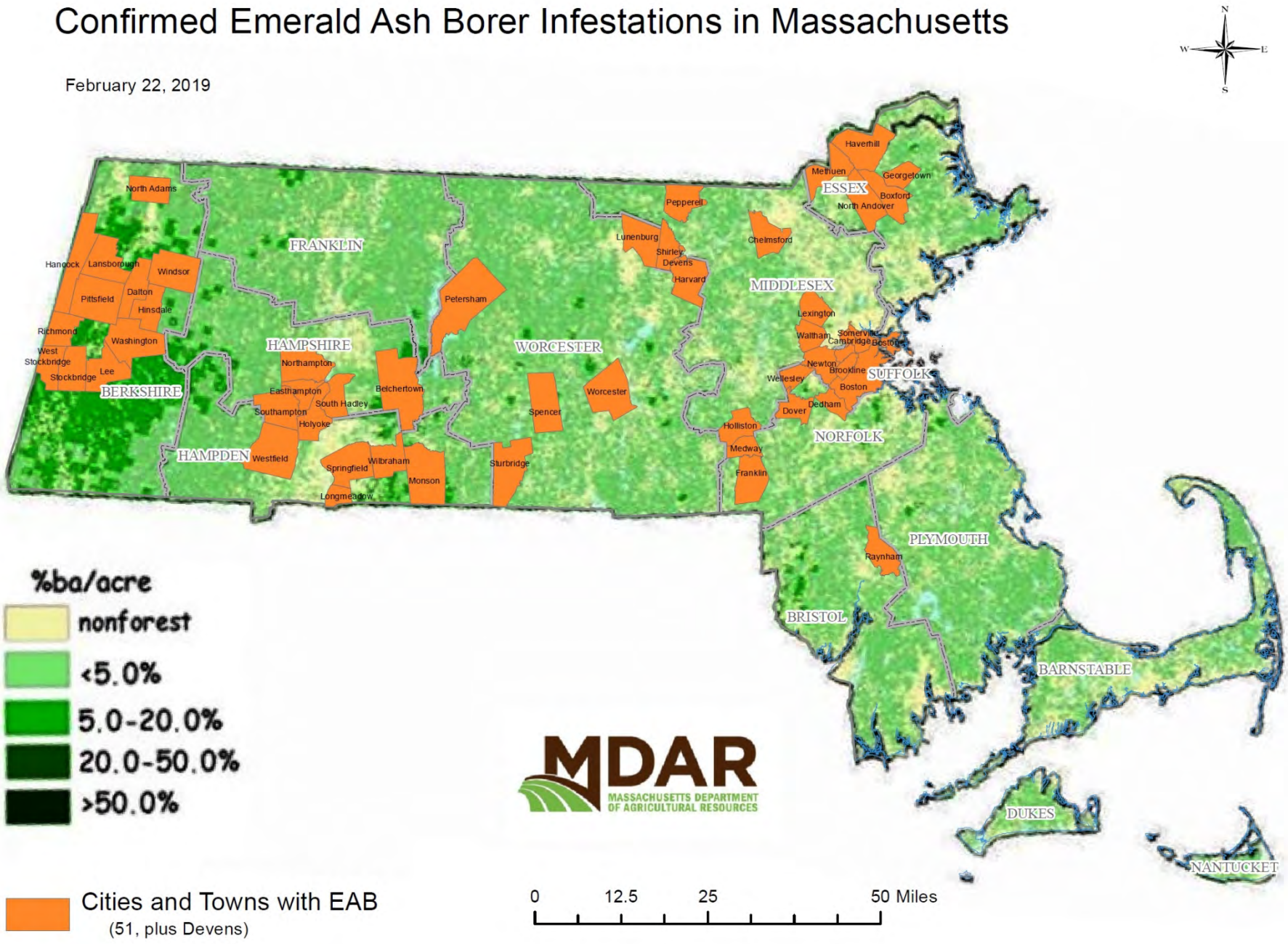
- Denigration of federal response
- Recognition that EAB cannot be eradicated
- Challenge to stop the spread of this pest

CURRENT DISTRIBUTION OF EAB IN USA



Confirmed Emerald Ash Borer Infestations in Massachusetts

February 22, 2019



CASE STUDY #3: SOD

Sudden Oak Death

(*Phytophthora ramorum*)

P. RAMORUM: QUICK FACTS

- Can cause oozing bark cankers, leaf lesions, shoot dieback, wilting
- Associated with dozens of host plants
  - Key genera are: Rhododendron, Viburnum, Camellia, Pieris
  - Also impacts pin/red oak, huckleberry, lilac
- Found in California and the Pacific Northwest
- Main vector of introduction: nursery industry
  - Infected plants, soil, irrigation water, potting medium

Scientific Name	Common Name(s)	Notes
Acer macrophyllum	Bigleaf maple	
*Acer pseudoplatanus**	Planetree maple	
Adiantum aleuticum	Western maidenhair fern	
Adiantum jordanii	California maidenhair fern	
Aesculus californica	California buckeye	
*Aesculus hippocastanum**	Horse chestnut	
Arbutus menziesii	Madrone	
Arctostaphylos manzanita	Manzanita	
Calluna vulgaris	Scotch heather	
Camellia spp.	Camellia - all species, hybrids and cultivars	
Castanea sativa	Sweet chestnut	
*Cinnamomum camphora**	Camphor tree – Sept 2011 (1)	
*Fagus sylvatica**	European beech	
Frangula californica (≡Rhamnus californica)	California coffeeberry	
Frangula purshiana (≡*Rhamnus purshiana*)	Cascara	
Fraxinus excelsior	European ash	
Griselinia littoralis	Griselinia	
Hamamelis virginiana	Witch hazel	
Heteromeles arbutifolia	Toyon	
Kalmia spp.	Mountain laurel - all species, hybrids and cultivars	

P. RAMORUM ACTIVITY

- Has yet to become established in Mass.
- EDUCATION (presentations, distribution of educational materials)
- Surveys
  - Detection is possible, but is expensive
    - Done in lab, involves ELISA and DNA testing
  - Visual id is challenging, sometimes everything looks like a sample
  - Resource-limited, can only sample a small portion of nursery stock/water samples
  - Mass. does *P. ramorum* surveys on a rotating schedule (every few years)
  - Have responded to trace forwards, but no infected plants found

Viburnum spp.

Viburnum spp.

Viburnum spp.

Viburnum spp.

Rhododendron spp.

Viburnum spp.

Viburnum spp.

Viburnum spp.

P. RAMORUM: THE FUTURE

- Remains a high-priority pathogen in our state
- Has yet to become established in Mass.
- EDUCATION (presentations, distribution of educational materials)
- Surveys
  - Detection is possible, but is expensive
    - Done in lab, involves ELISA and DNA testing
  - Visual id is challenging, sometimes everything looks like a sample
  - Resource-limited, can only sample a small portion of nursery stock/water samples
  - Mass. does *P. ramorum* surveys on a rotating schedule (every few years)

WHAT WE'RE DEALING WITH RIGHT NOW…

SLF

Spotted Lanternfly

(*Lycorma delicatula*)

WHAT IS THE SPOTTED LANTERNFLY?

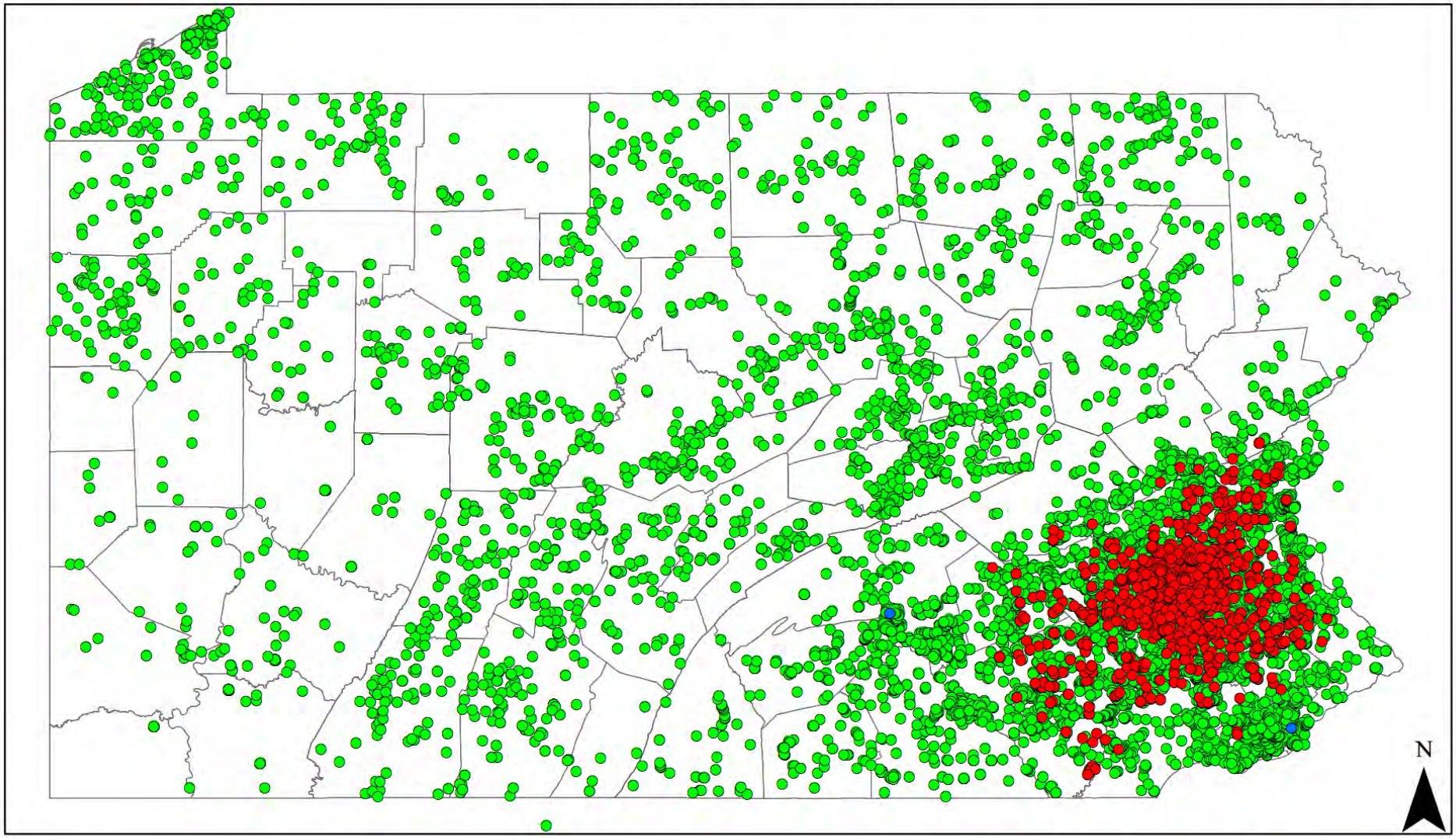
- Planthopper, native to Asia
- Uses tree of heaven (*Ailanthus altissima*) as a primary host
- Also found on 70+ other species
  - Grapes, fruit trees, maples and other hardwoods, Asiatic bittersweet, roses, etc.
- Damage caused:
  - Weeping wounds in trees
  - Dieback in grapevines
  - Honey dew secretions that can cause fungal infections (sooty mold)

SPOTTED LANTERNFLY DISTRIBUTION

- Discovered in Pennsylvania in 2014
  - Thought to have come in on crushed stone imports
- 13 counties in SE PA now under quarantine

2014 - 2018 Lycorma Detection Survey

Results through 13 March 2018

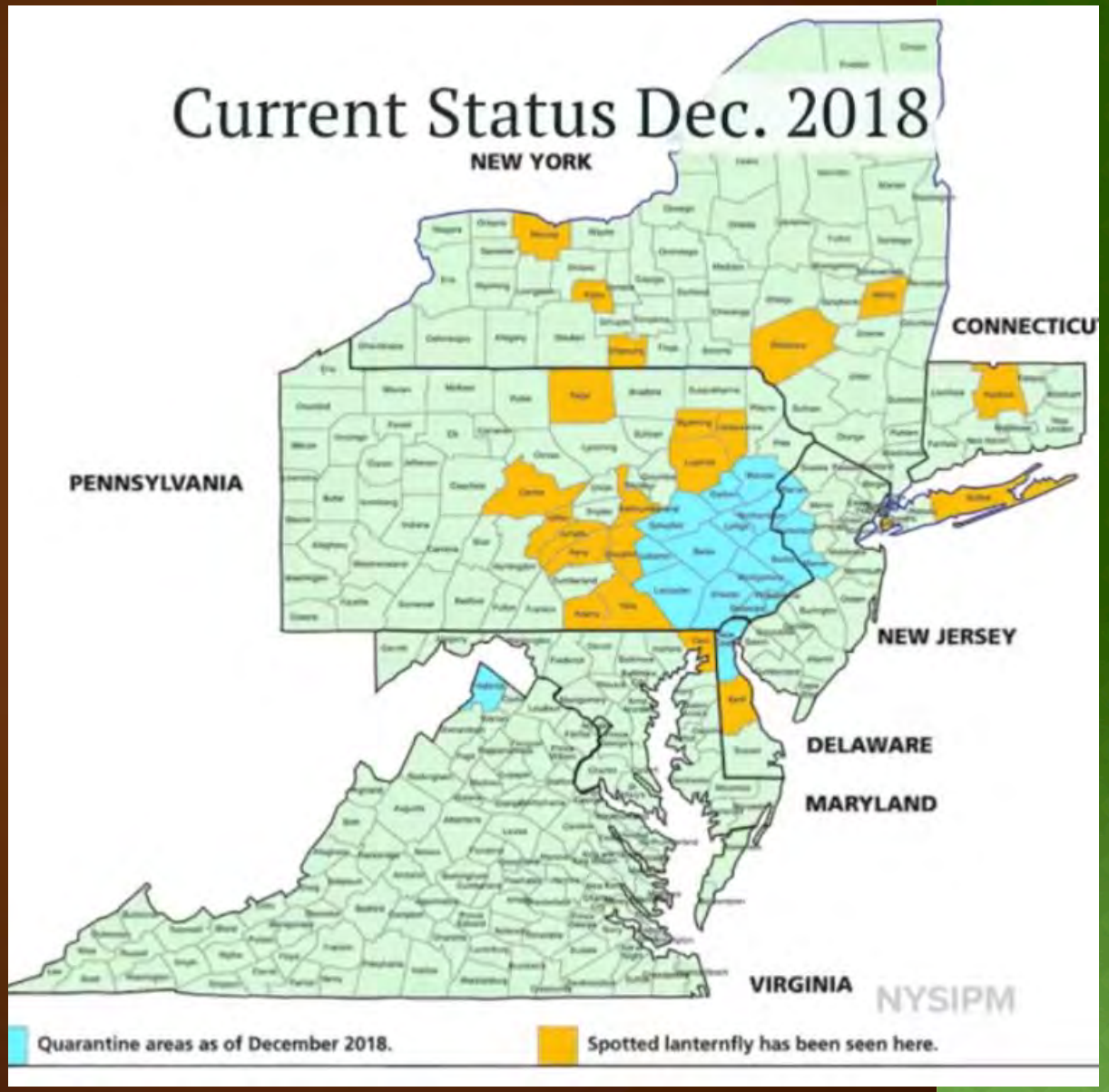


Spotted Lanternfly Presence Regulatory Incident Pos Neg

pennsylvania
DEPARTMENT OF AGRICULTURE

Video courtesy of Christopher Jordan

SPOTTED LANTERNFLY: DISTRIBUTION



SPOTTED LANTERNFLY: MASSACHUSETTS

- A single dead adult SLF was found in the Boston area in December 2018
- The dead insect was found in a potted poinsettia shipped from Pennsylvania during the holiday season
- Surveys of the locations where the plant was bought, kept, and brought to turned up no signs of SLF
- Surveys will continue in the summer
- This does NOT mean that SLF is established in Massachusetts

SLF ACTIVITY 2018 AND BEYOND

- SLF Working Group formed to determine response
  - Prepping response plan including survey protocols, resources needed
- Expecting this won't be the last time we find evidence of this pest in Mass.
- Following PA carefully to determine the possible impacts in our state
- Federal government is not regulating this pest, but is putting a lot of resources into developing traps, lures, and biocontrols
- Educating everyone…

SOMETHING ELSE TO LOOK OUT FOR:

Spotted Lanternfly

(*Lycorma delicatula*)

- Sap-feeding insect
- Primary host is tree-of-heaven, but attacks many other plants, including grapevines, apple and maple trees

Egg mass

nymph, 2nd instar (1st instar

nymph, 3rd instar

nymph, final instar

adult SLF, as seen at rest

LOOKING FORWARD

- Goal: to protect ecological and economic integrity of the state's natural resources
- Need to stay informed about potential pest and pathogen threats
- Education is a key part of the response
  - Educate ourselves and others
  - Tap in to online resources that connect the public with nature
- Sometimes we will need to make tough decisions in the reality of continual pest/ pathogen pressure and limited resources

SEE SOMETHING SUSPICIOUS? REPORT IT!

1. Get a photo or a specimen!
   Save specimens in a container in the freezer, or in a jar with rubbing alcohol
2. Report online:
   massnrc.org/pests

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