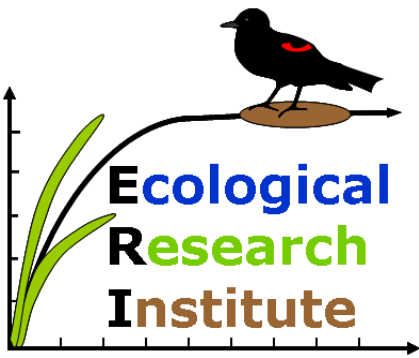


# Monitoring and Managing Ash (**MaMA**): A Protocol for Conservation and Mitigation



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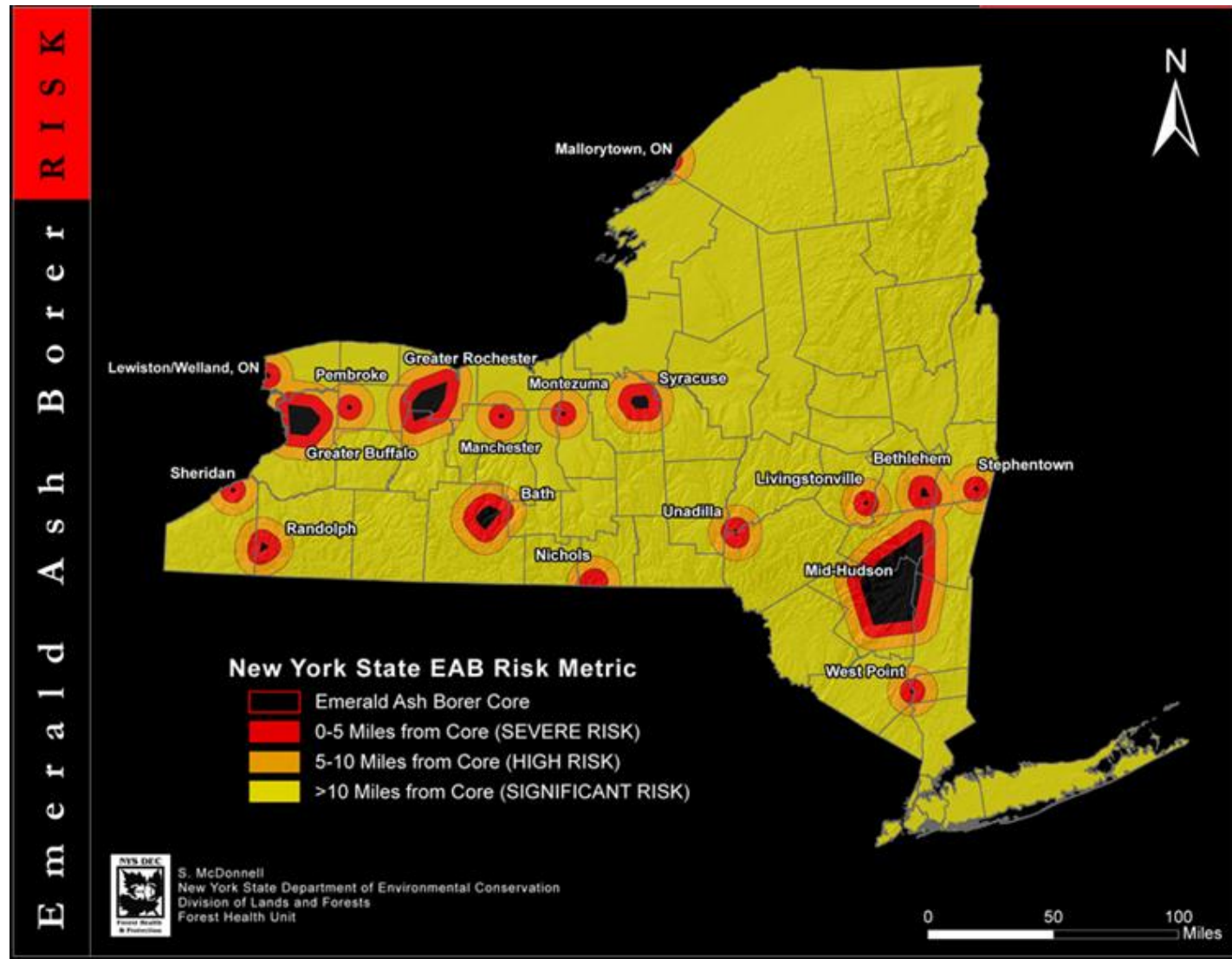
- MaMA now designed for NY and New England, but can be expanded
- Why is it needed?



# Emerald Ash Borer (EAB)

- Has killed hundreds of millions of ash trees (*Burr and McCullough 2014, Herms and McCullough 2014*)
- 99% mortality for common ash spp. in NE
- Predicted cost US\$12.7 billion through 2020 (*Kovacs et al. 2011*)

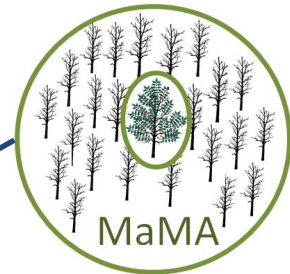
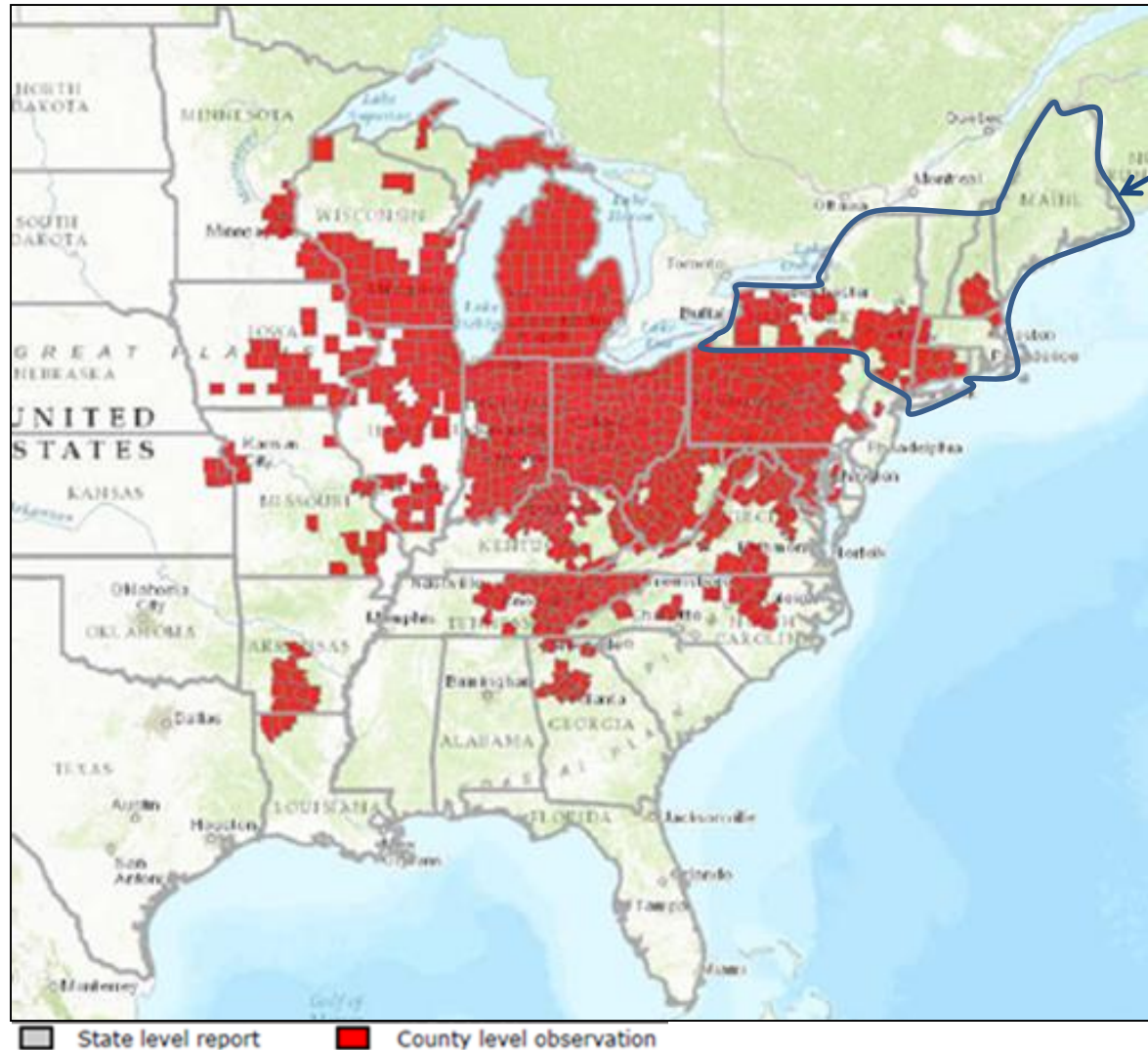
# Four emotional stages of EAB invasion



Denial, fear, despair, resignation

# County-level EAB distribution

USDA Forest Service - Alien Forest Pest Explorer



<https://foresthealth.fs.usda.gov/portal/Flex/APE>



# Tasks for each stage of EAB infestation

Pre-infestation EAB not yet present	Early infestation Some EAB signs; some dead ash along w/ healthy and declining trees	Mid-infestation Widespread EAB signs; higher ash mortality; few healthy trees	Late infestation Ash largely dead, with remainder very unhealthy except for <i>very rare</i> <b>lingering ash</b>
Assess ash presence/importance			
Decide which trees to be treated vs. cut vs. left for mortality monitoring/lingering ash detection			
Identify sites where mitigation needed (for invasive plants, hydrological changes, etc.)			
Document infestation onset			
General seed collection for diversity			
Establish <b>mortality monitoring</b> plots			
		Assess/monitor mortality: detect when 95% reached	
			Find/mark <b>lingering ash</b> , report for possible <b>scion collection</b> , collect their seed

# MaMA overview

- MaMA facilitates each of these steps
- Integrates global imperative for ash conservation into local actions

# Simplified decision tree

**Strictly local perspective  
(cost/benefit to land managers)**

## Cut

a) potential hazard tree and treatment not worth it **or**  
b) trees for commercial logging **or**  
c) to maintain habitat type (e.g., prevent hydrological change in black ash stands)

## Treat

Trees with special role in landscape, treatment practical and affordable

## Trees left to die

Passive response, embodying resignation



# Simplified decision tree

## Integrating local and global perspectives

### Cut if:

- a) Potential hazard tree but pesticide treatment too costly/impractical **or**
- b) Tree relied upon for harvesting **or**
- c) Cutting necessary to maintain habitat type (rare cases).

### Treat if:

Tree has special role in landscape, **and** treatment is practical/affordable.

### Use for mortality monitoring/ lingering ash detection if:

Tree doesn't need to be cut or treated **and** tree isn't planted cultivar **and** ash species conservation is a goal.

# MaMA website

[MonitoringAsh.org](http://MonitoringAsh.org) includes:

- Information on and links to tools for all appropriate steps over course of invasion
  - So participants can explore full range of actions, fit them into overall ash/EAB management plan
- Instructions for MaMA's three iNaturalist projects



[« Projects](#)

## Search projects

Search

1 - 3 of 3 results



### [Monitoring and Managing Ash \(MaMA\) 1: Ash/EAB surveys](#)

One of three citizen-science projects of the MaMA program (MonitoringAsh.org), which aims to mitigate EAB damage and help prevent ash extinction. In this one, participants report whether EAB have infested ash stands and whether any trees have died from EAB there. It enables fine-scale tracking o...



### [Monitoring and Managing Ash \(MaMA\) 2: Monitoring plots](#)

One of three citizen-science projects of the MaMA program (MonitoringAsh.org), which aims to mitigate EAB damage and help prevent ash extinction. In this one, participants set up plots to monitor ash tree mortality from EAB and report their data. After particular mortality thresholds are reached...



### [Monitoring and Managing Ash \(MaMA\) 3: Lingering ash](#)

One of three citizen-science projects of the MaMA program (MonitoringAsh.org), which aims to mitigate EAB damage and help prevent ash extinction. In this one, participants search for and report “lingering ash”, i.e., trees that are healthy even after EAB-caused mortality in the area has reached ...

# INITIAL ASH SURVEY/MANAGEMENT PLANNING COMPONENTS

- Assessing overall ash representation at site
- Assessing EAB infestation status
- Determining which (if any) trees should be **treated, cut,** or **neither**
- Determining if loss of trees will cause particular consequences requiring mitigation
  - Example: Imminent explosion of invasive plants due to canopy opening.



*Photo: D. McCullough.*





# MaMA's role in initial assessment/planning

- MaMA provides links to planning tools (e.g., cost calculators, treatment info., inventory approaches)
- iNaturalist **MaMA 1: Ash/EAB surveys** project enables real-time sharing of basic ash abundance and EAB infestation information *across state lines*, w/ assistance from website and community.



# MaMA 1: Ash/EAB surveys

## iNaturalist project

- Not necessary to ID trees to spp., but helpful to note if any are black ash,
  - because of hydrological role, restricted distribution, cultural significance, relatively little seed collection/ lingering ash work done on it



# Black vs. white and green ash



white ash (*Fraxinus americana*)



black ash (*F. nigra*)



green ash (*F. pennsylvanica*)



# MaMA 1: Ash/EAB surveys

## iNaturalist project

- Project also helps ID potential sites for **mortality monitoring** plots, can recruit help for them
- EAB presence data can be uploaded to iMapInvasives (participating states) from iNaturalist

# Abilities needed

- Participants need to recognize ash, recognize EAB signs and follow simple, yet rigorous protocol
  - Essential for this and MaMA's other iNaturalist projects

# EAB signs

Definitive



Possible



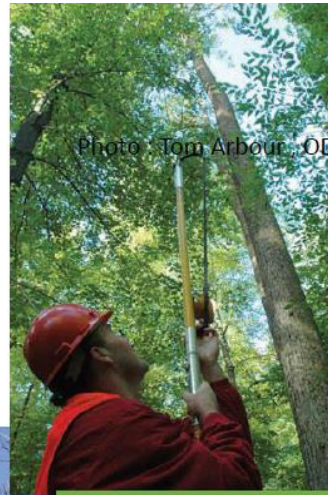
# Mortality monitoring plots and lingering ash detection

- Needed because mortality thresholds trigger area searches for “lingering ash”
  - i.e., trees that are **healthy** even after widespread, sustained mortality in area, likely due to genetic resistance to EAB



- USFS programs to find (led by K. Knight) and breed (led by J. Koch) lingering ash have collected scions and selected for resistance, interbreeding multiple resistant lines w/in species, producing highly resistant lines in 2<sup>nd</sup> generation of offspring.

# Collecting scions from lingering ash



Knight et al., 2010.  
Gen. Tech. Rep.  
NRS-55.14 pp.



Photo compilation by J. Koch

- Effective resistance even greater when EAB pop. lower, so these trees will do even better after EAB pop. reduced due to:
  - Crash of abundant susceptible food supply and/or
  - Effective EAB biocontrol, other techniques
    - So, lingering ash offer lots of hope!

- Until now, lingering ash search (USFS) in OH, MI
- Need locally adapted, diverse lingering ash from throughout range for broader breeding program
- Two MaMA iNaturalist programs to help achieve this: [Monitoring Plots](#) and [Lingering Ash](#)



# MaMA lingering ash criteria

- Completely healthy crown,  $\geq 10$  cm dbh
- 95% EAB-caused mortality for  $\geq 2$  years **or**
- 50% EAB-caused mortality for  $\geq 4$  years
- Can't be treated or be a planted cultivar

# MaMA 2: Monitoring Plots

## iNaturalist project

- Participants designate plot of  $\geq \frac{1}{2}$  acre and w/  $\geq 40$  10-cm-dbh ash trees
  - Count live and EAB-killed ash yearly to see when 50% or 95% mortality threshold reached
  - Location and mortality data shared through iNaturalist
    - Wide participation can reveal overall mortality pattern, enable broad lingering ash search

« Projects

Terms &amp; Rules | Edit p



## Monitoring and Managing Ash (MaMA) 2: Monitoring plots

[Add observations to this project](#)

## Stats

## Totals

5

[Observations »](#)

1

[Species »](#)

1

[People »](#)

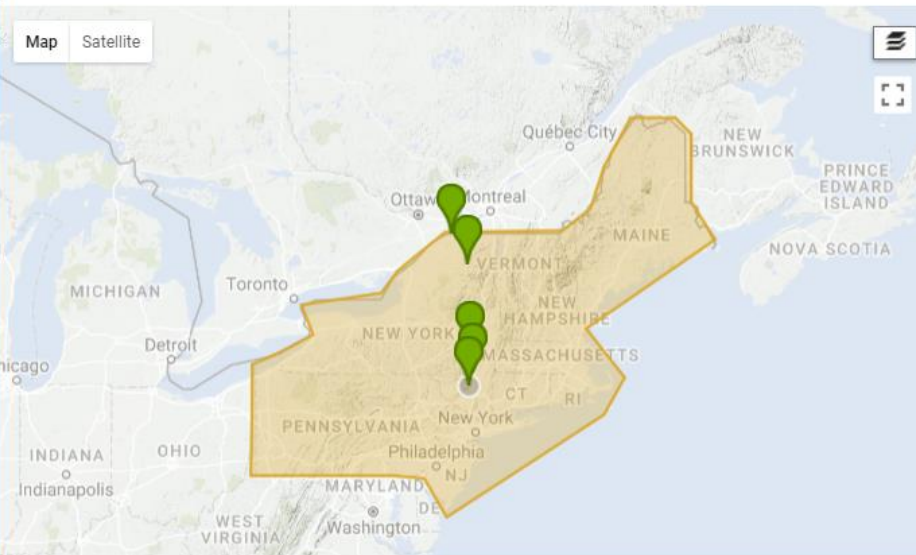
## Most Observations

ecoresearchinstitute  
3 observations

## Most Species

ecoresearchinstitute  
1 species

## Most Observed Species

White ash  
3 observations

## » Members

[View all members »](#)

## » Your membership

2 observat

## » Add from your observations

[Download template for use in the bulk upload](#)

## » Export observations

[Atom](#) / [KML](#) / [CSV](#)

## » Project List

## » Usage stats

## Project curator tools

# MaMA 3. Lingering Ash

## iNaturalist project

- Participants report findings for areas searched after threshold (50% or 95% mortality), waiting period (2 yrs. or 4 yrs., respectively)
- Need to recognize ash trees, EAB signs, and distinguish healthy crowns from those w/ thinning or die-back.

# Lingering ash must be healthy

Ash crown health scale (Smith 2006), images from Knight et al. 2013

1.  
Full,  
healthy  
canopy



2.  
Thinning  
canopy, but  
no die-back



3.  
Die-back (dead  
twigs/branches  
near treetop)



4.  
< 50 % of  
full canopy



5.  
Dead  
canopy





- If 95% already reached in area when first surveyed (i.e., not known when this % reached), wait 2 years for lingering ash search (some areas in Ulster Co.).
- Eventually, FIA mortality data sources might also be available and used to trigger search.

- Participants should mark lingering ash, notify land managers to prevent felling.

# How seed collection fits with lingering ash

- Seed collection can help preserve genetic diversity/local adaptation, but randomly collected seeds probably not from resistant trees; lingering ash scion collection superior.
- Widespread seed collection still worthwhile as fallback option
- Also, seed collection from lingering ash potentially especially useful.

# Be careful!



Photo from Knight et al. 2014

# Something to not do

- Although cutting ash for reasons mentioned above (hazard tree elimination, harvesting, etc.) is sensible,  
**Don't cut ash for purpose of decreasing mortality or EAB spread rate, because**  
... reducing ash presence *increases* local mortality (Knight 2013) and may increase spread rate (Mercader et al. 2011)
- Also, each healthy ash tree offers hope as a potential lingering ash ... cutting healthy ash trees diminishes hope.



# Partners wanted!

- Looking for partners throughout region to host training sessions for MaMA's citizen science projects
  - The iNaturalist projects should be done only after ash fully leafed out, and before autumn leaf drop
- Also looking for regional partners to host lingering ash breeding program – logistics of doing everything from OH daunting.

# Acknowledgements

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