

Emerald Ash Borer Impact in Pennsylvania Forests

Lessons Learned, Forest Management Strategies
for Forest Landowners and Managers

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2010 Emerald Ash Borer Forestry Professional Study Tour



EAB Forestry Professional Study Tour

Cleveland Metro-parks
Foresters- Connie Hausman
Terry Robison



EAB Forestry Professional Study Tour

Ohio Research Forests

USDA Forest Service-NRS

Kathleen Knight-Research Ecologist



EAB Forestry Professional Study Tour

USDA-APHIS-Bio-Control
Facility

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EAB Forestry Professional Study Tour

Forest Land Management Strategies,
Stand Composition Changes, Invasive
Species Problems, Bio-control

Deb McCullough- Michigan State Uni.

Roger Mech- Michigan DNR

Leah Bauer- US Forest Service

Ohio State Extension
Kathy Smith- Program Director



EAB Forestry Professional Study Tour

Utilization of Urban Ash
Woody Biomass for Energy
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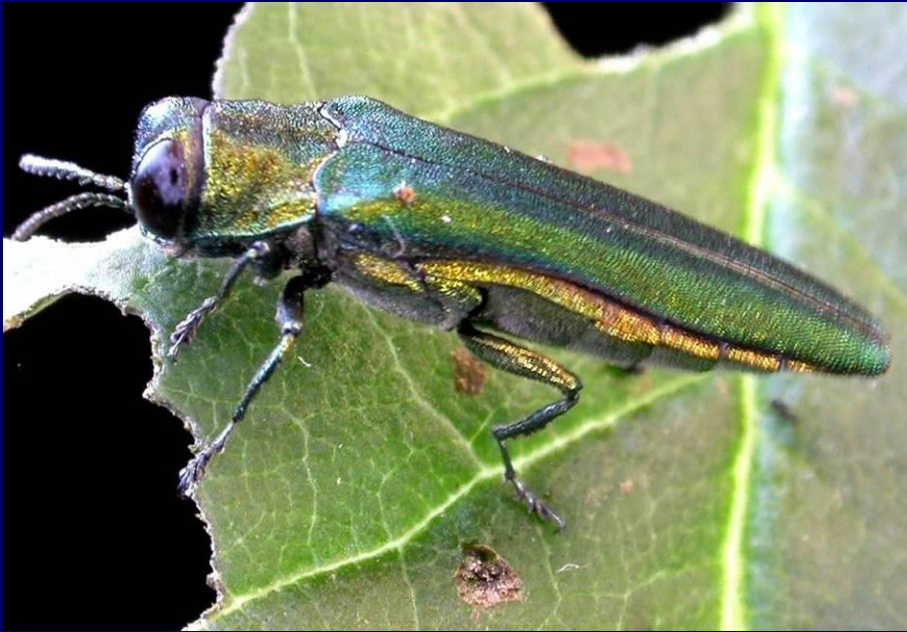
EAB Forestry Professional Study Tour



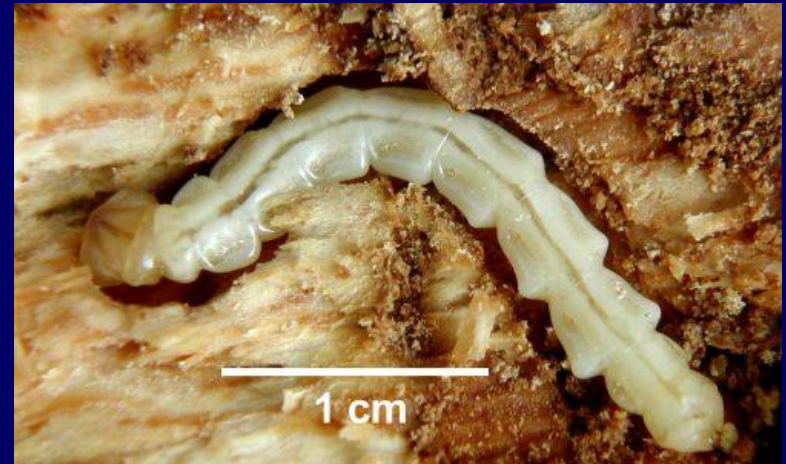
Ann Arbor Library
Ash Utilization for Construction



Emerald Ash Borer in PA



Agrilus planipennis



Adult: Emerald Green, 3/8 - 1/2 inches long and 1/8" wide

Larva: feeds under the bark, not in the wood, creating galleries that effectively girdle and kill ash trees

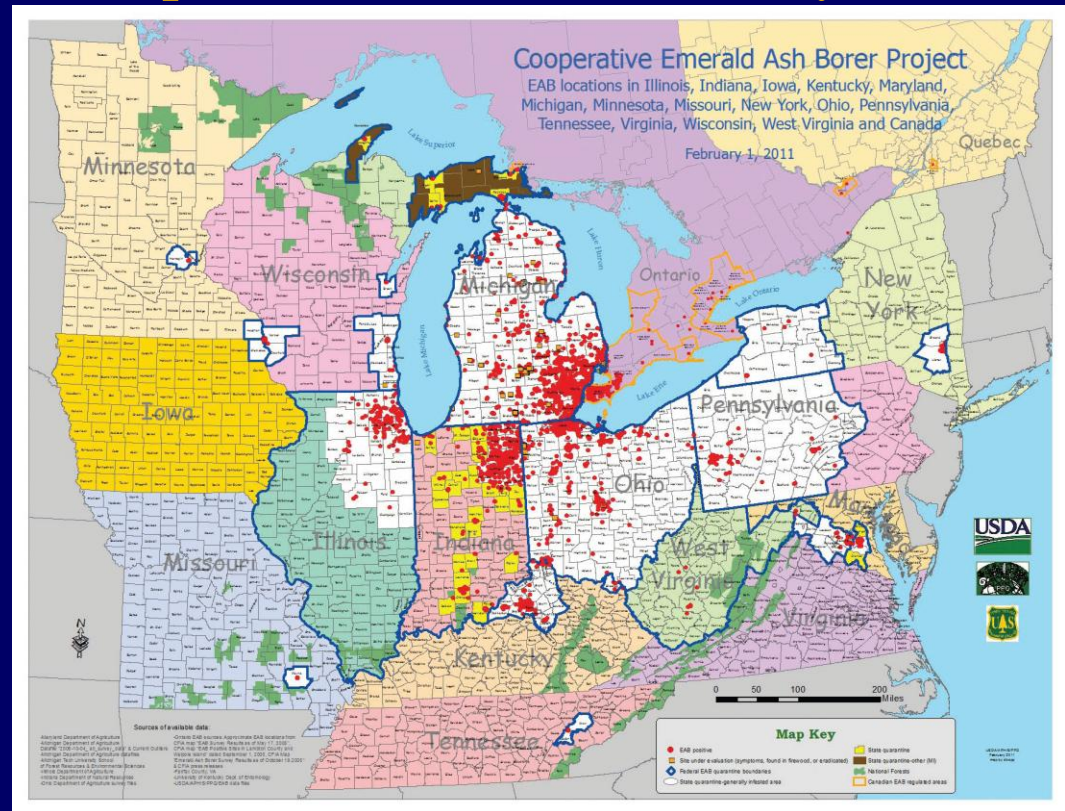
➤ July 2002: *Agrilus planipennis* first identified as cause of ash decline in Detroit, MI & Windsor, Ont.

➤ 2007: EAB detected in Cranberry Township, Butler County.

➤ 2009: EAB populations now in 10 states.

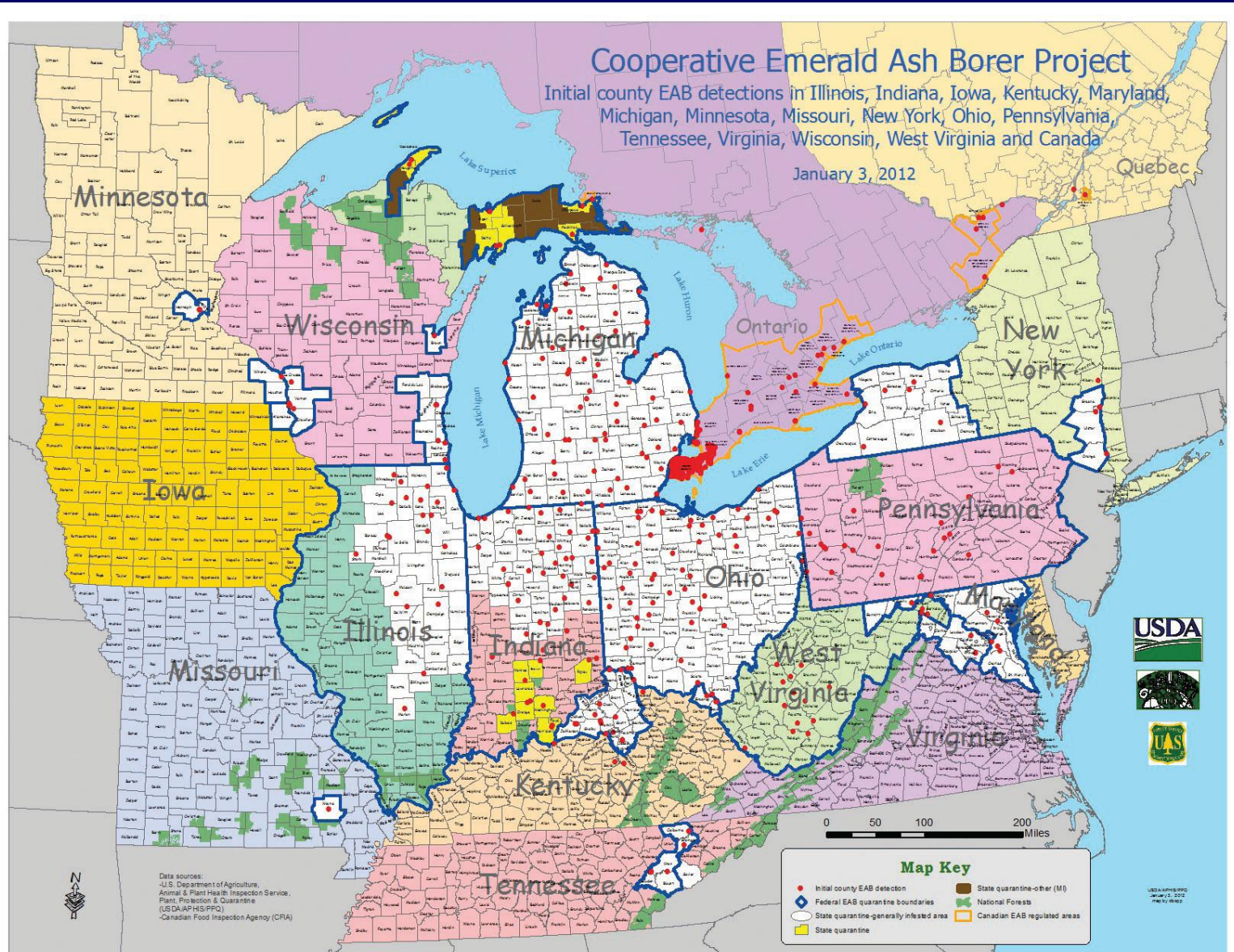
➤ 2010: EAB detected in Randolph, New York and in Maryland

EAB native to China & Korea; maybe Japan, Mongolia, E. Russia



www.emeraldashborer.info

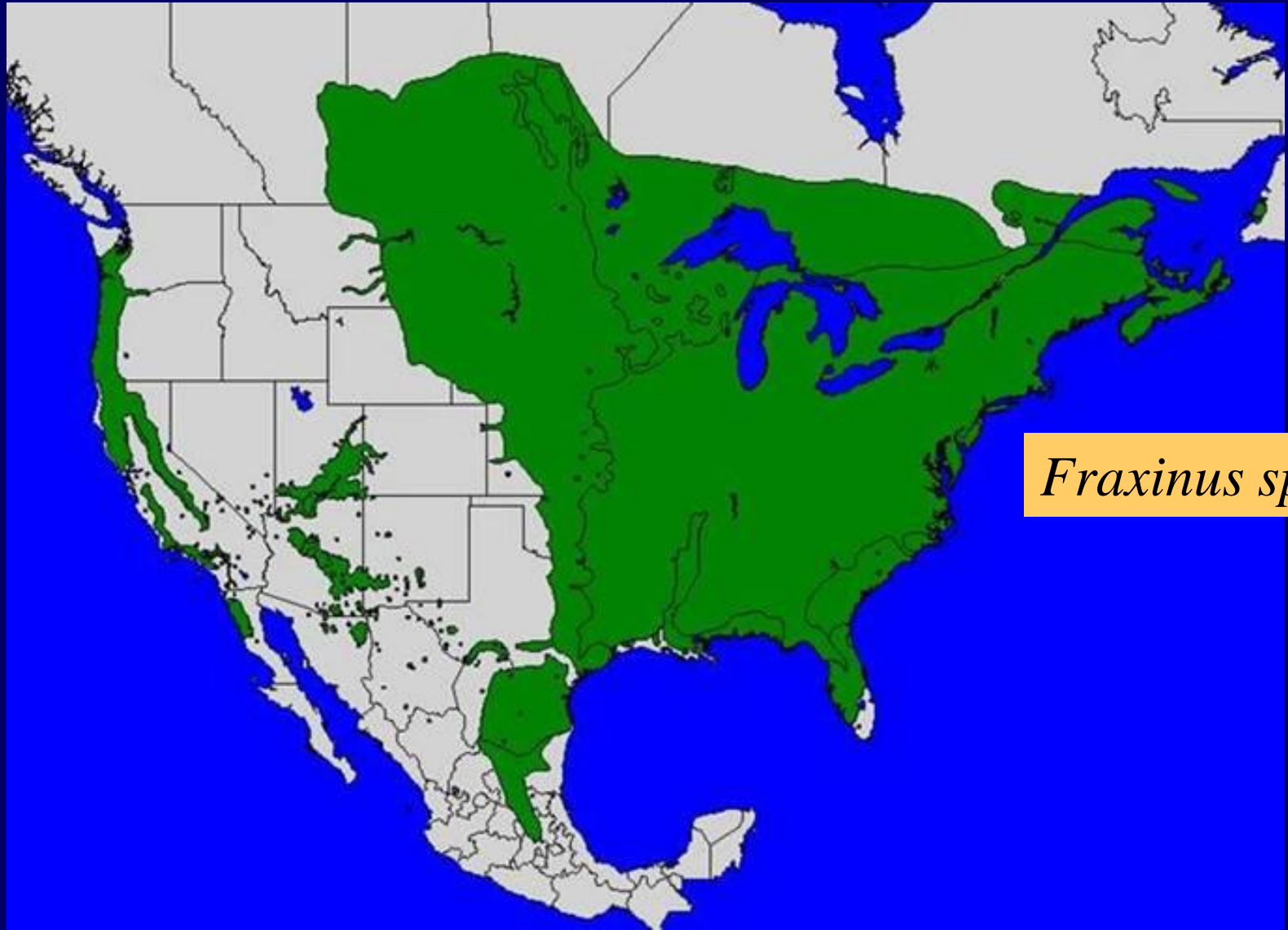
2012 Emerald Ash Borer Detections



EAB in Pennsylvania

- Now detected in 22 counties in Pennsylvania
- Butler County- 2007
- Mercer County- 2008
- Mifflin, Westmoreland- 2009
- Washington, Armstrong, Indiana, Juniata, Lawrence, Beaver, Allegheny, Bedford, Centre, Somerset, Fulton, Union, Clarion, Cumberland, Lycoming, Huntingdon, Wyoming, and Sullivan Counties

EAB Potential Impact in North America



Fraxinus sp.

Ash Mortality in Michigan



- At least 40 million ash trees in urban, rural & forested settings have been killed by EAB in MI.
- Only a few in PA.
- All native ash species (white, green, black, blue & pumpkin) exposed to EAB to date appear vulnerable.

Forest Trees Perspective

- 804 million ash in MI forests.
- 304 million Ash in PA (1" and larger) (FIA:2006-09)
- > 8 billion ash in U.S. forests and 15 species.



Ash in Pennsylvania Forests (FIA)

- Overall 3.9 % Ash component (5" and larger)
- White Ash- 3.8% (5" and larger)
- Green Ash- 0.1% (5" and larger)
- Black Ash- less than 0.1%
- Highest % age found in SE Pennsylvania counties
- Ash % by stand varies widely across the state
- Some stands have 50 % or more

Ash Shade Trees

- 500 million in US worth \$20-\$60 billion
- Ohio: estimated costs of landscape ash removal & replacement = \$1.8 to \$7.6 billion (*Sydnor et al. 2007*)



Ash in Community Forests in PA

- Philadelphia- ~107,100 Ash street trees (5.1 %)
- State College- 400 Ash street trees (6.2 %)
- Pittsburgh-
 - 387 Ash street trees (.96 %)
 - 60,000 – 500,000 Ash in greenways, urban woods



Emerald Ash Borer Biology

Slides/photos- Deb McCullough-MSU

EAB- Biology in North America



- Adults are present from mid-May through August.
- Feed on leaves during 3-6 week life span.
- Mating occurs 1-2 weeks after emergence.

EAB- Adult Laying Eggs in Bark



- Females begin laying eggs after 2-3 weeks of feeding.
- Laying about 30-60 eggs per female.
- Eggs hatch in ~ 2 weeks.

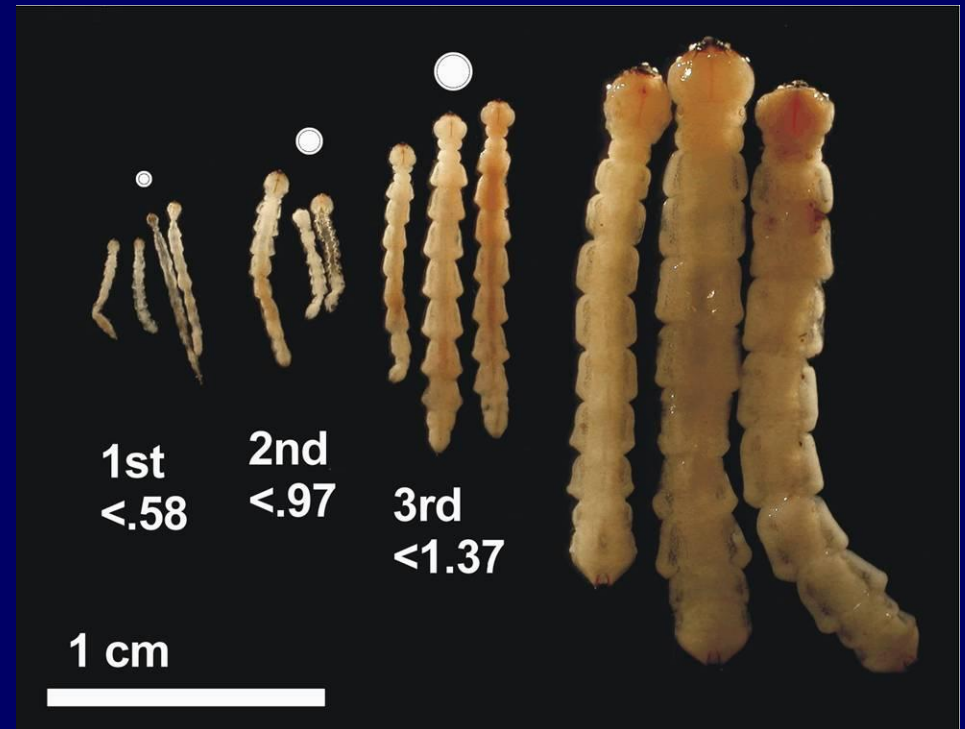


EAB- Larval Stages

Larvae feed in phloem from late July to Oct-Nov

Pass through 4 instars.

L1 L2 L3 L4



EAB- Deadly Damage

- Larval galleries in phloem (inner bark) disrupt vascular system in the tree over time
- Leading to canopy dieback & eventually tree death.



EAB-Overwintering



Most EAB overwinter as pre-pupae in thick bark or in the outer ½ inch of sapwood.

EAB Pupation Process

- Pupation begins in April & May.
- Generally about 22 days



EAB Adult Emergence

- Adult emergence begins in May
- Peaks in late June or early July.



Adults emerge from D-shaped holes

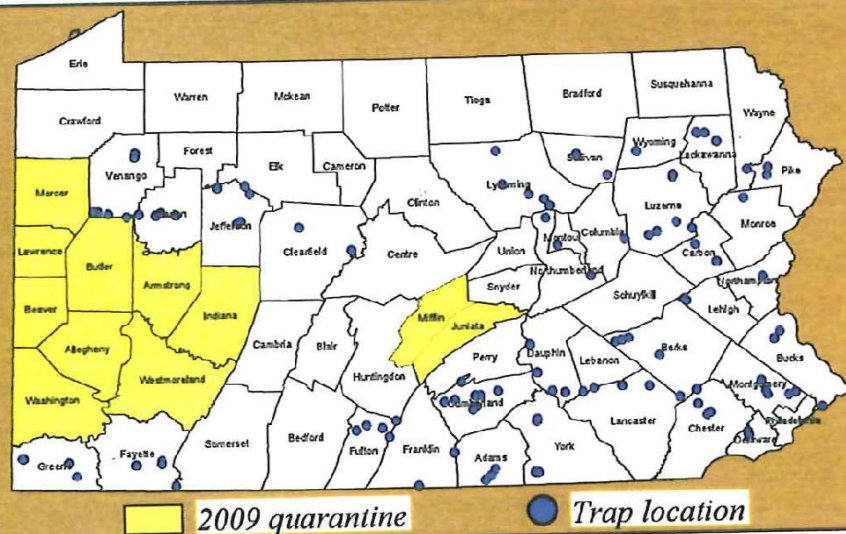
EAB Detection Methods

Purple EAB Detection Traps



- APHIS purple panel traps with Manuka oil as a lure.
- 100 mile perimeter of known sites and special locations like truck stops.
- Few new populations found.
- Great EAB awareness tool .

Trap Distribution for 2010 EAB Detection Survey



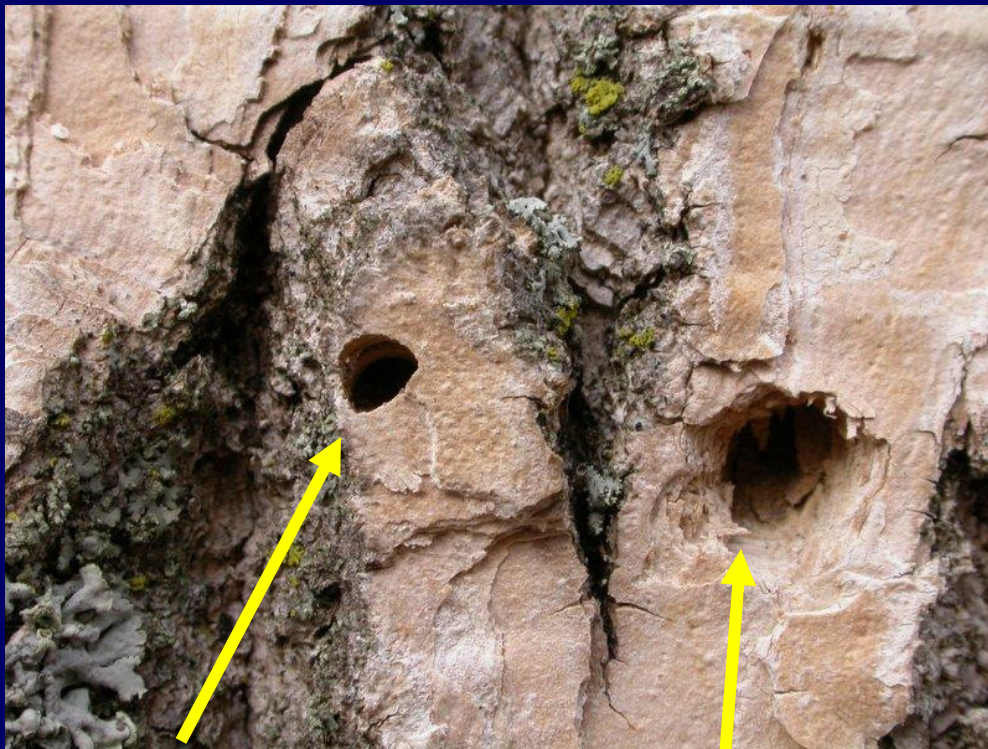
EAB Detection Trap Design



Bark splits, epicormic sprouts & canopy dieback become evident as EAB density increases.



Woodpecker predation of 4th instars & prepupae is often the first sign of EAB.



EAB exit

WP hole



Detection: Woodpecker Activity

Woodpecker predation of late instar larvae can be a good detection method.

Infestations often start high in small branches.

Dieback and woodpecker activity was often not noticed in early EAB infestation.



Woodpecker indications in EAB infested stands photographed in Cranberry Township.



EAB Look-alikes



EAB

Control Methods

Control of EAB

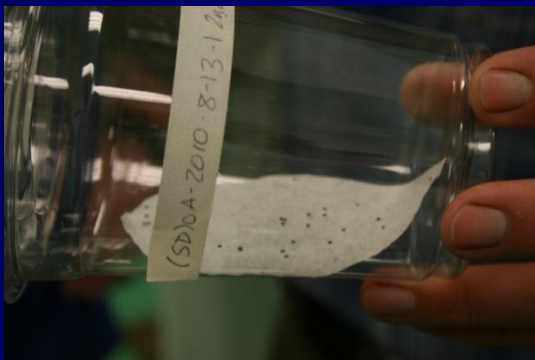
- Eradication attempts in Ohio: Failed
 - Early one mile buffer- eliminating all ash trees (public and private)
 - Bad PR and upset landowners
 - EAB adults moved farther and faster to next Ash populations.
- Insecticides:
 - Expensive
 - Cover Sprays
 - Systemics- Soil drench, Soil / Tree injection, Basal sprays
 - Used by individual homeowners and/or community street trees
 - Must be repeated (often annually) to maintain effectiveness.



Biological Control- Parasitoids

- 3 parasitoid (wasps) releases in Pennsylvania State Forests- 2011
- 3 Chinese parasitoids (Wasps) 1st released in Michigan in 2007

- *Egg parasitoid*
Oobius agrili
- *Larval parasitoids*
Tetrastichus planipennisi
Spathius agrili



Native Parasitoids

- Native *Atanycolus hicoriae* in late instar EAB galleries near Fenton, MI in Sept. 2007.
- Parasitism rates: up to 30-70% of EAB larvae in that site.

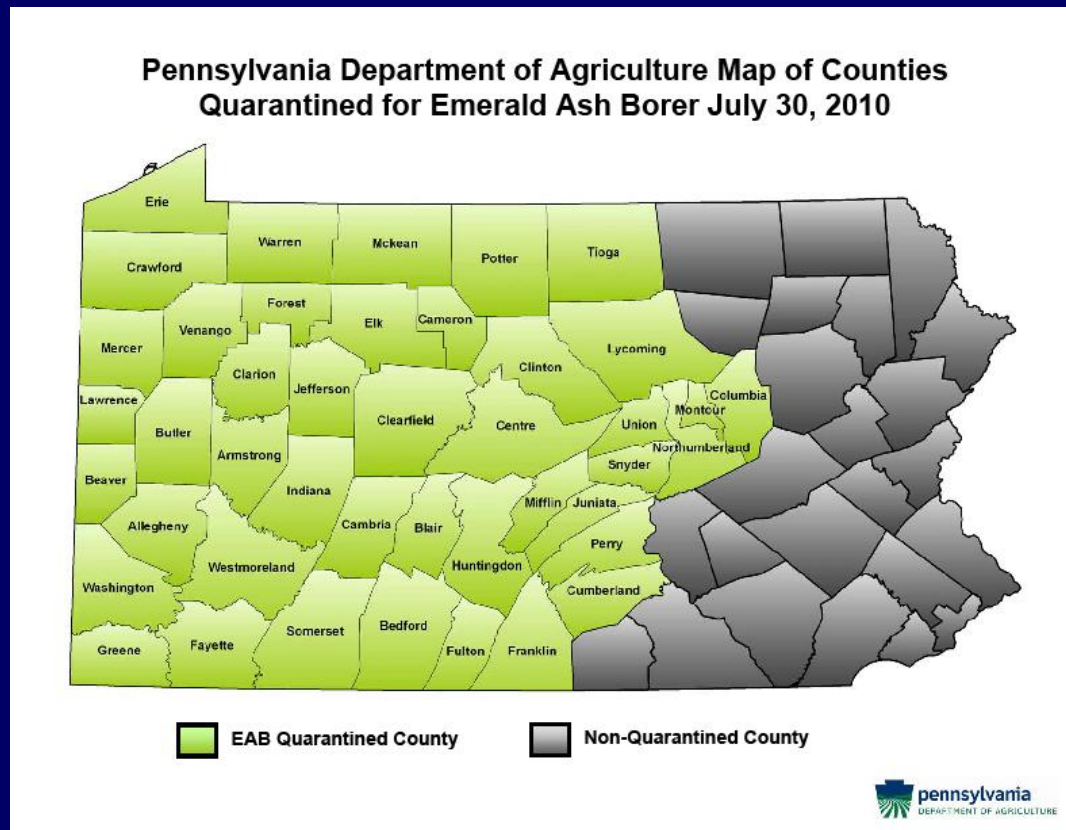


Utilization of EAB Damaged Ash

Pennsylvania Quarantines

Special Note: All EAB Quarantines in Pennsylvania repealed as of April 15, 2011

- Inrastate movement of Ash materials- OK
- Interstate movement of Ash materials- SAME as before





ALERT!

*Protect our
Forests and Trees.*

*Help Stop the Movement
of Exotic Pests.*



DO NOT MOVE FIREWOOD!

Exotic pests like the emerald ash borer can be spread when infested firewood is transported to new areas.

- Use LOCAL firewood
- Do not bring firewood from home
- If you have already transported firewood, do not take it home, do not leave it - BURN IT!



Woody biomass from
Ash used as a fuel for
electricity production
and district heat.
(Michigan)

Urban trees milled into
Ash lumber and sold on
consignment to
woodworkers, schools,
etc. (Michigan)



**Forest Management
Strategies for
EAB Infestations**

Forest Management Strategies for EAB

Important Considerations

BEFORE considering alternative strategies

- There are no assurances that EAB can be controlled or eradicated
- Knowledge about EAB is constantly evolving
- EAB should be of concern to all forest landowners even if present infestations are not close to their woodland.
- Many experts think it is not a matter of if EAB will spread throughout Pennsylvania but how fast.
- Proactive landowners have better control of the negative and long term impacts of an EAB infestation.
- Consultation with a professional forester is recommended.

Forest Management Strategies for EAB

Important Factors

- Risk Assessment
 - Low
 - High
- Inventory/Cruise of forest stands to determine percentage of Ash
 - 10 percent or less Ash component
 - 10 percent or more Ash component
 - Ash less than 12” DBH
 - Ash 12” DBH and larger
 - Stand Age, Species composition, Structure, Relative Density, Stocking, Regeneration potential
- Forest Stewardship Goal(s)
- Actions and Strategies

Forest Management Strategies for EAB

Risk Assessment

- Risk Assessment: EAB spread generally at a rate of about one mile per year (MI observations). Risk is assessed based on distance from existing populations and outliers
- Outliers-could be associated with firewood movement, campgrounds, interstate highways and truck stops.
- Low->10 mi. (infestation not imminent)
- High-within 10 mi. (infestation likely in 5-10 yrs)
- Monitor for new outliers



Forest Management Strategies for EAB

Understanding Stand Parameters

- Inventory/Cruise of forest stands to determine percentage of Ash
 - Ash by size and quality
 - Other species by species, size and quality
 - Regeneration potential-seedlings, saplings, seed source
 - Interfering vegetation
 - Invasive species
 - Deer impact



Forest Management Strategies for EAB

Forest Stewardship Goal(s)

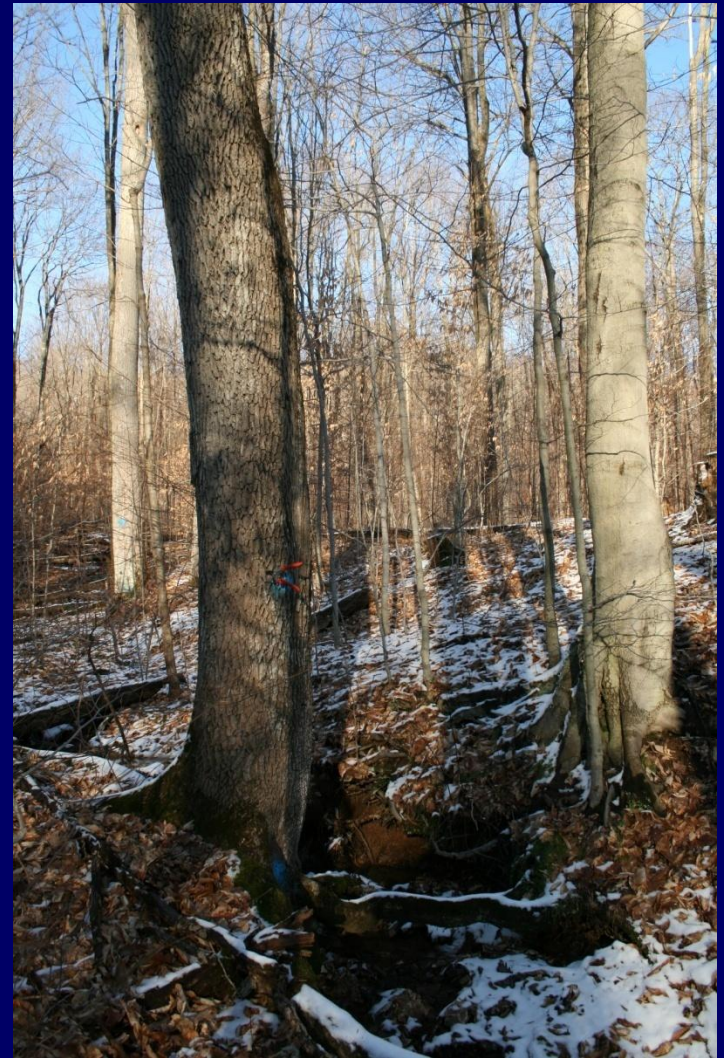
- Reduce forest vulnerability to EAB
- Slow expansion of EAB populations
- Reduce the loss of forest values
 - Economic and others
- Maximizing your options to control species composition in the overstory and understory.



Forest Management Strategies for EAB

Precautionary Notes

- Eradication is NOT feasible
- No Ash immunity to EAB- (*There may be some evidence of lingering ash*)
- Low quality/poor vigor Ash
 - More likely to be infested
 - Decline is quicker
- Must consider Beech Bark Disease and other forest health issues.
- Large canopy gaps- (LIGHT)
 - Ash regeneration
 - Undesirable Species/Invasives
 - Interfering Plants



Forest Management Strategies for EAB

Action Alternatives

➤ Take no action and EAB Infests

- Most probably all Ash will die
- Most economic value from Ash will be lost
- The more sawtimber size Ash component the higher the loss.
- Dead standing trees will last 5-10 yrs.
- Dead, standing trees will pose a substantial hazard for landowners, hunters, hikers and loggers
- Dead, standing trees will add considerable wildlife benefit to woodpeckers, cavity nesters, etc.
- Desirable tree seedlings and saplings may or may not develop
- Invasive species could dominate the understory
- EAB infestation can grow and/or spread faster

Forest Management Strategies for EAB Stands Less Than 10% Ash

Scenario #1: Most Ash less than 12" DBH

- Risk of economic loss is low
- Thin most Ash and low quality trees to shift growth to best residual trees.
- Products are firewood and pulpwood
 - ❖ Marketing may be a problem
 - ❖ Ash trees under 6" require additional treatment (time & cost)



Forest Management Strategies for EAB Stands Less Than 10% Ash

Scenario #2: Most Ash larger than 12" DBH

- Risk of economic loss is higher
- Thin most Ash and low quality trees to shift growth to better residual trees.
- Products are sawlogs, firewood and pulpwood
 - ❖ Marketing will be less of a problem and dependent on local conditions.



Forest Management Strategies for EAB Stands

>10% Ash – Important Considerations

1. Ash is often not evenly distributed
2. Any harvest may create openings
3. More removed the bigger the opening
4. More sunlight will encourage additional vegetative growth (good & bad)
5. Monitor openings in early years for desirable and/or undesirable plants
6. Additional treatments may be necessary



Forest Management Strategies for EAB

Stands >10% Ash

Scenario #3: Most Ash Less Than 12”

- Risk of economic loss is low
- Thin most Ash and low quality trees to shift growth to best residual trees.
- Products are firewood and pulpwood
 - ❖ Marketing may be a problem
- Monitoring openings created is important



Forest Management Strategies for EAB

Stands >10% Ash

Scenario #4: Most trees 12-18" DBH
and Good Quality

*Stand is NOT near maturity and/or
Non-Ash species are high
percentage of AGS*

- Potential for economic loss is high
- Integrated thin and remove Ash component while favoring desirable species and good quality trees.
- Greater attention to openings created.



Forest Management Strategies for EAB

Stands >10% Ash

Scenario #5: Most trees 12-18" DBH and Poor Quality

1. Economic loss potential is high
2. Best to remove Ash and low quality trees (*UGS as residuals won't increase in value*)
3. This approach requires a focus on what is being left (Residual)
4. Assess existing natural regeneration and factors affecting natural regeneration (site conditions, seed source, interfering plants, invasives, deer impact). Develop regeneration plan.



Forest Management Strategies for EAB

Stands >10% Ash

Scenario #6: Most trees >18" DBH

1. Economic loss potential is the highest
2. Remove all Ash. This approach will affect future regeneration potential.
3. Assess existing natural regeneration and factors affecting natural regeneration (site conditions, seed source, interfering plants, invasives, deer impact). Develop regeneration plan.



Forest Management Strategies for EAB

Where Regeneration is Important

Elements of a regeneration plan

- Residual Trees-
 - Good quality poles (future sawlogs)
 - Den trees and mast (wildlife)
 - Rare/uncommon species (diversity)
- Natural Regeneration
(seedlings/saplings)
- Limiting factors
 - Site conditions
 - Seed Source
 - Interfering vegetation
 - Invasive species
 - Deer impact



Forest Management Strategies for EAB

Where Regeneration is Important

Elements of a regeneration plan

If natural regeneration is present

- Many options

If natural regeneration is NOT present

- Shelterwood
- Mechanical / Herbicide control
 - Interfering plants
 - Invasives
- Artificial Planting
- Fencing



Forest Management Strategies for EAB

Summary

- *Assess your EAB risk (low or high)*
- *Identify which of the six scenarios best fits your forest stand situation.*
 - *Based on inventory*
- *Select your management strategy*
 - *Based on your objectives*
 - *Remember you **can always do nothing** but this may have potentially negative consequences if **EAB infests** your forest stands.*
- *Implement your selected strategy with the assistance of a professional forester.*
- *Monitor your forest stand periodically for problems.*

Forest Management Strategies for EAB

Summary

- *Be proactive rather than reactive*
- *Become knowledgeable and stay current on EAB*
- *Know the ownership/management objectives and evaluate potential EAB impacts*
- *Know your forests (recon/inventory) and evaluate potential EAB impacts*
- *Evaluate, select and implement appropriate management strategies*
- *Work with a professional forester*

SLowing A.sh M.ortality = SLAM

Objectives

- Reduce EAB numbers and growth of EAB Population
- Slow local invasion process
- Allow land managers time to be proactive

Strategies

- Destroy EAB stages before adults disperse and reproduce
- Concentrate and eliminate adult beetles and progeny
- Reduce the amount of food (Ash phloem) available
- Survey (trap trees, purple traps, etc.) to assess spread



More Information

http://www.dcnr.state.pa.us/forestry/fpm_invasives_eab.aspx

<http://www.emeraldashborer.info>

<http://ento.psu.edu/extension/trees-shrubs/emerald-ash-borer>

- What is the Emerald Ash Borer?
- Emerald Ash Borer Identification and Damage
- Distinguishing Ash from other Common Trees
- Symptoms and Signs of the Emerald Ash Borer
- Native Borers and Emerald Ash Borer Look-alikes
- My Ash is Dead...Now What Do I Do?
- Emerald Ash Borer and Your Forest
- Homeowners Guide to Emerald Ash Borer Treatment

Badbug@state.pa.us

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PA Department of Agriculture

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