Emerald Ash Borer Update
MSAF 2008

Bob Heyd
Forest , Mineral & Fire Management

Biology

Max. length ~26-32 mm

Length ~ 7.5-13.5 mm

Emerald Ash Borer

Bark Crack

Beetle Gallery

D-Shaped Exit Hole

Photos by Andrew Storer, MTU

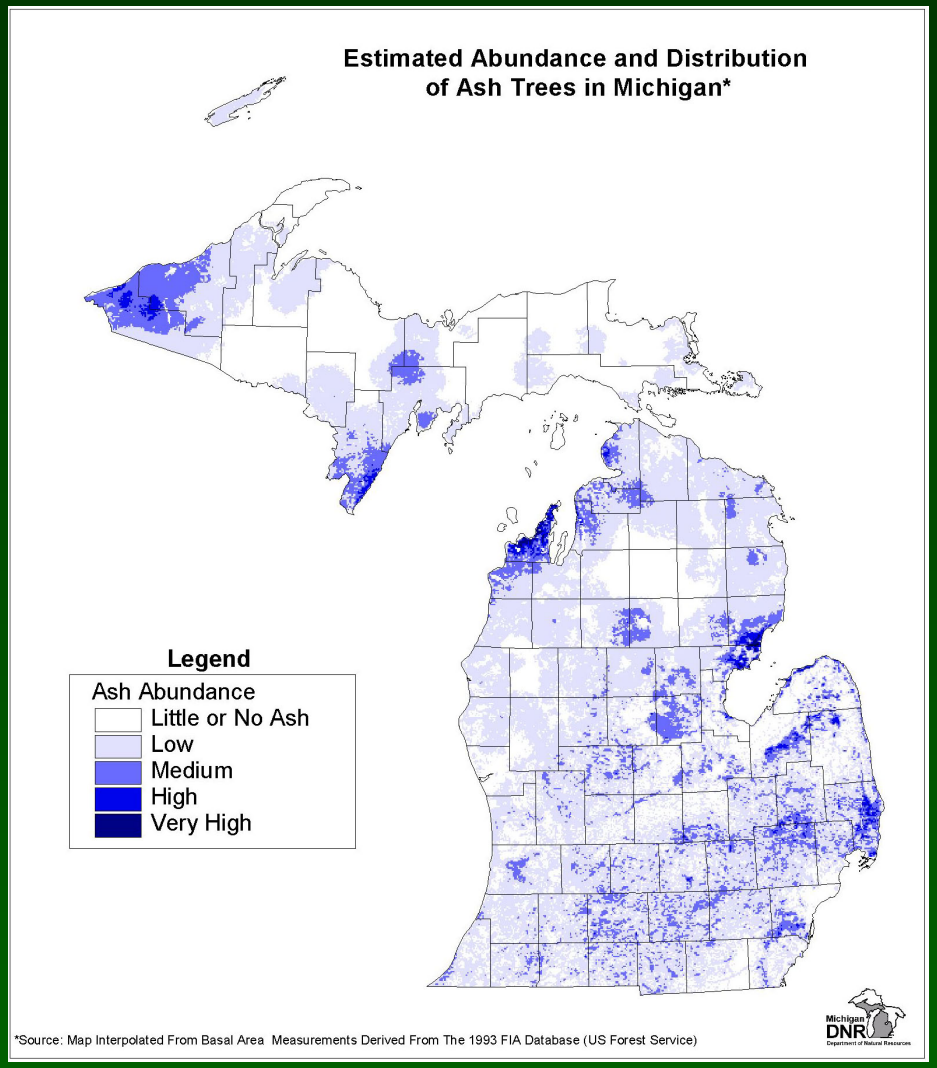
Downy Woodpecker

Red-bellied Woodpecker

Michigan's Ash Resource

- 917 million ash > 1"dbh
- 171 million ash > 5" dbh
- 51 million ash > 9" dbh

- White & green ash -2.6 billion board feet
- Black ash - .42 billion board feet
- 6% of hardwood volume
- 3.7% all species volume



How will EAB & management responses affect our future forests?

- **American Beech**
  - 3% of the hardwood volume
  - 1.8% of all species volume.
- **Beech + Ash**
  - 9% of the hardwood volume
  - 5.5% of all species volume

Impact of EAB

- McKnight & Hermes – Impacts on black, white and green ash.
  - Black and green ash more vulnerable
  - White ash eventually succumbs
  - No native ash species are surviving
- Stress => two-year to one-year life cycle

EAB Research

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Deb McCullough
Nate Siegert
Dave Cappaert

Therese Poland
Bob Haack
Leah Bauer
Toby Petrice

Ivich Fraser
Julie Gould

MichiganTech

Andrew Storer
Mike Hyslop

John Witter

Rural Ash Monitoring plot system

- to detect EAB
- to monitor the health of the ash resource
- to identify areas at high risk
- to develop a risk model by examining differences in sites, stands, plots& trees

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Assessment of Decline and Contributing Diseases in White Ash

Gerard C. Adams & Mursel Catal
Plant Pathology, MSU

- Distribution & severity of ash yellows, root and butt rots in urban, rural and forest ash trees across Michigan.
- Frequency of these diseases in forest stands with ash decline.
- Identify risk factors associated with these diseases in forested stands, including stand dynamics, climatic, physiographic and edaphic site factors and stand management history.
- Evaluate impact of these diseases on radial growth of ash.

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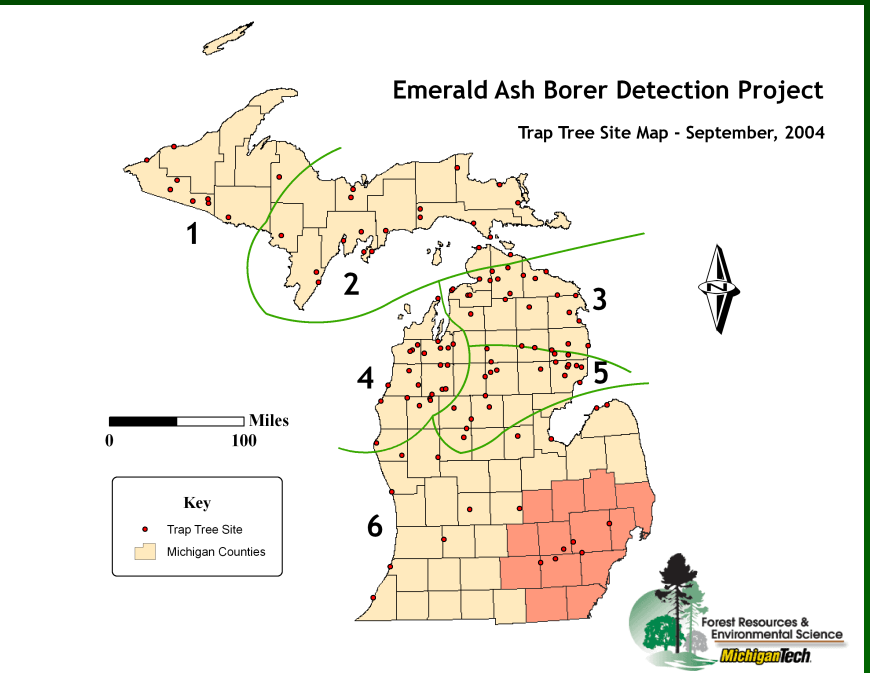
Assessment of Decline and Contributing Diseases in White Ash

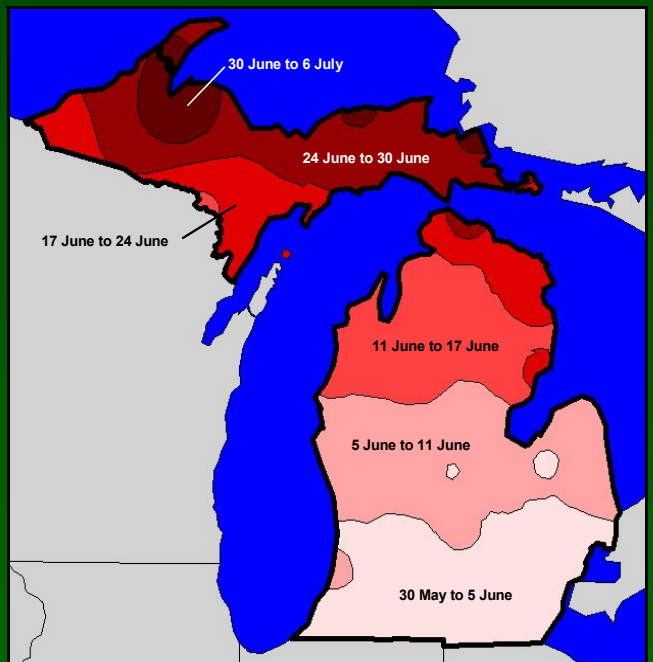
Gerard C. Adams & Mursel Catal
Plant Pathology, MSU

- Tested sprouts of 150 girdled EAB detection trees
- Ash Yellows is distributed throughout the LP and UP
  - Causes slow growth and decline of ash
  - MLO - mycoplasmalike organisms
- Declining crowns => roots infected by *Armillaria gallica*
  - ✓ A new disease report.
- Low areas
  - ✓ Windthrow due to root rot by *Scytinostroma galactinum*
  - ✓ Windthrow by snapping near the base associated with a cubical brown decay
- Black Ash Decline

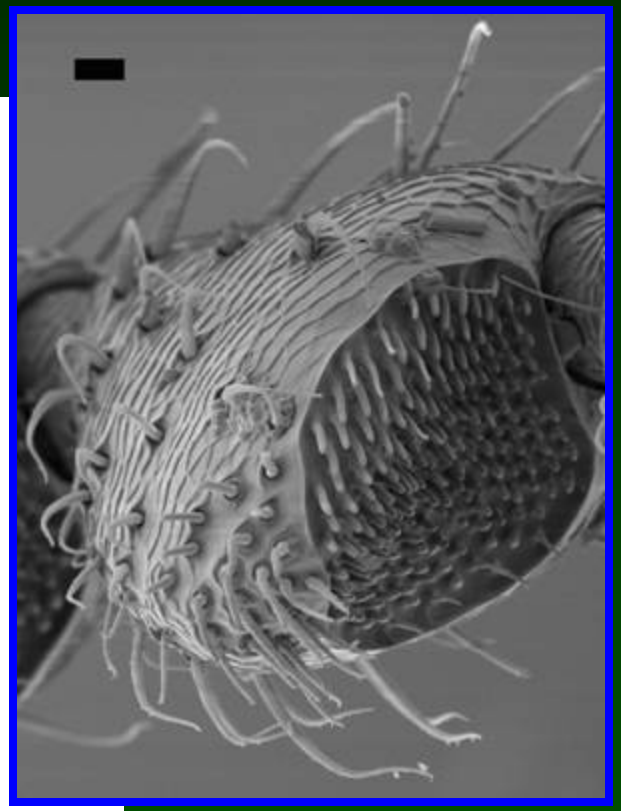
MTU / DNR / USFS Trap Tree Survey

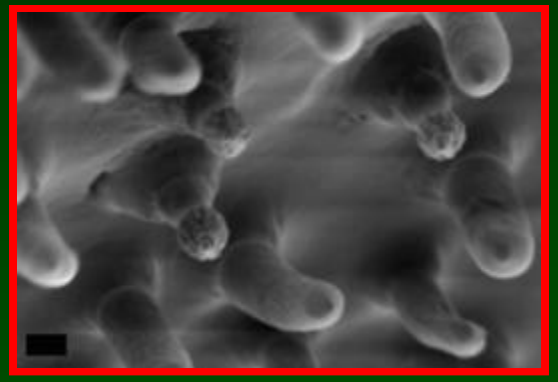
- SFC / SP Firewood inspections
- Questionnaires
- EAB
- Declining trees

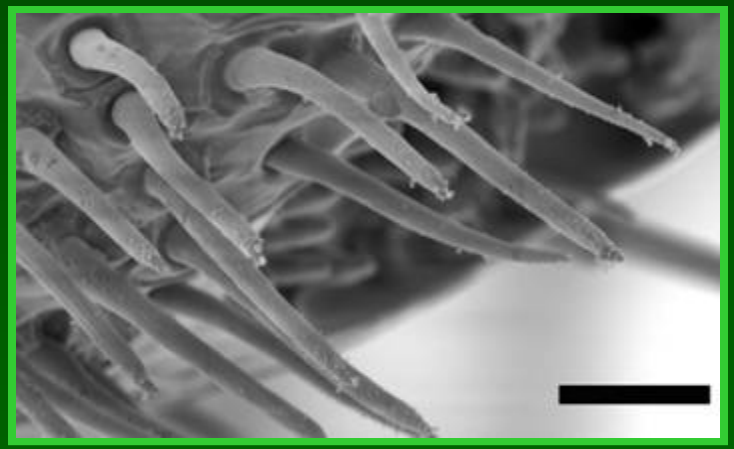




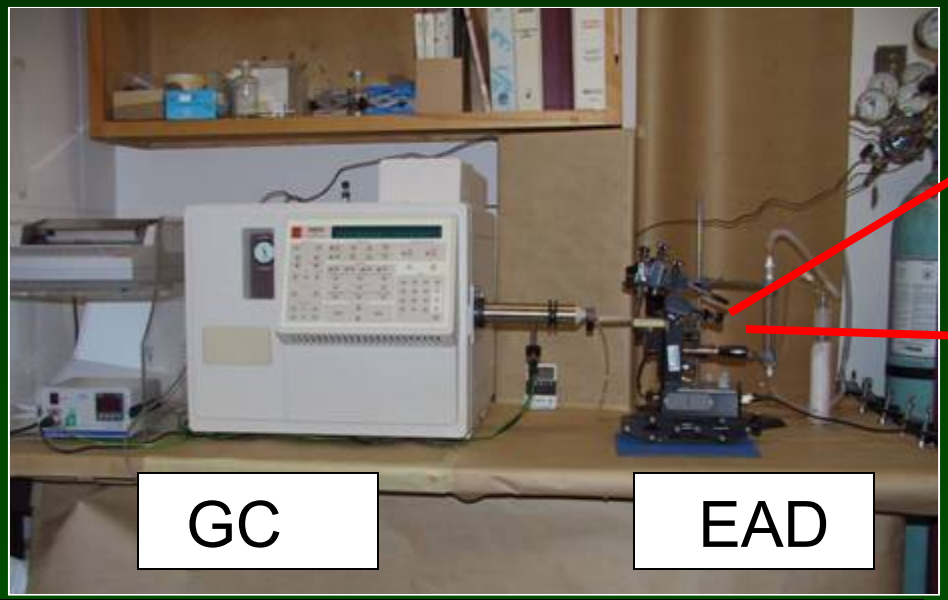
Analysis of Ash Volatiles to Identify Attractants for EAB

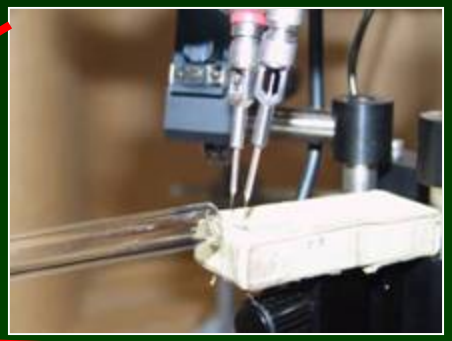


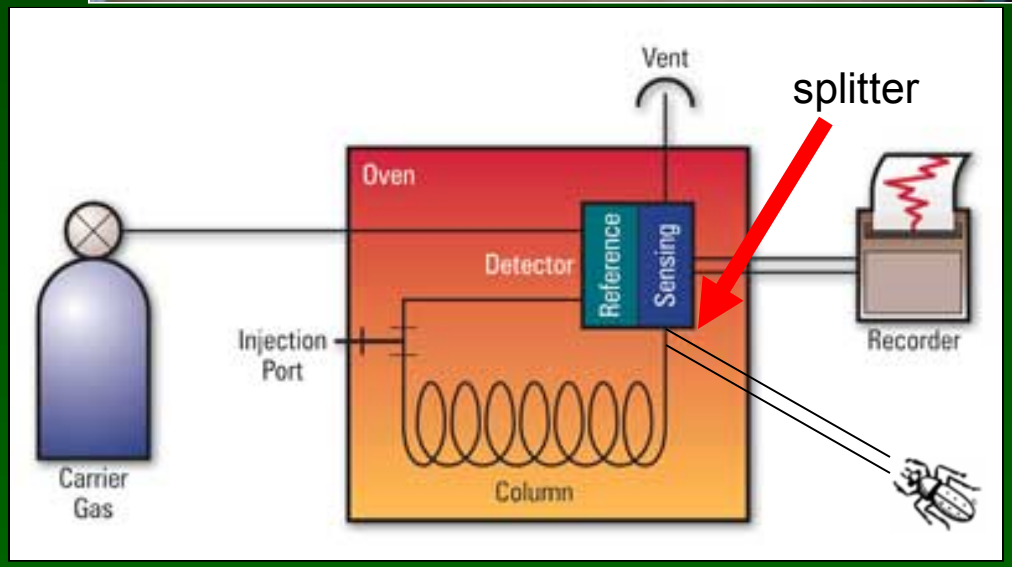


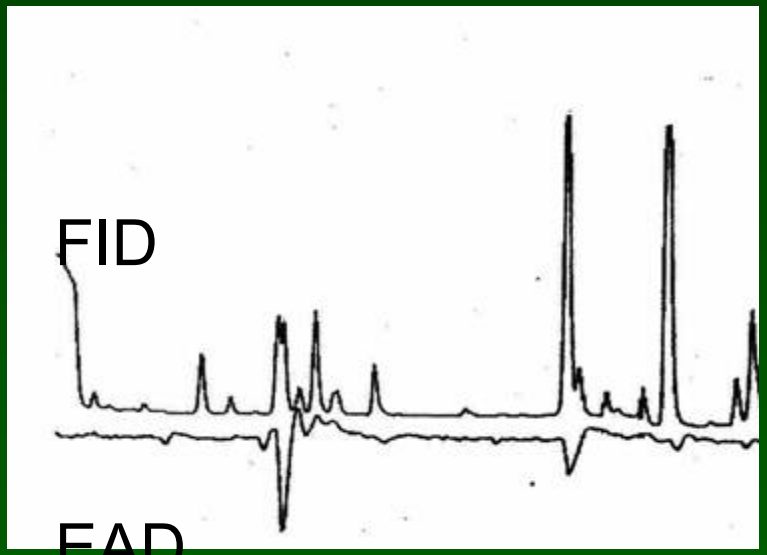


Identify Antennally-Active Volatiles

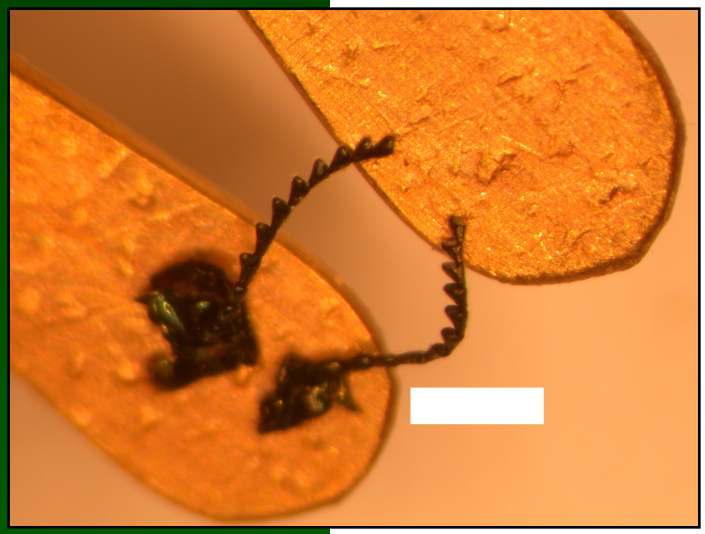


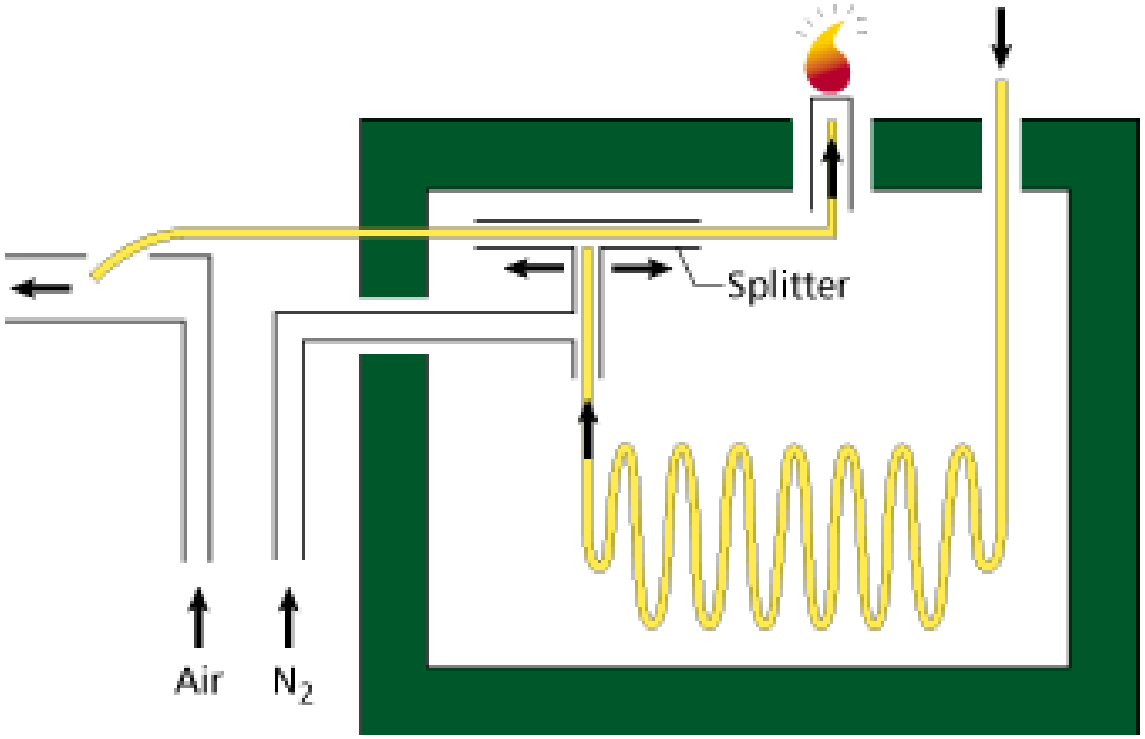






GC-EAD Analysis of Volatiles

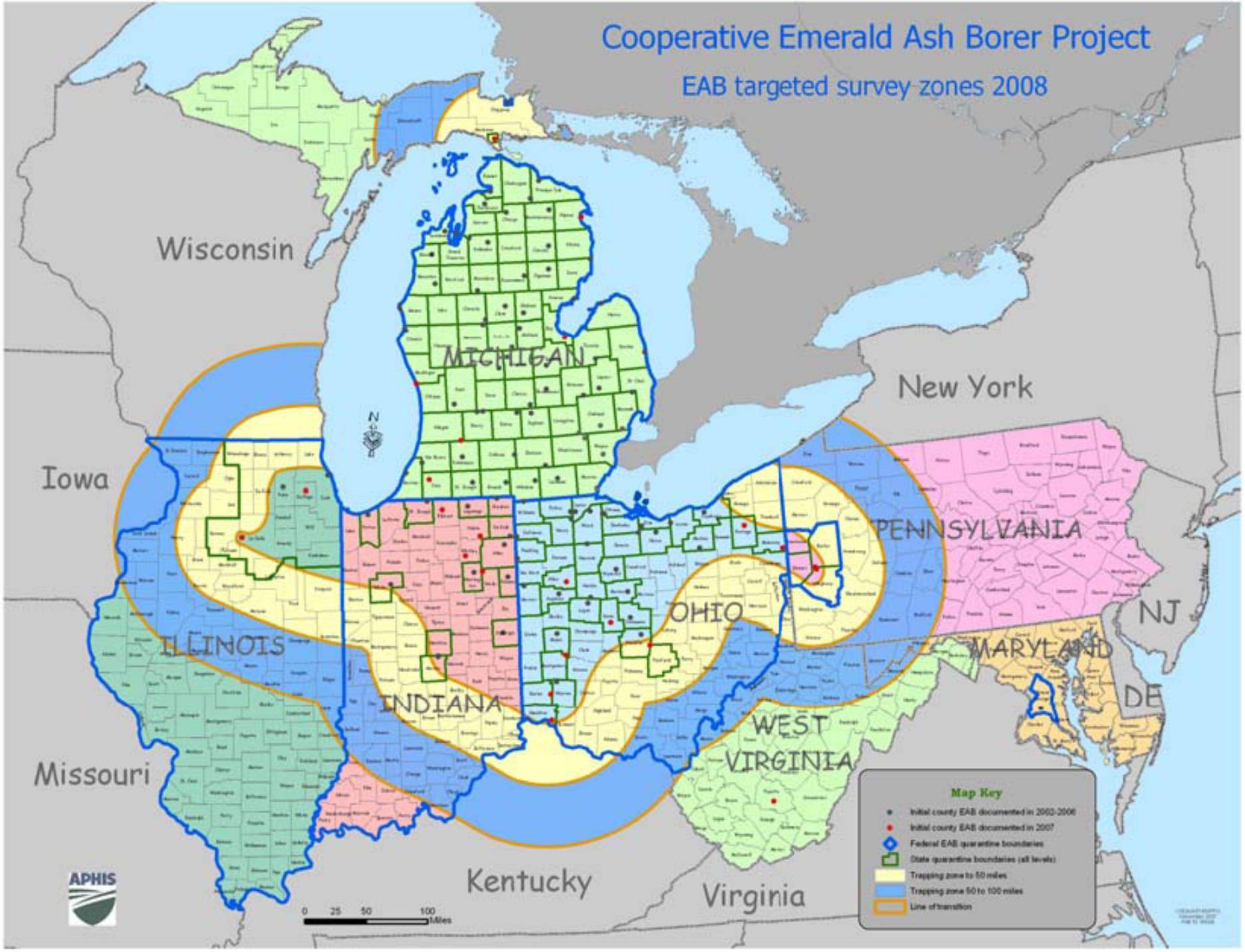




Detecting EAB populations in 2008

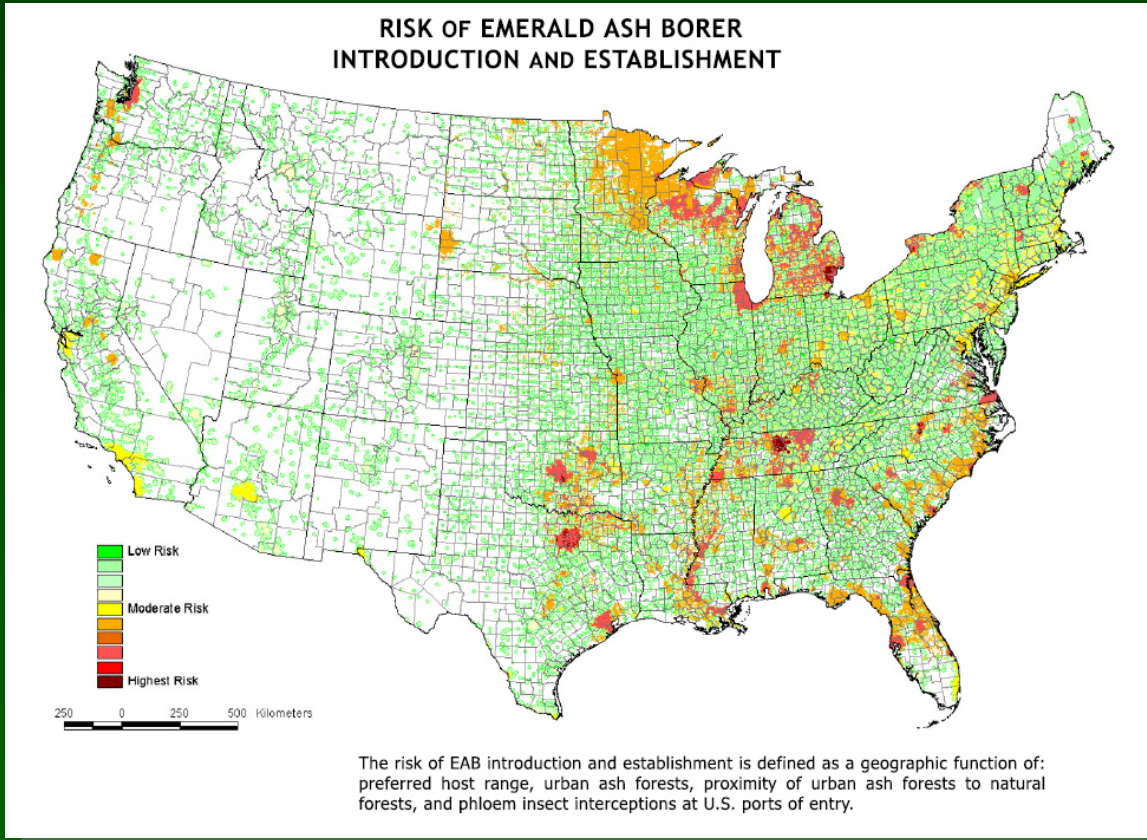
- Resource Professionals / Survey
  - Detections only of EAB impacted stands, not low level EAB populations
- Detection Surveys
  - NLP
  - UP

1 trap/mi2
up to 4 traps/site


Cooperative Emerald Ash Borer Project
EAB targeted survey zones 2008
Wisconsin
MICHIGAN
New York
Iowa
PENNSYLVANIA
OHIO
NJ
ILLINOIS
MARYLAND
INDIANA
DE
WEST VIRGINIA
Missouri
Kentucky
Virginia
APHIS
0 25 50 100 Miles
Map Key
Initial county EAB documented in 2002-2006
Initial county EAB documented in 2007
Federal EAB quarantine boundaries
State quarantine boundaries (all levels)
Trapping zone to 50 miles
Trapping zone 50 to 100 miles
Line of transition

National Risk Mapping Project

- A species-level assessment of mortality risk
- Multi-criteria framework



Grinding, Chipping and Debarking Studies

- Chipper produces smaller chips than grinder
- No EAB found in chips from chipper
- Chips > 1 inch are regulated
- Debarking sawlog grade logs removed 100% of bark and EAB larvae/pupae

FOREST SERVICE
US
DEPARTMENT OF AGRICULTURE

Do EAB Survive in Firewood?

Robert A. Haack and Toby R. Petrice
USDA Forest Service

- **2002-2003 Study Treatments**
  - **Month of felling**
  - **Sun vs Shade**

- **2003-2004 Study Treatments**
  - **Month of felling**
  - **Sun vs Shade**
  - **Split vs Whole bolts**
  - **Tarped vs Not tarped**

Survival of Emerald Ash Borer in Firewood

Toby R. Petrice and Robert A. Haack

- EAB successfully emerged from firewood for all cutting dates and all storage treatments.
- EAB emergence and survival was significantly reduced for firewood cut in July and August.
- EAB emergence and survival was lower in split logs compared to whole logs
- EAB emergence and survival did not vary significantly among treatments for whole firewood.

In summary

- Earlier felling dates lower EAB survival.
- Direct sunlight lowers EAB survival.
- The effect of tarping was not clearcut.
- **No combination of treatments resulted in complete mortality.**
- Hold firewood for at least two winters to be sure it is EAB free.

Evaluation of Firewood Bagging for Regulatory Control of EAB

Objectives

Treatment guidelines for storage and handling of confiscated firewood are needed

- Evaluate the use of bags to contain logs and prevent escape of EAB
- Determine if EAB mortality is increased in bagged logs

Director's Land Use Order
Firewood

State-owned lands, prohibited conduct

- Possess ash wood (Fraxinus spp.) upon any State lands, unless that ash wood is without bark attached.
- Actions: Fall "*firewood sweep*"

WisconsinNatural Resources
Firewood Ban

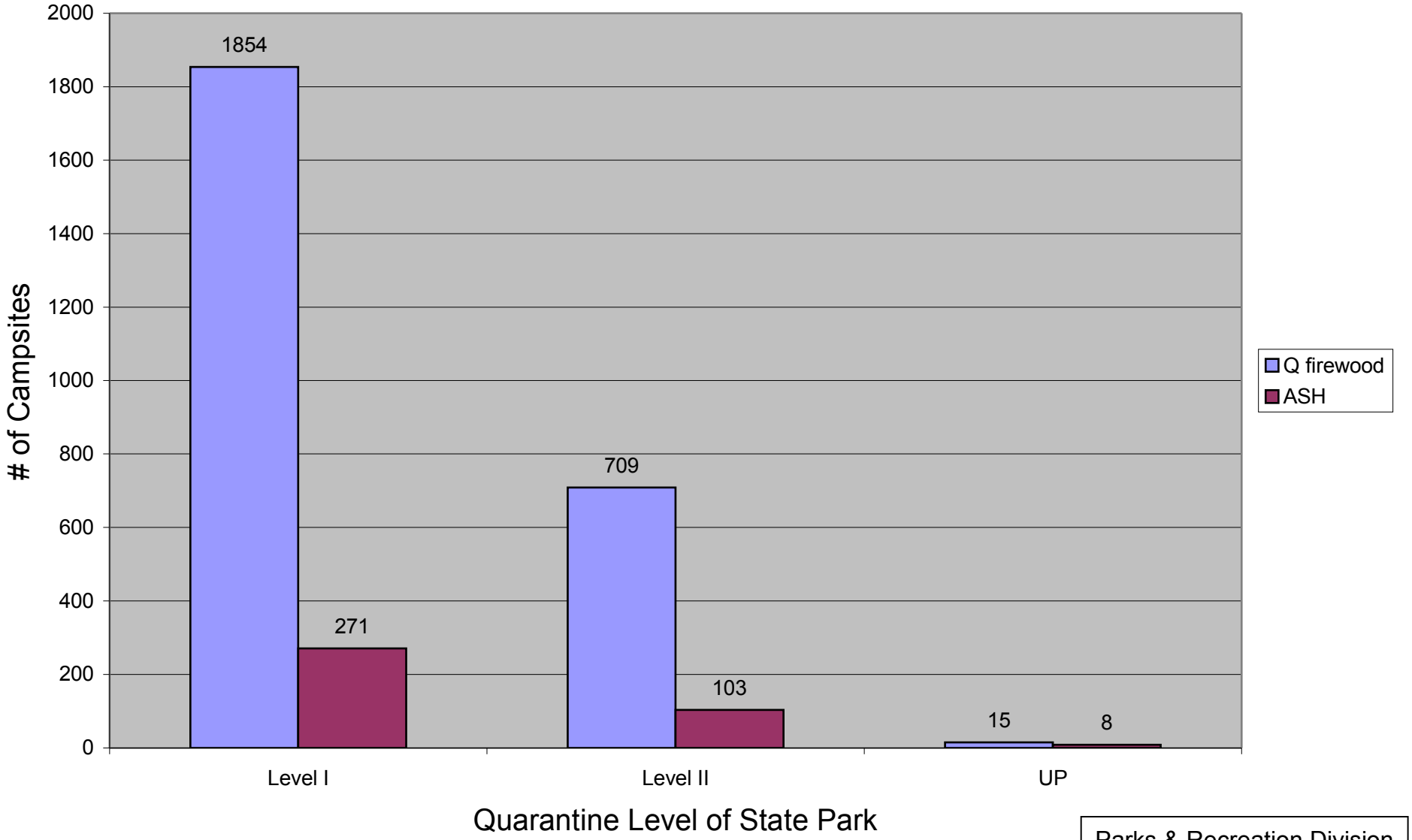
State Approved Emergency Rule

- Prohibits people visiting Wisconsin state parks, forests, and other DNR-managed properties where campfires are permitted from bringing out-of-state firewood onto those properties.

State Parks
Firewood Movement Data

Lisa Gamero
Parks & Recreation Division

2006 Campsites with Firewood from a Quarantined Area and with Ash Firewood



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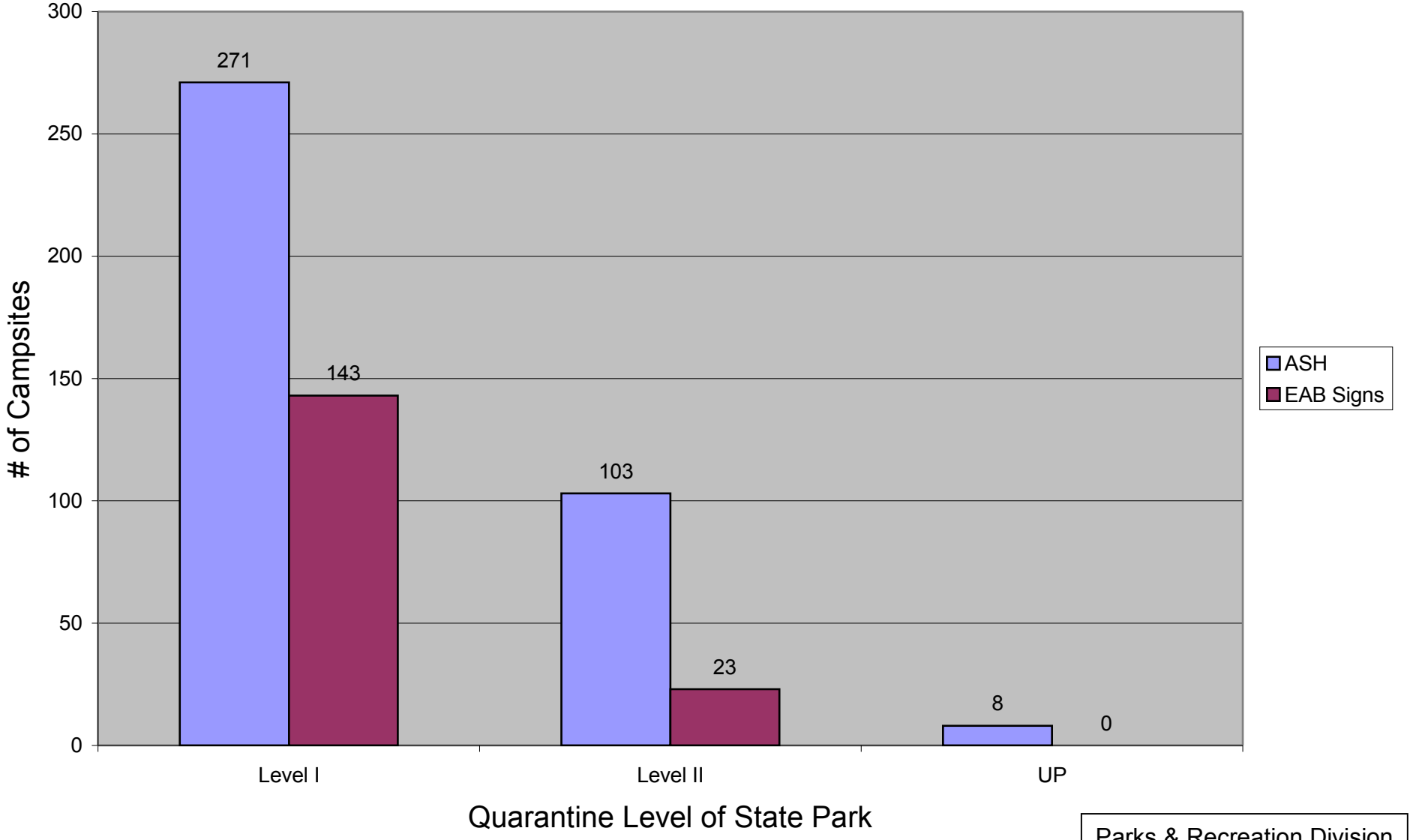
Lisa Gamero

2006 Campsites with ash firewood and ash with signs of EAB



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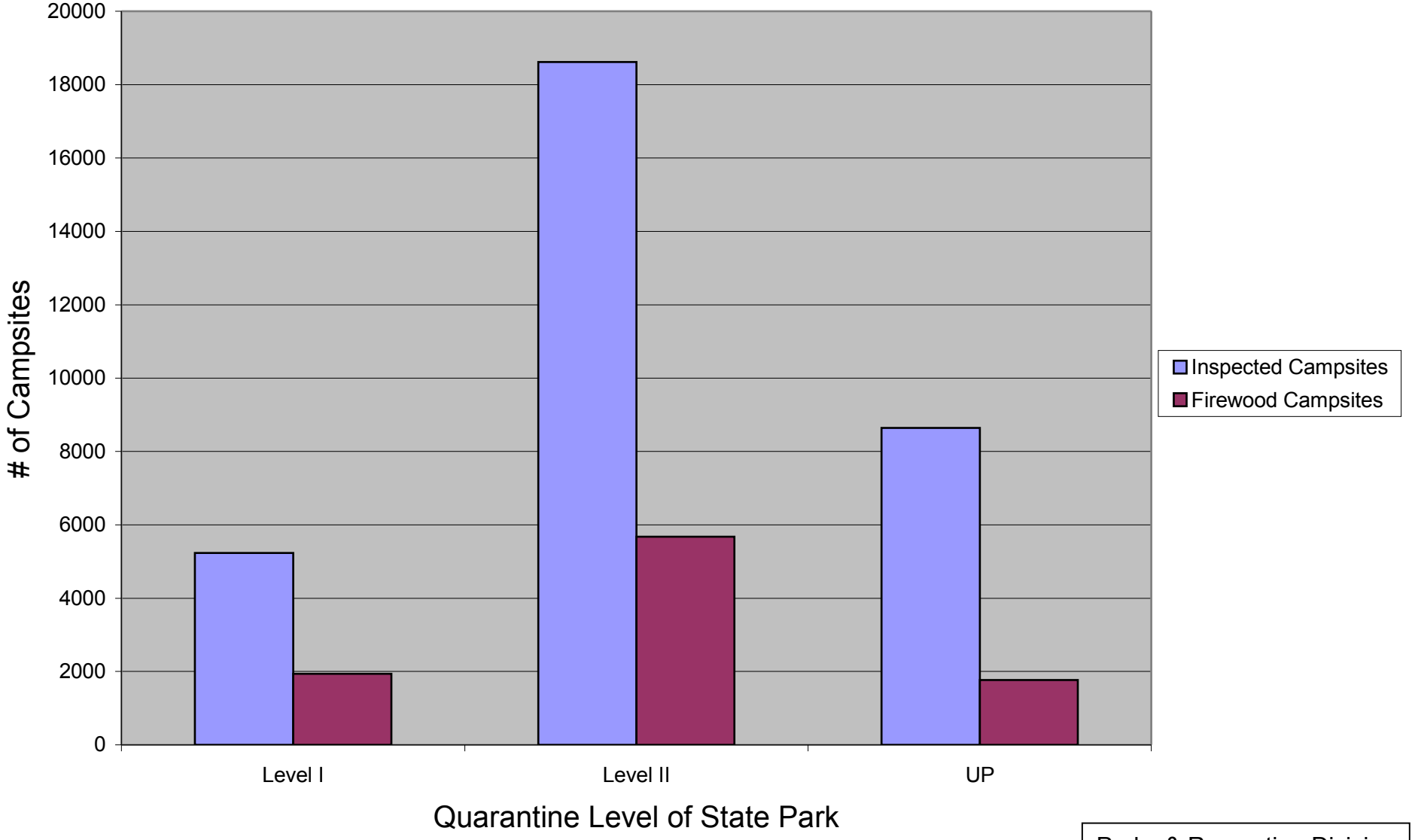
2007 Inspected Campsites and Campsites with Firewood



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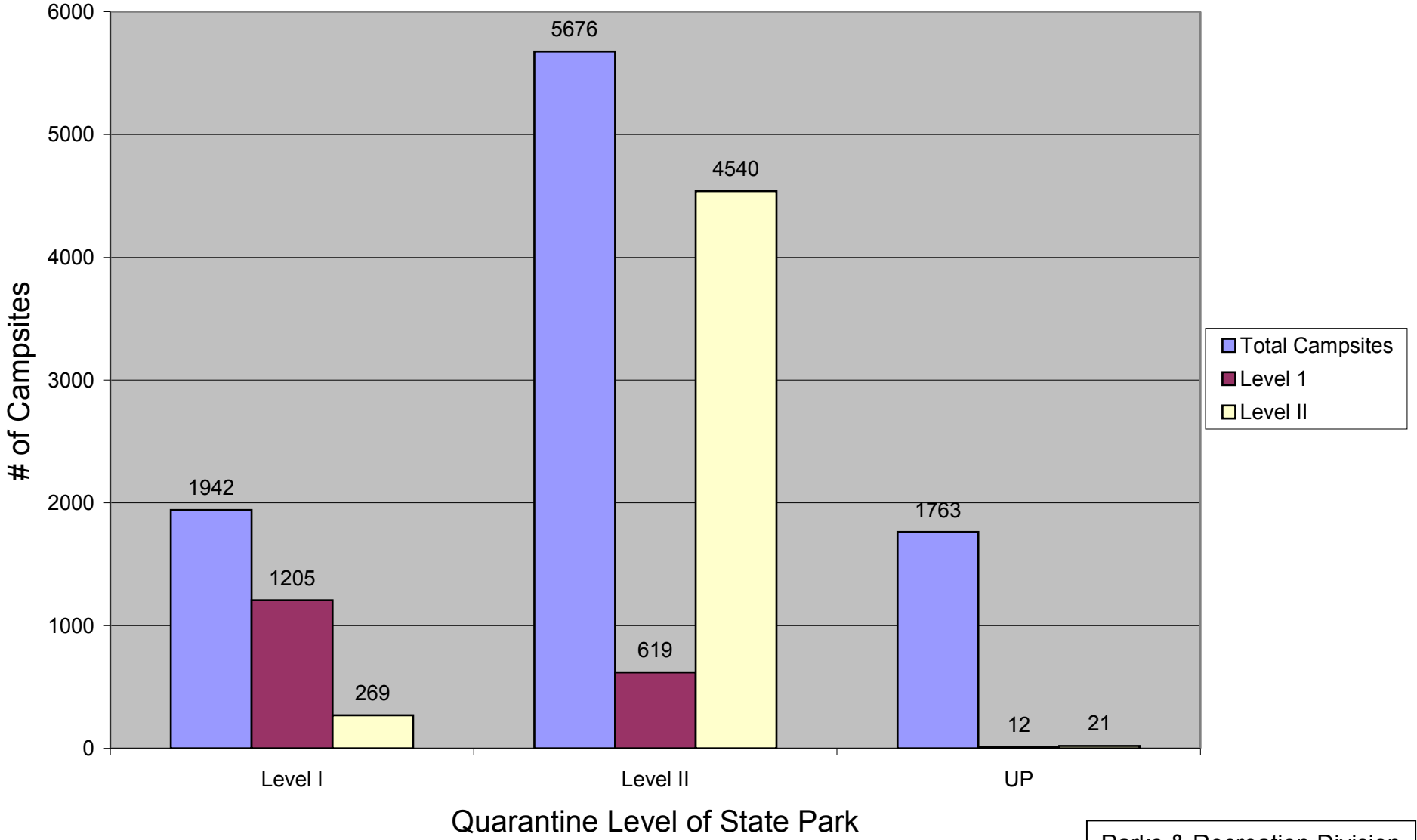
2007 Campsites with Firewood Showing Quarantine Level Origin



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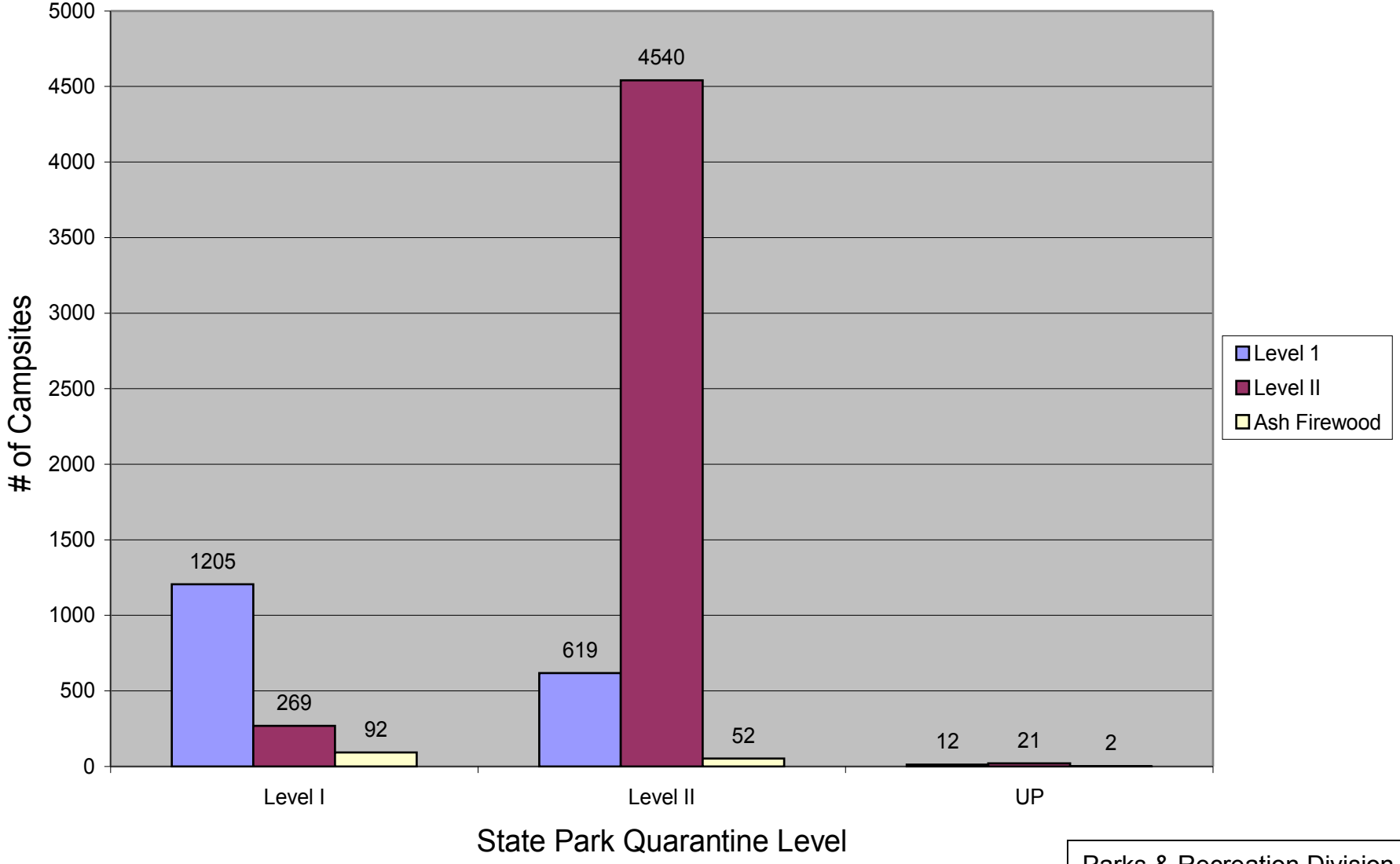
2007 Campsites with Quarantine Origin Firewood and Ash Firewood



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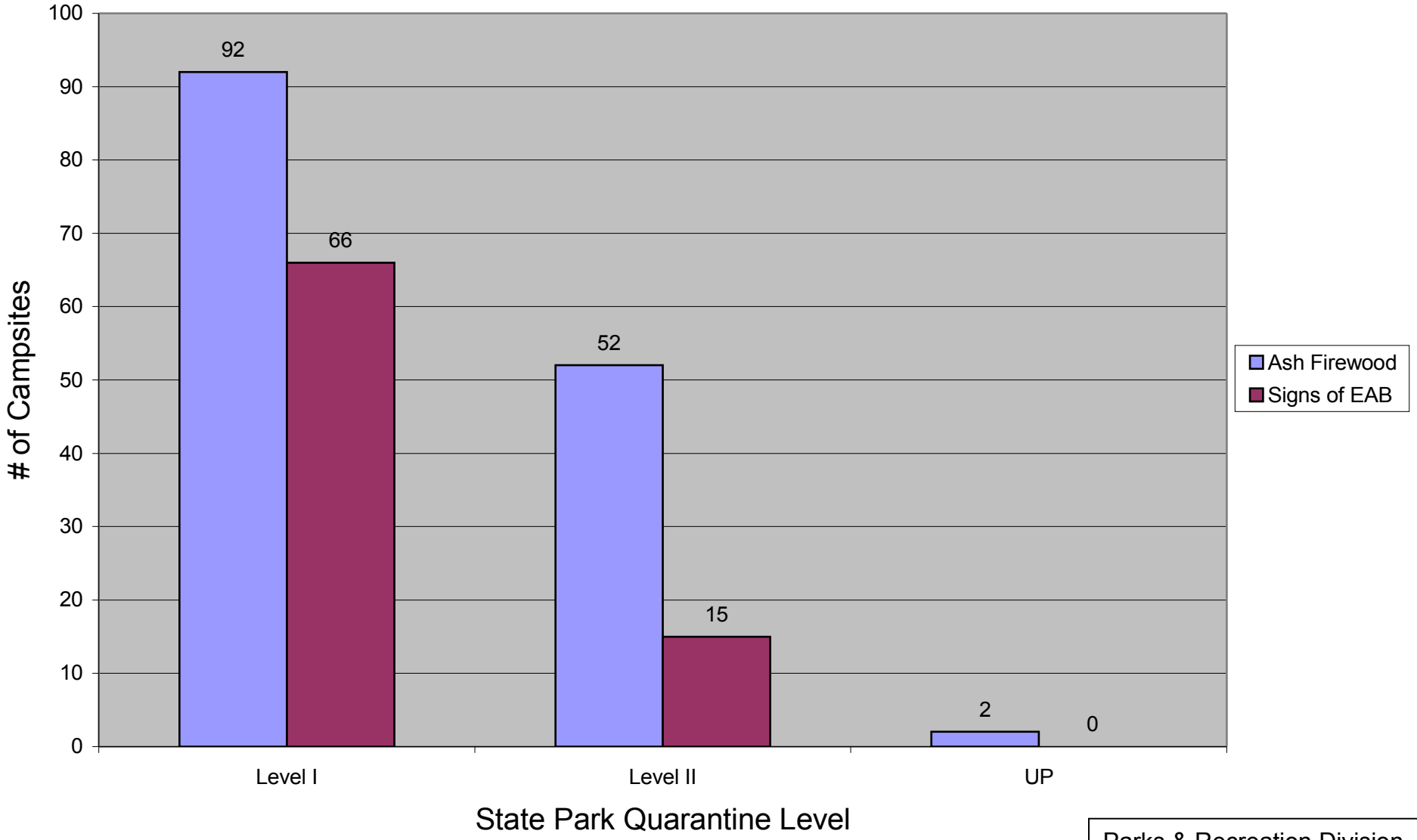
2007 Campsites with Ash and with Signs of EAB



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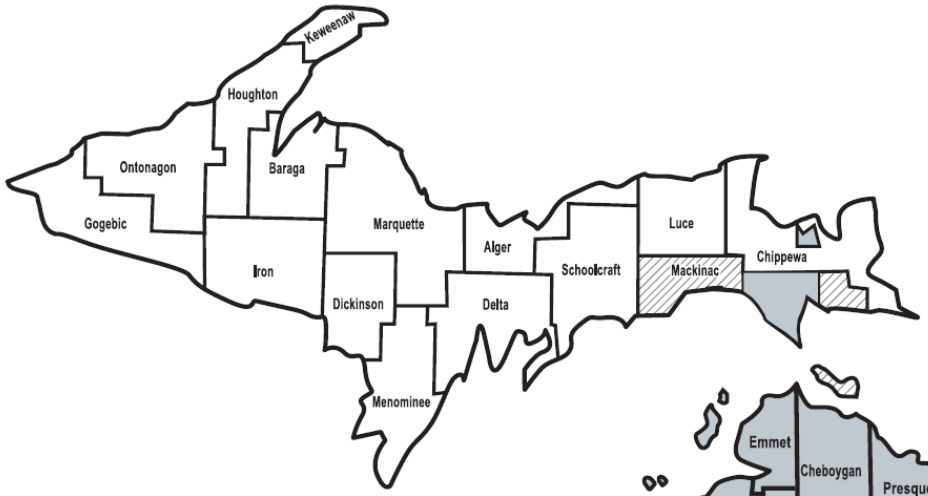
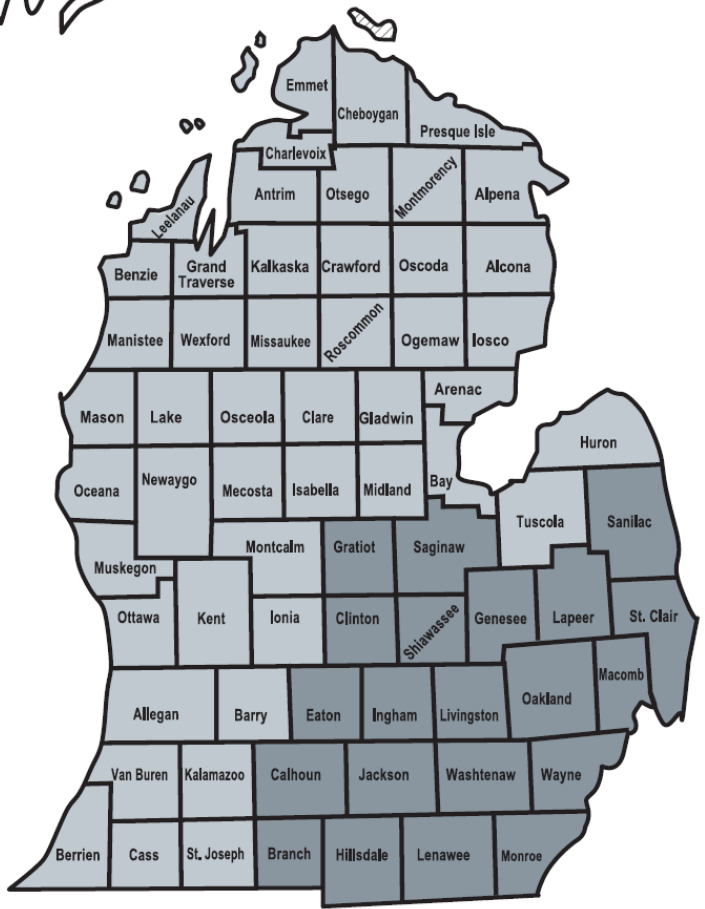
Emerald Ash Borer Quarantine

Michigan Department of AGRICULTURE





Level I
Level II
Level III

Firewood

- Problems Moved via Firewood
  - Emerald Ash Borer
  - Oak Wilt
  - Asian Longhorned Beetle & other Wood infesting insects
  - Beech Bark Disease
  - Sudden Oak Death
  - Bark Beetles
- Dead & dying trees most commonly used

Stump Treatments: Subsequent Stump Sprouting and EAB Infestation

Robert A. Haack and Toby R. Petrice
USDA Forest Service
East Lansing, MI

Stump Height/Cutting Season

- In 2004, we cut green ash trees apparently uninfested or lightly infested with EAB at three locations with moderate to high EAB populations
- Stumps were cut at 8-10”, 4-6”, or 0-2” above the ground.
- Stumps were cut in spring (late April-early May), summer (June), or fall (September).
  - Most stumps sprouted regardless of height or cutting season.
  - **No EAB were found in 0-2” stumps <u>nor</u> in stumps cut in the spring for all heights tested.**
  - Stumps cut 8-10” high in the summer had the highest colonization by EAB.

Ash Reduction Model Tutorial
Version 2.0

Tara L. Eberhart, Andrew J. Storer, Linda M. Nagel

Reduce the amount of ash resource; thus reducing EAB potential population density

- Trees / Acre INPUT => diameter limit harvest options related to phloem reduction
- The model can retain small trees & large diameter ash depending on management objectives.

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Ash Reduction Model
http://www.ashmodel.org

- INPUT
  - ✓ Ash only TPA from stock and stand tables
  - ✓ Diameter class => 2”, 1”, or 2cm, 1cm classes.
- OUTPUT
  - ✓ % of the total surface area represented by a particular diameter size class.

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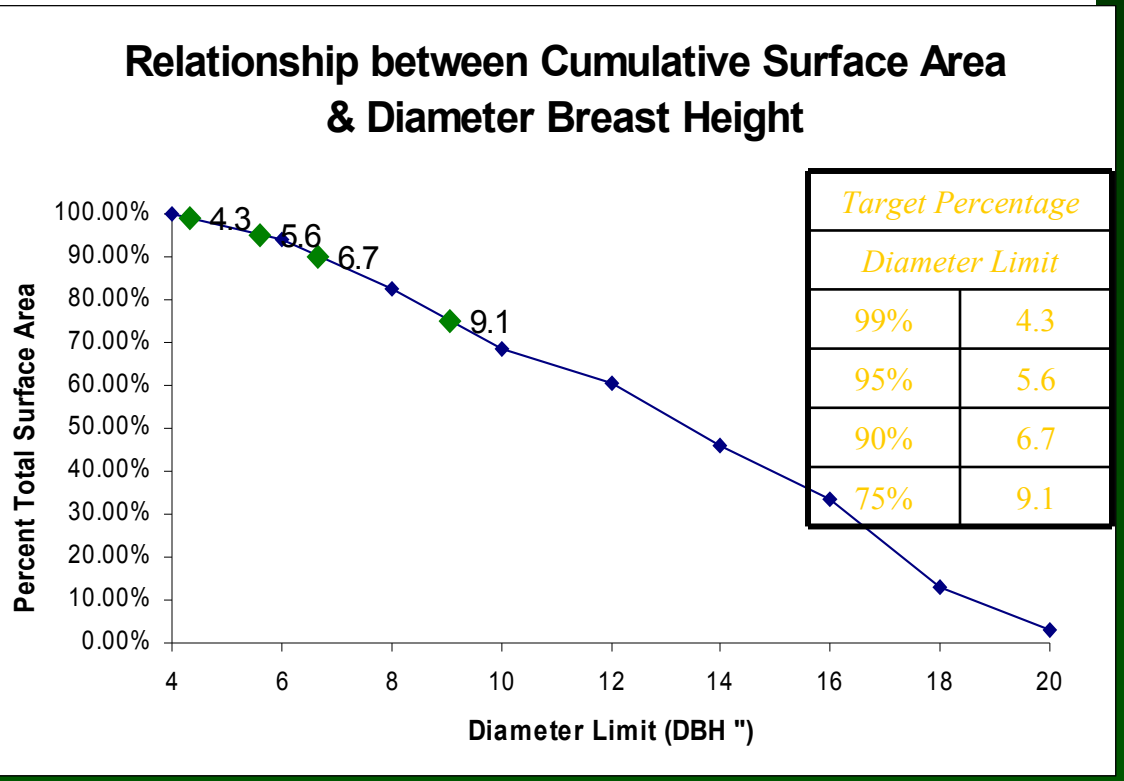
Using Data from a Real Stand to Retain Small Trees

2" Size Class Increments

Diameter Class"	No. Trees/Acre	% Surface Area
4	10	6.21%
6	12.7	11.40%
8	10.7	13.75%
10	4.6	8.24%
12	6.0	14.47%
14	4.0	12.59%
16	5.1	20.40%
18	2	9.93%

Note: These data are only *Fraxinus spp.*



Therefore in this stand, to retain small trees and remove 90% of the phloem the diameter limit would be 6.7". Remove all ash trees above 6.7 inches to take out 90% of the ash surface area.

Using Data from a Real Stand to Retain Large Trees

2" Size Class Increments		
Diameter Class"	No. Trees/Acre	% Surface Area
4	10	6.21%
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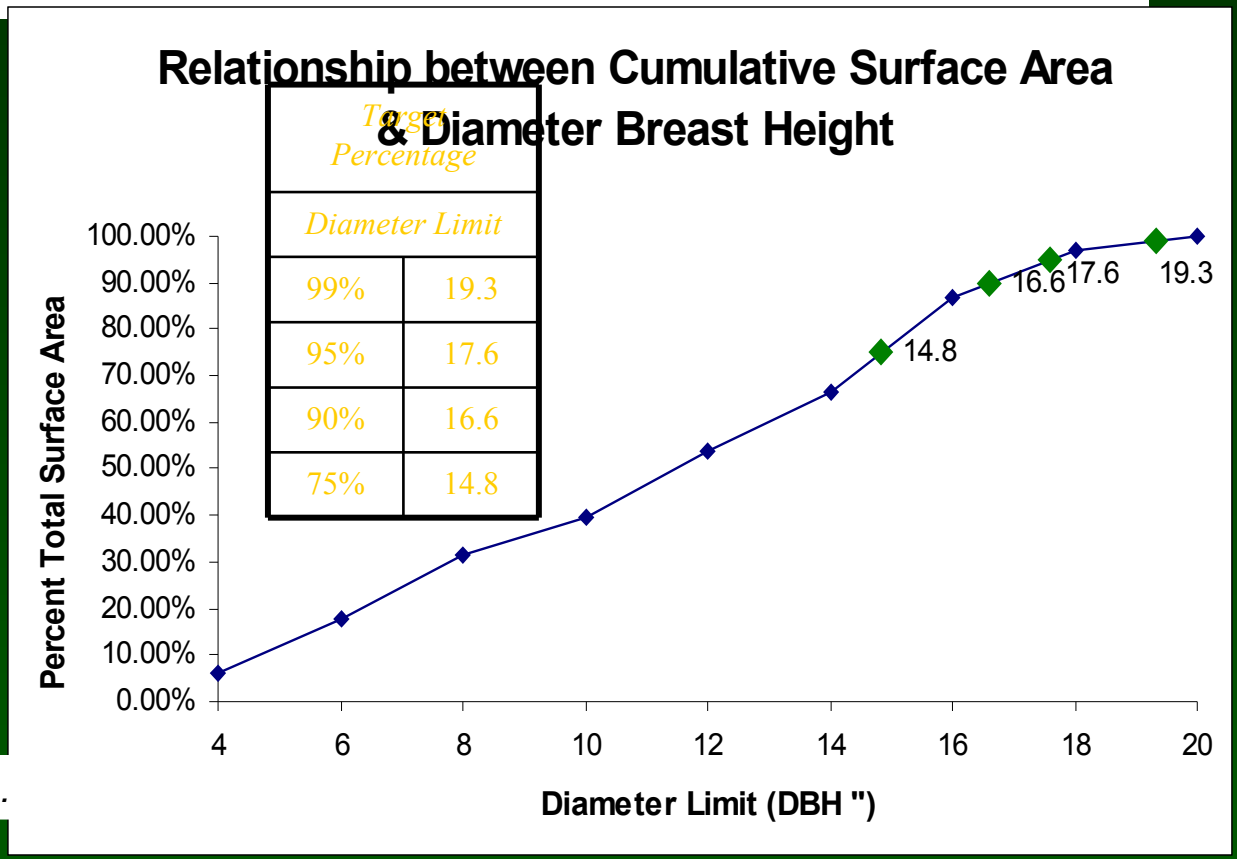

In this stand, to retain large trees and seedlings and still remove 95% of the phloem the diameter limit would be 17.6". Remove all ash trees below 17.6 inches to take out 95% of the ash surface area and keep large trees for wildlife, aesthetics, or a seed source.

EAB Parasitoids Released in 2007

Oobius agrili
Egg parasite

Spathius agrili
Larval parasite

Tetrastichus planipennisi
Larval parasite

Emamectin benzoate Tree-age ™

- Protect valuable landscape ash trees
- A special 24(c) registration
- Available by mid-May
- Purchased and applied only by trained, certified arborists and landscapers.
- Trunk injection at tree base.
- Systemic insecticide, more effective in healthy trees
- Pricing is not yet available.

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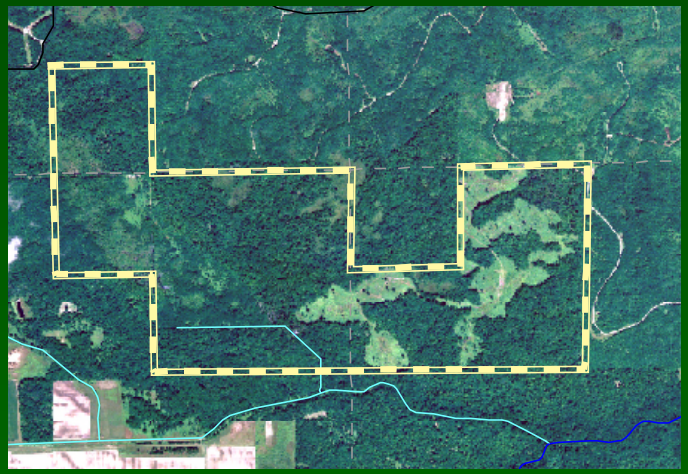
Outline of Presentation

- Reconstruction of historical EAB establishment
- Dispersal and spread of isolated populations
- Phloem reduction and population suppression
- Basic EAB spread and dispersal model
- Large-scale field projects in progress

Large-Scale Field Evaluations

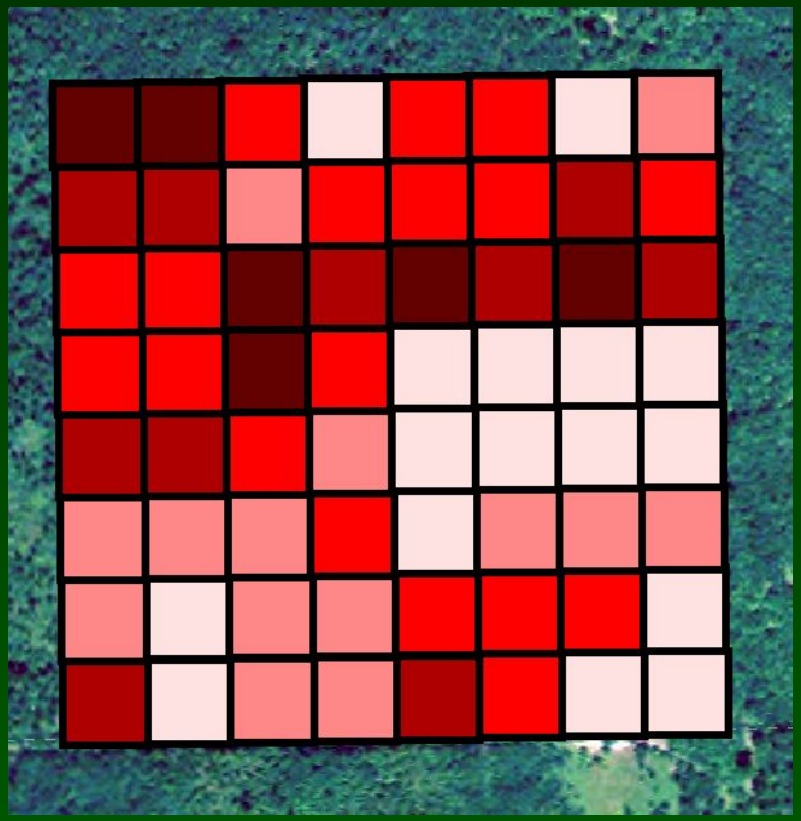
Efficacy of sinks in operational EAB programs



- Replicated study began in 2007 in northern MI outlier sites near Midland & Ocqueoc Lake.
- Integrated management of EAB outliers in forested sites.
- Sites encompass 180 ac

(Siegert, McCullough, Poland & Heyd)

Field Methods



- Each site divided into 50 × 50 m grid cells.
- Conducted pre-treatment EAB surveys.
- Inventoried all ash (≥1” diam.) by size class.

Goal: track EAB density, distribution & spread over time relative to the existing ash component; compare sites with & without clusters of sink trees.

Treatments at Field Sites

- Slow the spread of EAB?
- Effects of clusters on spread?
- Attraction radius of clusters?
- Study expanded to 500 ac in 2008.
- Other treatments in 2008 may include traps, insecticides and biological control

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Evaluation of Alternative Techniques to Treat EAB Outlier Sites in Forested Settings.

McCullough, Poland & Siegert

- Refine detection, survey and monitoring methods
- Understand EAB host selection behavior
- Develop alternative management strategies to reduce rate of spread
  - intensive surveys to quantify ash density and estimate EAB density and distribution
  - Strategically placed clusters of 6-10 trees will be girdled
  - treat half of the girdled clusters in May with imidacloprid

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Evaluation of Alternative Techniques to Treat EAB Outlier Sites in Forested Settings.

McCullough, Poland & Siegert

- Selected removal of marketable trees
- Cost-efficient treatment of small, unmarketable trees
- An improved understanding of EAB ecology and behavior at low-density and forested situations
- Effects of forest site and stand characteristics, host stress and host availability on EAB dynamics
- The effectiveness and efficiency of lethal trap trees in areas with limited host availability

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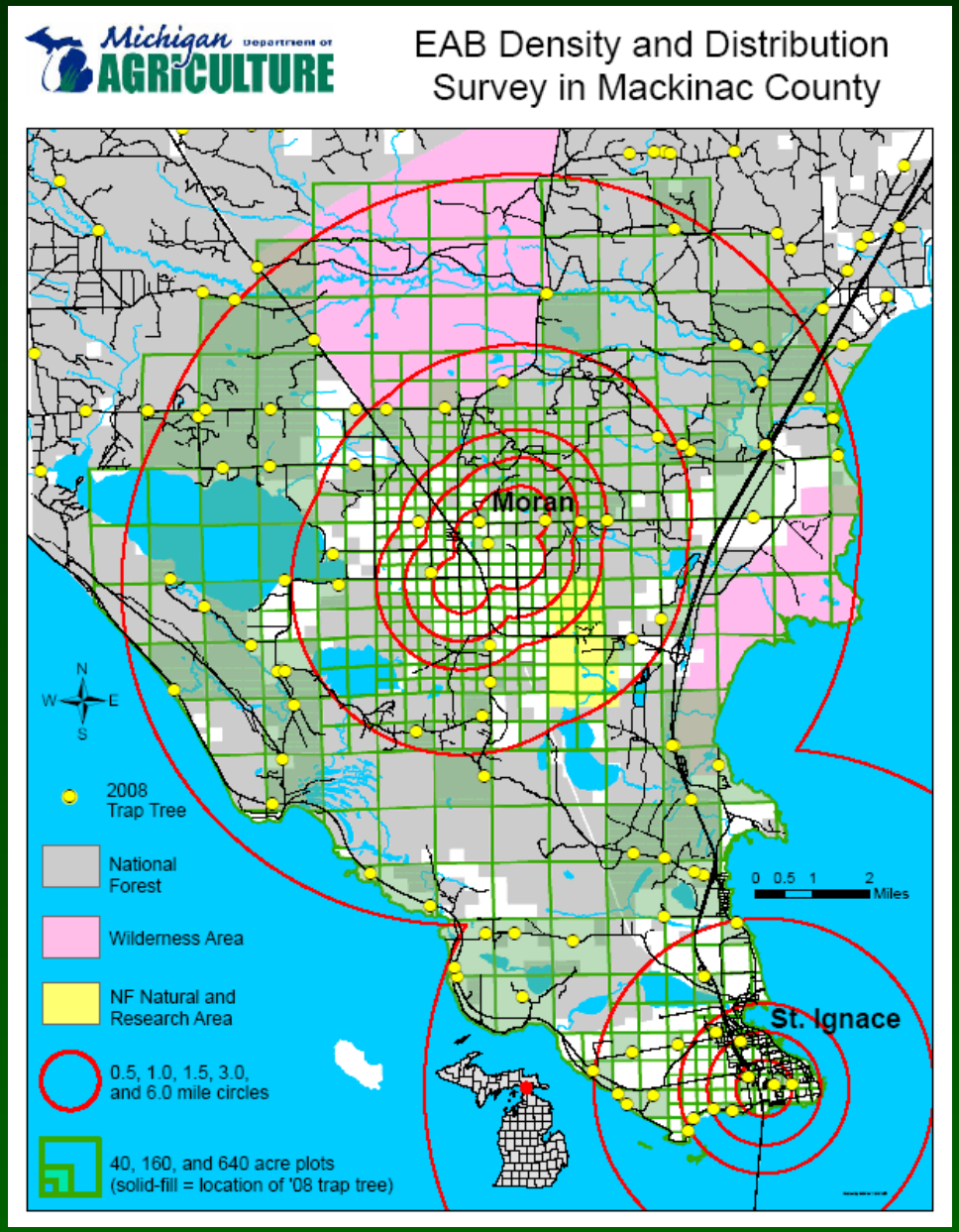
Moran / St. Ignace SLAM

- Trap Trees
- Sinks
- Phloem Reduction
- Education & Outreach
- Research
- Restoration



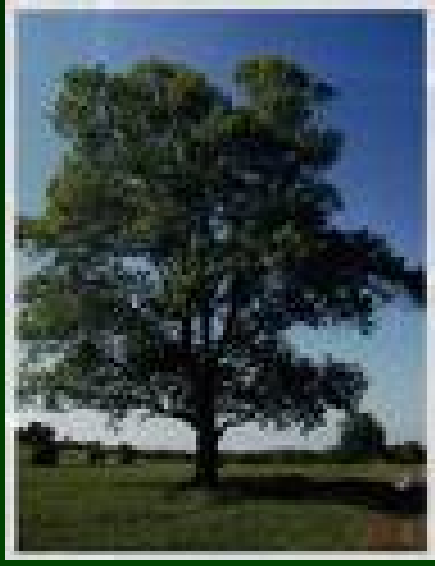
Forest Management

- Dealing with exotics after they become established is the real challenge for resource management.

White Ash: Mid-tolerant species (Dr. Mike Walters, MSU)

- Greater survival than intolerant species in moderate sized canopy openings
- Mid-tolerant regeneration has greater productivity than shade tolerant dominated regeneration in these openings.

An Ash



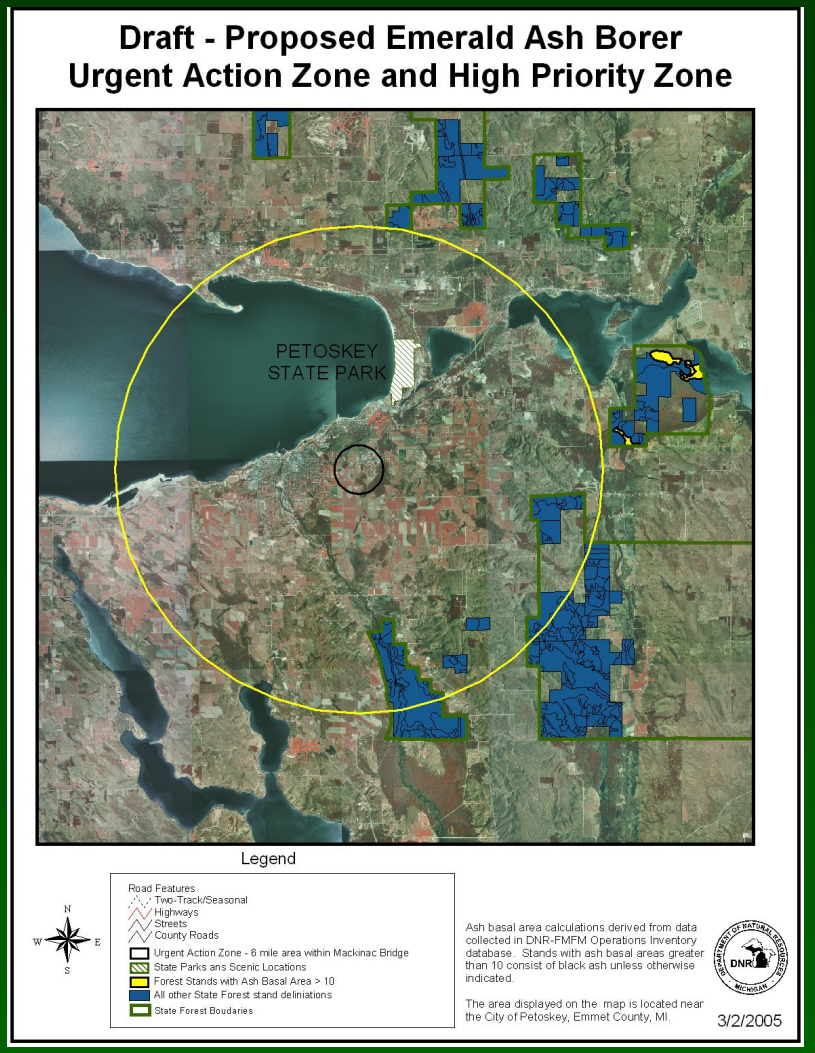
- Landscape
  - Personal
  - Property values
  - Aesthetics / Noise abatement
  - Wind break / Shade
  - Ownership .. Firewood
- Native American cultural values

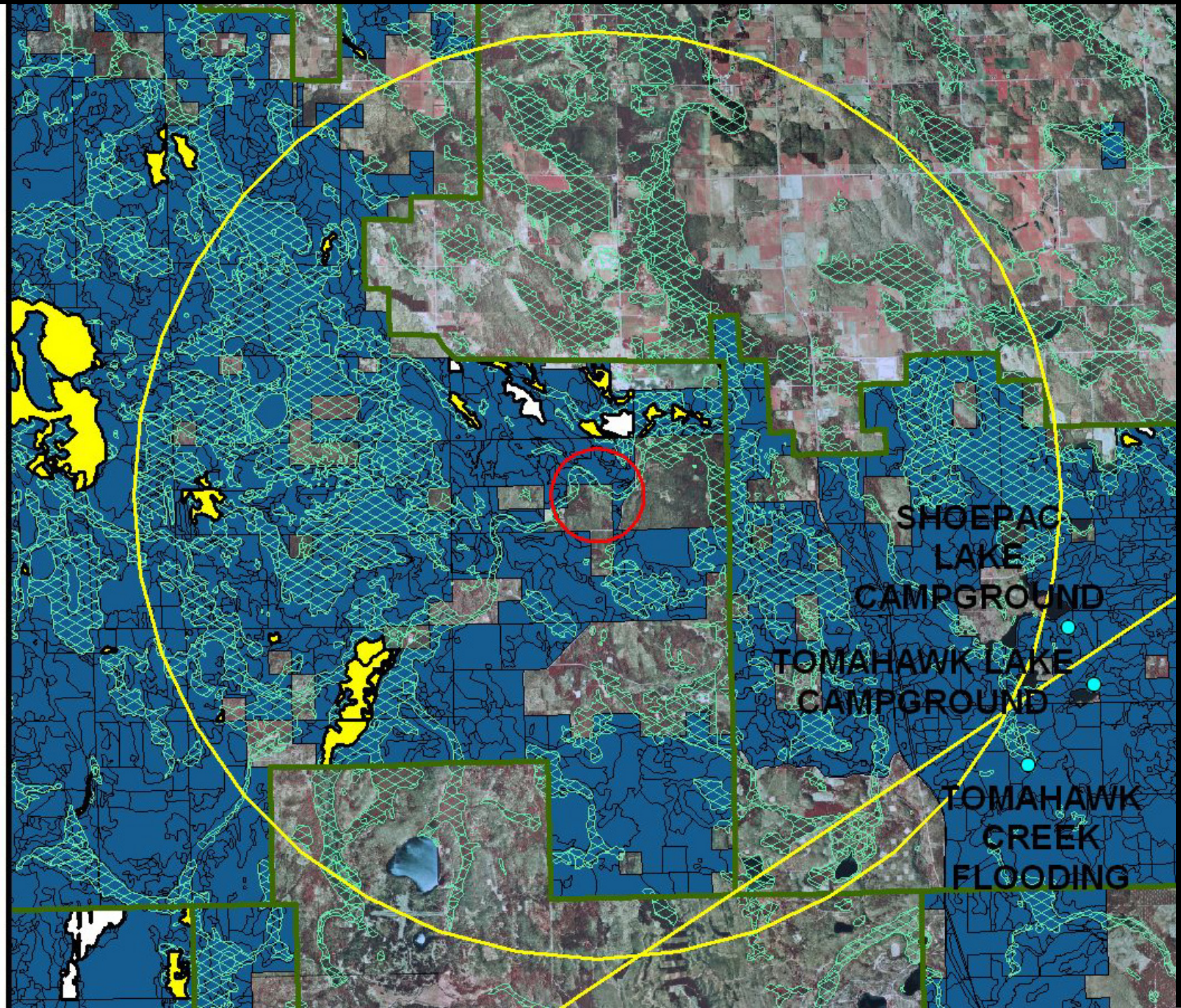
Ash Pre-salvage or Salvage

- EAB attack does little to degrade ash wood products
- Quickly detecting ash dieback related to EAB attack greatly improves the opportunities to minimize losses

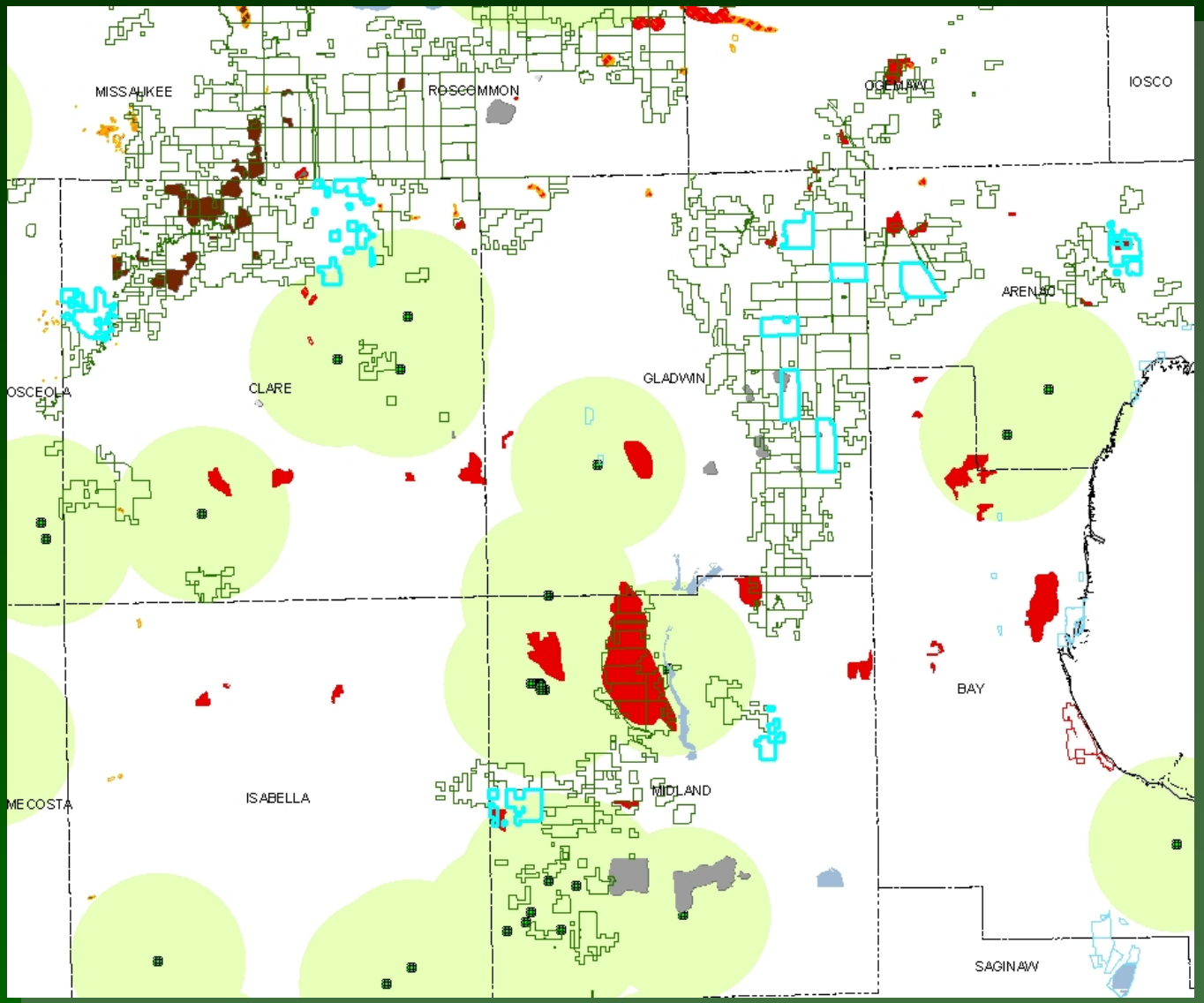
Forest Management

- Reduce stocking by first removing larger ash
- Prioritize removals by
  - Proximity to outliers / Populations
  - High ash volume / value
  - Ash vigor




SHOEPAC LAKE CAMPGROUND
TOMAHAWK LAKE CAMPGROUND
TOMAHAWK CREEK FLOODING

Using Forest Health Monitoring Information



Ash Silvicultural Guidelines

- Ash resources greater than 10 miles from EAB
  - Low risk of decline and mortality within 10 years
    - Decrease ash BA if greater than 10-20% of total BA
    - Increase species diversity

Ash Silvicultural Guidelines

- Ash resources within 5-10 miles of EAB
  - High risk of decline and mortality within 10 years
  - Reduce ash if greater than 10-20% of total stand BA
    - Upland ash
      - Keep BA 75 sq. ft. or above
      - Remove largest ash first (phloem model)
      - Limit canopy gaps to <60 ft. in diameter to discourage ash
    - Lowland or wetland ash
      - Salvage and pre-salvage often not practical
      - Allow EAB mortality to run its course
      - Convert stand to other species
      - Alter management to non-timber objectives

Reducing EAB Stand Vulnerability

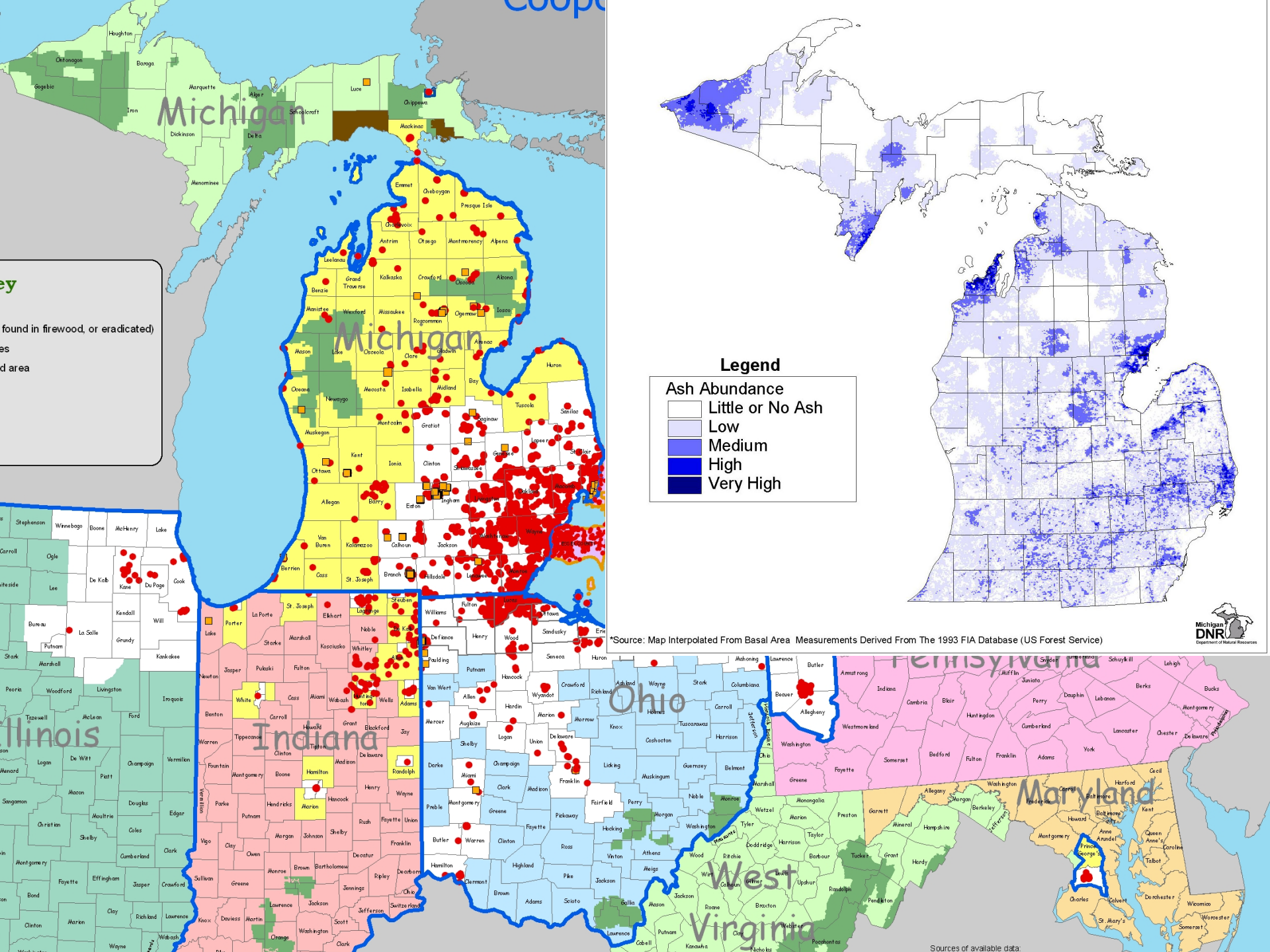
- The objective is to create a stand that will maintain a minimum basal area in the event that all ash is eventually lost to EAB.
- After pre-salvage and salvage harvests…
  - Restore productivity
  - Improve tree species diversity

Species Diversity & Regeneration

- EAB mortality and/or ash harvests may lead to:
  - under stocking
  - conversion to undesirable tree species
  - areas of non-forest cover.
- American beech & ash in same stand
- Treatment of ash regeneration via cutting and/or herbicide application
- Planting canopy openings to attain the desired mix of tree species…versus selection harvest

EAB:
Inherent Problems

- Difficult to detect
- Effective Vector
  ..Firewood
- Ash decline
  - Ash yellows
  - Drought
  - Over stocking


Michigan
Michigan
Indiana
Ohio
West Virginia
Maryland
Legend
Ash Abundance
Little or No Ash
Low
Medium
High
Very High
*Source: Map Interpolated From Basal Area Measurements Derived From The 1993 FIA Database (US Forest Service)
Michigan DNR
Department of Natural Resources
found in firewood, or eradicated)
Sources of available data:

Chestnut Blight

Dutch Elm Disease

Beech Bark Disease

Emerald Ash Borer

Thank you

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