How are we going to deal with The Emerald Ash Borer?

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DEPARTMENT OF ENVIRONMENTAL CONSERVATION · NEW YORK STATE ·

FOREST SERVICE US DEPARTMENT OF AGRICULTURE

APHIS

Female

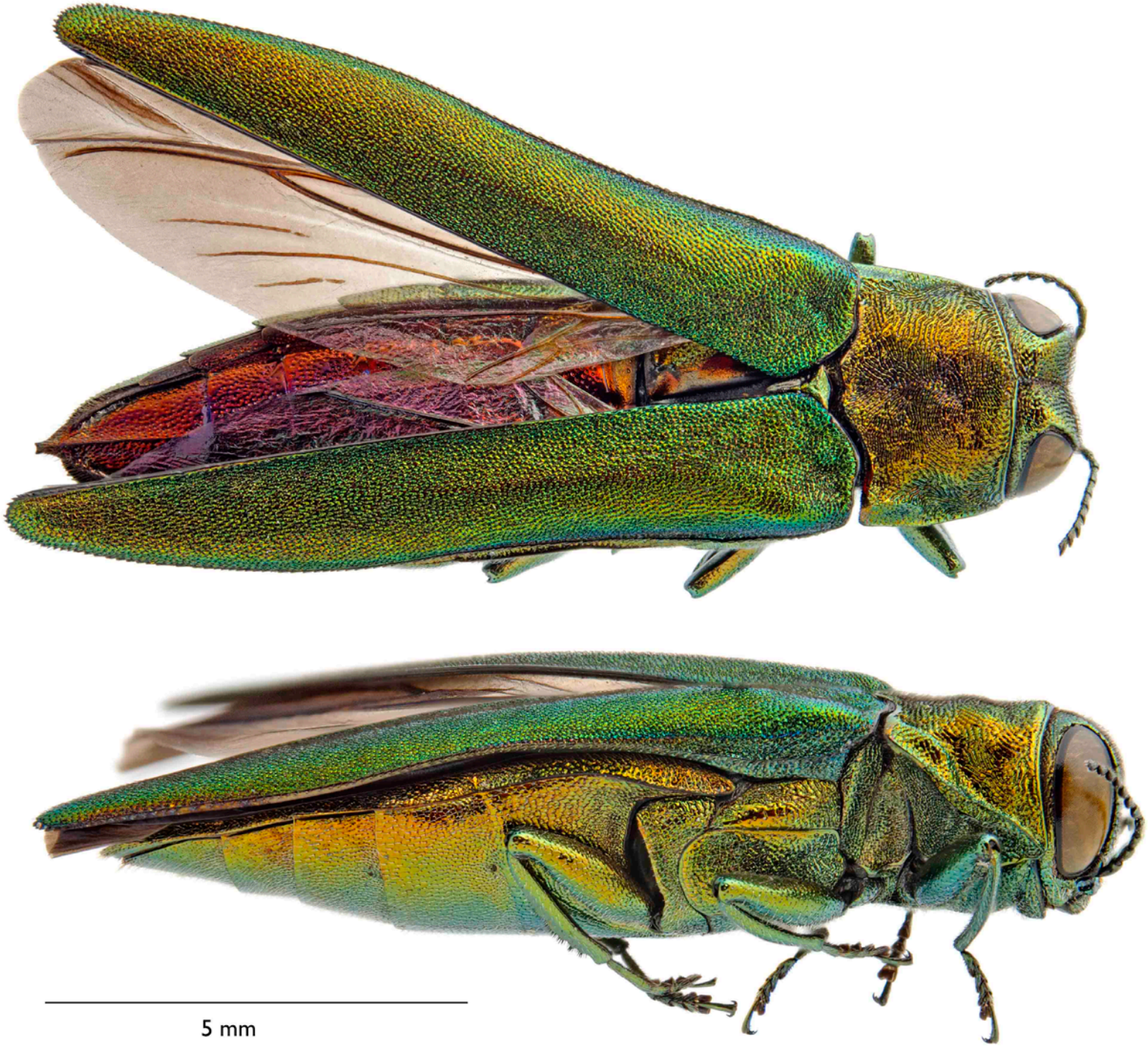


Photo by
Kent Loeffler,
Cornell University

1-Year Life Cycle

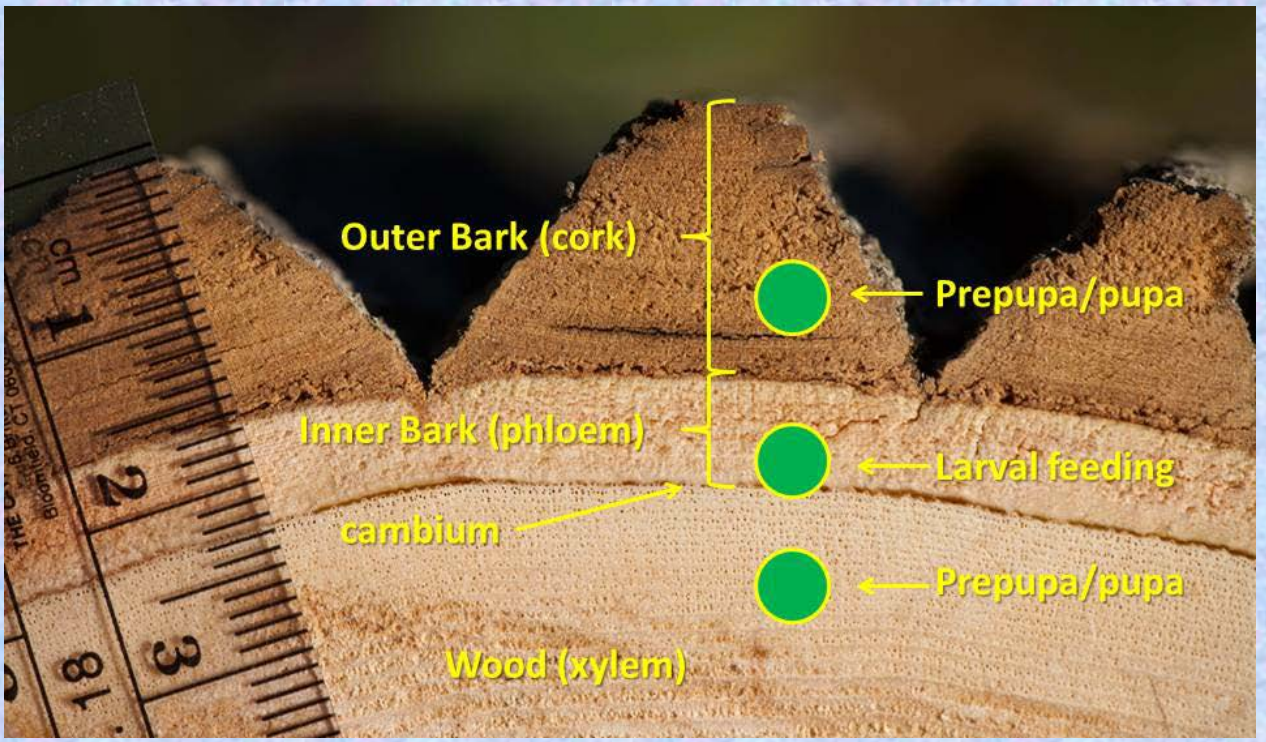
June/July
Oviposition

Summer/Fall
Larval growth

Winter
Pre-pupae

Early spring
Pupation

May/June
Adult Emergence
Ovary maturation



Red-headed Ash Borer
Neoclytus acuminatus

EAB larva:
Nested bells
Small head

EAB Detection

- **EAB will not attack just one tree**
  - Look at others in the vicinity
- **Use multiple symptoms in diagnosis**
- **The ash in our area look like heck, it must be EAB**
  - Ash decline is common in White ash growing on saturated soils – look for signs and symptoms.

Bugwood.org

EAB Population Behavior

- **Pest Pressure = The number of bugs in one place at one point in time.**
  - **How quickly a tree will be killed**
    - Lots of EAB or High Pest Pressure, death is 2 to 3 years
    - Few EAB or Low Pest Pressure, death can be 7 years or more
  - **Rate of spread in an infestation**
    - Lots of EAB or High Pest Pressure, faster spread
    - Few EAB or Low Pest Pressure, slower spread
- **Host tree density**
  - **Rate of population buildup**
  - **Rate of spread in an infestation**

Visual Signs & Symptoms

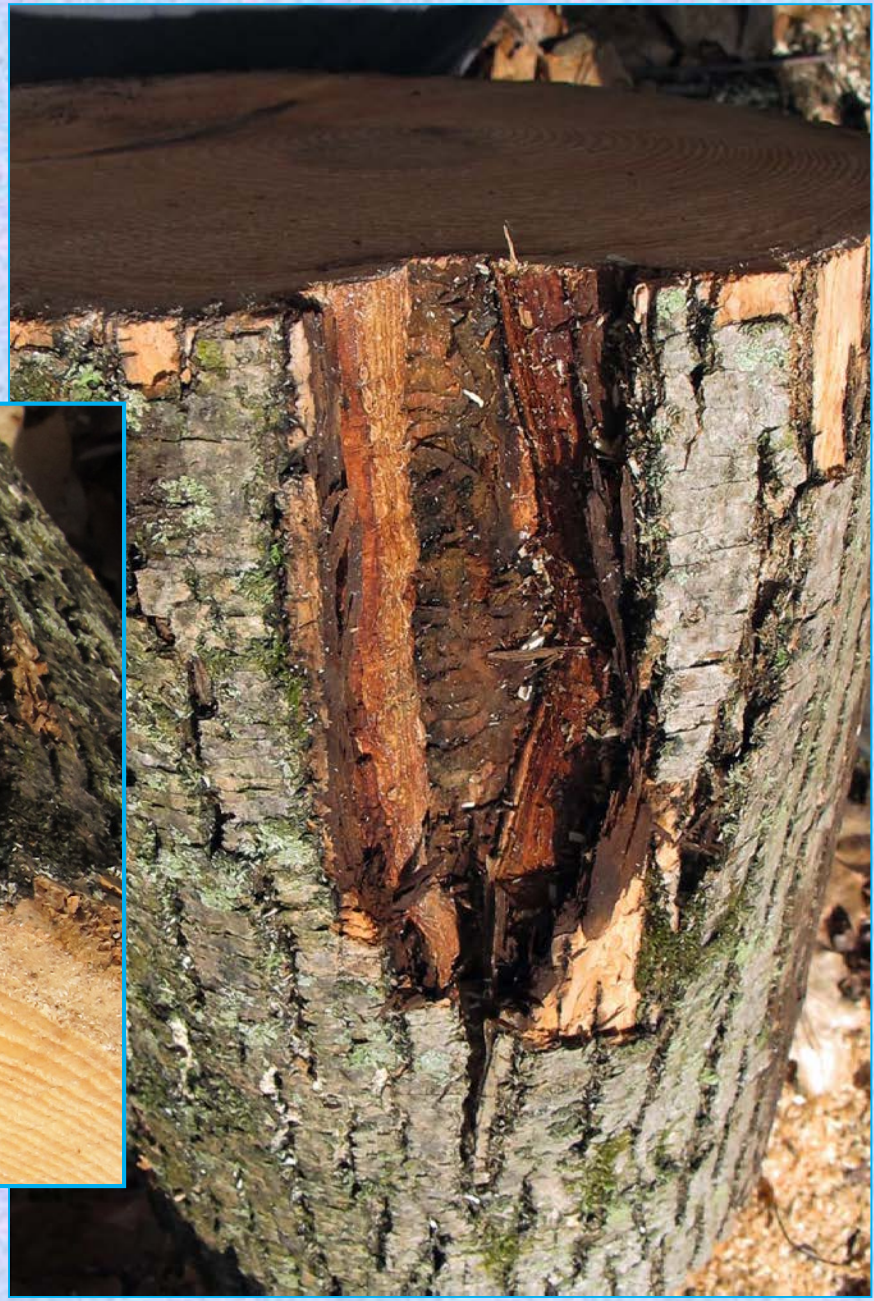
Varies with Pest Pressure

- Tier I: Early infestation
  - Bark Splitting
  - Woodpecker foraging
- Tier II: Mid level infestation
  - Woodpecker foraging
  - Canopy thinning
  - Epicormic sprouting
- Tier III: Heavy infestation
  - Canopy thinning
  - Woodpecker foraging
  - Epicormic sprouting

Bugwood.org

Bark splitting

Bark splitting



5 year-old EAB wound

Red-headed Ash Borer

EAB

Signs & Symptoms

- Epicormic, or water sprouts

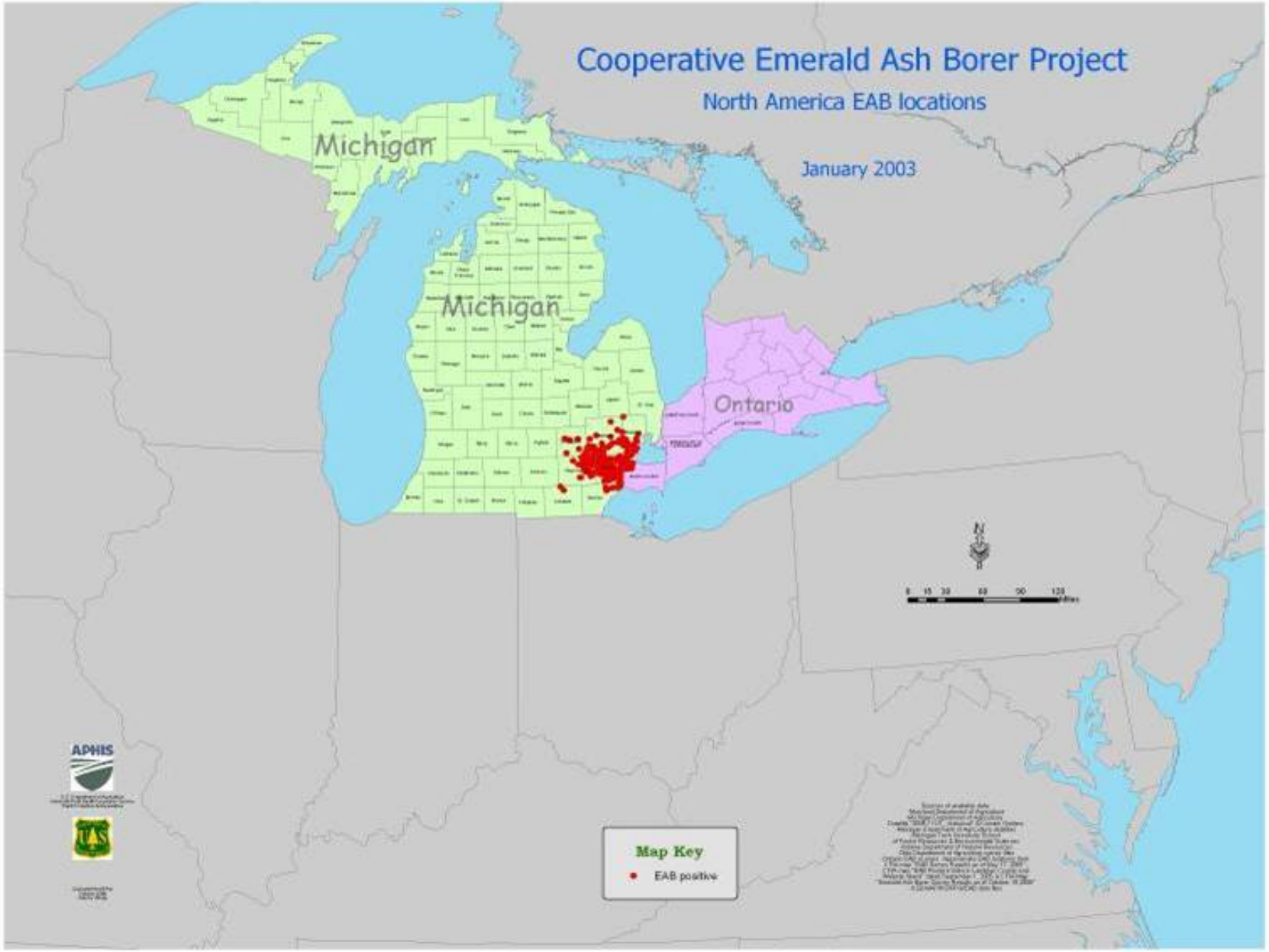
Signs & Symptoms

Canopy thinning

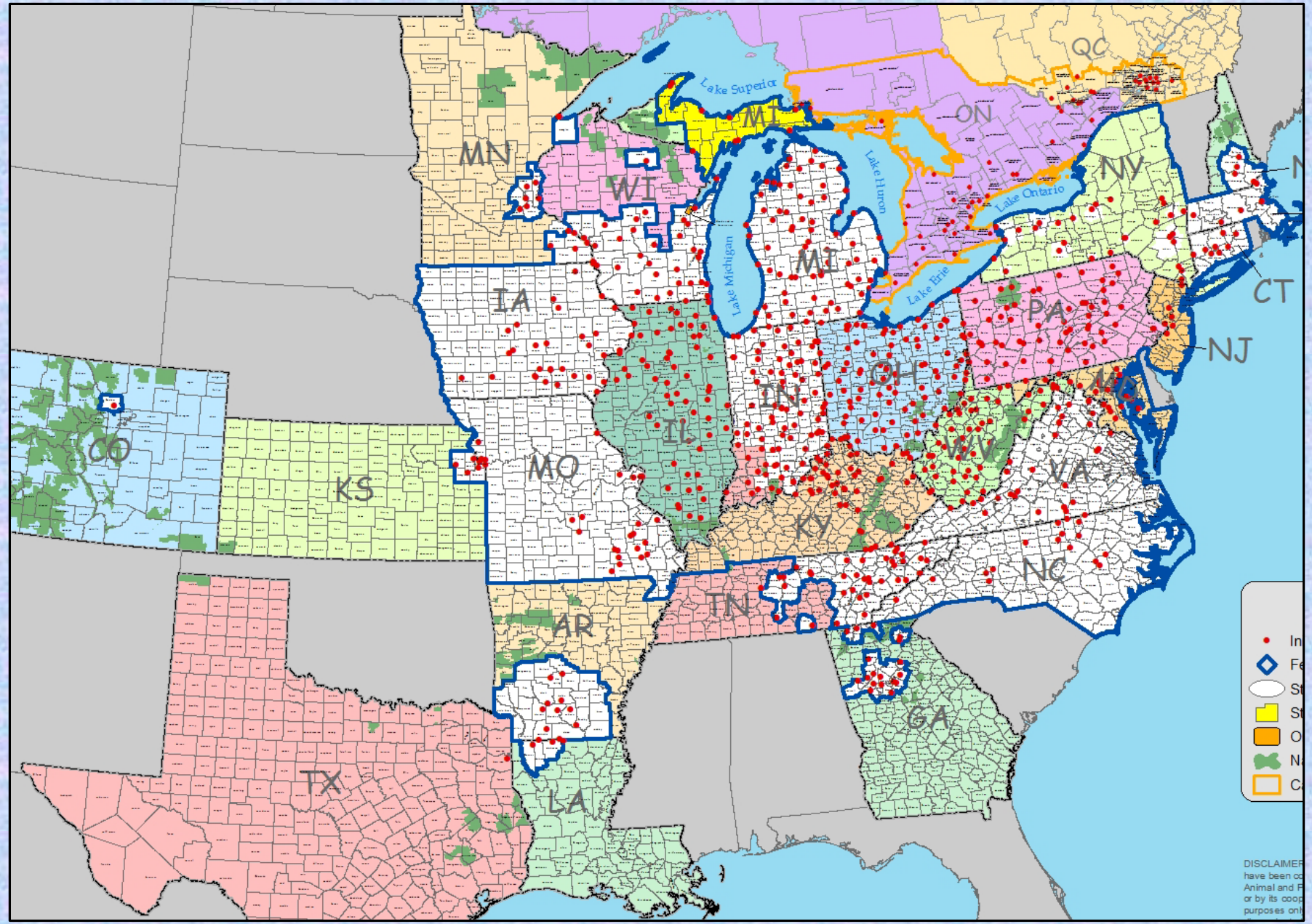
But it still has green leaves!

Look, no phloem!

January 2003



June 2016


Lake Superior
Lake Michigan
Lake Huron
Lake Erie
Lake Ontario
MN
WI
MI
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TX
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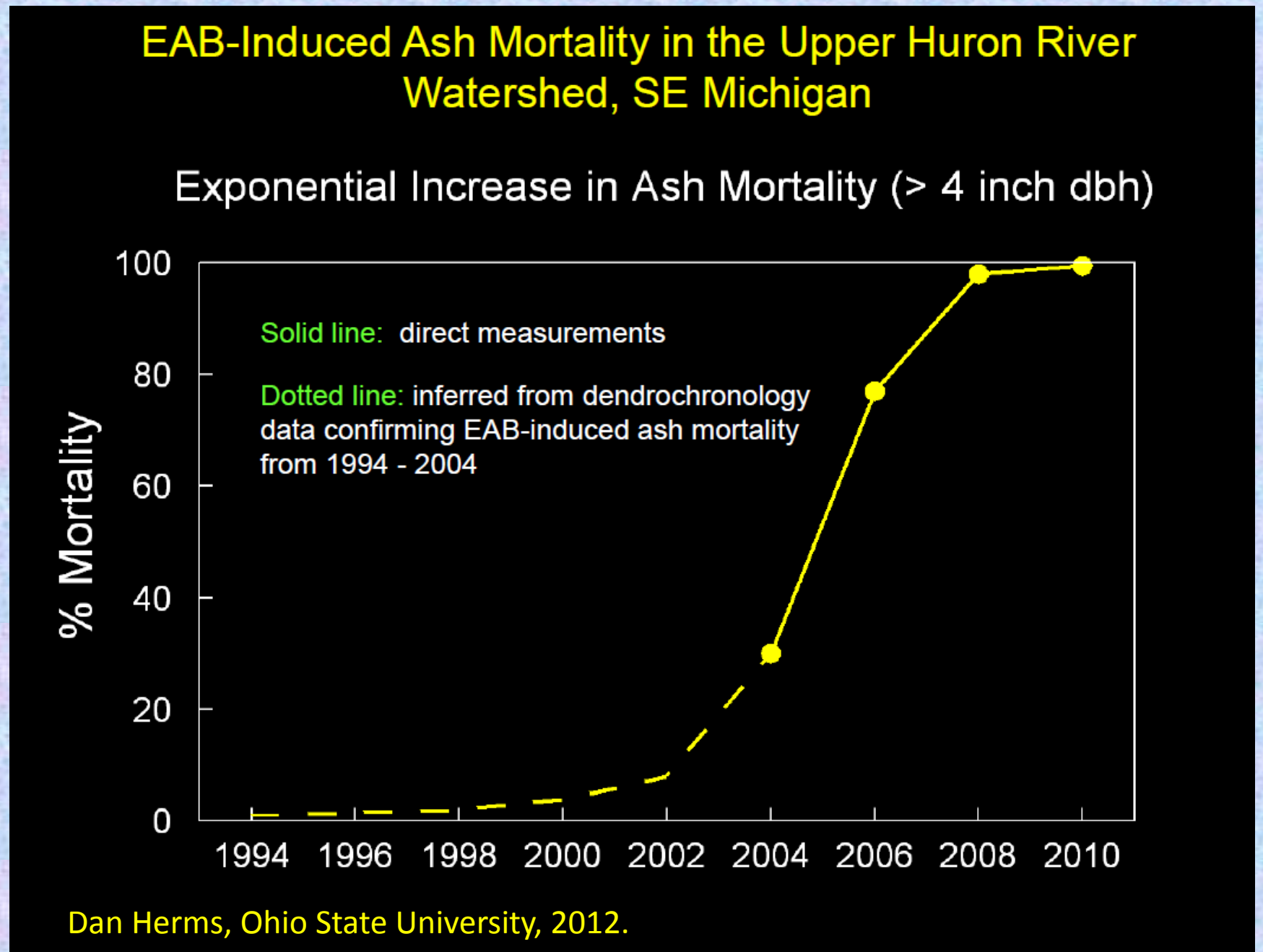
EAB Death Curve

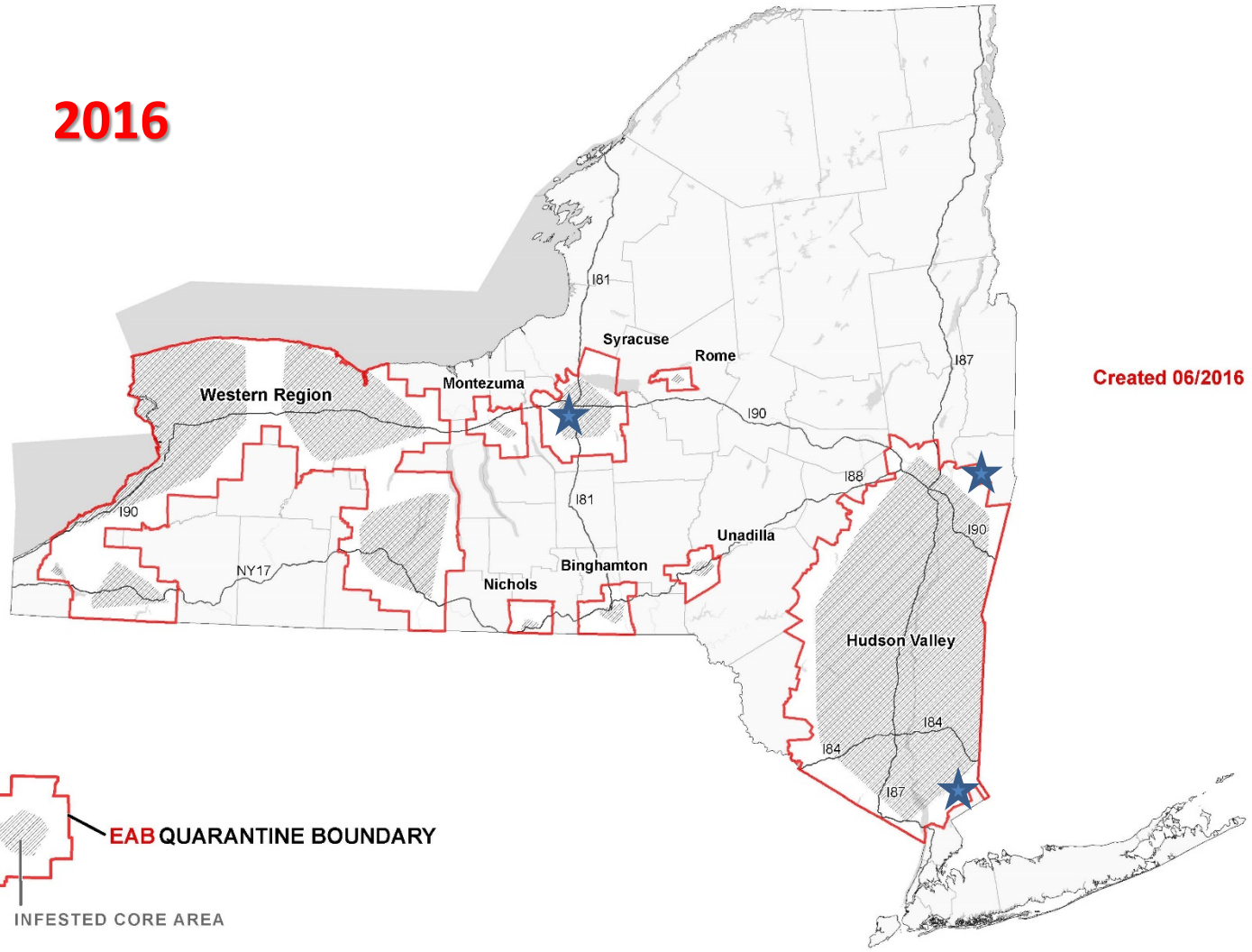


Emerald Ash Borer (EAB)
Quarantine Boundaries

Binghamton, Hudson Valley, Montezuma, Nichols, Rome, Syracuse, Unadilla, Western Region

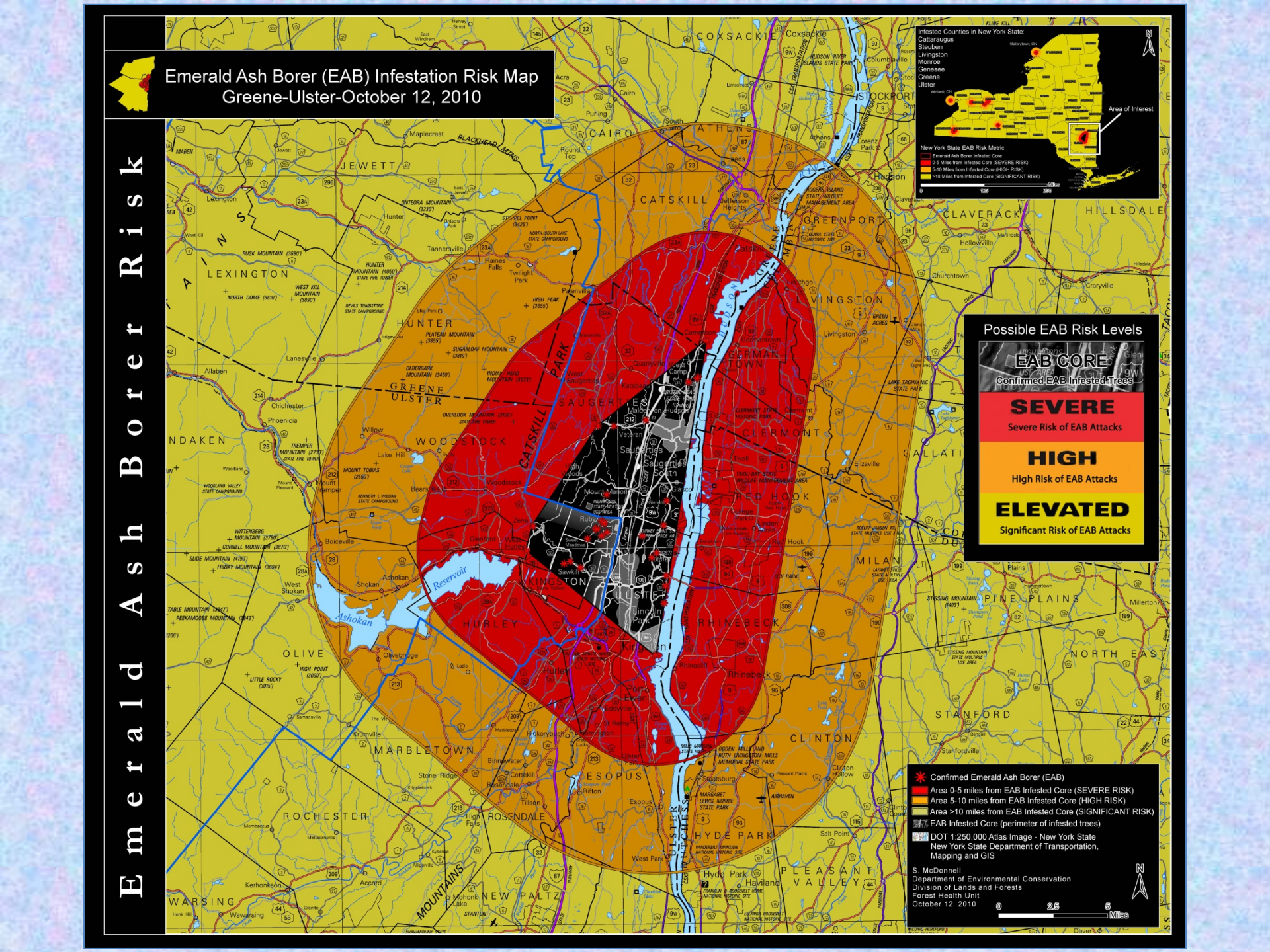
NEW YORK STATE OF OPPORTUNITY. Department of Environmental Conservation | Agriculture and Markets

2016



Created 06/2016

S. McDonnell - Geographer
Division of Lands and Forests
Forest Health Unit

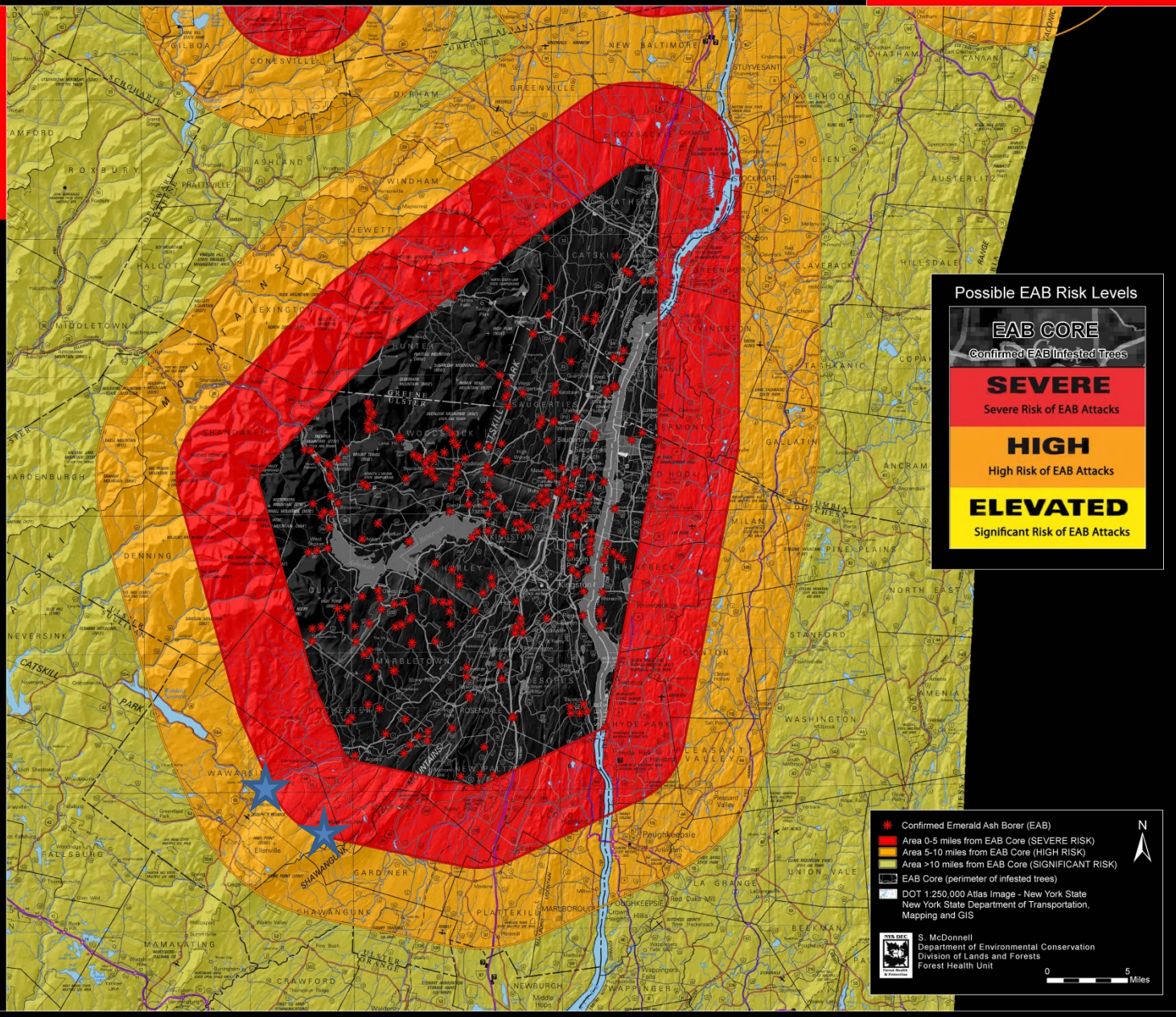

Emerald Ash Borer (EAB) Infestation Risk Map
Greene-Ulster-October 12, 2010
Emerald Ash Borer Risk
Infested Counties in New York State:
Cattaraugus
Steuben
Livingston
Monroe
Genesee
Greene
Ulster
Area of Interest
New York State EAB Risk Metric
Emerald Ash Borer Infested Core
0-5 Miles from Infested Core (SEVERE RISK)
5-10 Miles from Infested Core (HIGH RISK)
>10 Miles from Infested Core (SIGNIFICANT RISK)
Possible EAB Risk Levels
EAB CORE
Confirmed EAB Infested Trees
SEVERE
Severe Risk of EAB Attacks
HIGH
High Risk of EAB Attacks
ELEVATED
Significant Risk of EAB Attacks
Confirmed Emerald Ash Borer (EAB)
Area 0-5 miles from EAB Infested Core (SEVERE RISK)
Area 5-10 miles from EAB Infested Core (HIGH RISK)
Area >10 miles from EAB Infested Core (SIGNIFICANT RISK)
EAB Infested Core (perimeter of infested trees)
DOT 1:250,000 Atlas Image - New York State
New York State Department of Transportation,
Mapping and GIS
S. McDonnell
Department of Environmental Conservation
Division of Lands and Forests
Forest Health Unit
October 12, 2010
0 2.5 5 Miles
N
COXSACKIE
ATHENS
CAIRO
JEWETT
CATSKILL
GREENPORT
LEXINGTON
HUNTER
GREENE
ULSTER
CATSKILL PARK
WOODSTOCK
SAUGERTIES
GERMANTOWN
CLERMONT
RED HOOK
LIVINGSTON
MILAN
HURLEY
OLIVE
RHINEBECK
MARBLETOWN
ESOPUS
ROSENDALE
ROCHESTER
HYDE PARK
PLEASANT VALLEY
NEW PALTZ
WARSING
STANFORD
CLINTON
NORTH EAST
PINE PLAINS
CLAVERACK
HILLSDALE
Ashokan Reservoir
Hudson
Catskill
Kingston
Rhinebeck
Woodstock
Saugerties
Hyde Park
New Paltz

Emerald Ash Borer (EAB)
Management Response Plan
Mid-Hudson (Tier 3)

Last Updated 06/2014

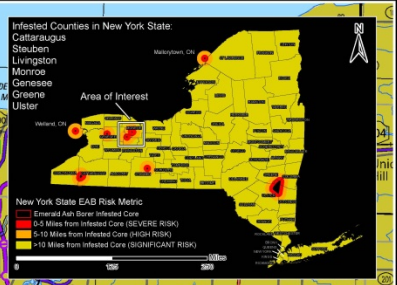
RESPONSE PLAN

Emerald Ash Borer RISK



Emerald Ash Borer (EAB) Infestation Risk Map
Livingston-Monroe-October 18, 2010

Emerald Ash Borer Risk



Possible EAB Risk Levels

EAB CORE
Confirmed EAB Infested Trees

SEVERE
Severe Risk of EAB Attacks

HIGH
High Risk of EAB Attacks

ELEVATED
Significant Risk of EAB Attacks

- Confirmed Emerald Ash Borer (EAB)
- EAB Infested Core(single location)
- Area 0-5 miles from EAB Infested Core (SEVERE RISK)
- Area 5-10 miles from EAB Infested Core (HIGH RISK)
- Area >10 miles from EAB Infested Core (SIGNIFICANT RISK)
- EAB Infested Core (perimeter of infested trees)
- DOT 1:250,000 Atlas Image - New York State New York State Department of Transportation, Mapping and GIS

S. McDonnell
Department of Environmental Conservation
Division of Lands and Forests
Forest Health Unit
October 18, 2010

0 2.5 5 Miles

N

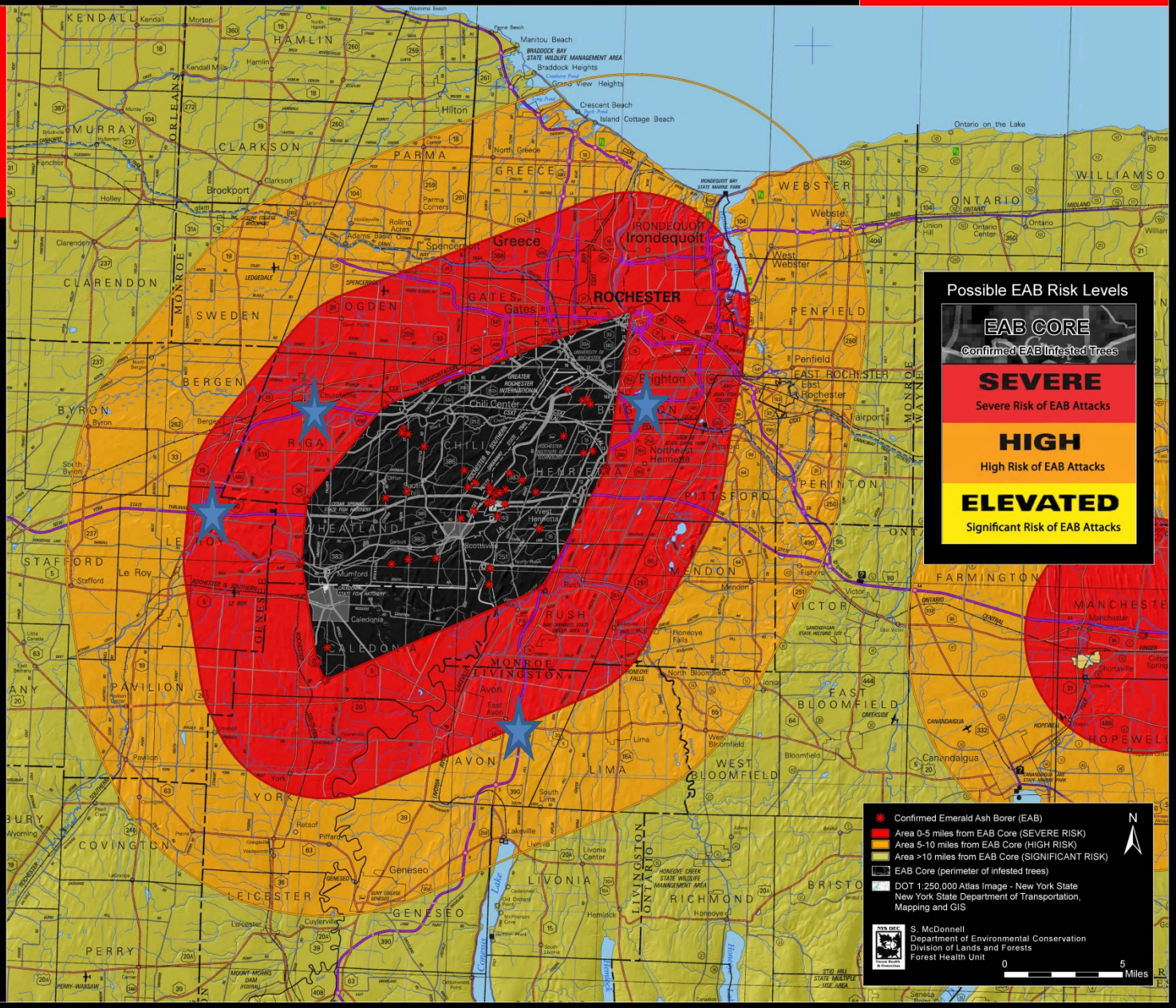
Emerald Ash Borer (EAB)
Management Response Plan
Greater Rochester (Tier 3)

Last Updated 05/2014

RESPONSE PLAN

RISK

Emerald Ash Borer



OPEN ACCESS Freely available online

PLoS one

Economic Impacts of Non-Native Forest Insects in the Continental United States

Juliann E. Aukema[1*], Brian Leung[2,3], Kent Kovacs[4], Corey Chivers[2], Kerry O. Britton[5], Jeffrey Englin[6], Susan J. Frankel[7], Robert G. Haight[8], Thomas P. Holmes[9], Andrew M. Liebhold[10], Deborah G. McCullough[11], Betsy Von Holle[12]

- September 9, 2011

- "We found that costs are largely borne by homeowners and municipal governments."
- "Wood- and phloem boring insects are anticipated to cause the largest economic impacts by annually inducing nearly $1.7 billion in local government expenditures and approximately $830 million in lost residential property values."
- "Given observations of new species, there is a 32% chance that another highly destructive borer species will invade the U.S. in the next 10 years."

What's at stake?

What's at stake?

What's at stake?

What's at stake?

What's at stake?

Power Transmission Lines in NYS

Total Miles of Transmission lines: 109, 358

Primary Distribution:	94,026
Sub Transmission:	6,706
Transmission:	5,150

TOTAL VULNERABLE: **105,885 miles of transmission lines**

This estimate does not include lines going to homes or along driveways.

National Grid estimates there are about 242 trees/mile along their lines = **26,000,000 total trees**

Conservative estimate is that 20% are Ash = **5,000,000 ash trees**

Conservative estimate of tree removal by National Grid is $300/tree = **$1,540,000,000**

Thanks to Brian Skinner, National Grid, for the data estimates

What are MY objectives?

1. Restore ALL ash species to the North American landscape.

2. Mitigate the Economic Impacts of Emerald Ash Borer.

Restore Ash on Landscape

- **The 3 point plan**
  1. ***Establish Biological Controls***
  2. ***Identify and incorporate resistance***
  3. ***Conserve the ash genome***

EAB Biological Control

- ***Classic Biocontrol from Eastern Asia***
  - Egg Parasitiod
    - *Oobius agrilli*
  - Larval parasitoids
    - *Tetrastichus planipennisi* – gregarious endoparasitoid
    - *Spathius agrili* – gregarious ectoparasitoid
    - *Spathius galinae* – Russia - not approved by EPA yet.
- ***Native Biocontrol***
  - Larval Parasitoids of wood-borers
    - *Spathius floridanus* (Hymenoptera: Braconidae)
    - *Atanycolus spp.* (Hymenoptera: Braconidae)
  - Predators
    - *Enoclerus* sp. (Coleoptera: Cleridae)
    - Woodpeckers!

Ash Resistance to EAB

- Chemical and genetic work underway to **identify mechanisms of resistance**
- **Crosses with Asian species** and back-crosses are being made now.
  - Similar to the technique used for American Chestnut
- **Lingering ash project**
  - Identify individuals that seem to survive

Conserve Ash Genome

- **Collect seed**
  - Federal, regional, and state programs underway
  - Must act fast to preserve the breadth of the genetic diversity across the landscape
- **Preserve magnificent individuals**
  - Systemic insecticides

Mitigate Economic Impacts

- **Proactive planning**
  - Tree inventories/ EAB Cost Calculator
  - Identify priorities for management
- **Engage communities**
  - Inter-municipal cooperation
- **Develop novel management techniques**
  - Pesticide treatments
  - Wood utilization

Management Options

- **Do nothing**
  - Liability issues
- **Remove all ash before they become infested**
  - Loss of valuable canopy
- **Remove ash as they become infested**
  - Expensive reactive management – potential exposure to liability
  - REMEMBER THE DEATH CURVE!!!
- **Treat with insecticides**
  - Retain canopy
  - Many management options available with more time

EAB Population Behavior

- **Pest Pressure Impacts Management Decisions**
  - **Pest detection**
    - Difficult at Low Pest Pressure, but well worth the effort.
    - At High Pest Pressure… You are way behind the curve.
  - **Treatment options**
    - **Timing of management decisions – the earlier the better.**
      - **Use the EAB Cost Calculator.**
    - **Pesticide effectiveness varies with pest pressure**
      - **Only the best pesticides work at High Pest Pressure.**
      - **My dog can protect your tree if there are no EAB in the vicinity.**

Systemic Insecticides for EAB

- **Imidacloprid (Merit, Xytect, and others)**
  - Must be used annually, injection and soil drench
- **Dinotefuran (Safari)**
  - Must be used annually, fast acting bark spray
- **Emamectin benzoate (Tree-äge)**
  - Most effective product under high pest pressure
  - Effective for up to 3 years, injection only
- **Azadirachtin (Treeazin)**
  - Only product available in Canada
  - Must be used annually, injection only
  - Environmentally benign – insect growth regulator

Pesticide Use Strategies

- **Use insecticides to spread out tree removals according to your schedule, not the bugs.**
  - Plan for treatments at least 12 years in the future
  - Must start early in the infestation cycle to minimize costs and retain maximum tree health – Early detection!
- **Determine which trees to protect for keeps**
  - Pay attention to canopy characteristics and damage
    - Remaining structure must be able to form a balanced tree
  - Plan to aggressively protect these trees for 12 years or more

EXTENSION ENTOMOLOGY | EAB IN INDIANA

Emerald Ash Borer Cost Calculator

PURDUE UNIVERSITY

- Instructions
- Forests
- Input
- Comparisons
- About EAB Calculator
- Contact Us
- Tutorials

Tree Size Class Distribution | Costs and Infestation Stage | Management Plans

Welcome **mark whitmore** (logout)

Active Forest: **demo 2**

Tree Size Class Distribution

Please use your street tree inventory data to enter the number of ash trees of each size class in your forest in the table below. Size span should be entered the diameter of the trunk at breast height (DBH), or at 4.5 feet above the soil line. Use the default values for tree size range or change the size class to correspond with the summary statistics you have on hand.

Size Span (inches)	Number of Trees
1 - 3	200
3 - 6	500
6 - 12	900
12 - 18	300
18 - 24	75
24 -	25

Save Changes | Add Span

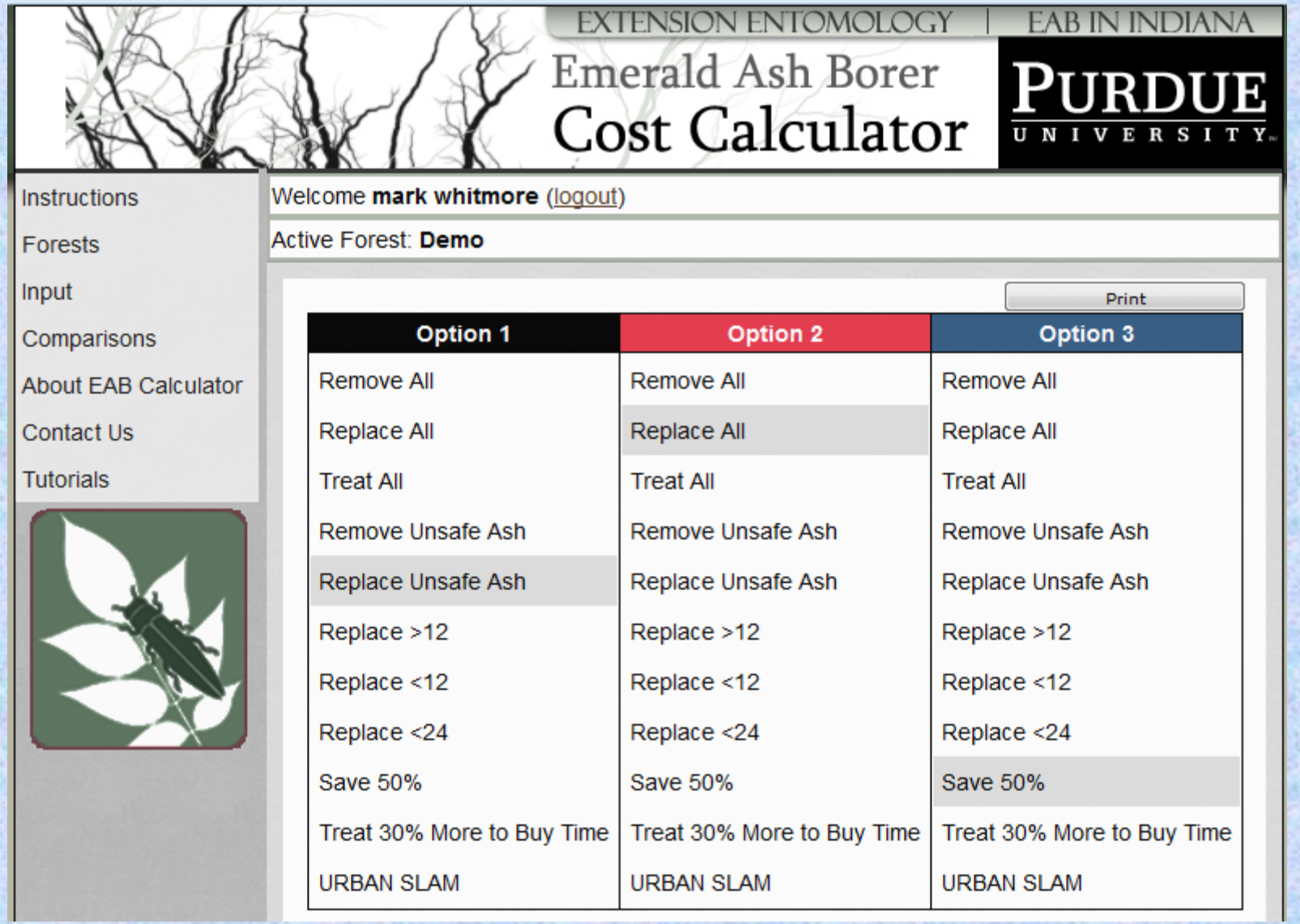
Changes Saved

View Plan Comparisons Now or Customize Costs and Infestation Stage

eabindiana.info

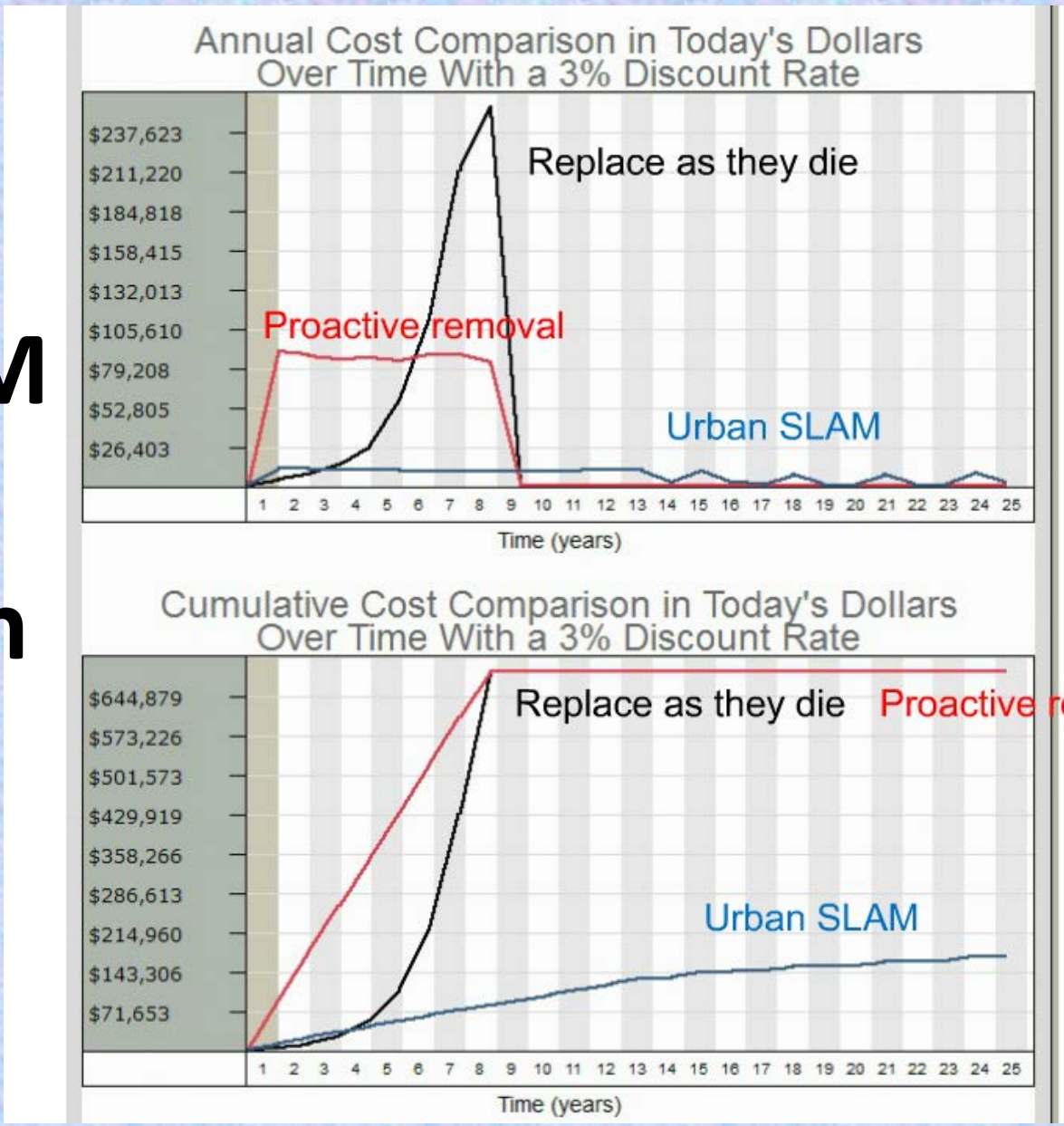
Created by Cliff Sadof, Purdue University

eabindiana.info



Option 1	Option 2	Option 3
Remove All	Remove All	Remove All
Replace All	Replace All	Replace All
Treat All	Treat All	Treat All
Remove Unsafe Ash	Remove Unsafe Ash	Remove Unsafe Ash
Replace Unsafe Ash	Replace Unsafe Ash	Replace Unsafe Ash
Replace >12	Replace >12	Replace >12
Replace <12	Replace <12	Replace <12
Replace <24	Replace <24	Replace <24
Save 50%	Save 50%	Save 50%
Treat 30% More to Buy Time	Treat 30% More to Buy Time	Treat 30% More to Buy Time
URBAN SLAM	URBAN SLAM	URBAN SLAM

Urban SLAM Cost Comparison



Cliff Sadof, Purdue University (2013)

Benefits of Urban Trees

- Two models used: CTLA & iTree
- Landscaping – up to 40% of property value
- Energy savings
- Water interception and use
- Business activity
- Human health

Benefits of Urban Trees

American Journal of Preventive Medicine

Volume 44, Issue 2, February 2013, Pages 139–145

Research article

The Relationship Between Trees and Human Health: Evidence from the Spread of the Emerald Ash Borer

Geoffrey H. Donovan, PhD[a], David T. Butry, PhD[b], Yvonne L. Michael, ScD[c], Jeffrey P. Prestemon, PhD[d], Andrew M. Liebhold, PhD[e], Demetrios Gatziolis, PhD[a], Megan Y. Mao[a]

[a] Pacific Northwest Research Station, U.S. Department of Agriculture Forest Service, Pacific Northwest Research Station, Portland, Oregon

[b] National Institute of Standards and Technology, Gaithersburg, Maryland

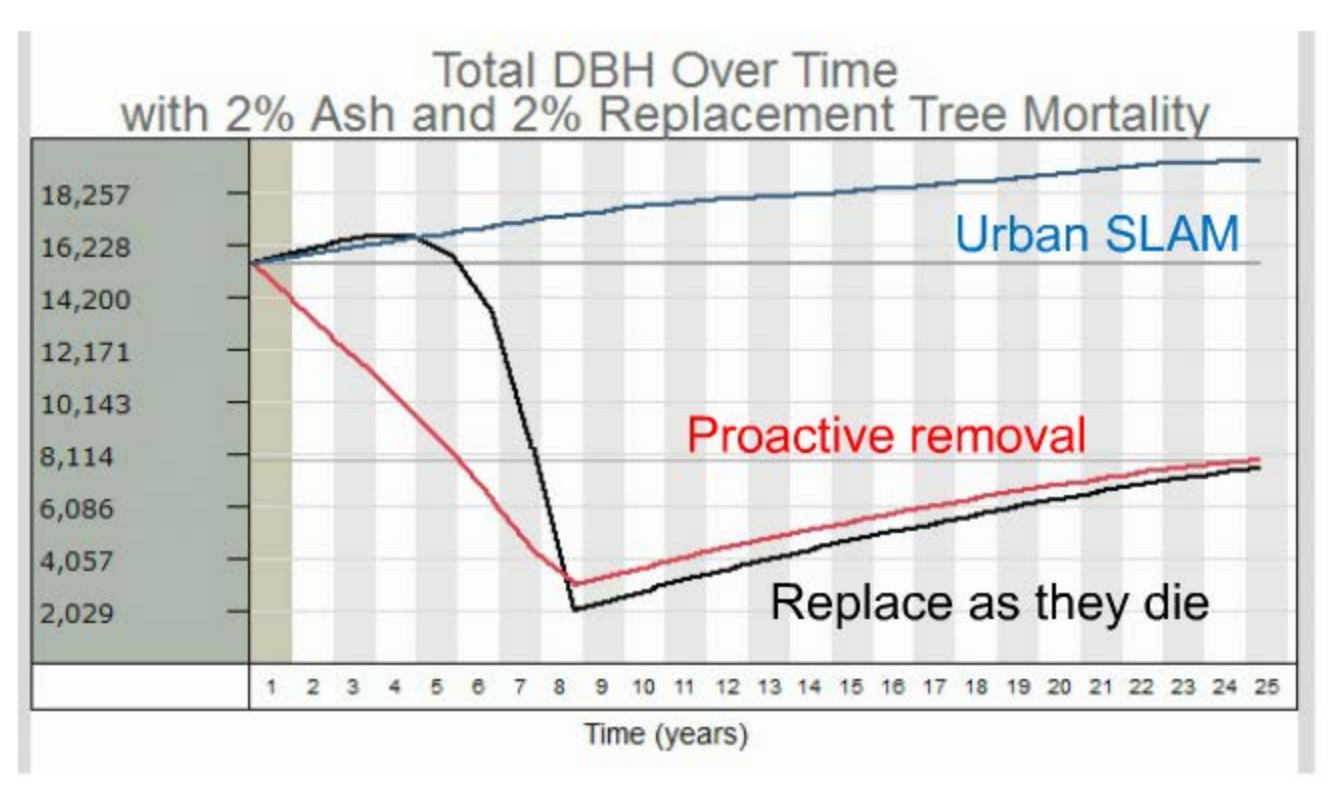
[c] Department of Epidemiology and Biostatistics, Drexel University, Philadelphia, Pennsylvania

[d] U.S. Department of Agriculture Forest Service, Southern Research Station, Research Triangle Park, North Carolina

[e] Northern Research Station, U.S. Department of Agriculture Forest Service, Morgantown, West Virginia

Results suggest that loss of trees to the emerald ash borer increased mortality related to cardiovascular and lower-respiratory-tract illness. This finding adds to the growing evidence that the natural environment provides major public health benefits.

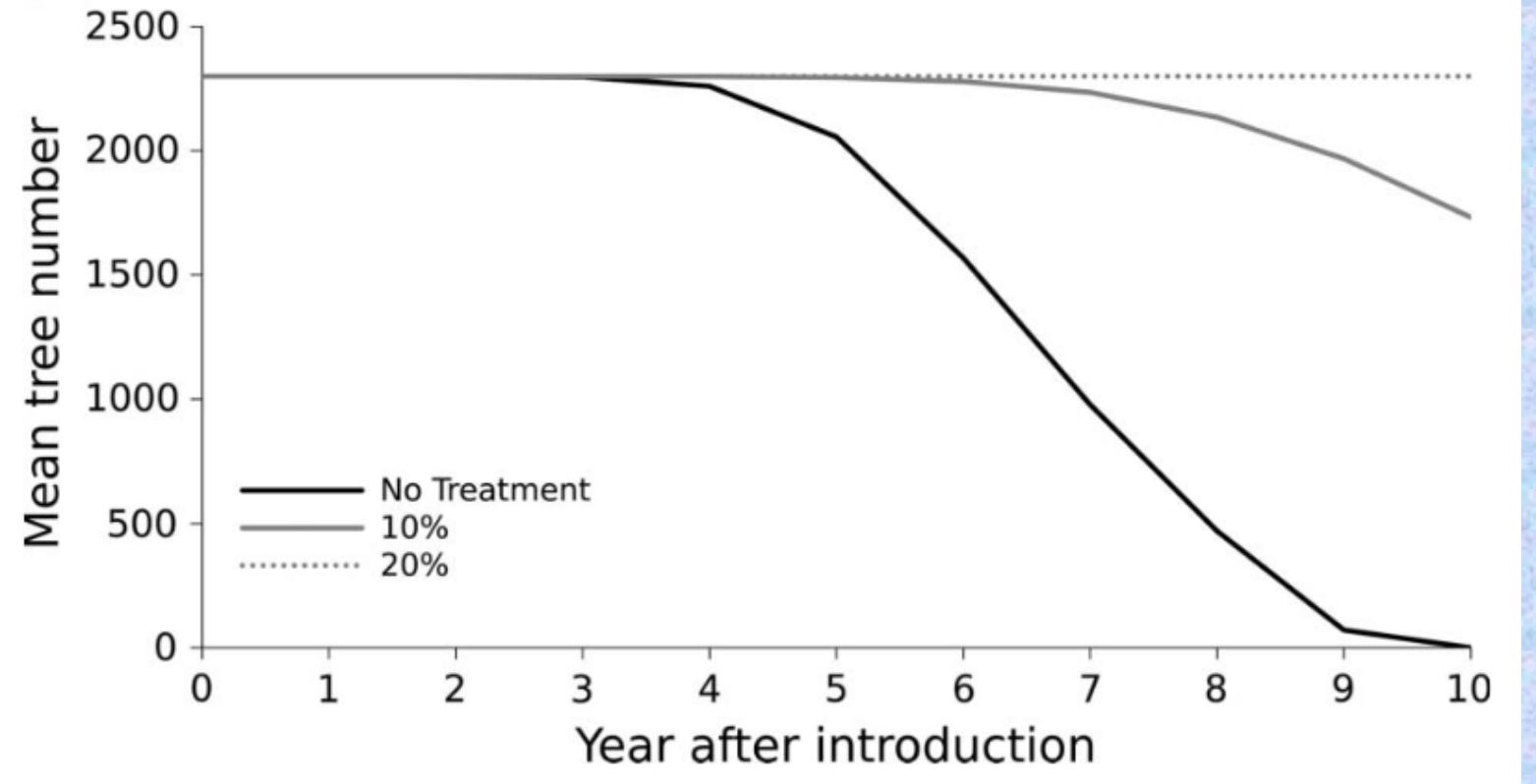
Size of Remaining Ash Forest



Cliff Sadof, Purdue University (2013)

Urban SLAM – SLow Ash Mortality

Deborah G. McCullough & Rodrigo J. Mercader (2012): Evaluation of potential strategies to SLow Ash Mortality (SLAM) caused by emerald ash borer (Agrilus planipennis): SLAM in an urban forest, International Journal of Pest Management, 58:1, 9-23

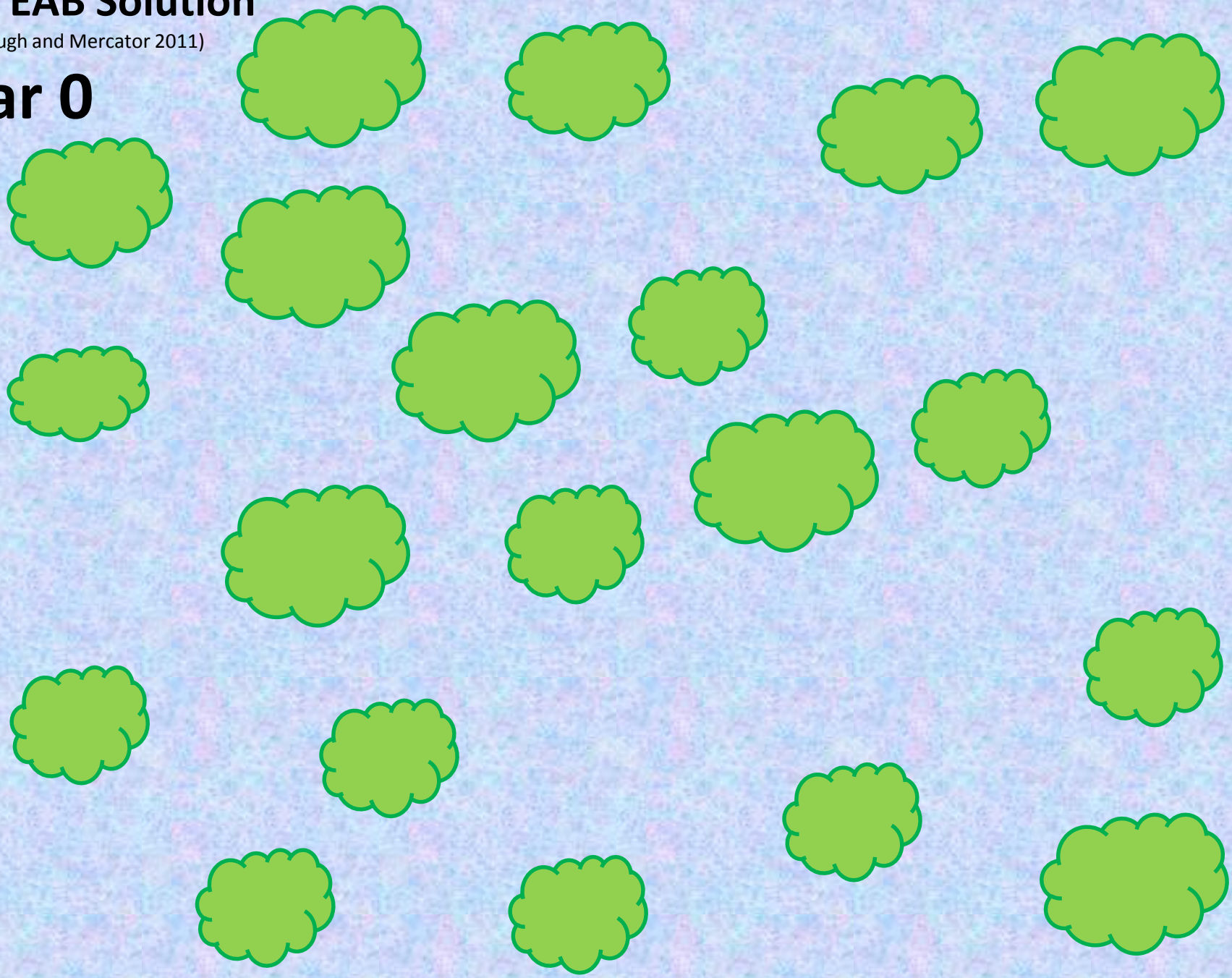


The 20% Solution

20% EAB Solution

(McCullough and Mercator 2011)

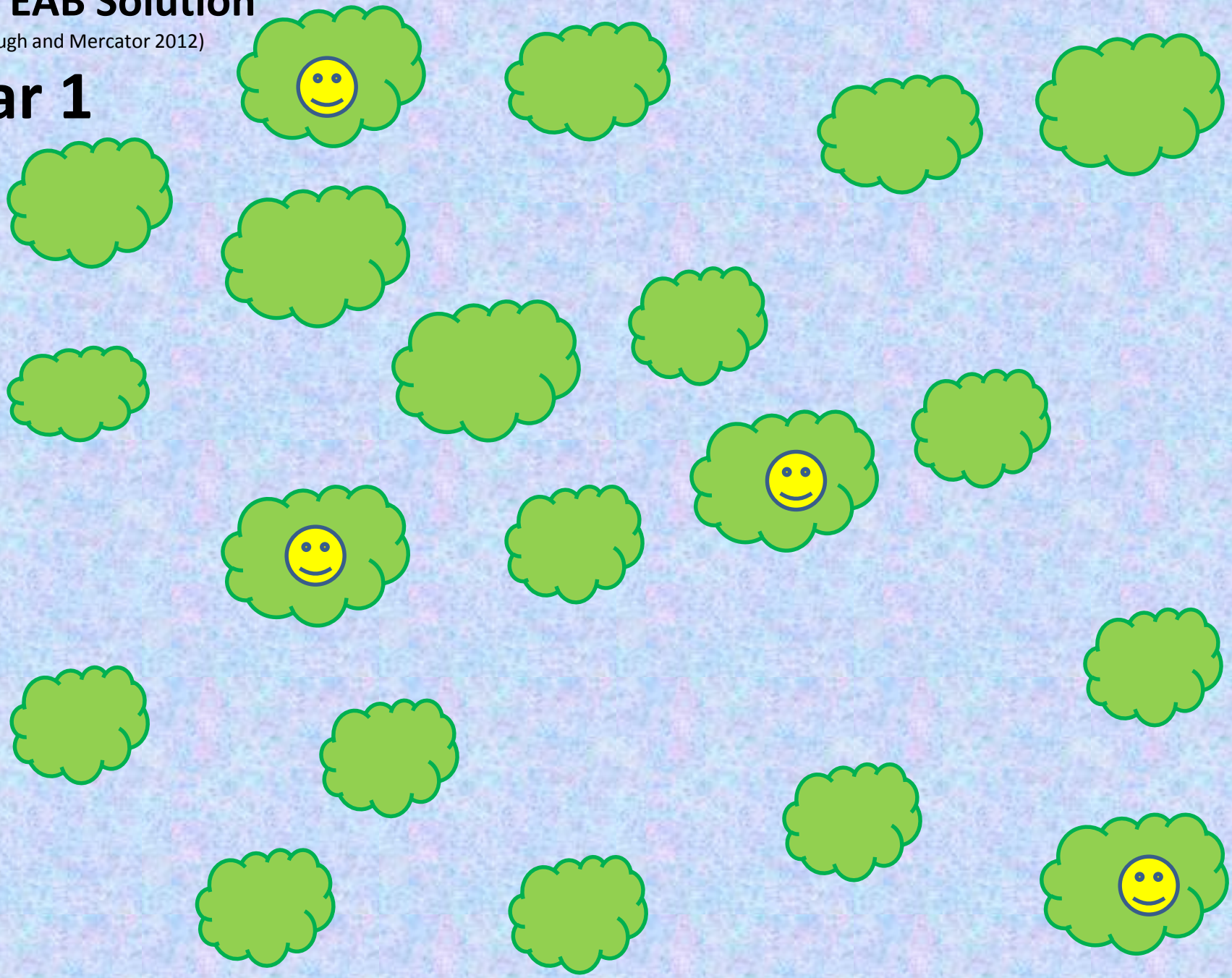
Year 0



20% EAB Solution

(McCullough and Mercator 2012)

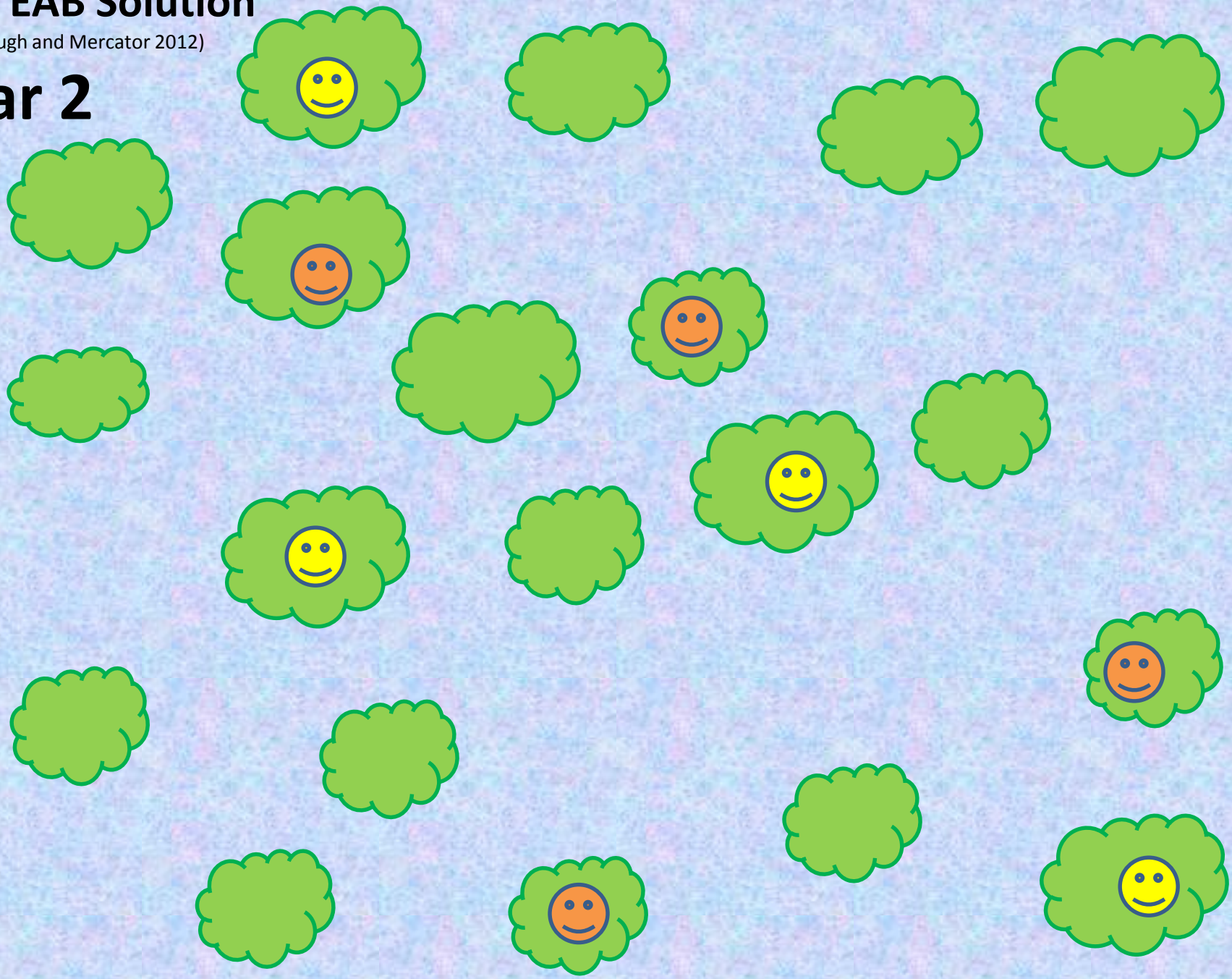
Year 1



20% EAB Solution

(McCullough and Mercator 2012)

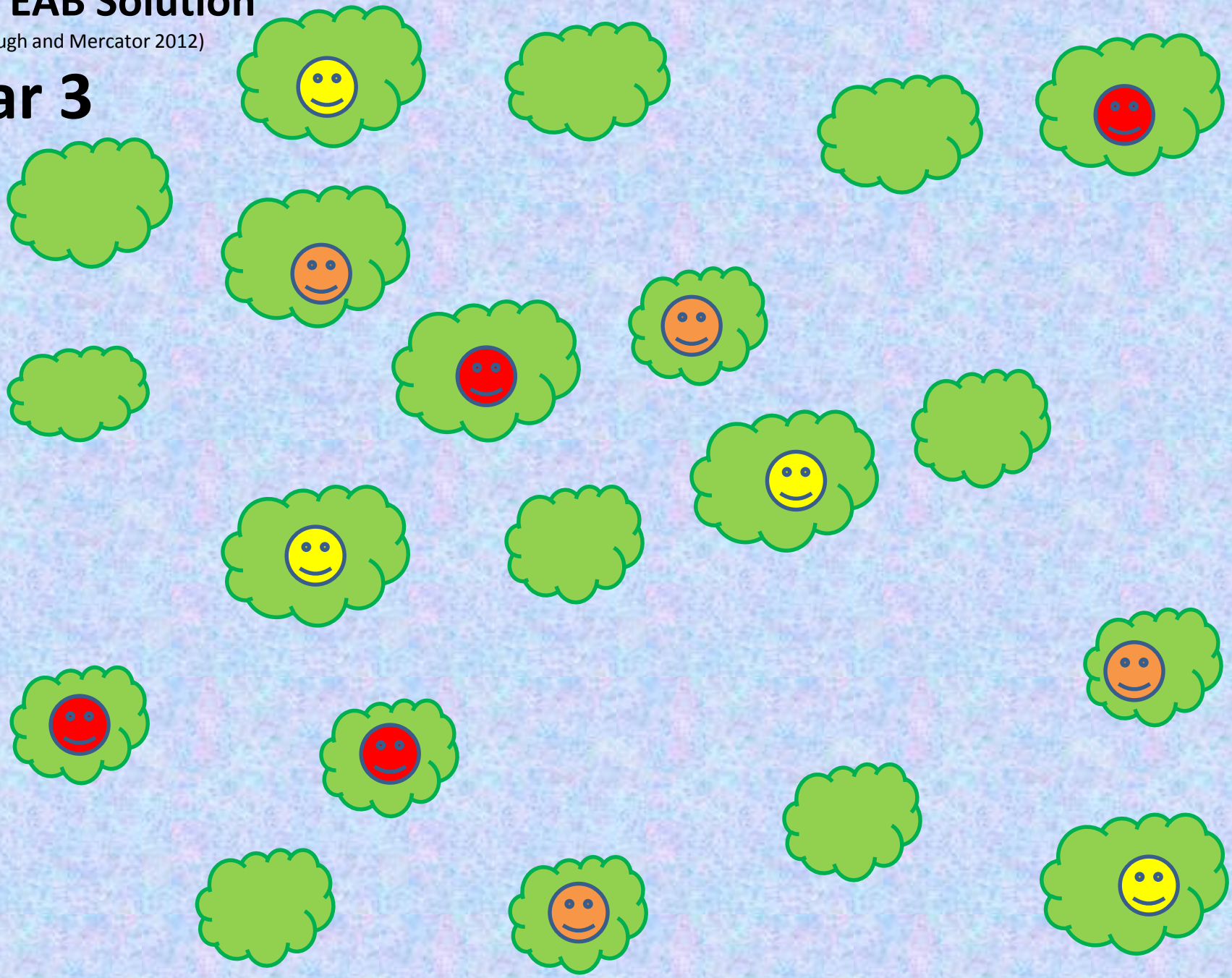
Year 2



20% EAB Solution

(McCullough and Mercator 2012)

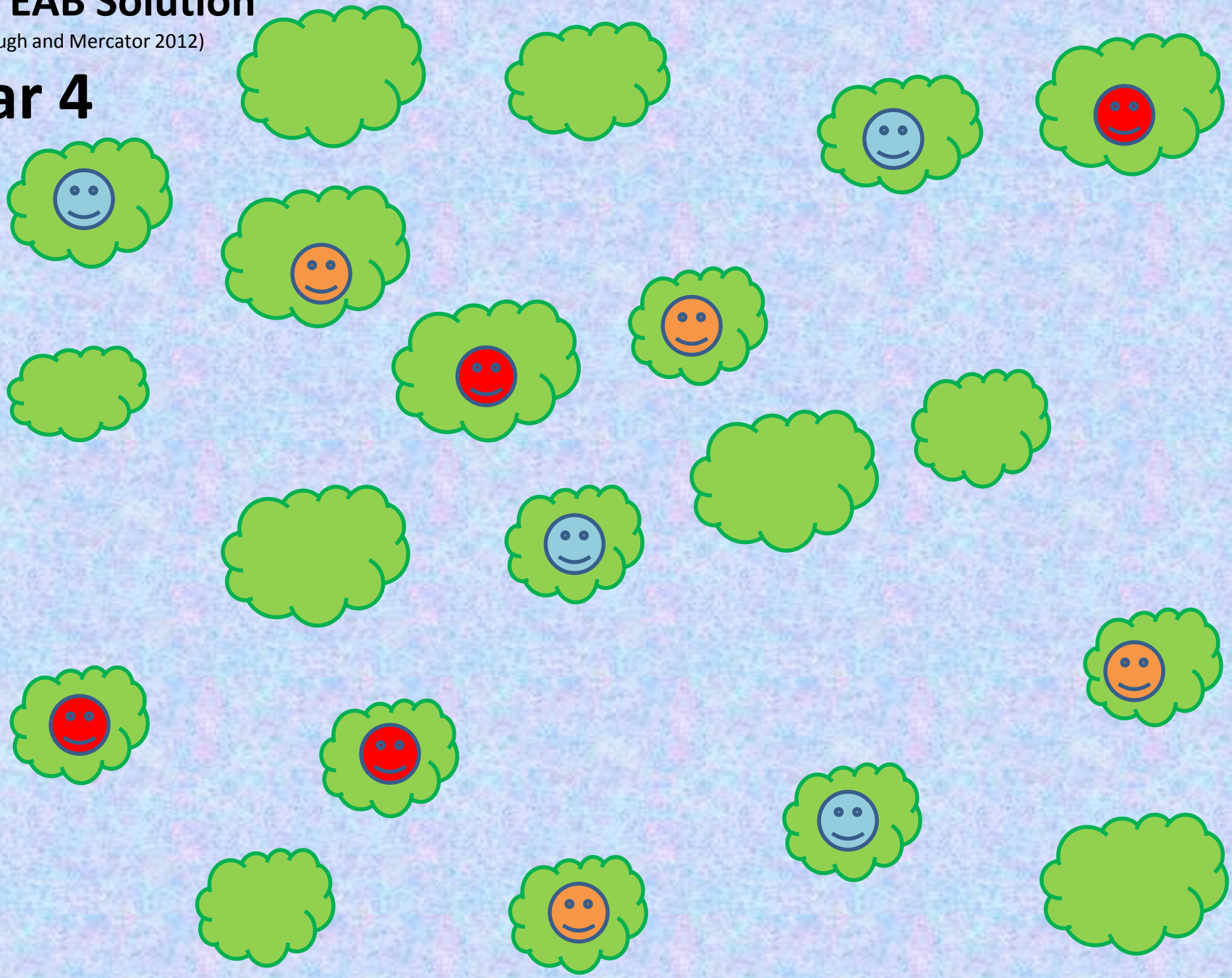
Year 3



20% EAB Solution

(McCullough and Mercator 2012)

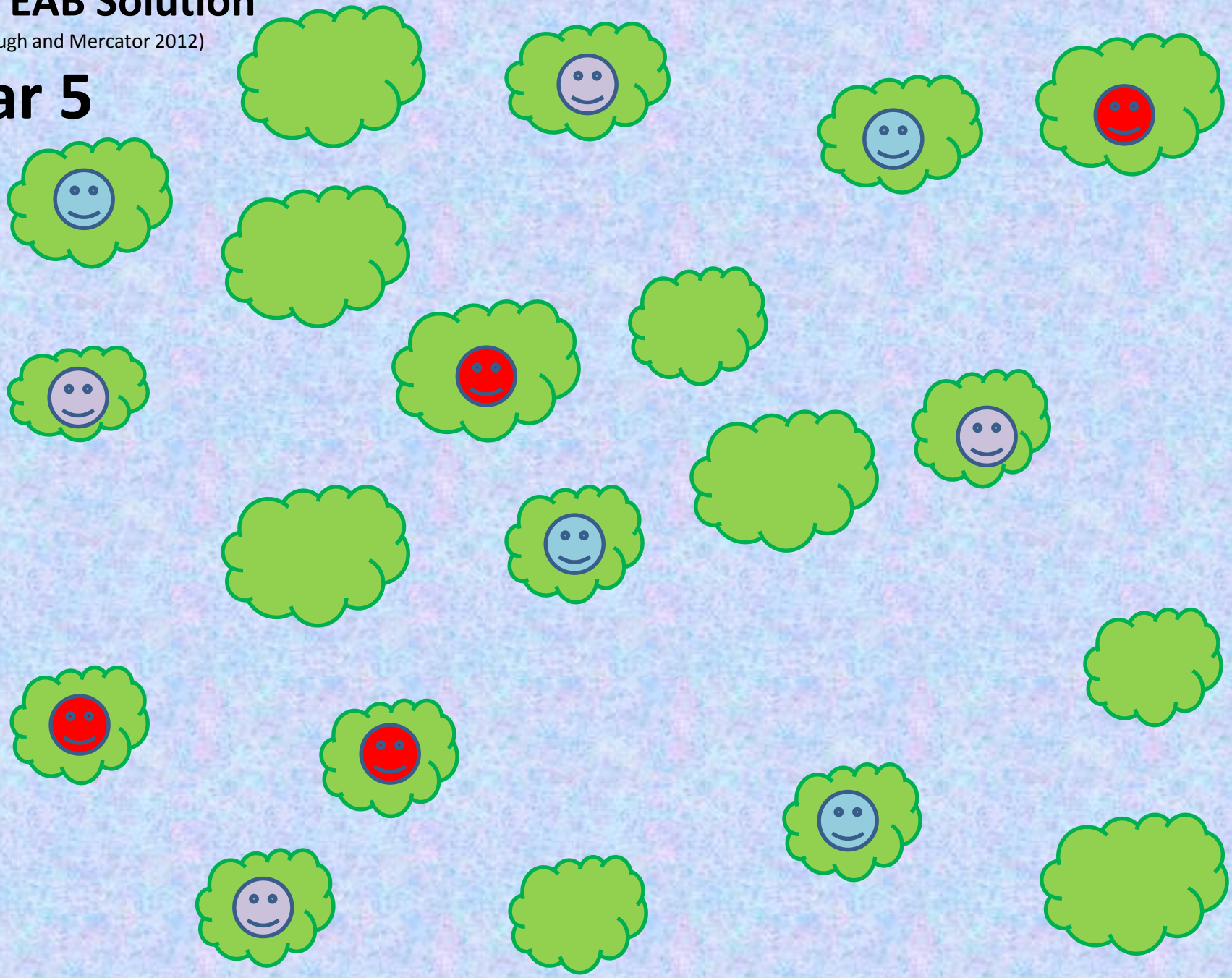
Year 4



20% EAB Solution

(McCullough and Mercator 2012)

Year 5

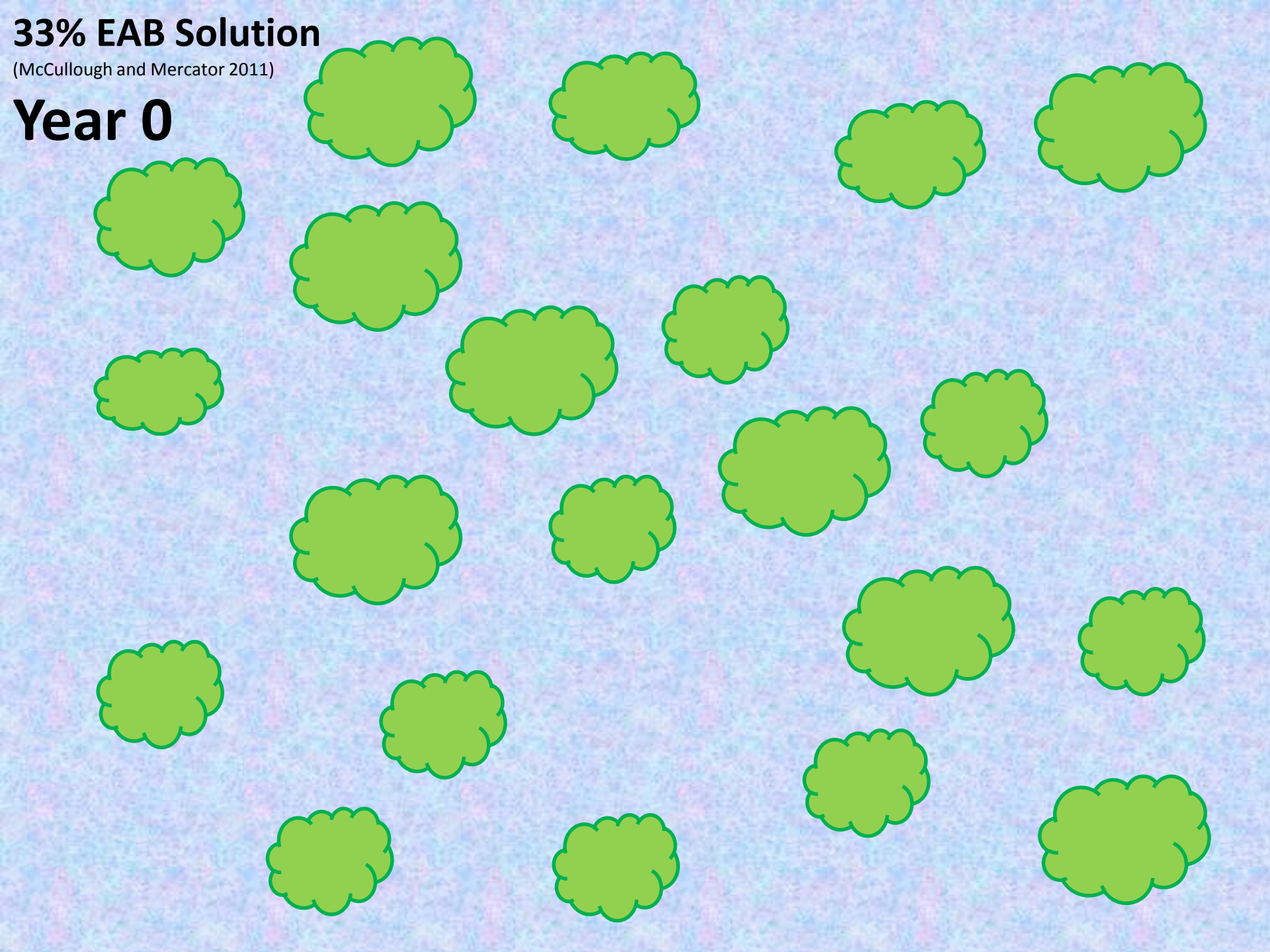


The 33% Solution!

33% EAB Solution

(McCullough and Mercator 2011)

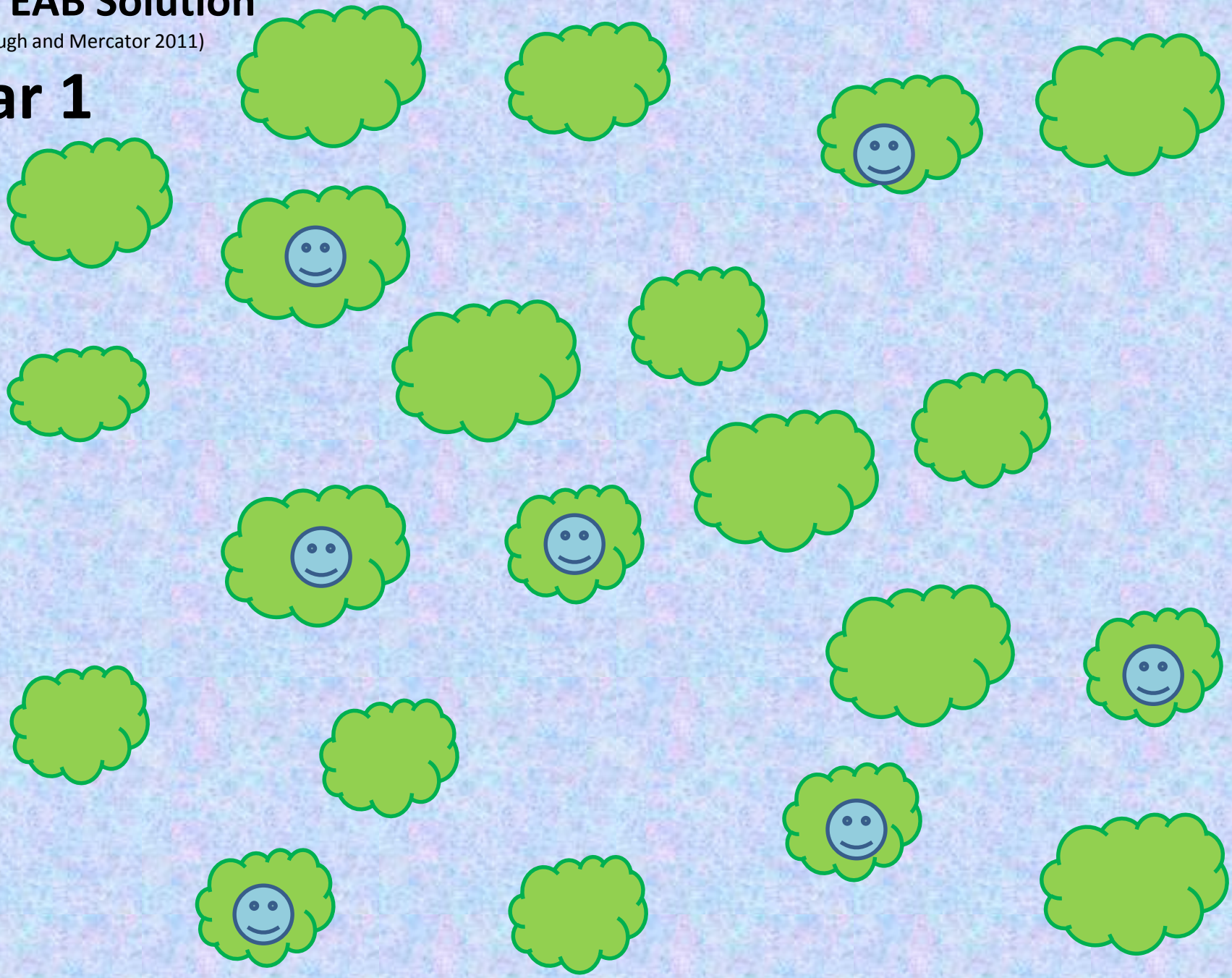
Year 0



33% EAB Solution

(McCullough and Mercator 2011)

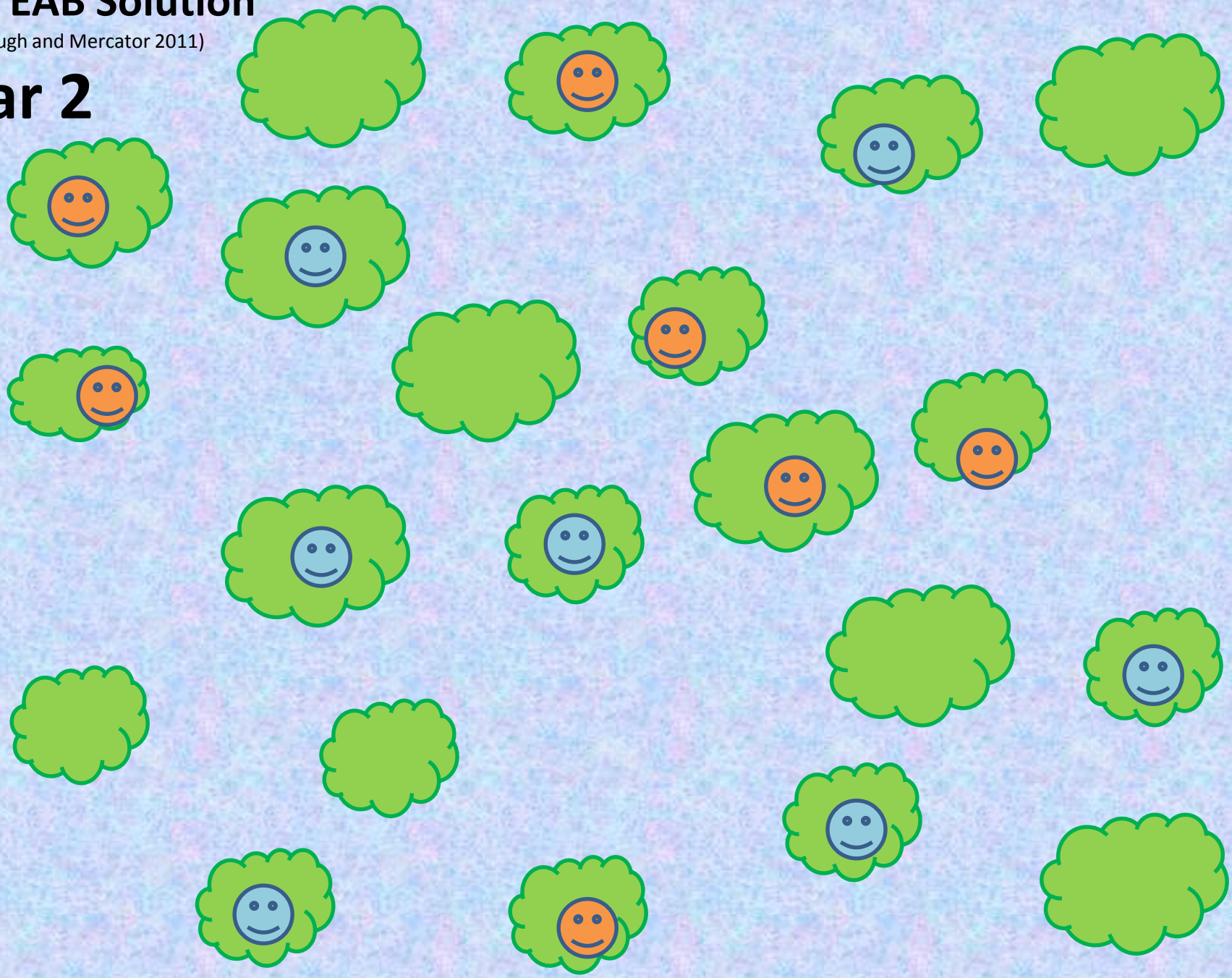
Year 1



33% EAB Solution

(McCullough and Mercator 2011)

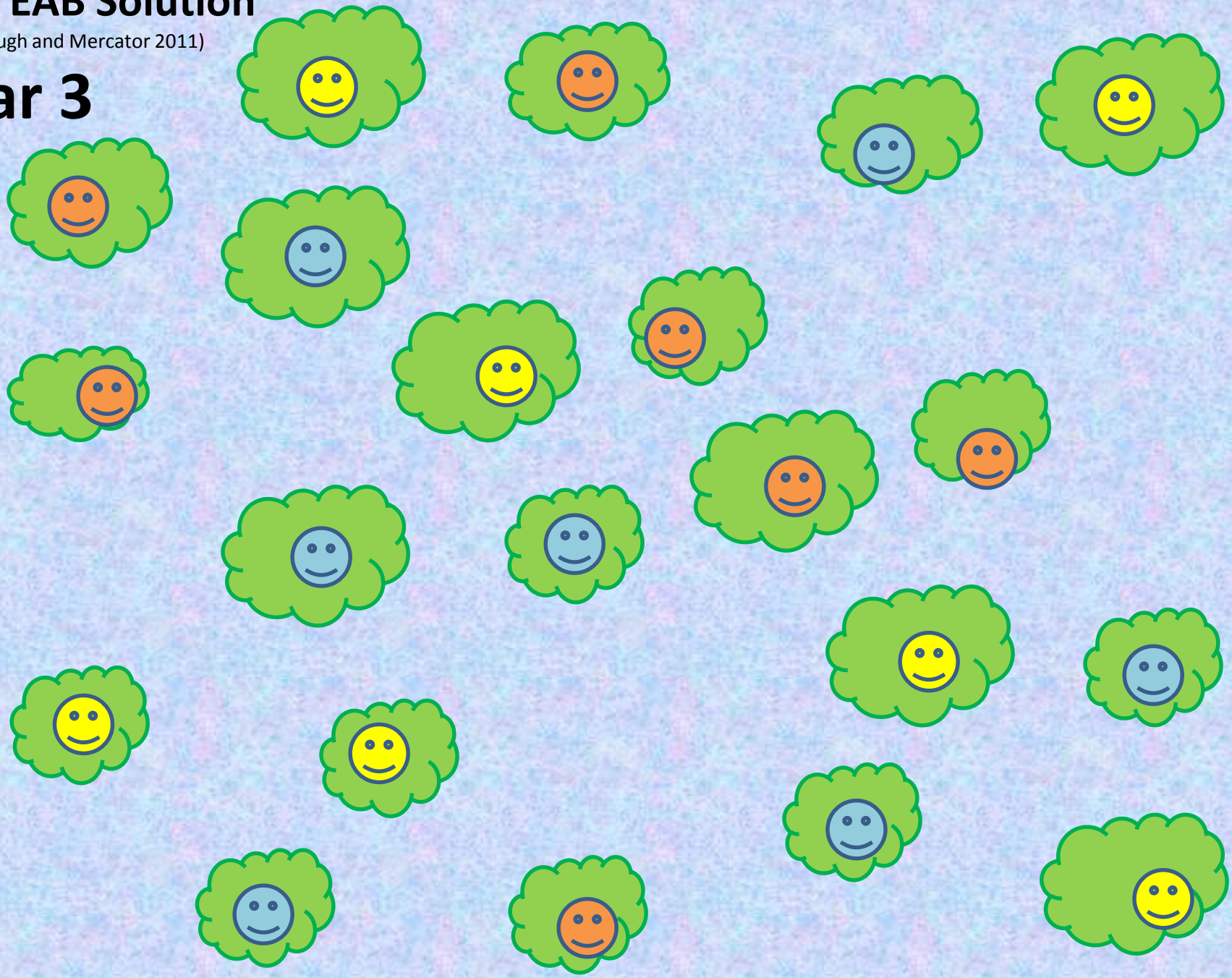
Year 2



33% EAB Solution

(McCullough and Mercator 2011)

Year 3



What can you do now?
As a homeowner or community member

- Inventory your ash.
  - Prioritize your management activities
- Explore management options.
  - EAB Cost Calculator from Purdue University
    - eabindiana.info
- Know where EAB is.
  - Early detection is critical!
- Participate in local EAB Task Force

nyis.info

Mark Whitmore
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Cornell University

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APHIS