Connecticut Department of Energy and Environmental Protection

Connecticut Department of
ENERGY &
ENVIRONMENTAL
PROTECTION

Emerald Ash Borer and Potential Municipal Responses

Tools available to Public Tree Managers

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Introduction

Agrilus planipennis
(Coleoptera: Buprestidae, adult aprox. 1 cm long)

Fraxinus americana (Oleaceae), Simsbury, CT
22 North American species of *Fraxinus*

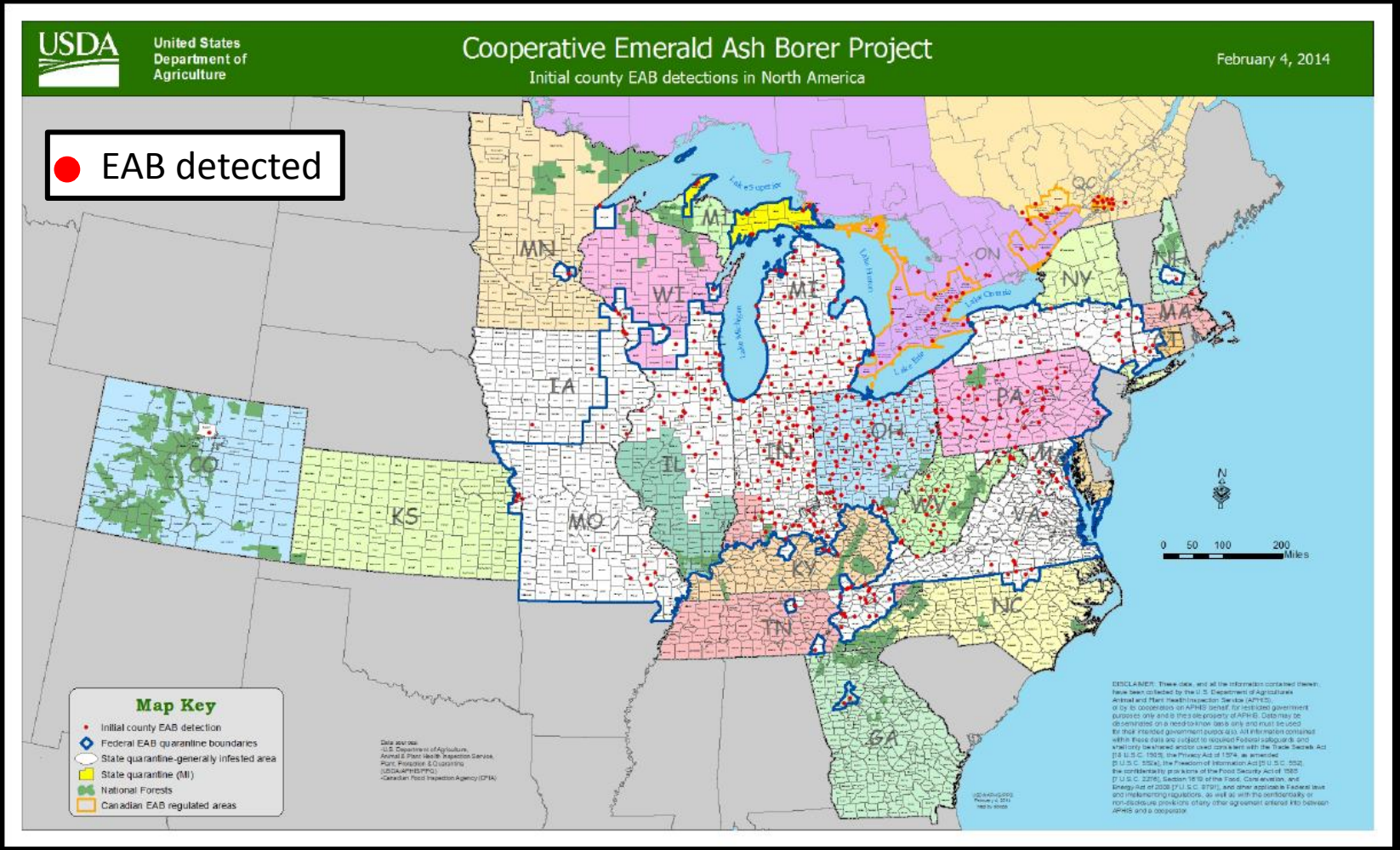
North America Invasion

Natural distribution of EAB in Asia

Detected in 2002, Detroit-Michigan Area

emeraldashborer.info

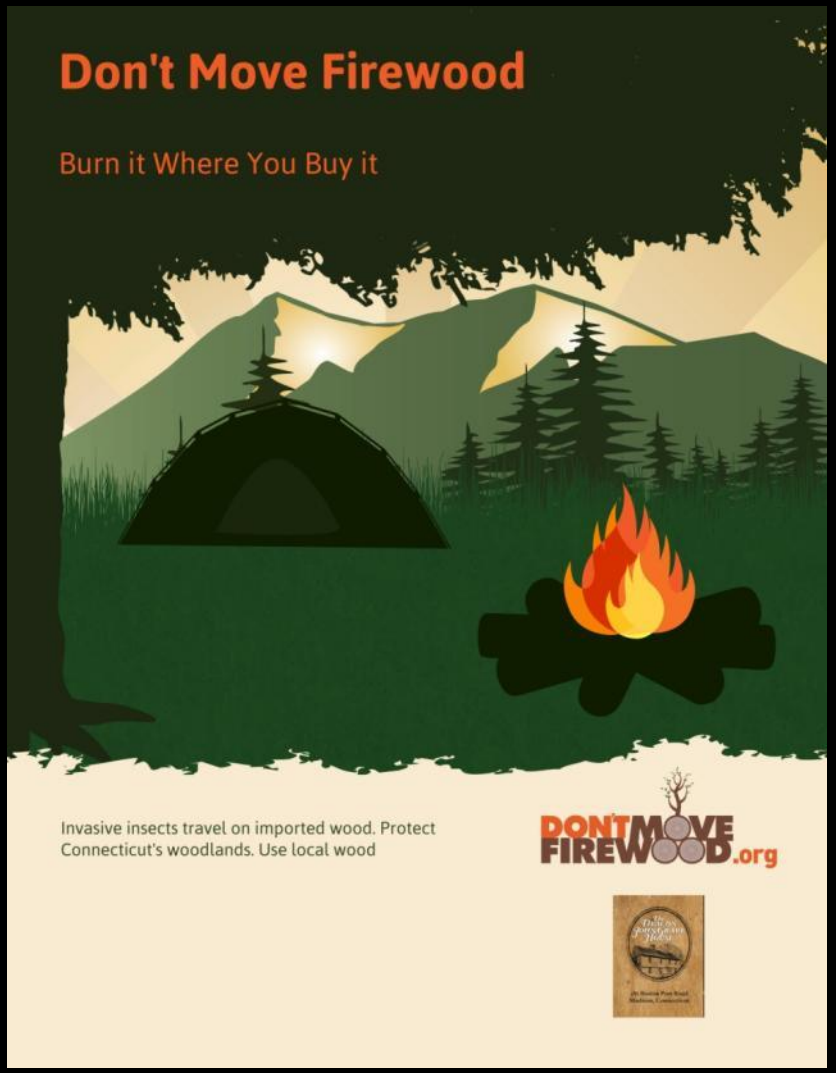
Spread of EAB in North America



20 US states, two Canadian provinces

Spread of EAB in North America

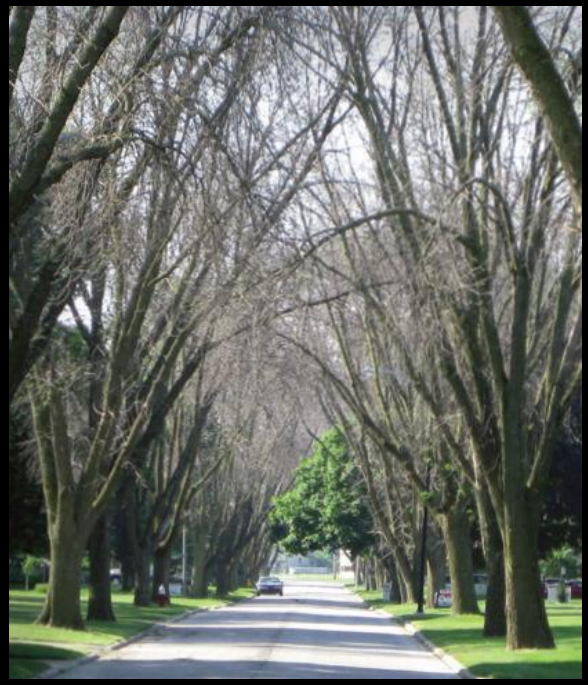
Natural spread: 0.5-1 miles per year
But…



Loss of Millions of Ash Trees in North America

Before

After



Dan Herms, The Ohio State University

8 billion ash trees in North America
Tens of millions ash trees killed by EAB in North America

EAB Life Cycle

Adults mate

Adults lay eggs in ash bark

Eggs hatch into larvae and tunel into tree

Larvae feed under bark, creating S-shaped galleries

Larvae pupates

Adults emerge, leaving D-shaped exit holes

Symptoms and Signs

S- shaped (serpentine) galleries
Larvae about 3 cm long
Disrupt flow of nutrients
Most of the damage

Symptoms and Signs

D-shaped adult exit holes (0.3-0.6 cm)

Symptoms and Signs

Epicormic shoots

Dieback

Symptoms and Signs

Woodpecker damage (yellowing)

Symptoms and Signs

Woodpecker damage (holes and bark flecking)

Ash Canopy Condition

(rating scale by Smith, 2006)

1 2 3 4 5

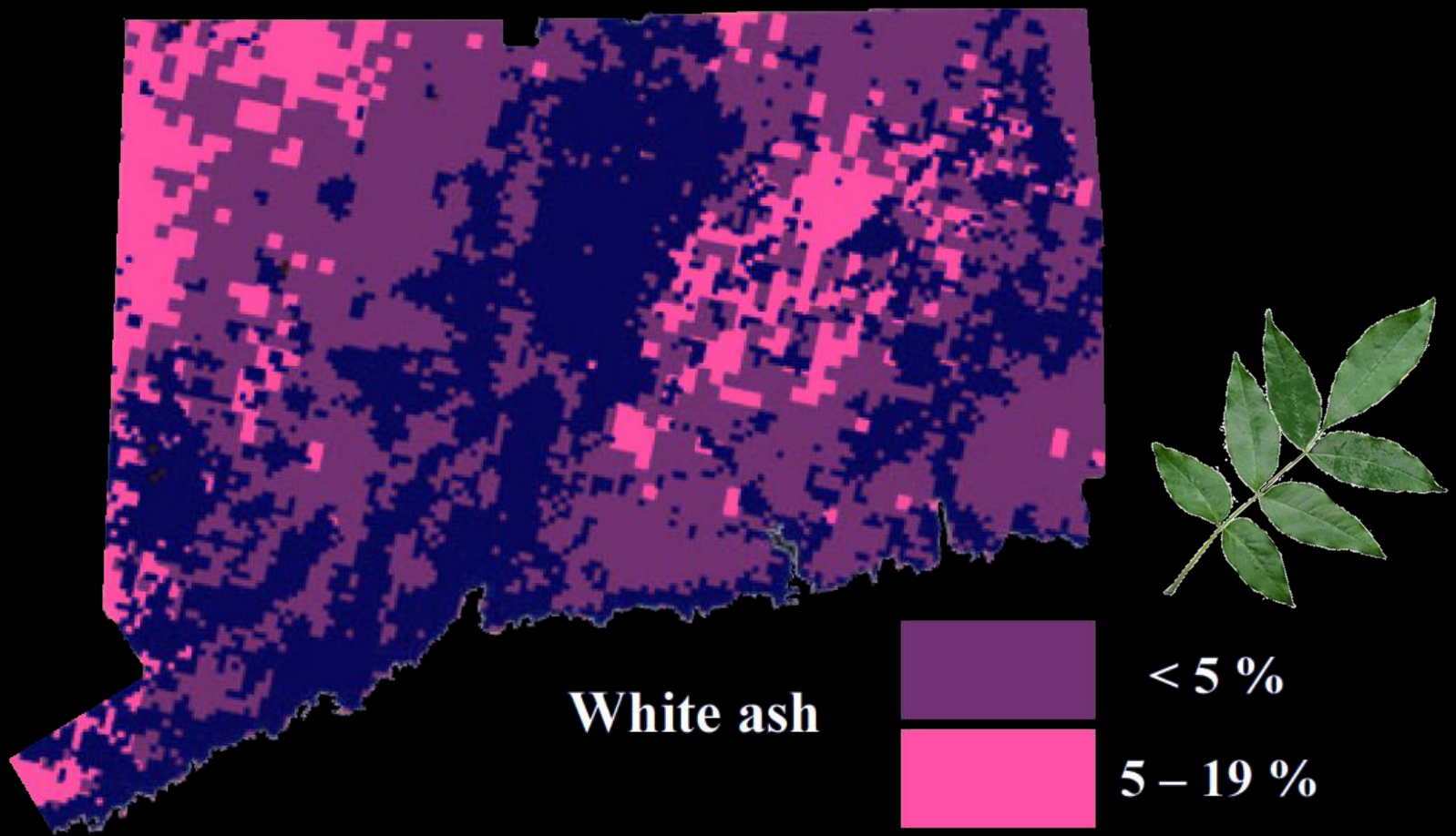
Healthy Tree

Dead Tree

Six years to kill a healthy, mature tree

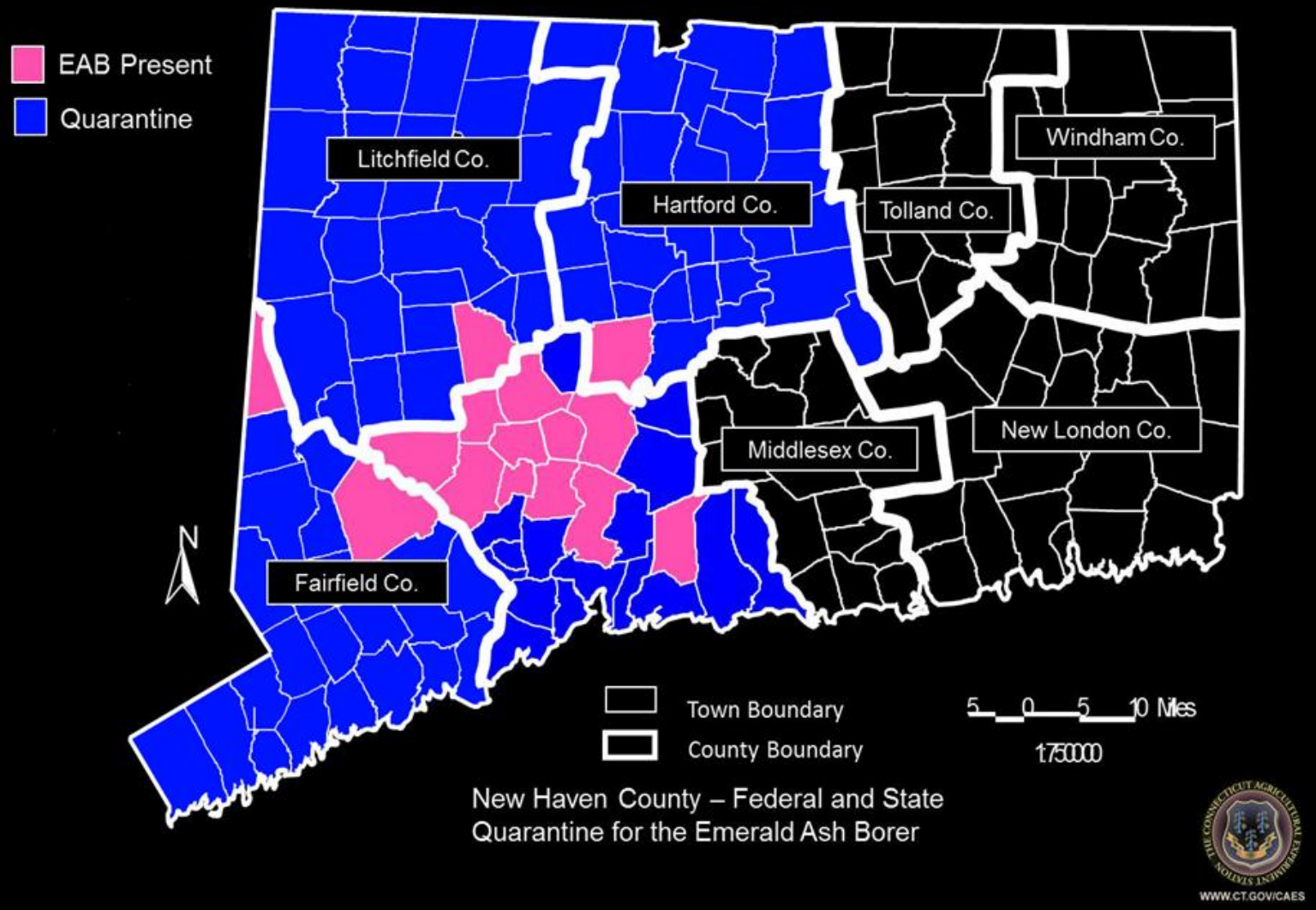
(Knight et al. 2013. *Biol. Invasions* 15: 371–383)

Ash in Connecticut Forest

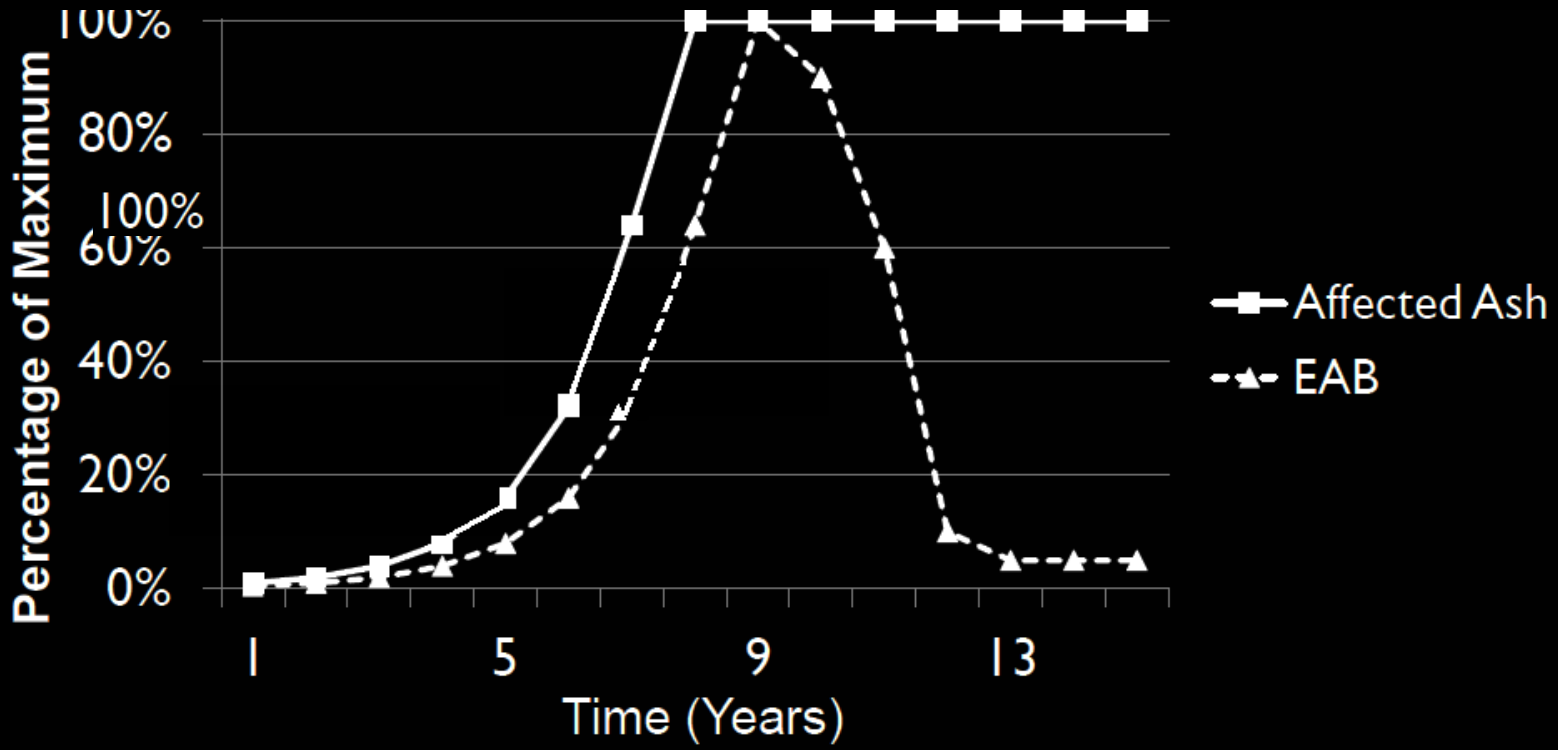


Warthon et al, 2004

EAB in Connecticut



EAB Invasion Wave Curve



Cusp
- -EAB population builds up
- -No or little visible symptoms
- -EAB hard to detect

Crest
- -Peak of population density
- -Widespread symptoms
- -Hazardous trees

Post-Crest
- -Untreated trees have died
- -Resources have depleted
- -EAB colonizes new areas1

EAB Cost Calculator

http://extension.entm.purdue.edu/treecomputer

Web-based tool to help urban foresters make decisions about ash tree management related to emerald ash borer.

Sadof et al., 2011

Milford, CT

Inventory

Size class distribution for Milford's ash

Size Span (inches)	Number of Trees
0 - 4	95
4 - 6	32
6 - 8	74
8 - 10	61
10 - 12	55
12 - 15	83
15 - 20	43
20 - 25	31
25 - 30	16
30 - 40	18
40 - 50	7
50 -	3

Milford

- 100% street tree inventory, 2004
- Milford Tree Inc. - Volunteers
- 15,871 street trees
- 518 (3%) ash trees

Inventory

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25 - 30	16
30 - 40	18
40 - 50	7
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Treatment Cost

DBH	Cost / DBH For Treatment
0 - 4	$3
4 - 6	$3
6 - 8	$3
8 - 10	$3
10 - 12	$3
12 - 15	$3
15 - 20	$4
20 - 25	$4
25 - 30	$4
30 - 40	$4
40 - 50	$4
50 -	$4

Removal Cost

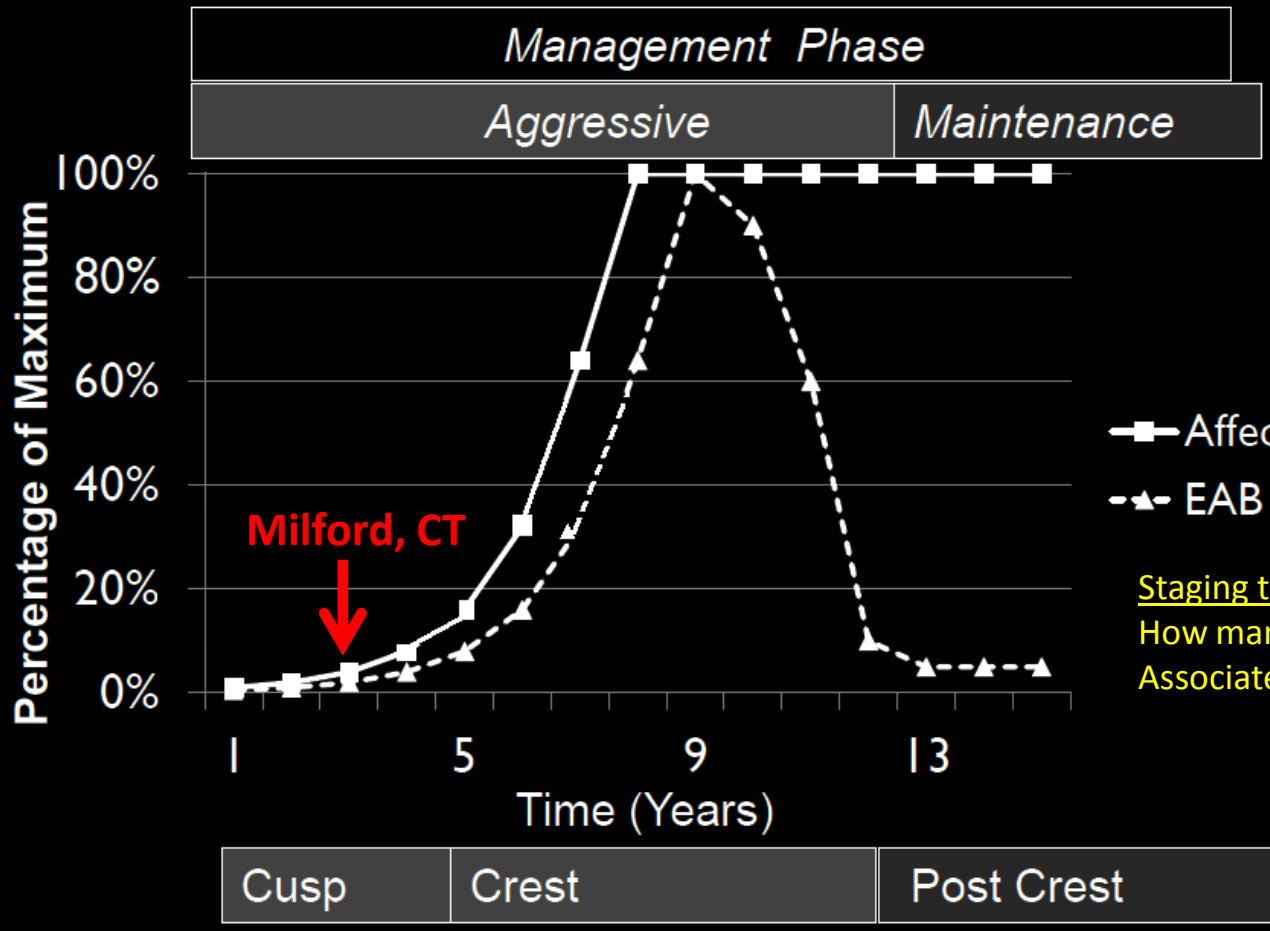
DBH[1]	Avg. Cost / DBH	Adjusted Cost
0 - 4	$11.15	$11.15
4 - 6	$11.15	$11.15
6 - 8	$11.15	$13.35
8 - 10	$11.15	$17.75
10 - 12	$17.75	$17.75
12 - 15	$17.75	$25.00
15 - 20	$17.75	$25.00
20 - 25	$19.20	$25.00
25 - 30	$25.00	$33.00
30 - 40	$25.00	$33.00
40 - 50	$33.00	$33.00
50 -	$33.00	$33.00

Cost s of treatment and removal correspond to dbh

Management Strategies

- Simple Strategies
  - Treat ash trees with insecticides
  - Remove ash trees
  - Replace ash trees with resistant trees
- Pre-designed Strategies
  - Replace <24”
  - Save 50%, etc.
- Custom Strategies

EAB Invasion Wave Curve



Staging the infestation
How many hazardous/dead trees
Associated cost

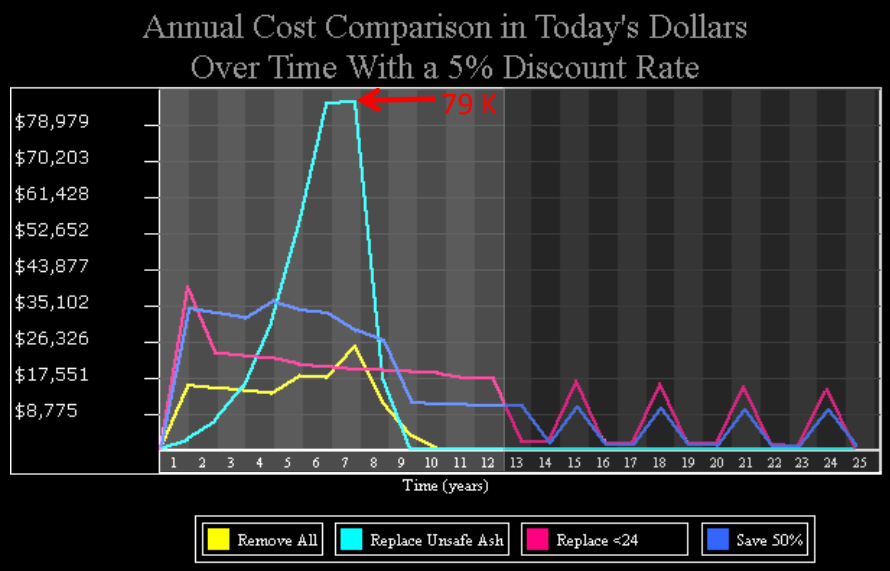
Aggressive
-Cusp+Crest
-Aggressive prevention
-More frequent treatment application

Maintenance
-Post-Crest
-Tree inspection
-Less frequent treatment application

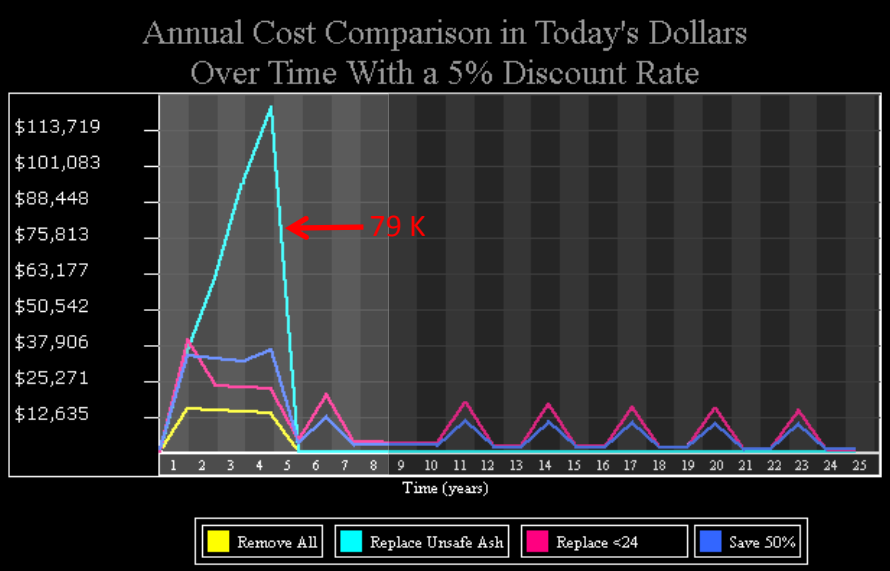
Milford's Case

- Strategies
  - Remove all
  - Replace unsafe ash
  - Replace <24"
  - Save 50%
- Simulations
  - Year 0
  - Year 4
- Treatment
  - Systemic insecticide imidacloprid-Merit ($3/dbh)
    - Aggressive- 1 year application
    - Maintenance- 3 year application

Annual Cost Comparisons



Year 0

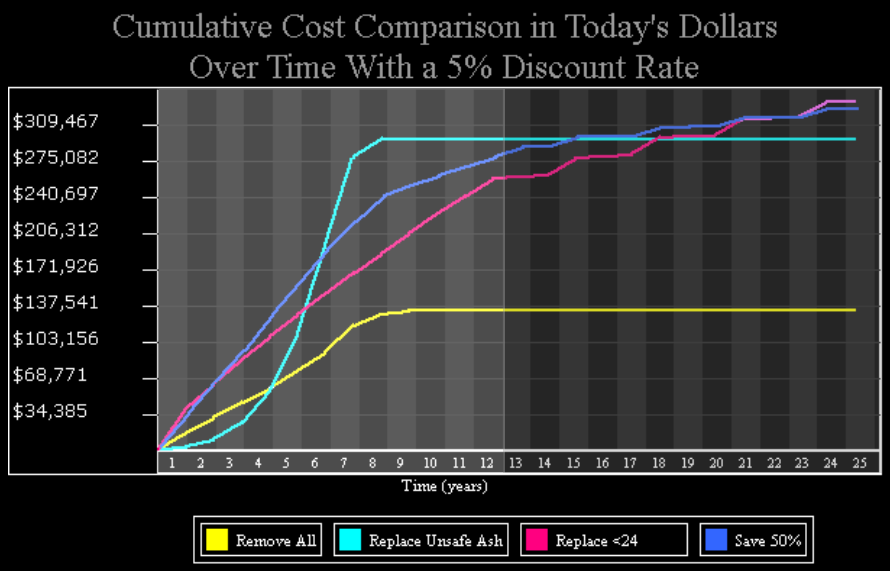


Year 4

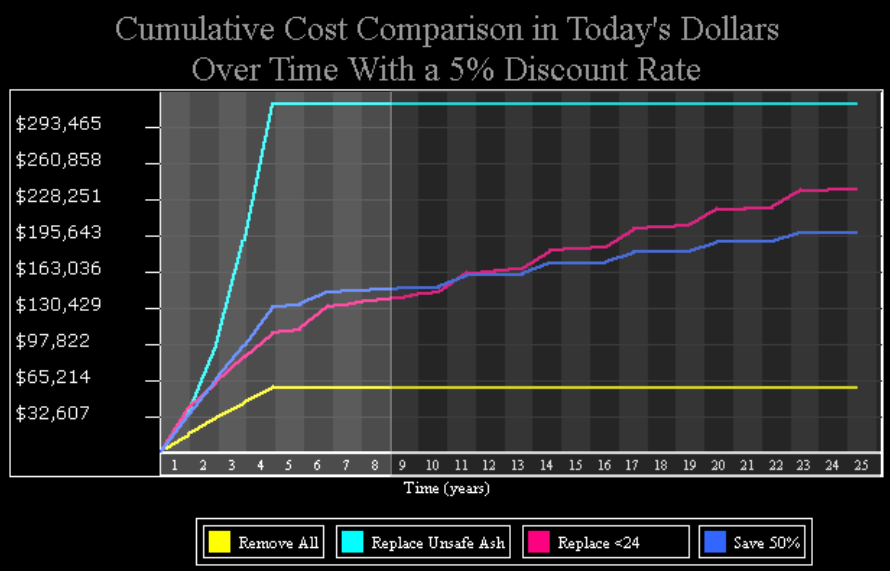
Aggressive Phase (1 year)

Maintenance Phase (3 years)

Cumulative Cost Comparison



Year 0

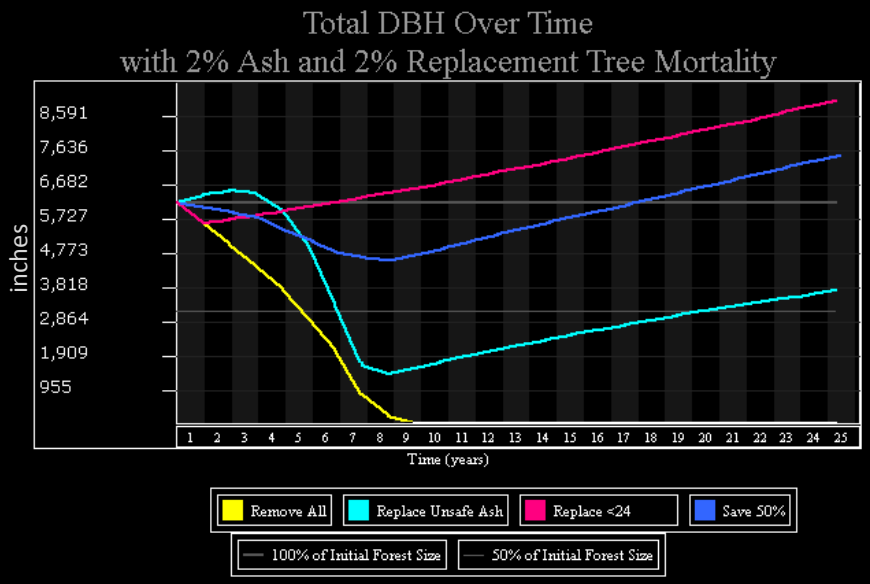


Year 4

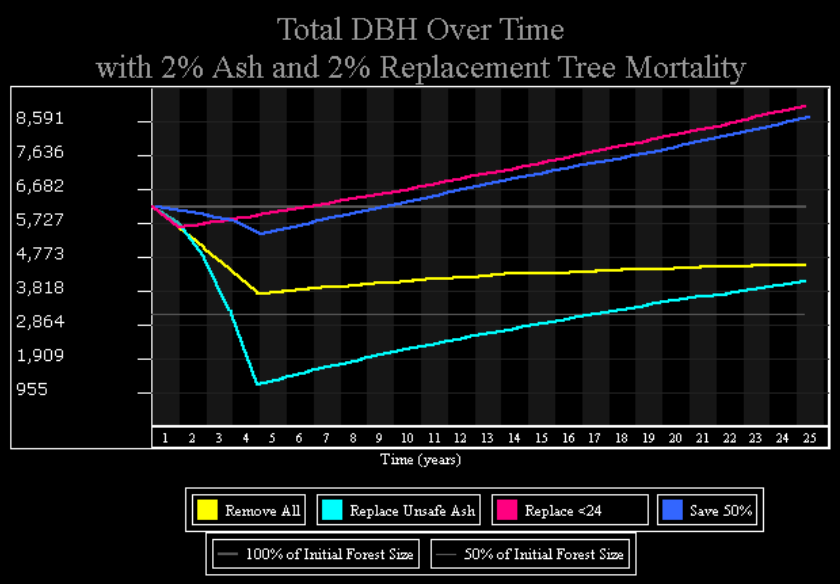
Aggressive Phase (1 year)

Maintenance Phase (3 years)

Total DBH

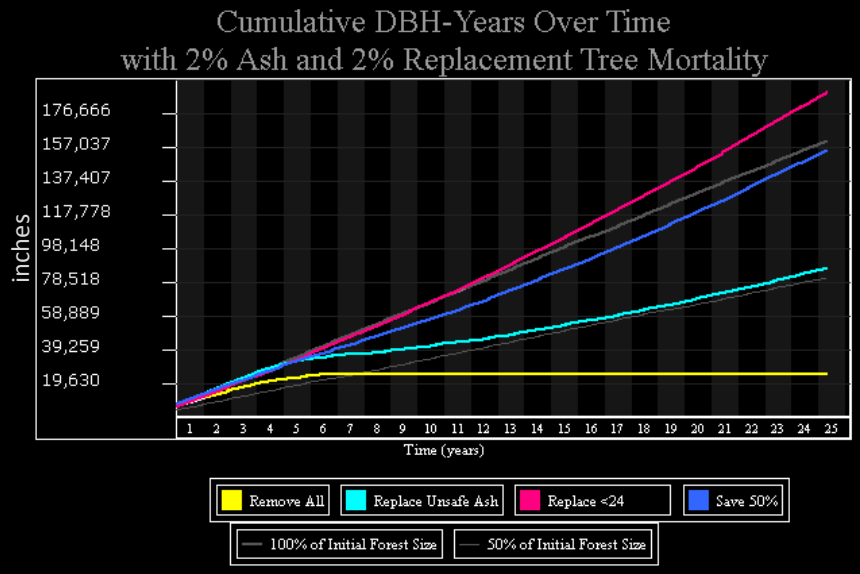


Year 0

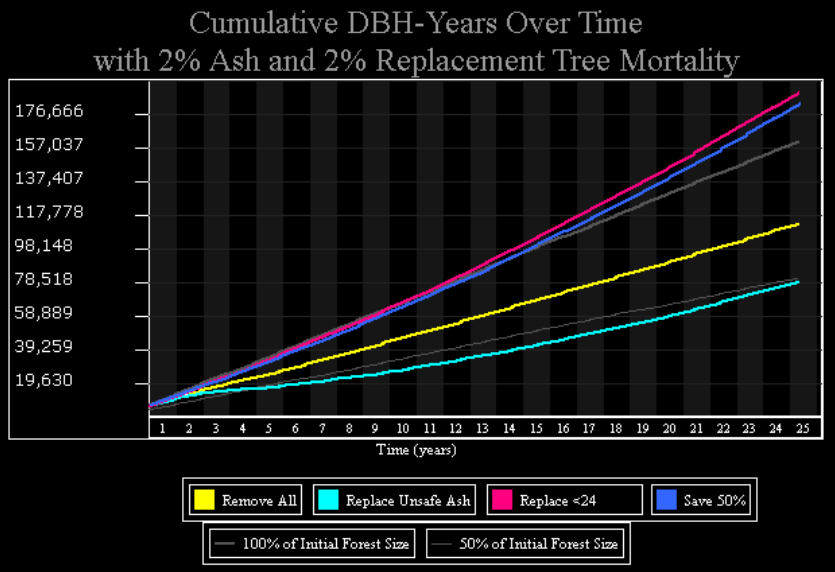


Year 4

Cumulative DBH



Year 0



Year 4

Integrating Tree Benefits

- i-Tree Streets

www.itreetols.org

Benefits
Energy conservation
Air quality improvement
Carbon dioxide sequestration
Stormwater interception
Increase in property value

	All ash trees (518 trees)		Ash Trees Larger than 24" (44 trees)	
	Annual Benefits (US$/tree)	Net Annual Benefits (US$/year)	Annual Benefits (US$/tree)	Net Annual Benefits (US$/year)
Fraxinus americana	120.76	38,160	286.84	6,884
Fraxinus pensylvanica	128.74	26,258	276.17	5,523
Average/Total	124.74	64,418	281.51	12,407

Larger (healthy) trees provide more benefits
9% of ash trees provide 20% of the benefits

Public Involvement

- EAB detection
- Tree surveys (inventories)
  - Complete inventory
  - Sample based survey
  - “Windshield survey”

Conclusions

- EAB infestation is hard to detect before year 4-5
- Tree inventory is crucial
- Pro-active response reduces short-term costs
- Treatment and replacement strategies promote canopy recovery
- It is important to consider tree benefits

Acknowledgements

- Milford Tree Inc. for providing data from Milford, CT
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Questions?

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