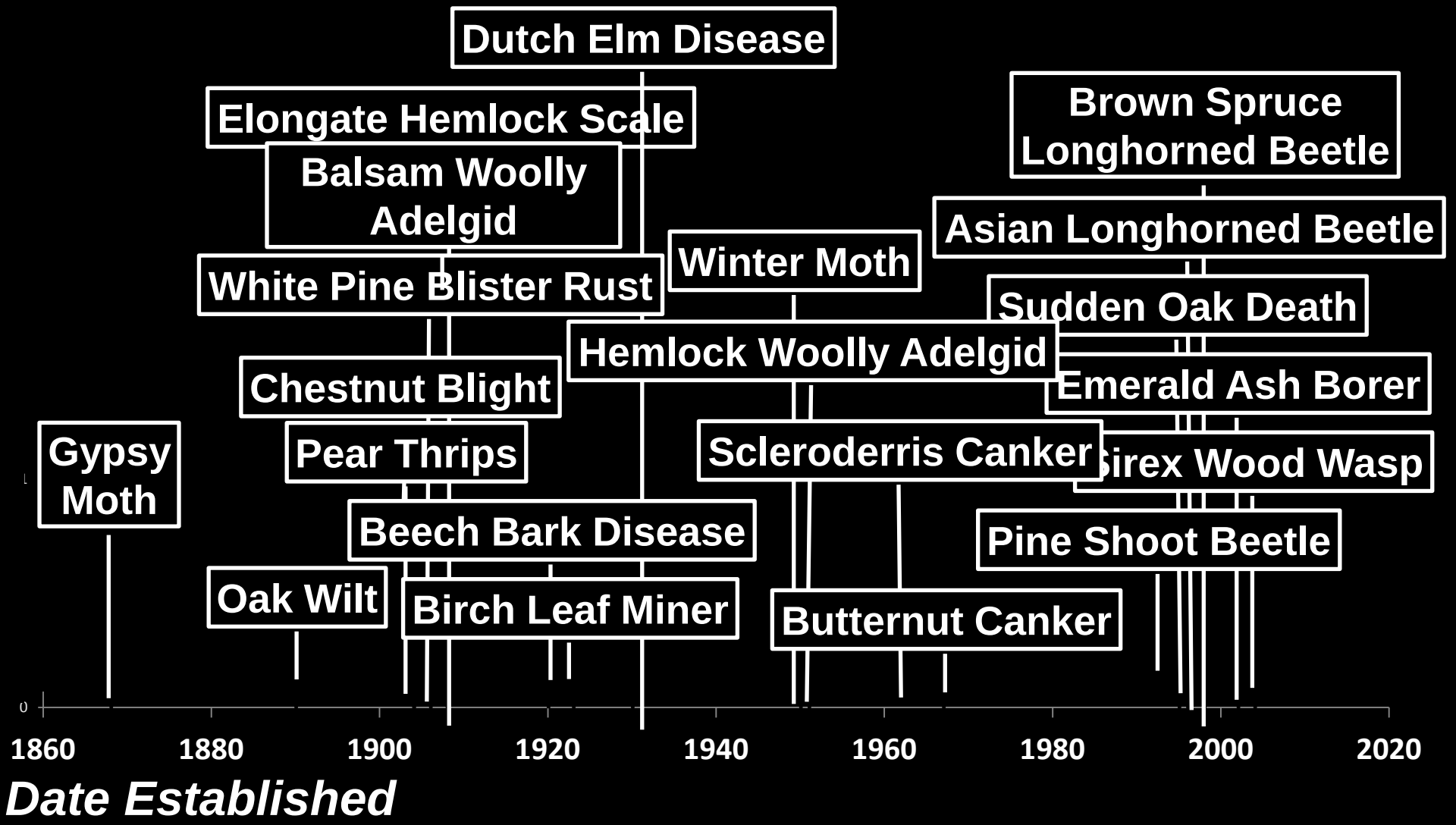
Managing Non-native Forest Pests in Vermont:

Background for Discussing the Role of Pesticides

Non-native Forest Insects and Diseases Established in North America

± 500 known Species



Asian Longhorned Beetle

Emerald Ash Borer

Hemlock Woolly Adelgid

Asian Longhorned Beetle

Hosts of Asian Longhorned Beetle


Sugar Maple (*Acer saccharum*)


Silver Maple (*Acer saccharinum*)


Red Maple (*Acer rubrum*)


Weeping Willow (*Salix babylonica*)


Black Willow (*Salix nigra*)


European Mountain Ash (*Sorbus aucuparia*)


Common Hackberry (*Celtis occidentalis*)


Green Ash (*Fraxinus pennsylvanica*)


Norway Maple (*Acer platanoides*)


Box Elder (*Acer negundo*)


Sycamore Maple (*Acer pseudoplatanus*)


American Sycamore (*Platanus occidentalis*)


London Plane Tree (*Platanus x acerifolia*)


Horse Chestnut (*Aesculus hippocastanum*)


Golden Rain Tree (*Koelreuteria paniculata*)


Gray Birch (*Betula populifolia*)


Paper Birch (*Betula papyrifera*)


Siberian Elm (*Ulmus pumila*)


American Elm (*Ulmus americana*)


Poplar (*Populus alba*)


Katsura (*Cercidiphyllum japonicum*)


Silktree (*Albizia julibrissin*)

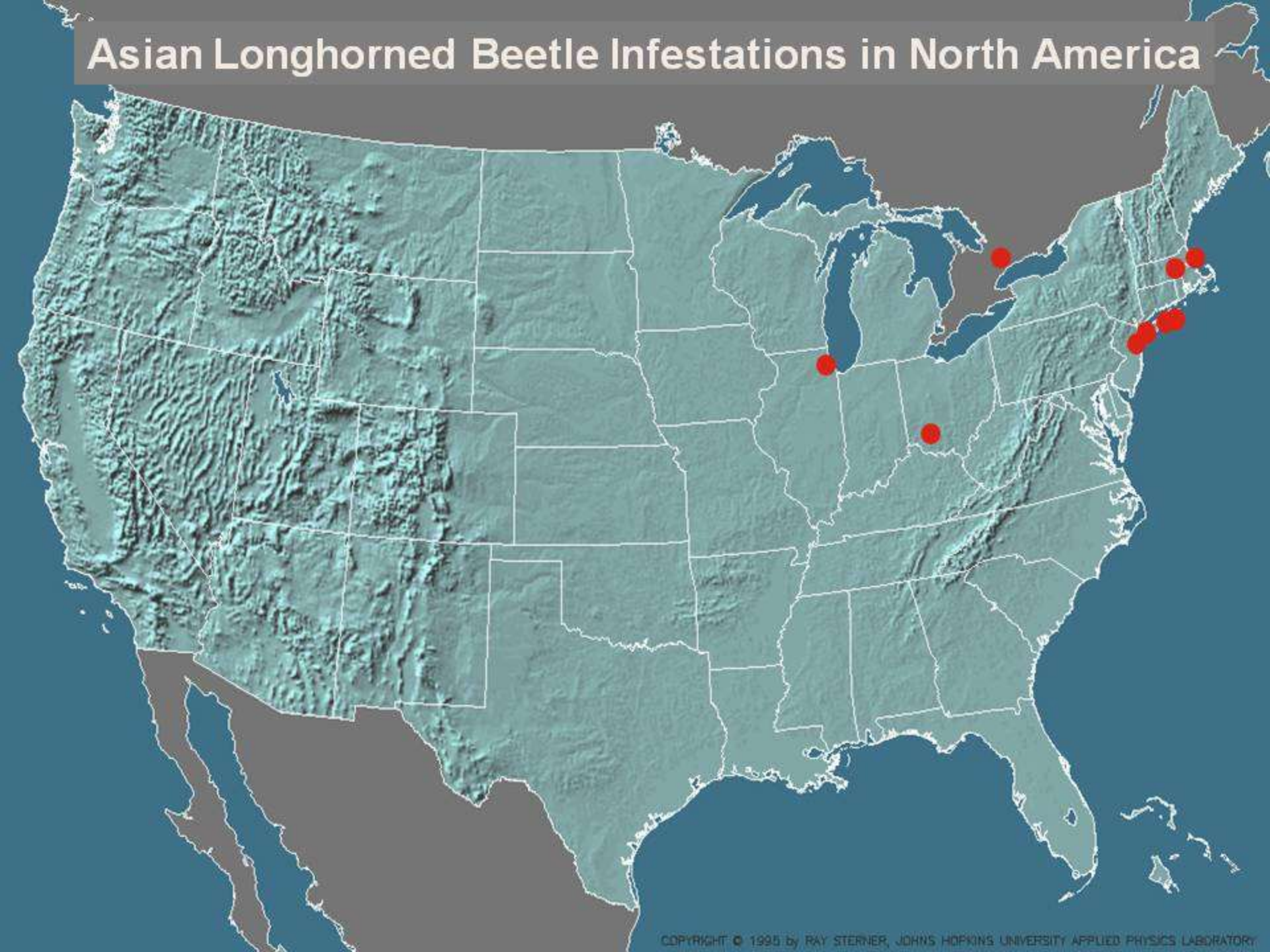
NOT Host Trees:

- oak
- apple, crabapple
- cherry, other stone fruit trees
- pine, fir, spruce and other softwoods (conifers)

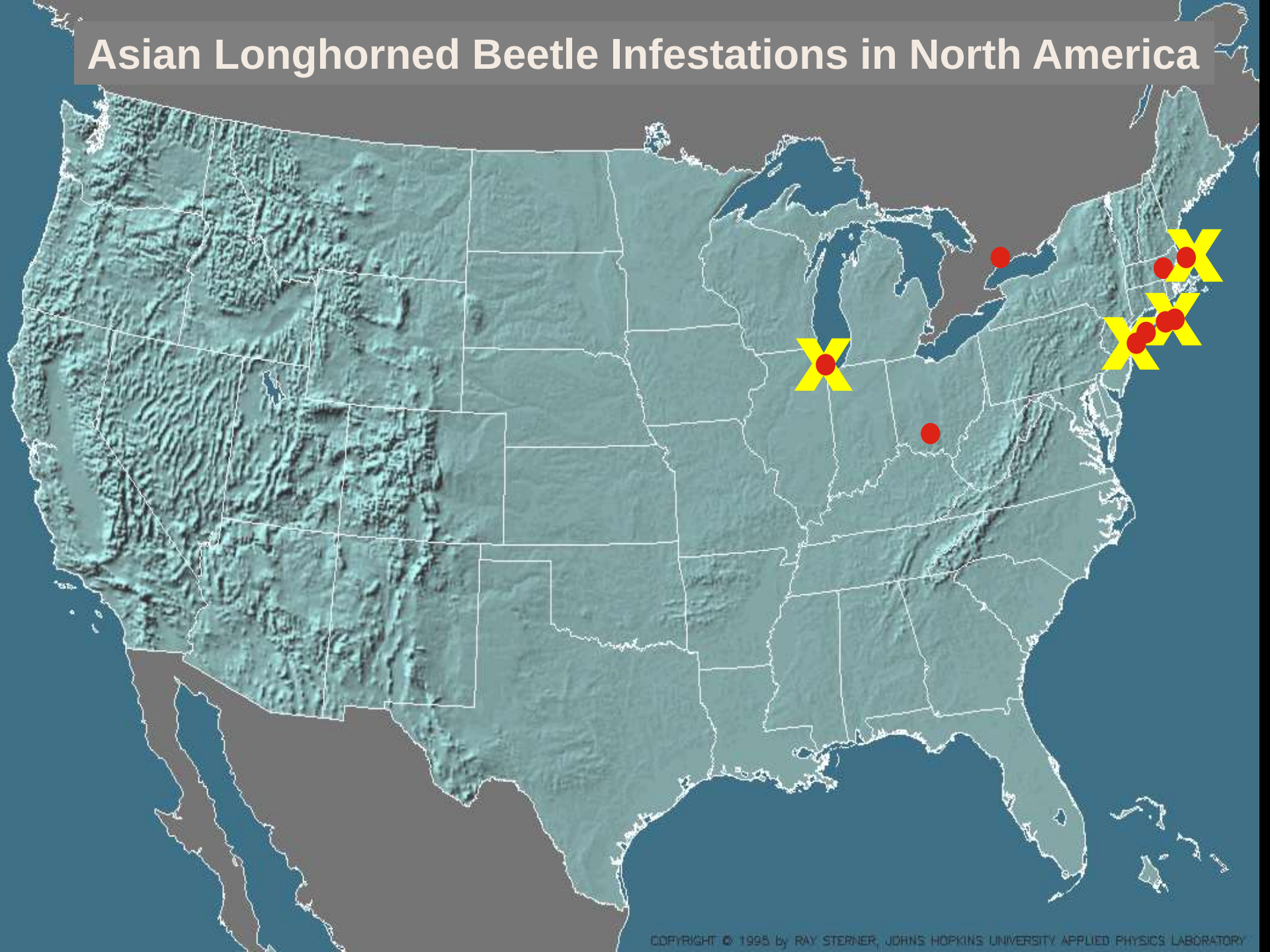
MDAR
MASSACHUSETTS DEPARTMENT OF AGRICULTURAL RESOURCES
http://www.mass.gov/agr

E. Richard Hoebeke, Cornell University, Bugwood.org

Asian Longhorned Beetle Infestations in North America



Asian Longhorned Beetle Infestations in North America



Asian Longhorned Beetle

Control Strategy

Infested trees: Remove ALB-infested host material. Presence of oviposition sites or exit holes indicates infestation.

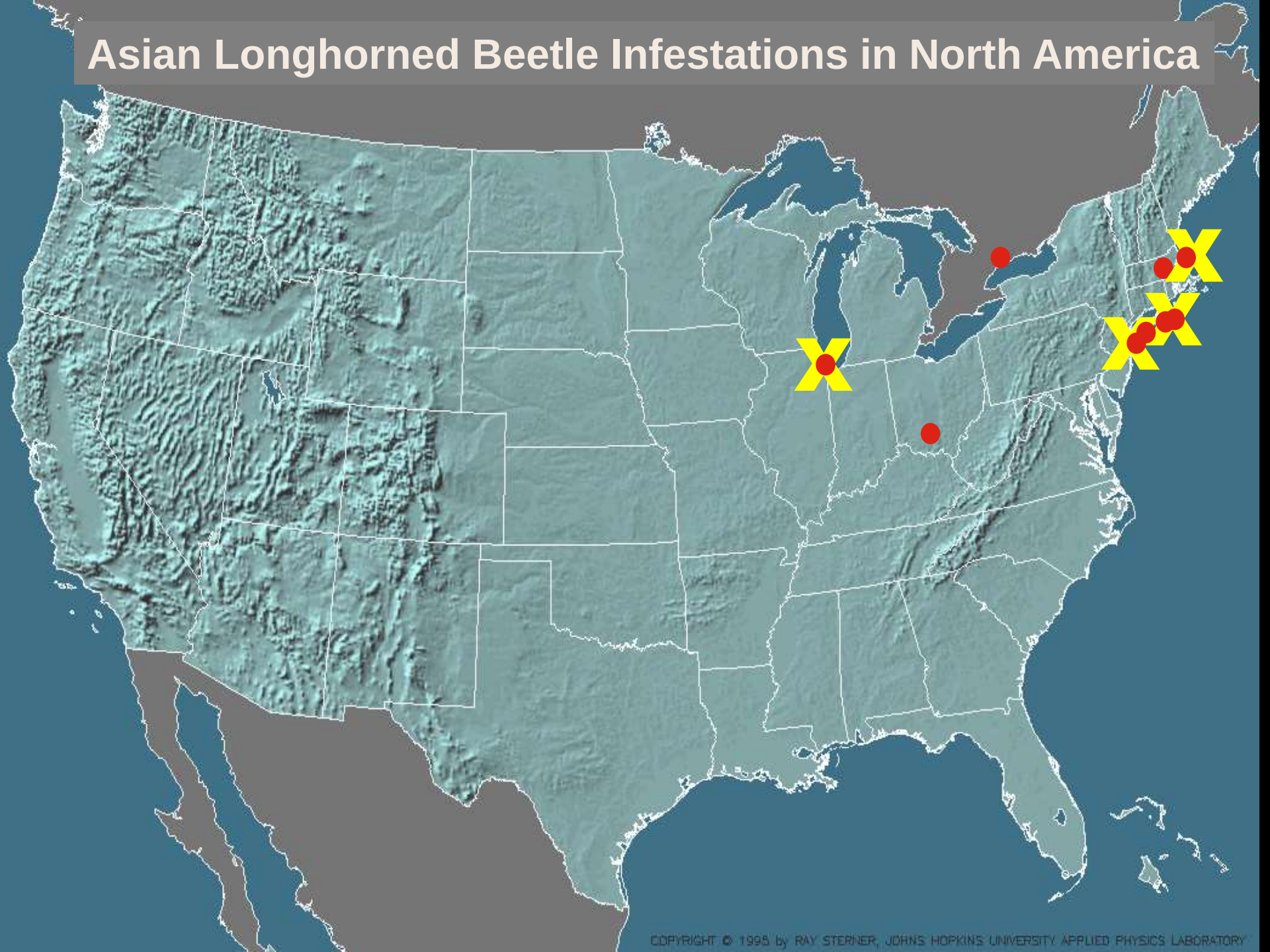
Control zone: Remove or chemically treat all ALB host material up to ½ mile radius of infested hosts.

1. Soil or trunk injection of insecticides:
Imidacloprid, a chemical with systemic properties and low mammalian toxicity, has been found to be effective against adult ALB as it feeds on small twigs, the female when depositing eggs, and young larvae. This insecticide is formulated for soil and trunk applications from a number of sources. The contractor/applicator and Contracting Officer's Representative (COR) must have all pesticide and 2(ee) labels (if required by the state) at all times

E. Richard Hoebeke, Cornell University, Bugwood.org


UGA1393008

Asian Longhorned Beetle Infestations in North America



Emerald Ash Borer

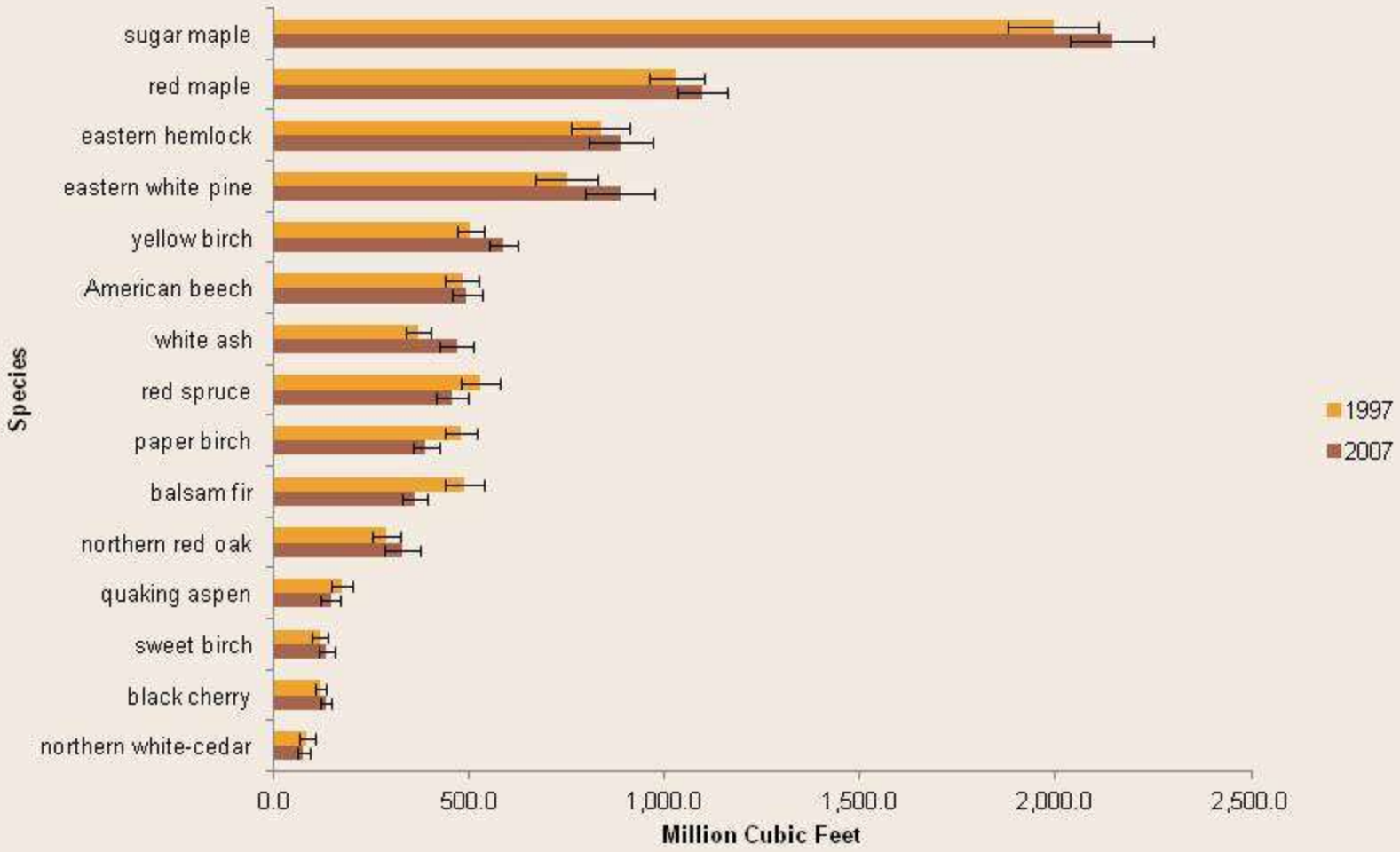
Only feeds on Ash.

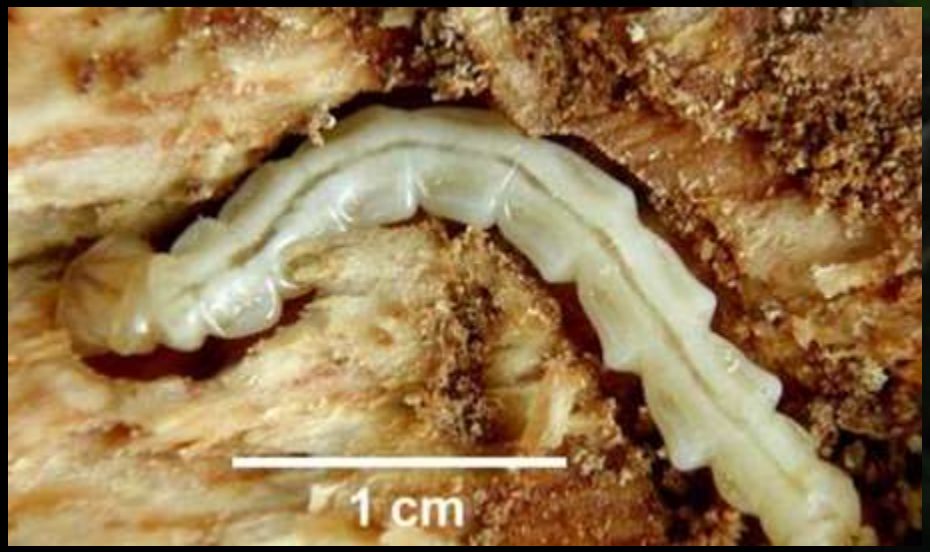
White Ash

Green Ash

Black Ash

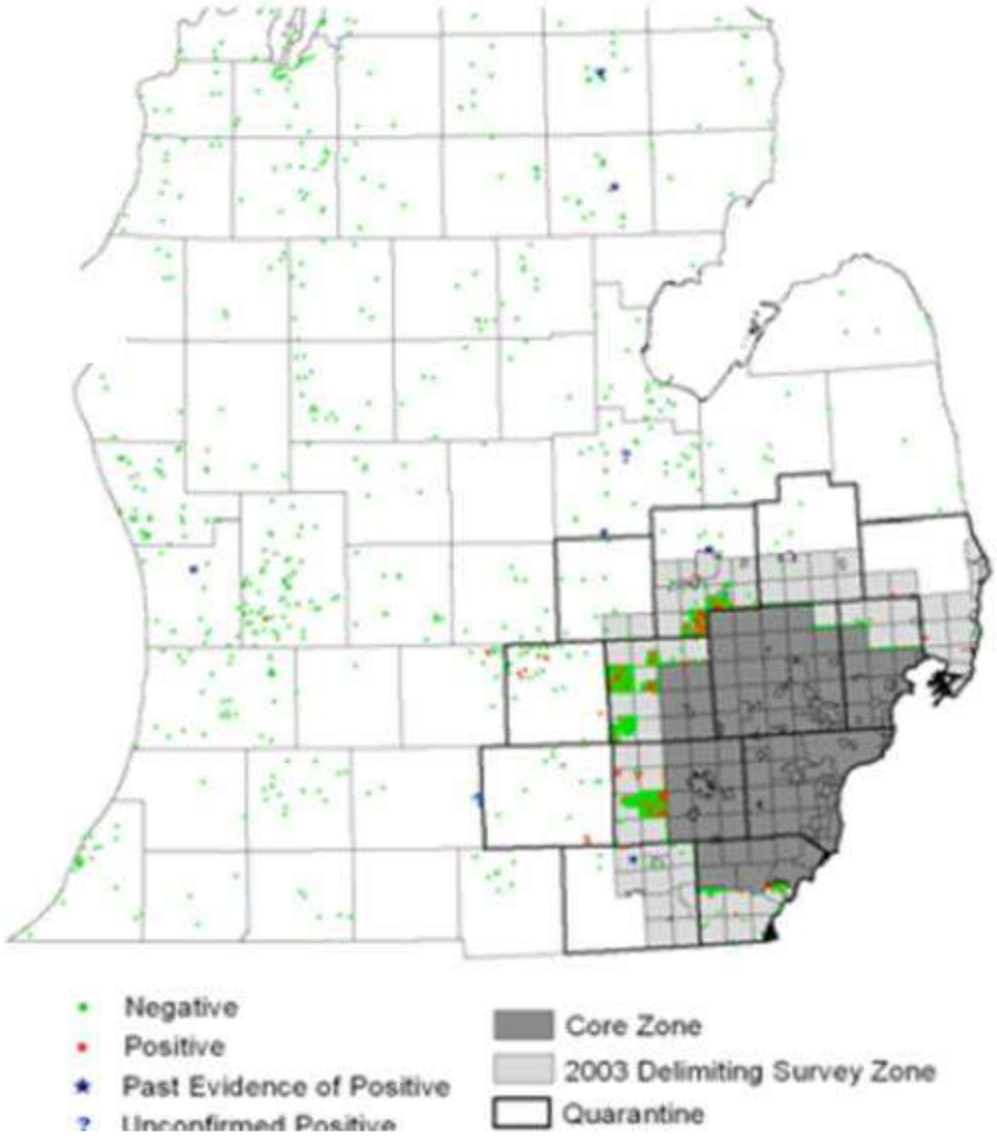
Growing Stock Volume by Species




1 cm


Michigan 2004

Found near Detroit in 2002.

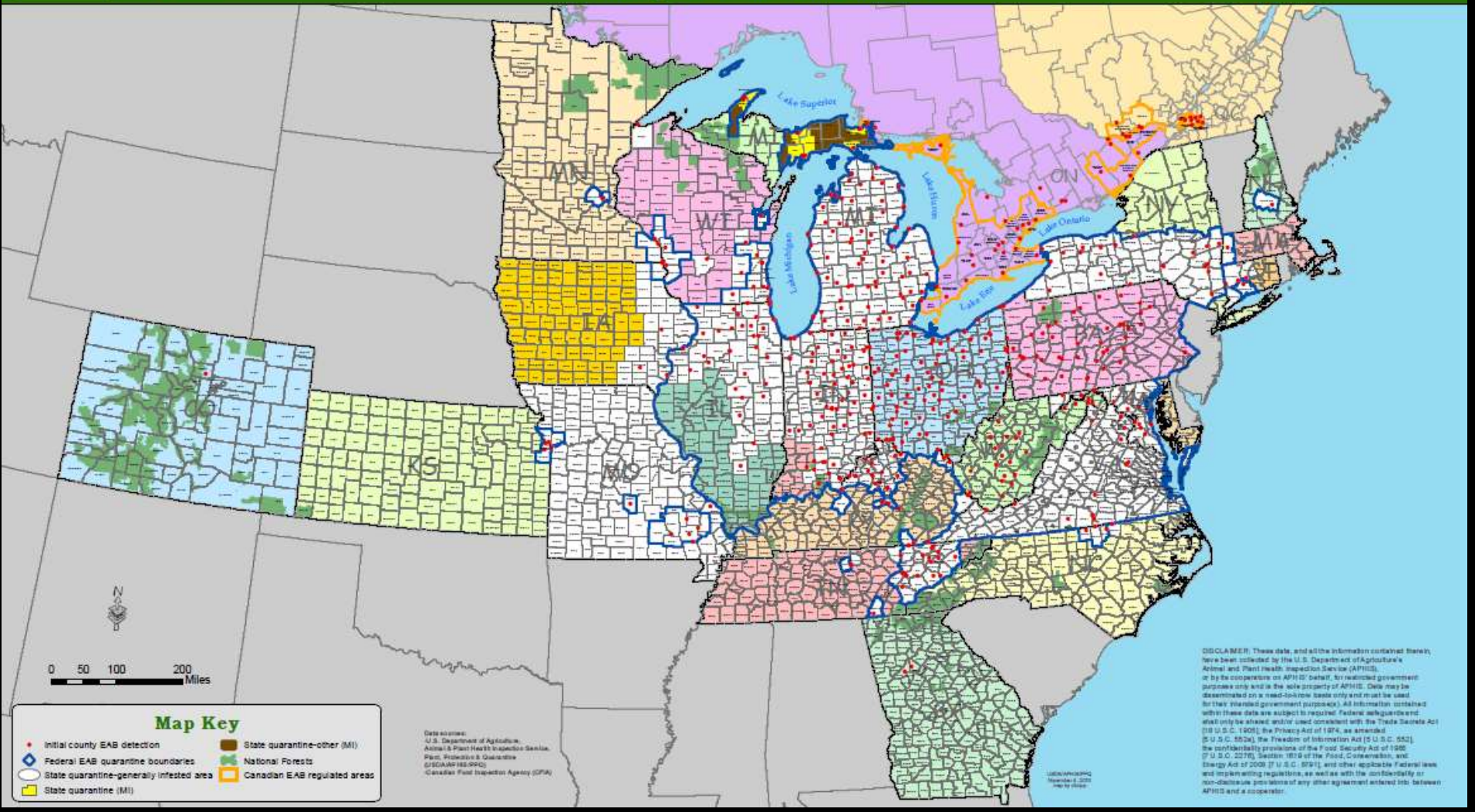


USDA United States Department of Agriculture

Cooperative Emerald Ash Borer Project

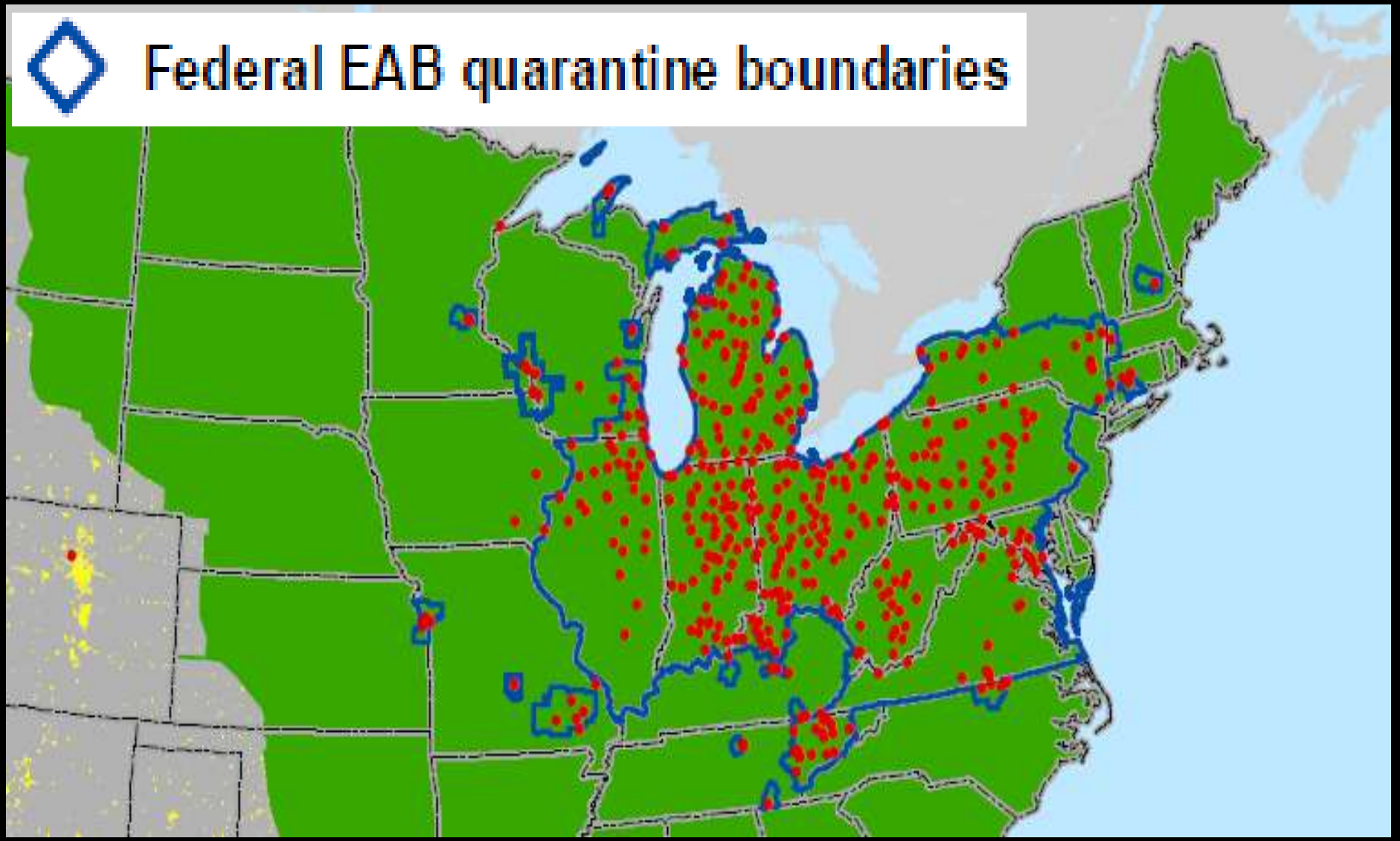
Initial county EAB detections in North America

November 4, 2013

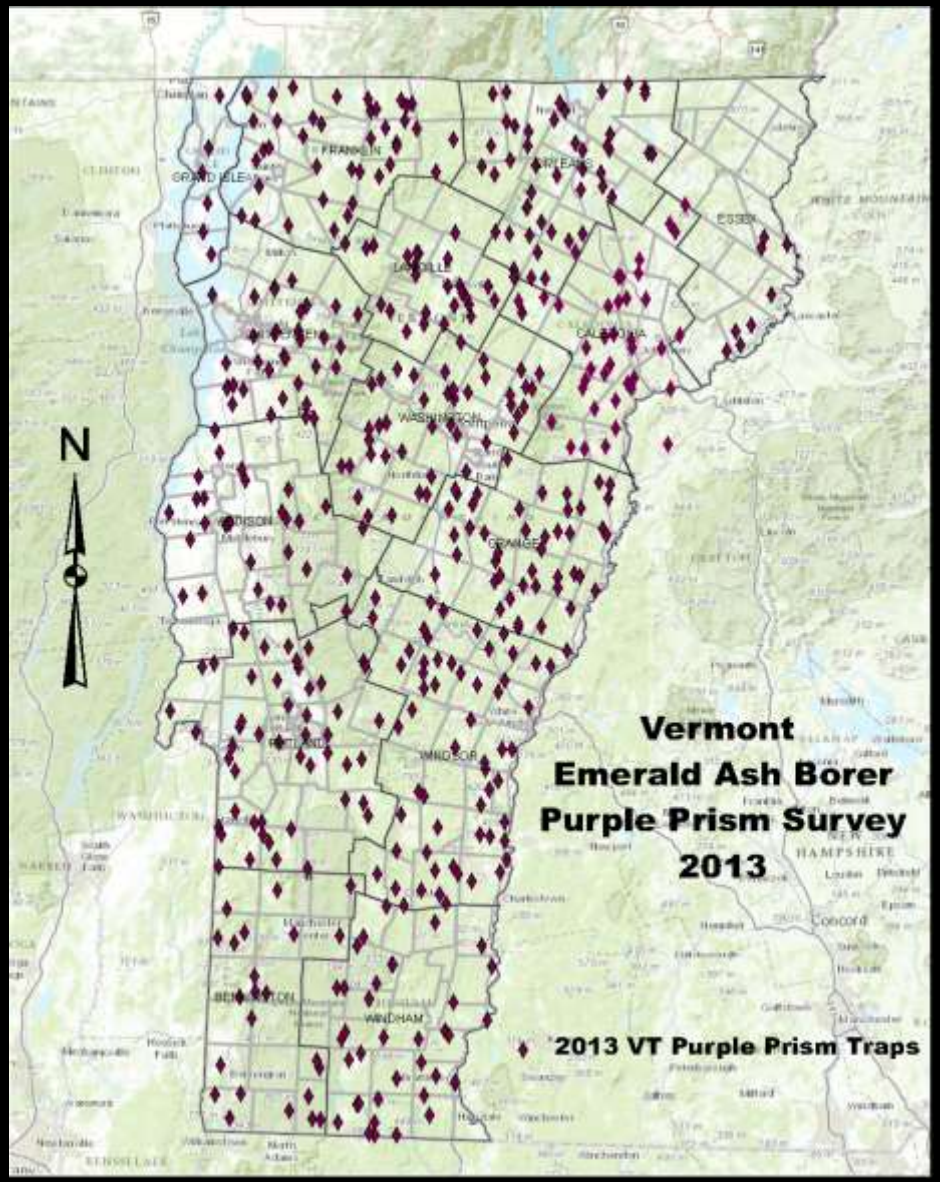


We won't get rid of EAB by removing ash trees.

USDA United States Department of Agriculture
Animal and Plant Health Inspection Service



USDA United States Department of Agriculture
Animal and Plant Health Inspection Service



USDA United States Department of Agriculture
Forest Service

Emerald Ash Borer

Identification, Selection and Testing of "Lingering Ash" in Emerald Ash Borer Long Term Monitoring Plots in Michigan and Ohio

Research Issue

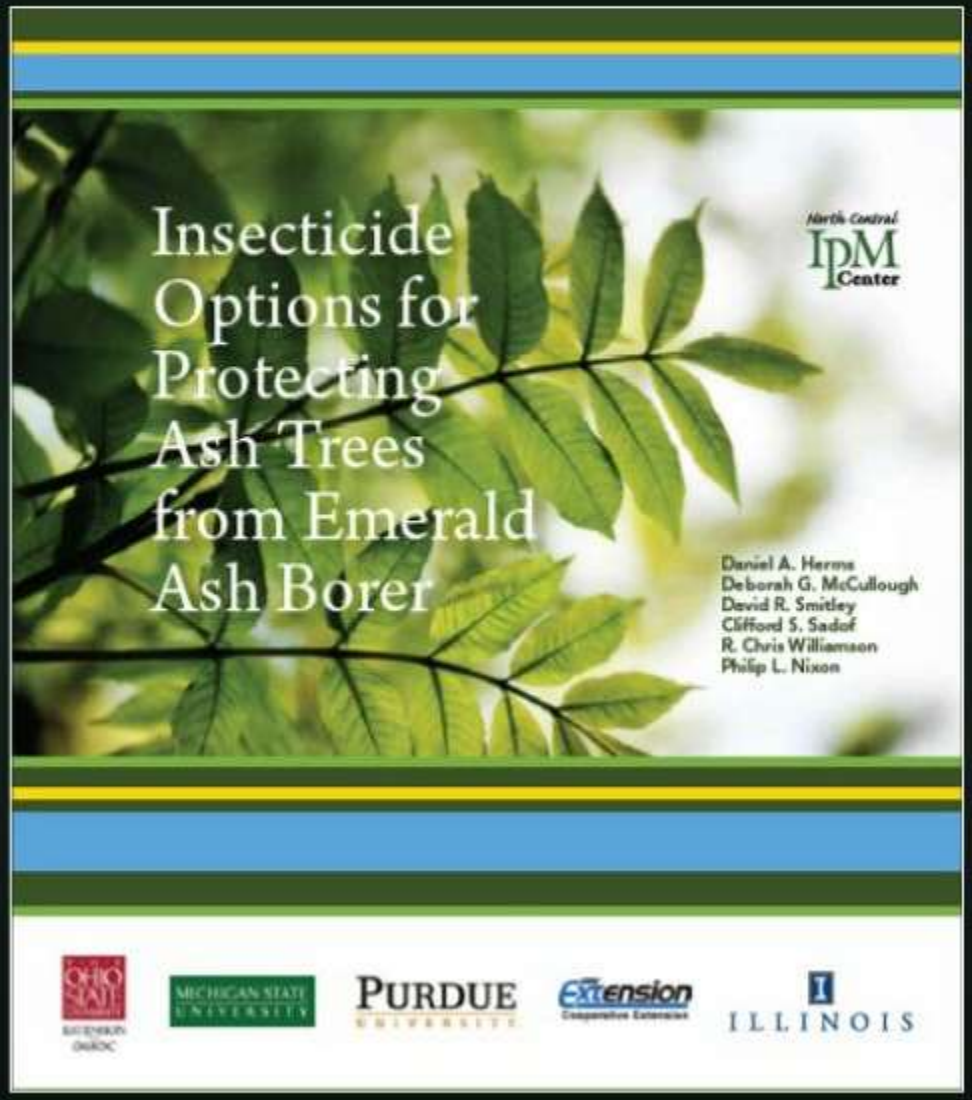
Initial reports after the outbreak of emerald ash borer (*Agrilus planipennis*, EAB) indicated that there was no resistance to this insect in the Detroit area, where ashes were popular street trees. Urban trees are usually only a few horticultural selections of the species and are thus a limited representation of the species' genetics.

As the beetle spread away from urban areas into more genetically diverse native stands and woodlots, plots were established to monitor the impact of EAB in these areas. During this yearly

0.3% of ash trees "linger"

Parasites from Asia have been released in many infested states.

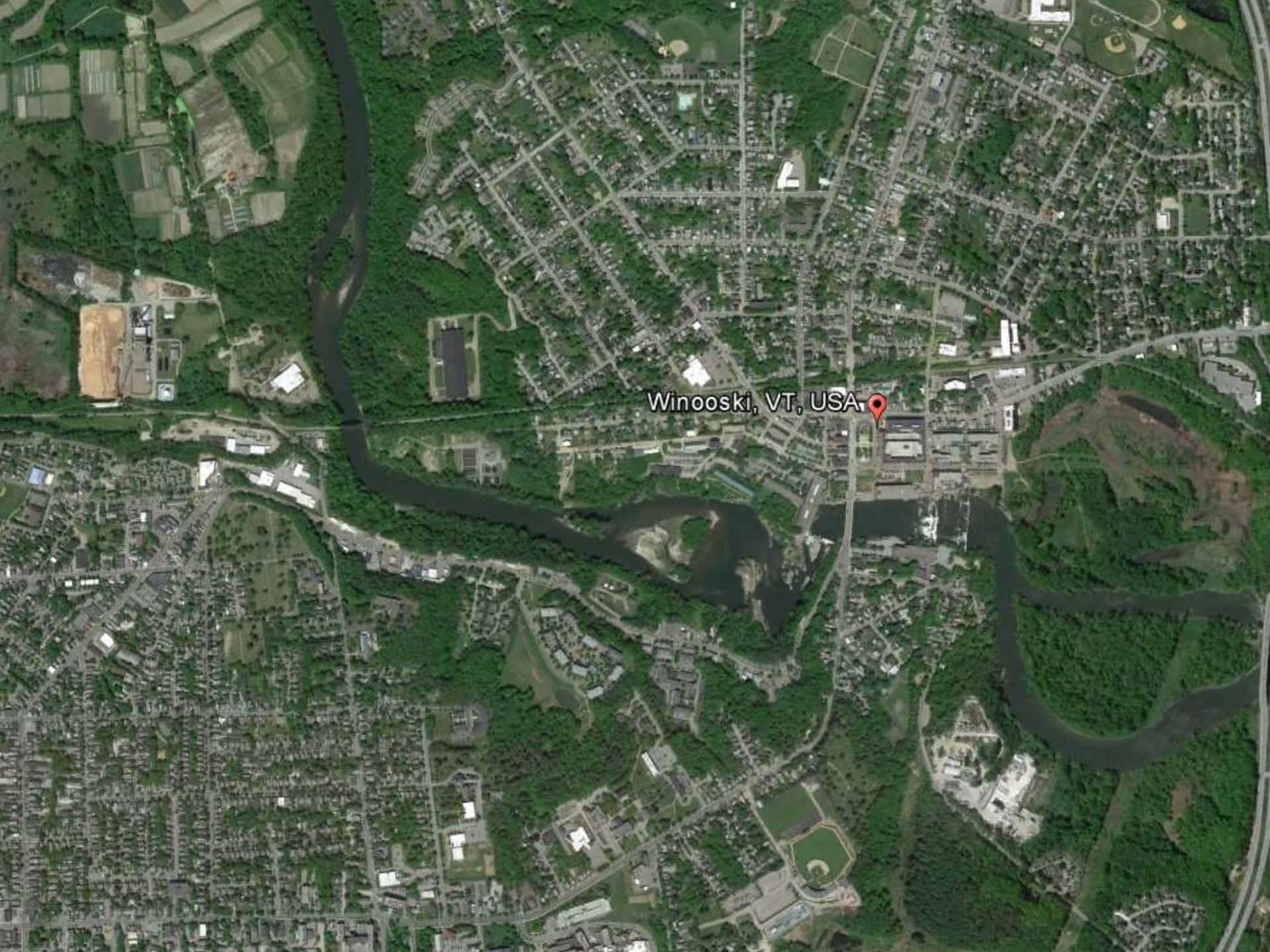
emeraldashborer.info



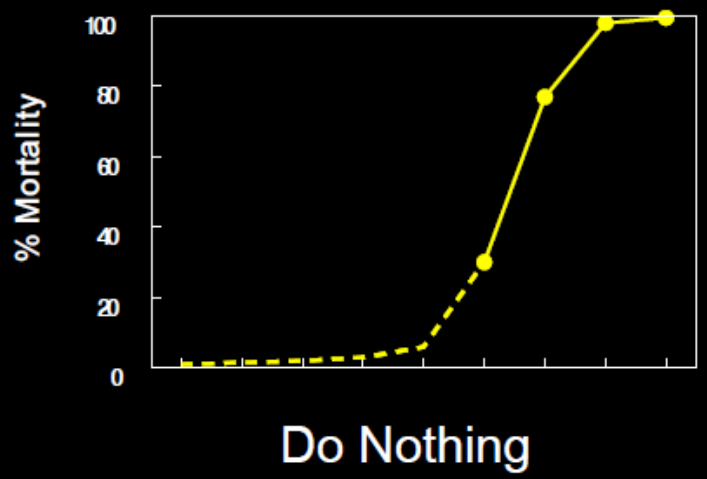
Key Conclusions:

1. Insecticides are effective on large trees even under intense pest pressure.
2. Imidacloprid soil drenches most effective on large trees when applied at the 2X (2.8 g ai / inch DBH) rate.
3. All things equal, spring imidacloprid soil treatments are more effective than fall.
4. Safari soil and basal bark spray treatments providing good control.
5. Emamectin benzoate provides 2 years of control on very large trees even at lowest rate.
6. In head-to-head comparison, TREE-äge trunk injection and Xytect soil drench were more effective than Pointer.

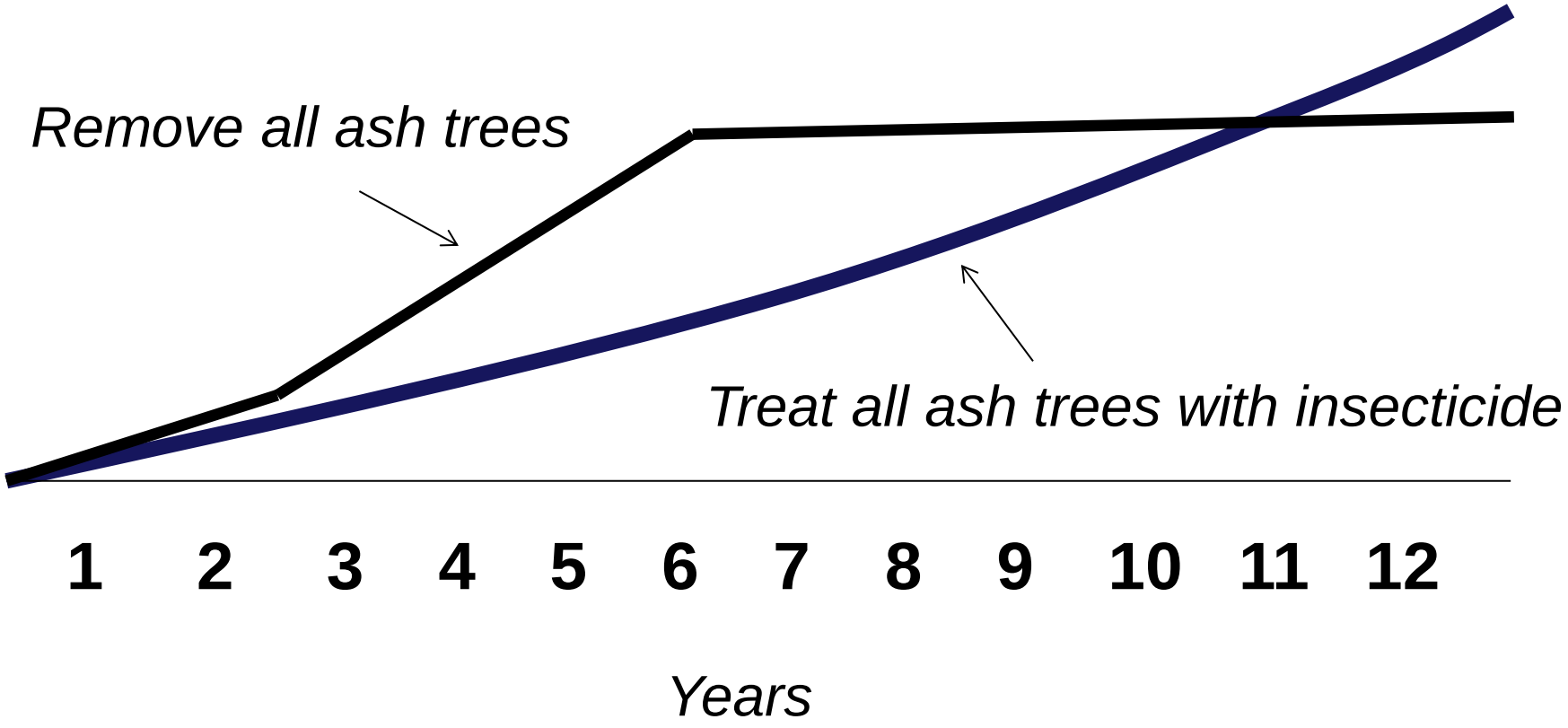
David Cappaert, Michigan State University, Bugwood.org


Winooski, VT, USA

Hypothetical Ash Mortality Trajectories as Manipulated by Insecticides



Cumulative Cost in Today's Dollars



VERMONT
INVASIVES
Actively Conserving our Environment

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Prepare Your Community

Non-native invasive forest pests, such as the emerald ash borer (EAB), Asian longhorn beetle (ALB) and hemlock woolly adelgid (HWA), know no boundaries. Their arrival does not just affect private landowners; these pests affect communities as well. Plan ahead to minimize the severity of impacts and establish a solid foundation for recovery.

UNIVERSITY OF VERMONT EXTENSION
CULTIVATING HEALTHY COMMUNITIES

Chemical control

Healthy, properly located, large-canopy trees provide the most environmental, social and economic benefits to a community. Preserving these trees as long as possible will do the most to minimize the impact of EAB on your community.

There are several effective insecticides labeled for EAB control. The toolkit of chemical options and application techniques is likely to change as research advances. In general, the cost of chemical treatment is reasonable compared to the cost of removal and the social and environmental benefits of a healthy, mature ash tree. However, applications must be treated on a 1-3 year interval depending on the chemical and application technique and even at a reasonable cost it seems unlikely that municipalities/homeowners will be willing to treat a high percentage of ash trees. Municipal tree managers will have to determine how many ash trees to treat and at what point is it more costs effective to remove the tree and replace it with a different species. Managers will need to set criteria for determining if a tree should be injected, even with private funds.

When to begin preventive insecticide treatments is open to debate. The official recommendation is to begin treatments when EAB is within about 15 miles of your site. However, since early detection methods are not very reliable and trees in new infestations typically don't show obvious symptoms for the first few years, you can't be certain where EAB is until it has already begun damaging a tree. Available resources, the value of the tree and your tolerance for risk will have to go into your decision on when to start treatment.

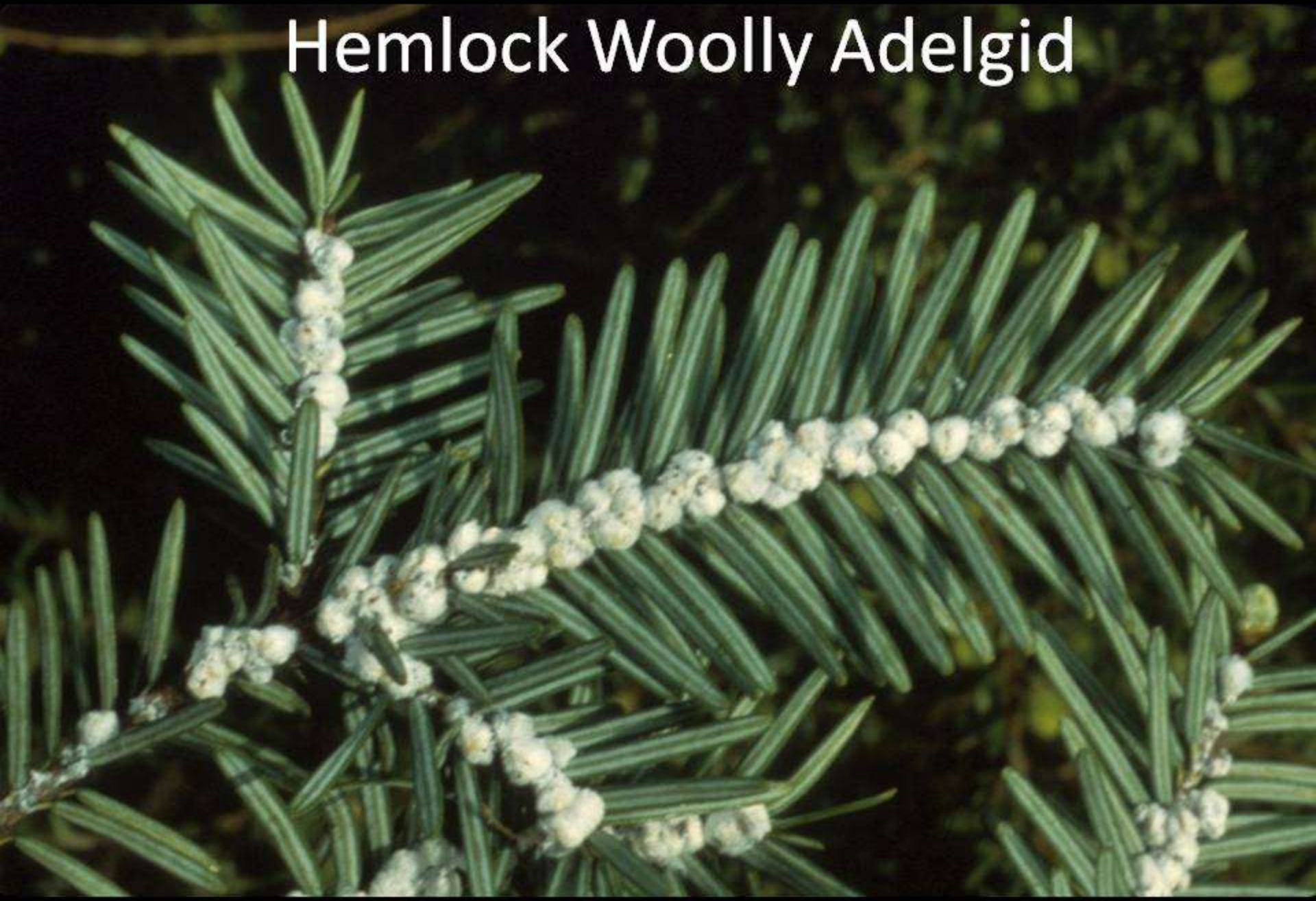
The document Pesticide Considerations will assist you with selecting trees to treat, how to treat them and by whom.

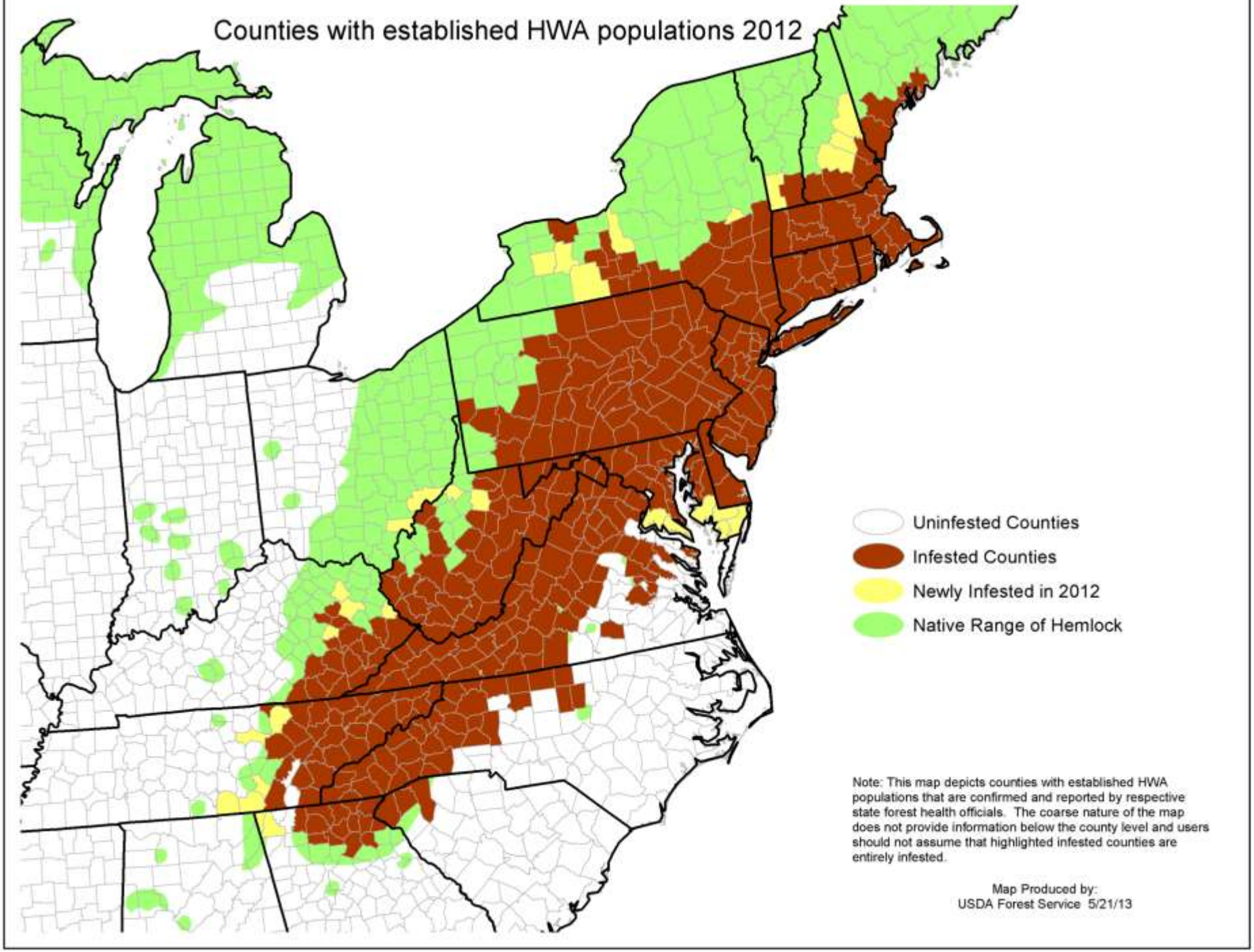
Download the list of Certified Pesticide Applicators for Category 3A-Ornamental & Shade Tree pest control as of October 2012. or search the Vermont Agency of Agriculture Pesticide Applicators Database. Contact Matthew Wood Matthew.Wood@state.vt.us or (802) 828-3482 for an updated list.

For information about EAB and pesticide use, go to:

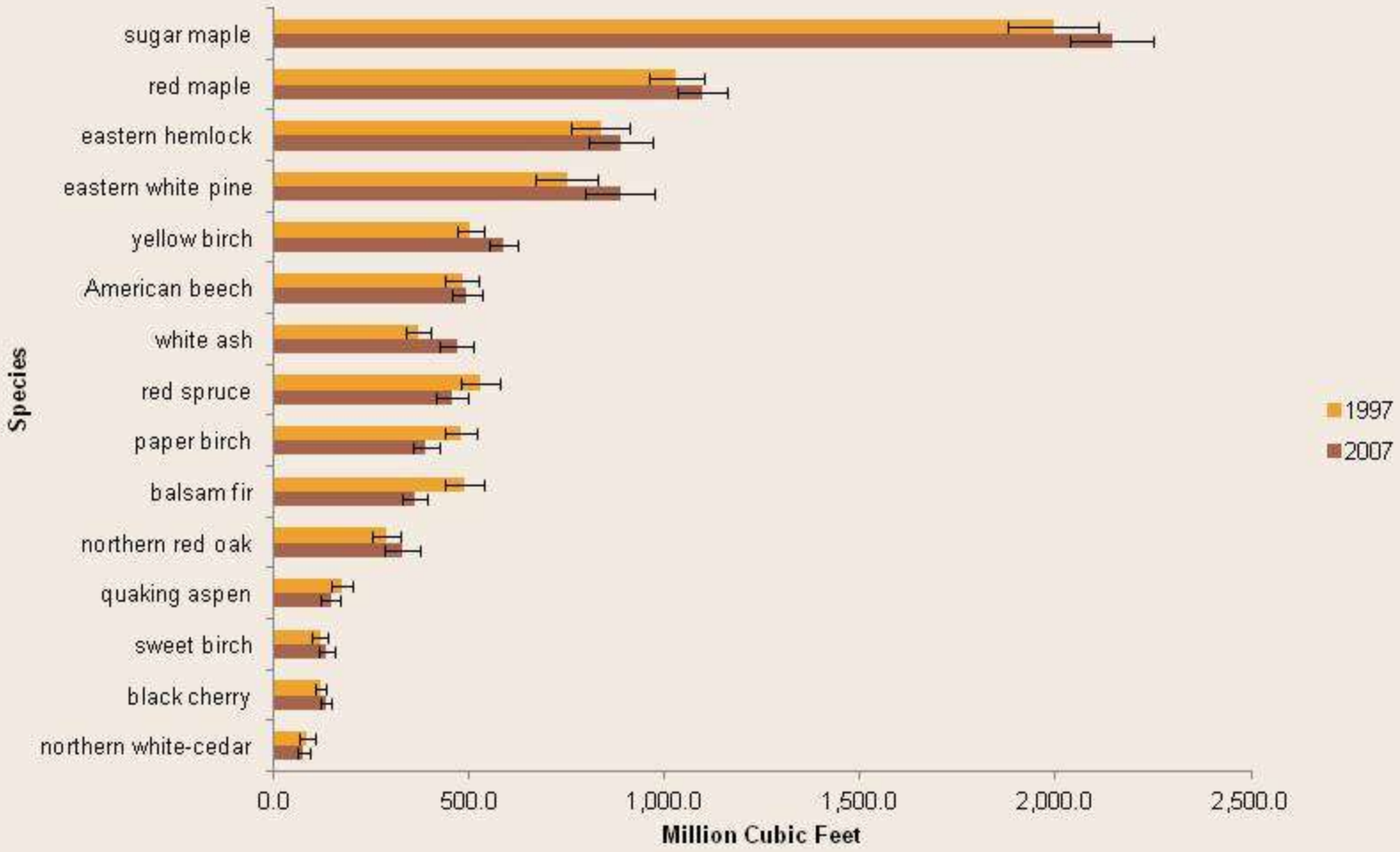
- EAB Management Statement, Coalition for Urban Ash Tree Conservation
- Insecticide Options for Protecting Ash Trees from EA
- FAQs Regarding Potential Side Effects of Systemic Insecticides Used To Control Emerald Ash Borer
- Protecting Ash Trees with Insectices, Purdue Extension
- Insecticide Treatment of Ash Trees in New York for Emerald Ash Borer
- More info. at http://www.emeraldashborer.info/treatment.cfm#sthash.6xwouDUo.dpbs

Hemlock Woolly Adelgid




Counties with established HWA populations 2012
Uninfested Counties
Infested Counties
Newly Infested in 2012
Native Range of Hemlock
Note: This map depicts counties with established HWA populations that are confirmed and reported by respective state forest health officials. The coarse nature of the map does not provide information below the county level and users should not assume that highlighted infested counties are entirely infested.
Map Produced by:
USDA Forest Service 5/21/13

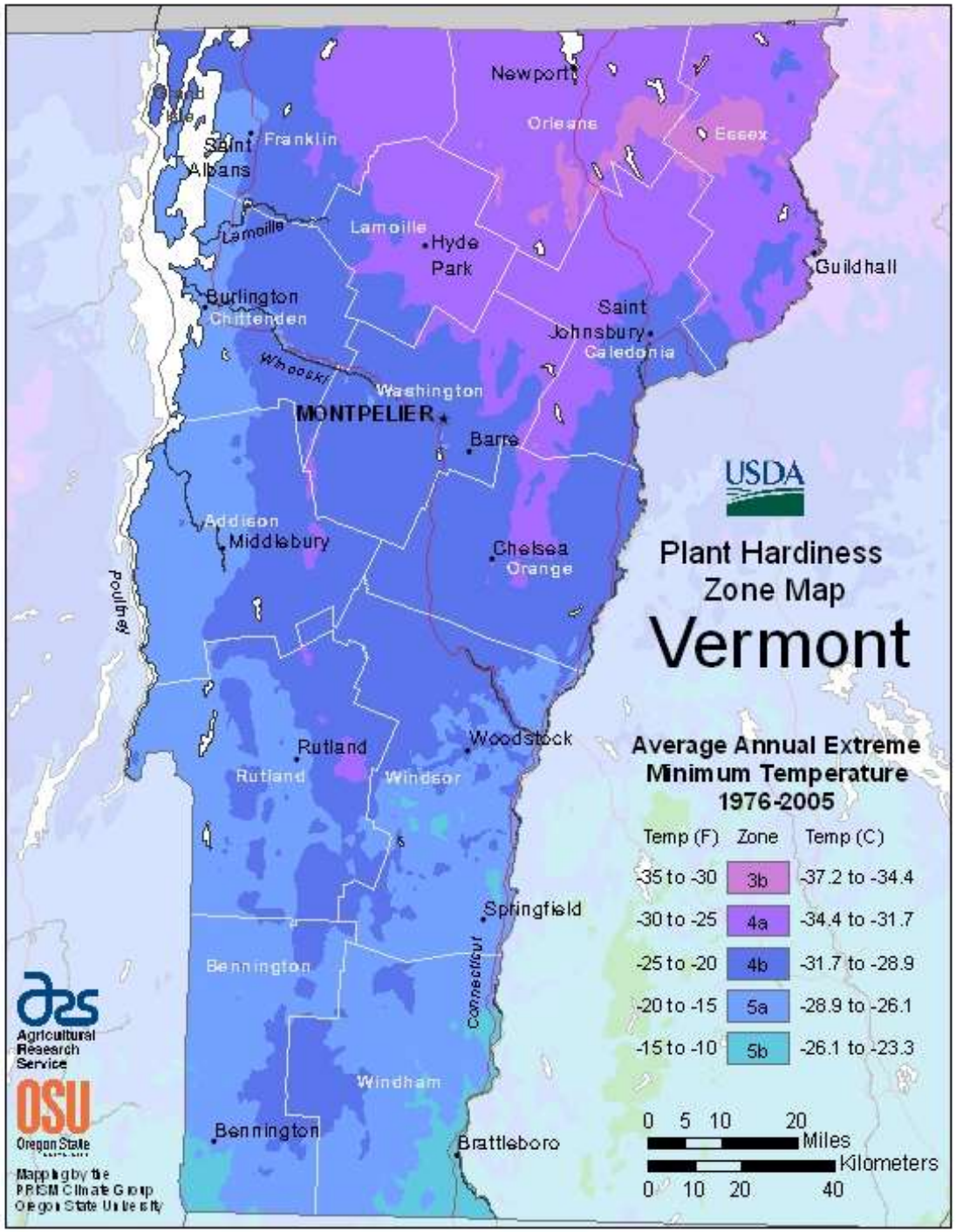
Growing Stock Volume by Species



2007


Delaware Water Gap


Jamaica, VT


Newport
Orleans
Essex
Saint Albans
Franklin
Lamoille
Lamoille
Hyde Park
Guildhall
Burlington
Chittenden
Saint Johnsbury
Caledonia
Washington
MONTPELIER
Barre
USDA
Addison
Middlebury
Chelsea
Orange
Plant Hardiness Zone Map
Vermont
Poultney
Rutland
Rutland
Woodstock
Windsor
Average Annual Extreme Minimum Temperature 1976-2005
Temp (F) Zone Temp (C)
-35 to -30 3b -37.2 to -34.4
-30 to -25 4a -34.4 to -31.7
-25 to -20 4b -31.7 to -28.9
-20 to -15 5a -28.9 to -26.1
-15 to -10 5b -26.1 to -23.3
Springfield
Bennington
Connecticut
Windham
Bennington
Brattleboro
0 5 10 20 Miles
0 10 20 40 Kilometers
Agricultural Research Service
OSU Oregon State
Mapping by the PRISM Climate Group Oregon State University


USDA
United States Department of Agriculture
Animal and Plant Health Inspection Service

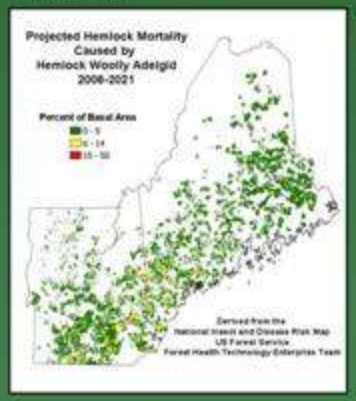
Slow-the-Spread Management of Hemlock Woolly Adelgid at the Northern Edge

Allison Kanoti, Dave Struble - **Maine Forest Service**
Kyle Lombard, Jen Weimer - **New Hampshire Division of Forests and Lands**
Barbara Burns, Jim Esden - **Vermont Department of Forests, Parks and Recreation**

ABSTRACT:
This project addresses hemlock woolly adelgid management at the northern edge of its distribution in New England. Hemlock landscapes comprise nearly one million acres of forestland in the three-state area.

Communication and cooperation is fostered through development of a coordinated program to slow the spread of hemlock woolly adelgid in the northern New England states of Maine, New Hampshire and Vermont. This results in strengthened regional partnerships and increased management efficiency.

Activities are focused on eradication of outlying populations, suppression activities at the leading edge and integrated management in the infested area.



Contact: Allison Kanoti, allison.m.kanoti@maine.gov
Kyle Lombard, kyle.lombard@dred.state.nh.us
Barbara Burns, barbara.burns@state.vt.us
Michael Bohne, mbohne@fs.fed.us

This project was funded by the USDA Forest Service, Northeastern Area.

INTRODUCTION

Hemlock woolly adelgid (HWA) finds its northern distribution in southern Maine, New Hampshire and Vermont. The three northern New England states have worked together to address the threat of HWA since the 1980's when, lacking a national effort to contain the pest, we enacted parallel quarantines and wood movement protocols. This collaborative approach has continued over the past twenty years, and has been critical in limiting expansion of the insect's range.

The hemlock resource in northern New England covers approximately one million acres and provides critical wildlife wintering habitat, protects riparian areas, has aesthetic benefits and is a significant component of the local wood products industry. Hemlock woolly adelgid is one of the most significant contributing agents to the National Risk Map and losses in excess of 10% of basal area are expected in the region within the next twelve years.

The purpose of the project is to implement an integrated Slow-The-Spread program. The project influences positive change on the ground by shifting our response to HWA from exclusion/eradication into a more complex program that integrates containment and impact mitigation within the generally infested area. Strategies include early detection, biocontrol agents, public awareness, outreach to affected industries, regulatory restrictions, identification of forest management strategies and appropriate use of chemicals. Important components of the project are public awareness, participation of cooperators and mobilization of volunteers.

SURVEY

State cooperators agreed upon minimum standards and uniform methods for surveys for detection of HWA, predator sampling and overwintering mortality of HWA.

Detection Survey Results:

- By the end of May five sites were surveyed in all towns bordering infested towns. At least 200 branches per site were examined for HWA.
- NH survey resulted in six new positive towns, ME and VT one new positive town each.

Overwintering Mortality of HWA Results (at least 500 adelgids sampled):

ME: 17% NH: 50% VT: 24%

Goals and Objectives

- Conduct surveys to outline the infestation, detect spread, and monitor eradication.
- Train volunteers to conduct surveys through landowner, "green", and industry groups.
- Create public awareness through outreach.
- Solicit input from stakeholders on HWA management.
- Eradicate or suppress HWA in selected sites using pesticides or tree removal.
- Utilize biocontrols to establish natural enemies and reduce HWA populations.
- Establish assessment plots to monitor infestation dynamics and impacts.
- Maintain quarantines through information, compliance agreements and inspections.

Above: Surveying for HWA in Vermont.
Below: Sampling for predators in Maine

MANAGEMENT EFFORTS

- States use a combination of chemical, biological and physical control in response to new adelgid finds.
- NH and ME have conducted chemical control to suppress or eradicate populations.
- All three states have participated in the biological control program. A sampling method tailored to the region has been adopted.
- VT has implemented a Mycotal trial at a state park.

Left: Basal bark application of Dinotefuran. Right: Mycotal application.

OUTREACH

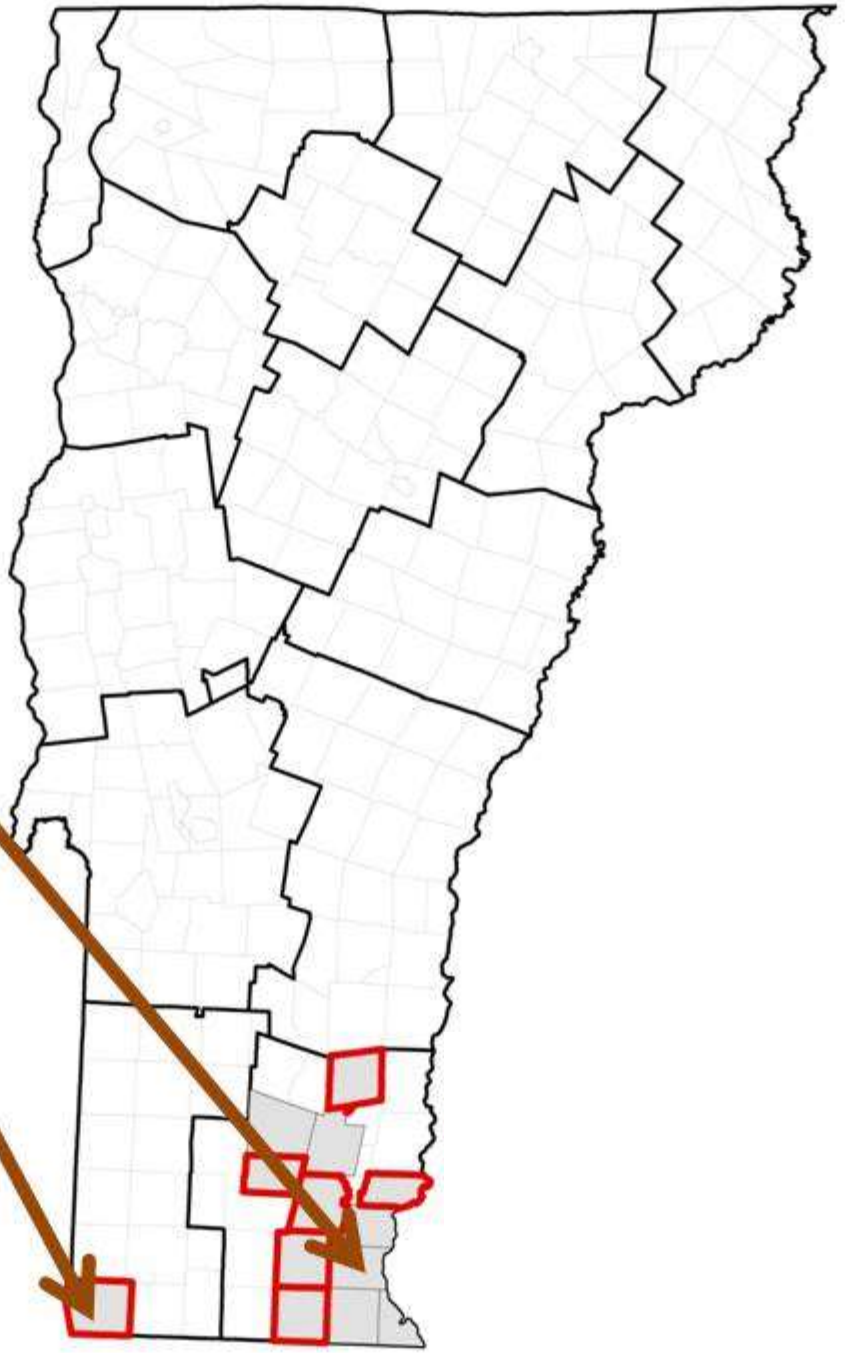
- Activities with high media value, such as predator releases, new detections and volunteer trainings, are used to help raise public awareness through traditional media outlets as well as social media, and trade newsletters.

- Workshops and outreach events sensitize profe and the public.
- New outreach materials are in development.
  - HWA Fact sheet modified from existing material
  - Draft HWA/elongate hemlock scale wallet card
  - Plans for region-specific guidelines for forest managers

Above: Draft wallet c

Credit: A. Kanoti

Laricobius nigrinus



Experimental Application of the Fungus Mycotal

Credit: R. Cooke

Hemlock Woolly Adelgid Fungal Spray Trial
Preliminary Progress Report

Prepared by Bruce L. Parker, Margaret Skinner, Vladimir and Svetlana Gouli
University of Vermont Entomology Research Laboratory
661 Spear Street, Burlington, VT 05405-0105
Tel: 802-656-5440 Email: Bparker@uvm.edu

Each treatment was replicated four times. The fungal treatments were a mixture of conidia, mycelia and sclerotia suspended in sterile distilled water. A total of 50 ml of the suspension was applied to each tree with a hand-held applicator. Treatments were made between 1:00-1:30 pm. During the treatment, it was mostly sunny with wind speeds averaging 1.6 mph (gusting to 7.9 mph), an average temperature of 24.2°C (76°F) and RH of 62%. The homeowner was contacted to determine weather conditions overnight. She informed us that it did not rain in the night following the treatment, but had started to rain lightly at around 10:30 on 25 August, but stopped as of 2:00 pm. Heavy rain (6-8 in) fell on 28 August from the remnants of Hurricane Irene.

Fig. 1. Trees used for fungal trial, Aug. 2011 (note blue and yellow flags indicating treatment tree).

Sampling. Prior to treatment, four twig samples were taken from each of the 16 trees and placed in separate bags for inspection in the laboratory. After the spray treatment had dried on the branches, additional twig samples were taken post spray and placed in tubes with sterile moist sand. An additional set of post-spray samples were taken approximately 5 weeks later, on 27 September 2011, and brought back to the laboratory for immediate inspection. From each twig sample, 10 HWA settles (sistens) on new growth were inspected to determine if they were alive or dead. Only adelgids on new growth were evaluated because there were definitely from the current year's growth.

Best Management Practices Guide for Resource Managers in Northern New England States

4. **Insecticide Treatments.** When geographic extent is small and tree value is high insecticides can be an effective option.

Vermont
Forest Health

Hemlock Woolly Adelgid in Vermont:

Recommendations for Landowner Response

Department of Forests, Parks, & Recreation
August 2012 vtforest.com

Landscape/Ornamental Setting

Low-pressure foliar application equipment is appropriate for homeowners.

Photo credit: Bugwood/National Park Service.

Soil drenching (left) can be done by homeowners without special equipment. Soil injection (right), as well as trunk injection and high pressure foliar sprays, are generally performed by professional applicators.

Photo credit: Bugwood/ National Park Service & FPR staff.

What would be useful:

Identification of where/how VPAC would like to be involved

Recommendations re VT's current recommendations

Pre-work we should be doing

Review of ANR Lands pesticide policy

What else?