Community Detectors

Invasive Tree Pests to Know

Forest Pest Outreach Program

A project of the Maine Department of Agriculture, Conservation & Forestry / Division of Animal & Plant Health and Maine Association of Conservation Districts

This material is made possible through a grant from the Maine Department of Agriculture, Conservation and Forestry (DACF) and is funded in part by a Cooperative Agreement from the United States Department of Agriculture (USDA) Animal and Plant Health Inspection Service (APHIS). USDA, DACF and MACD are equal opportunity lenders, providers and employers.

Today's program sponsors:

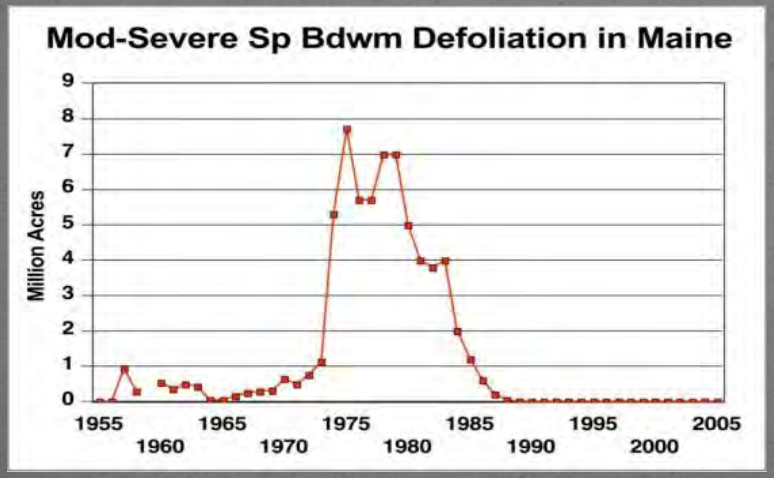
What are invasive species?

- Are not naturally found in the area
- Cause harm to:
  - environment
  - economy
  - human health
- Any benefits are outweighed by harm

Most non-native (alien) species are not invasive

Native Pests vs. Invasive Pests

- Trees have some resistance
- Predators and parasites
- Populations often cycle
- Example: spruce budworm



- Trees often have no resistance
- Few or no effective natural enemies
- Populations build, often until host collapses

What is the harm?

- More than $100 billion per year to control invasive species
  - Costs beyond your control!
    - e.g., property values and browntail moth
- Ecological damage
- Human Health Issues
  - In ME: browntail moth

U.S. History of Invasive Tree Pests

American Chestnut

> 3 billion mature trees in Eastern U.S.

U.S. History of Invasive Tree Pests

Chestnut Blight

discovered 1904 in NY; killed nearly all 3 billion by 1940s

U.S. History of Invasive Tree Pests

American Elm

Predominant street tree – provides beauty and shade

U.S. History of Invasive Tree Pests

Dutch Elm Disease

New Invasive Pests: Deciduous Trees

In Maine!

Winter Moth

Browntail Moth

In Maine!!!

Emerald Ash Borer

Asian Longhorned Beetle

NOT in Maine... yet

Winter Moth

Geometrid moth; "inchworm"

Adults emerge late Fall

Tom Murray, BugGuide.net

Nov - Jan

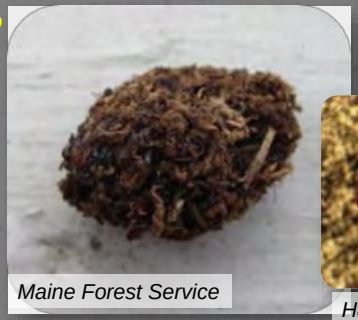
Waltham Services

Eggs overwinter

Gyorgy Csoka, Hungary Forest Research Institute, Bugwood.org

Dec - Apr

Pupa looks like soil



Maine Forest Service

Hannes Lemme, Bugwood.org

Jun - Nov

Cape Cod Times/Steve Heaslip

Caterpillars chew leaves

Apr - Jun

What does WM do?

Larvae feed in early spring

- On newly forming buds
- Then free-feed on expanded foliage
- Causes “swiss cheese” effect


P. Johnson

Favored hosts:

- oak
- apple
- maple
- birch
- basswood
- highbush &
  wild blueberry
- cranberry


Back Bay Garden Club


Maine Forest Service

Winter Moth Males Drawn to Lights

Cape Elizabeth

Photo: R. Cronin

Winter Moth

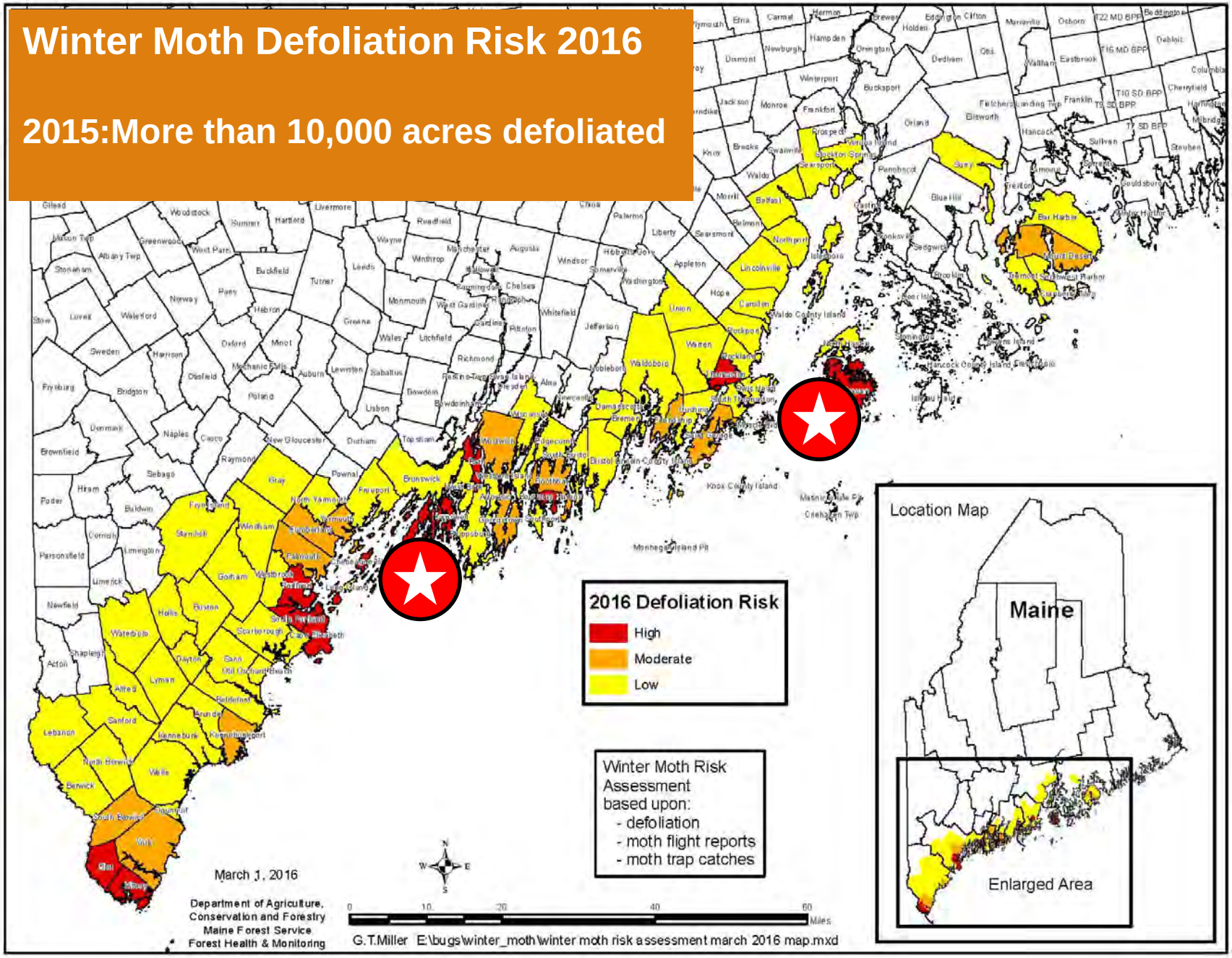
Massachusetts

- Now defoliating 100's of thousands of acres
  - Primarily eastern MA
- Killing thousands of trees – <u>especially oaks</u>
  - In Nova Scotia, 40% red oak mortality after 4 years of defoliation!

MA Dept Conservation and Recreation

Winter Moth Defoliation Risk 2016

2015:More than 10,000 acres defoliated



Winter Moth - *Operophtera brumata*

- More likely to be found in 2nd home areas than forest
- Probably brought from Southern NE in landscape plantings

Winter Moth

Biocontrol

- Parasitic fly (*Cyzenis albicans*)
- It will take years for it to become effective
- Not guaranteed to work in ME. Has worked in Nova Scotia.

Long Term Outlook—Biological Control

- Cyzenis albicans – Parasitic Fly

- Organism recovery in 2016!
- Experimental cocoon release in 2016 (Harpswell)

ME Towns with *Cyzenis albicans* Releases

Location	Year
Harpswell	2013, 2014, 2016
Cape Elizabeth	2013, 2015
Kittery	2014
Vinalhaven	2014
Portland (Peaks Island)	2015

Parasitic Wasp in ME

- **Searching activity observed**
- **Specimens collected**
- **Species ID unknown (perhaps undescribed)**
- **Important mortality factor in MA**

Winter Moth

Chemical Control

- An early April horticultural spray on trunks and branches of infested trees to kill eggs may be helpful.

Physical Control

- There are heavy weight paper strips available that are covered with a sticky substance that will snare the climbing moth or caterpillar.

Winter Moth vs. Bruce Spanworm

Steve Dunbar , BugGuide.net

- *Operophtera brumata*
- Exotic
- Prefers oak, apple, maple, birch, blueberry
- Population growth exponential
- Adult moths

Females longer wings stubs

- *Operophtera bruceata*
- Native
- Prefers maple, beech, birch, poplar
- Occasional outbreaks
- Adult moths

Females shorter wing stubs

All other photos: Maine Forest Service

Climate Limitations?

- Eggs are tolerant of extreme freezing temperatures

BUT…

- Late fall/early winter cold/snow/frozen ground reduces adult emergence—especially males.

Browntail Moth

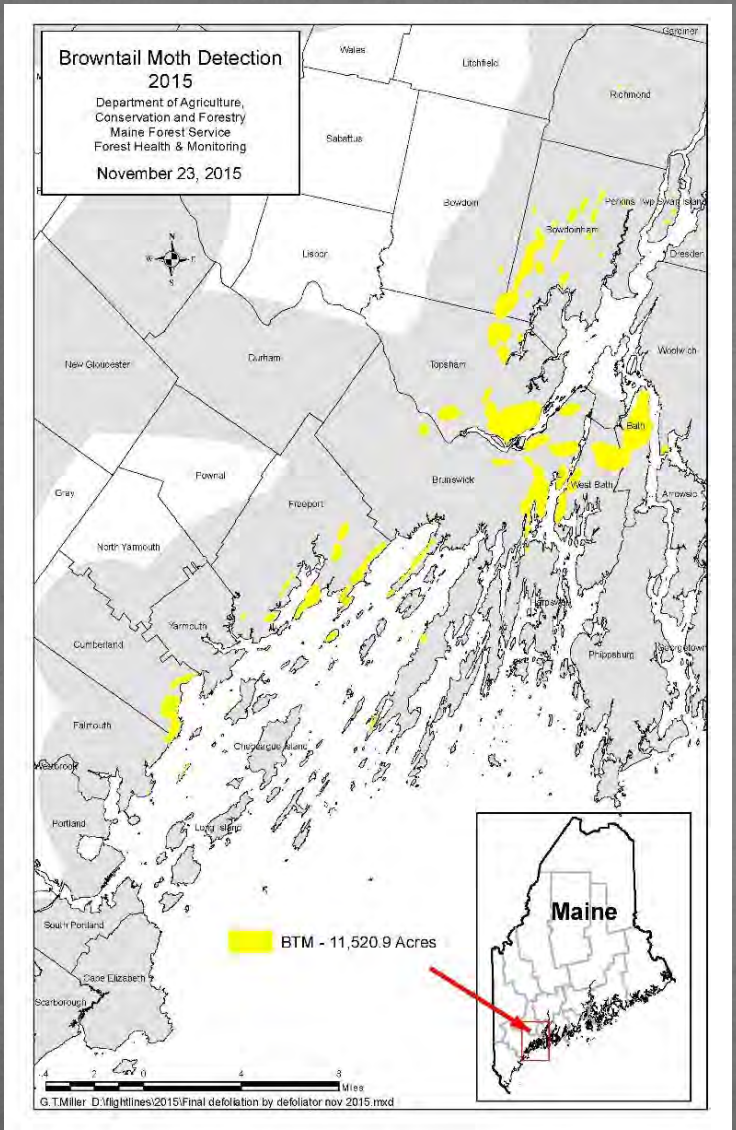
Euproctis chrysorrhoea

- Invasive insect from Europe
  - Order: Lepidoptera (moths)
  - Family: Lymantriidae
- Caterpillars have toxic hairs

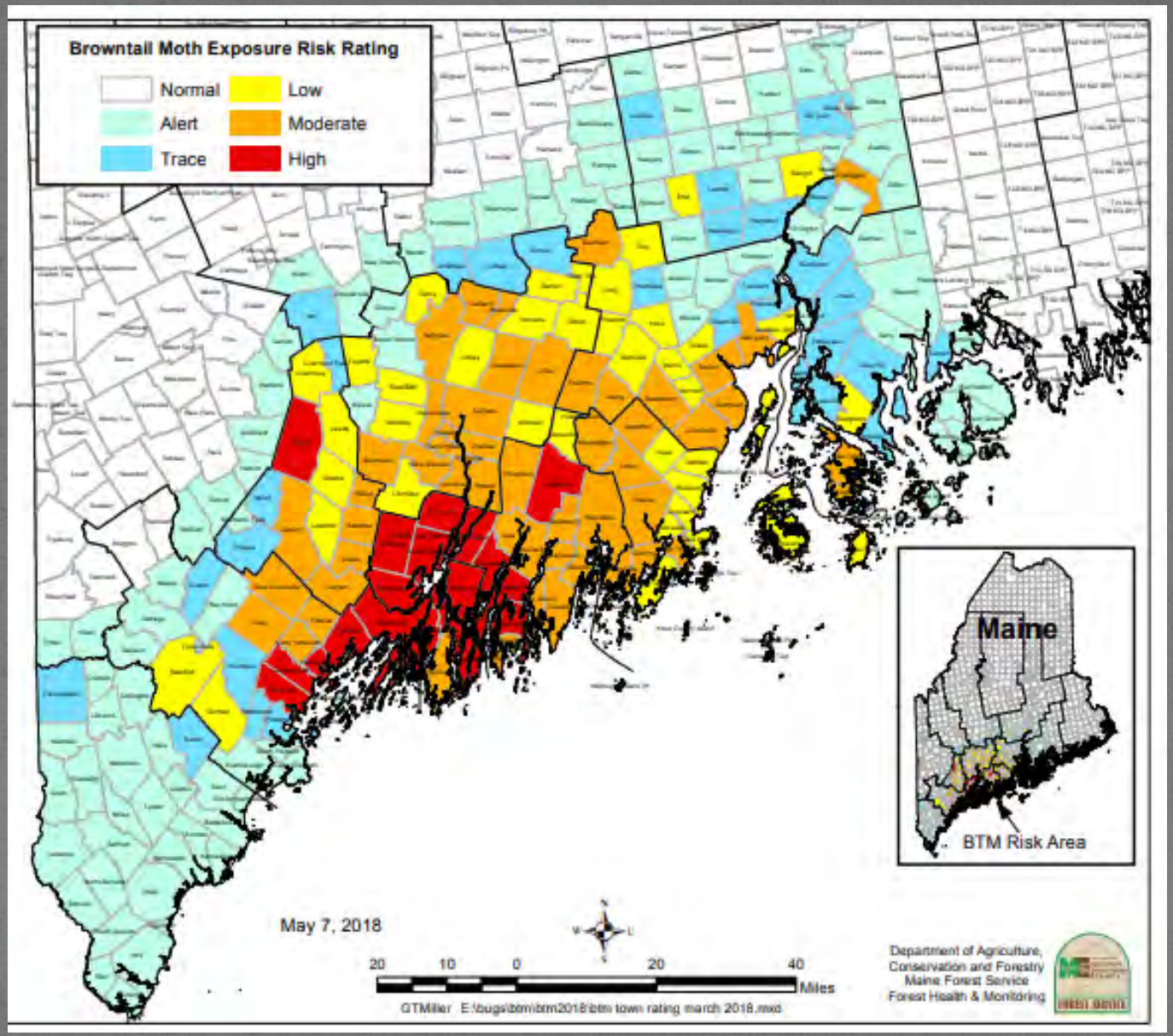
Browntail Moth

- Major defoliator
  - Huge host range
  - Prefers hardwood trees and shrubs; oak, apple, cherry, hawthorn, beach plum, rugosa rose…
- Caterpillar hairs are poisonous
  - Can cause severe rashes
  - Can cause respiratory problems

Browntail Moth Defoliation



- Nov 23, 2015
- DACF – MFS - Forest Health and Monitoring
- 11,520.9 acres defoliated
- Coastal damage
  - Small populations are surviving in Lewiston, Vassalboro, Augusta, Gardiner, Turner & Waterville


Browntail Moth Exposure Risk Rating
Normal
Alert
Trace
Low
Moderate
High
Maine
BTM Risk Area
May 7, 2018
20 10 0 20 40
Miles
GTMiller E:\bugs\btm\btm2018\btm town rating march 2018.mxd
Department of Agriculture, Conservation and Forestry
Maine Forest Service
Forest Health & Monitoring

Browntail Moth

Recognizing

- Adult moth
  - White with tuft of brown at tip of abdomen
  - Active July-August
- Caterpillar
  - Brown with red & white markings
  - Very hairy
  - August-following June
  - Make nests out of autumn leaves to overwinter

Browntail Moth

Look for winter webs

Webs

- White
- Tightly woven around leaves
- Tips of branches, esp. oak and apple
- Seen *late fall thru early spring*

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Browntail Moth

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- Seen *late fall thru early spring*

Browntail Moth

Controlling

- Non-chemical
  - *Clip off the webs*
    - Mid-September to mid-April
    - Soak in soapy water
- Chemical
  - Licensed applicator
  - Apply in May

- *Protect yourself from toxic hairs!*
  - Cover up
  - Wear a respirator when mowing
  - Wash body and clothes after

Comparison of Life Stages of Native and Invasive Tree Defoliating Moths

	native	native	INVASIVE	INVASIVE	INVASIVE
	Eastern Tent Caterpillar (*Malacosoma americanum*)	**Fall Webworm** (*Hyphantria cunea*)	**European Gypsy Moth** (*Lymantria dispar*)	**Browntail Moth** (*Euproctis chrysorrhoea*)	**Winter Moth** (*Operophtera brumata*)
Description - caterpillar				 CAUTION! *Toxic hairs of caterpillars can cause severe rash and respiratory problems.*	
Season	**Early spring - June**	**July - September**	**Early spring - June**	**Previous summer- June**	**Early spring - June**
Description - adults		*Forewing variation* 	*male* *female* 		*male* *female* 
Season	July	Late June - July	July-August	July-August	July-August
Overwinters as:	**egg**	**pupa**	**egg**	**larva**	**egg**
Favored hosts:	apple, cherry, crabapple	apple, cherry, ash, willow, oak, birch, other deciduous species	oak, maple, birch, apple, alder, poplar, pine, spruce, etc...	oak, shadbush, apple, cherry, beach plum, and rugosa rose	oak, maple, apple, ash, crabapple, cherry, blueberry...
What to look for:	 tightly-webbed tents in branch crotches - **spring**	 large loose webs esp. on apple, cherry – **summer/fall**	 egg masses on trees, vehicles, picnic tables, etc. - **fall/winter**	 winter webs, esp. in oak, at tips of branches - **winter**	 holes in newly expanding leaves - **spring**

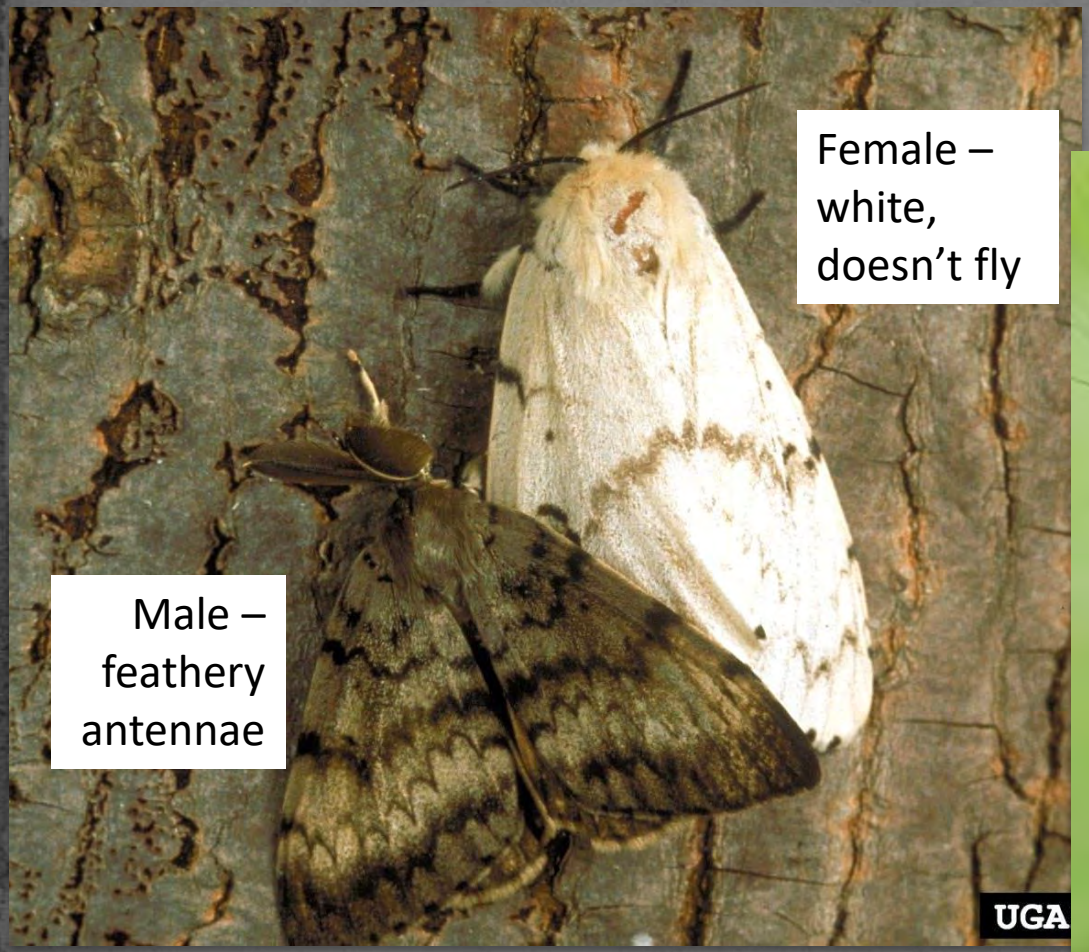
maine DEPARTMENT OF Agriculture Conservation & Forestry

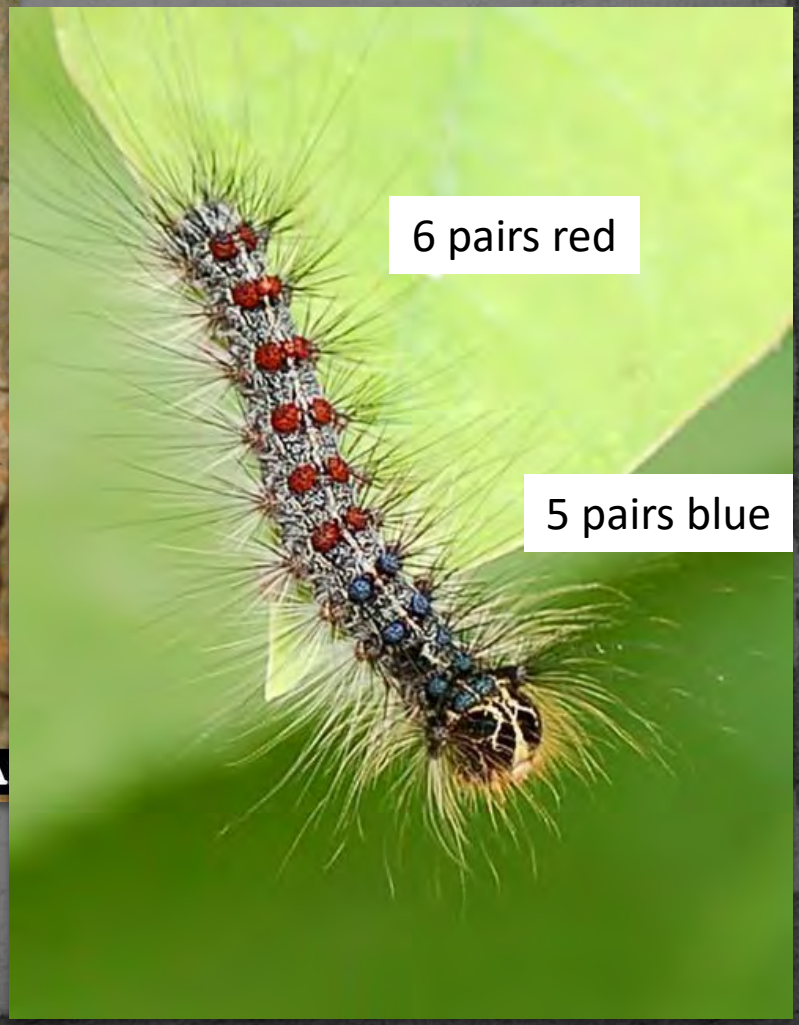
Maine Department of Agriculture, Conservation and Forestry
Division of Animal and Plant Health

Gypsy Moth

Intentionally introduced

Gypsy Moth


Female – white, doesn't fly
Male – feathery antennae
UGA

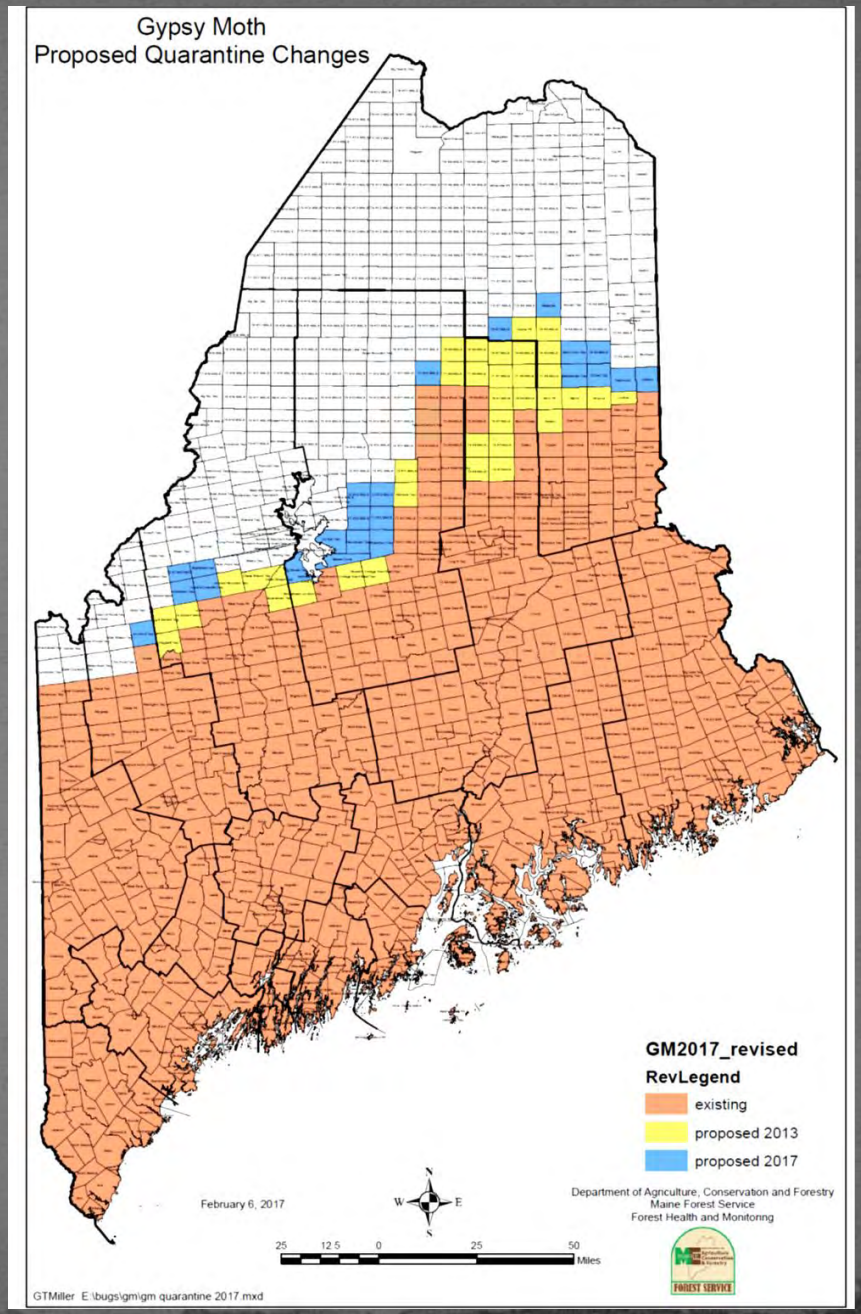

6 pairs red
5 pairs blue

Look for egg masses

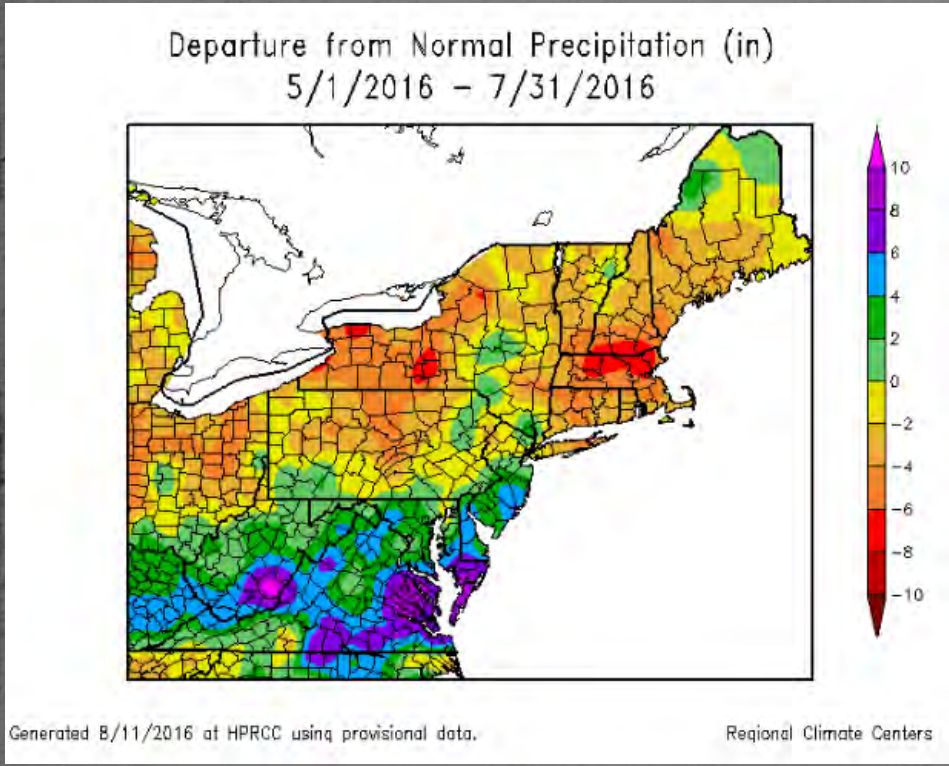
…not just on trees…

Gypsy Moth

- Quarantine
  - Cannot move firewood, logs, chips out of quarantine area exc. to a regulated receiver
- Host trees – high mortality
  - Oak *(but will eat almost anything and everything)*
  - Tamarack
  - Poplars
  - Birches
  - Alder
- 2002 last significant epidemic in ME



Gypsy Moth Outbreaks



↓ Rainfall = ↑ GM survival

Dry conditions in areas traditionally hard-hit by gypsy moth and affected by hemlock woolly adelgid may spell trouble for their hosts.

Image Source: Northeast Regional Climate Center.

Emerald Ash Borer

Small and Deadly

Material from Karen Coluzzi, Colleen Teerling, Nathan Siegert (USFS) and Others

Emerald Ash Borer (EAB)

Agrilus planipennis

David Cappaert, Michigan State University, Bugwood.org

Troy Kimoto, Canadian Food Inspection Agency, Bugwood.org

From: Asia **FOUND IN MAINE**

What is the Emerald Ash Borer (EAB)?

- metallic woodboring beetle (Buprestidae)
- native to Asia
- 1-2 year lifecycle in N. America

Larva in gallery

Adult

~ ½" long
metallic green

How did EAB get to North America?

- Solid wood packing materials (SWPM), like pallets, crates and spools, are used to transport goods from China to the U.S.

- SWPMs were infested with live EAB larvae.

Why is EAB a Problem?

- Early detection is difficult:
  - Adult beetle is tiny
  - Signs are hard to see
  - Symptoms are confusing

- Spreads easily through firewood
  - 75% of detected infestations are due to movement of firewood

Why is EAB a Problem?

- EAB attacks all species of ash (*Fraxinus spp.*) grown in N.A.
  - None of our species are resistant to attack
  - All attacked ash trees die
  - Over 50 million ash trees have died since EAB was discovered in 2002
  - The white fringetree is also a host (2014)
- Numerous industries affected:
  - Furniture/flooring
  - Tool making
  - Sports equipment
  - Native American basketmaking

Ash mortality in Ontario

EAB Food – Ash Trees (*Fraxinus sp.*)

White

Green

Brown

Recognizing ash

- Opposite branching
- Compound leaves
- Bark – diamond-shape furrows or corky
- Oar-shaped seeds

Photos from "Forest Trees of Maine" by the Maine Forest Service

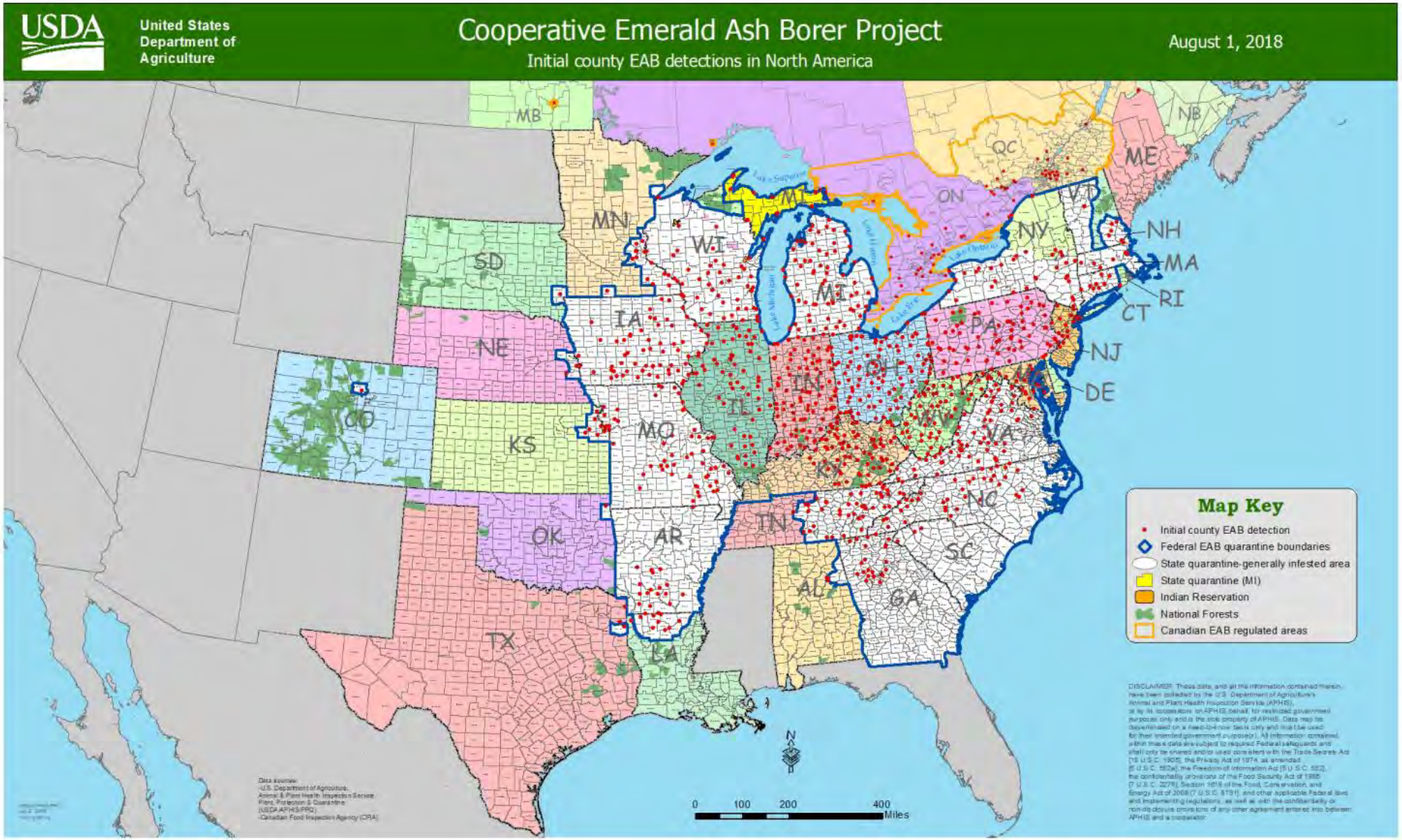
EAB Food

The white fringetree (*Chionanthus virginicus*) was recently discovered as a host for EAB.

Perhaps other species in the same family? (Oleaceae; e.g. olive, forsythia, lilac)

Paul Wray, Iowa State University

Photos from "Forest Trees of Maine" by the Maine Forest Service


USDA
United States Department of Agriculture
Cooperative Emerald Ash Borer Project
Initial county EAB detections in North America
August 1, 2018
MB
NB
QC
ON
ME
MN
WI
MI
VT
NH
NY
MA
SD
MT
RI
CT
ND
NE
PA
NJ
OH
IN
DE
CO
KS
IL
MD
WV
VA
MO
KY
NC
OK
AR
TN
SC
AL
GA
TX
LA
Map Key
Initial county EAB detection
Federal EAB quarantine boundaries
State quarantine-generally infested area
State quarantine (MI)
Indian Reservation
National Forests
Canadian EAB regulated areas
N
0 100 200 400
Miles
Data sources:
-U.S. Department of Agriculture, Animal & Plant Health Inspection Service, Plant Protection & Quarantine (USDA APHIS PPQ)
-Canadian Food Inspection Agency (CFIA)
DISCLAIMER: These data, and all the information contained therein, have been collected by the U.S. Department of Agriculture's Animal and Plant Health Inspection Service (APHIS), or by its cooperators on APHIS behalf, for restricted government purposes only and is the sole property of APHIS. Data may be determined on a need-to-know basis only and must be used for their intended government purpose(s). All information contained within these data are subject to required Federal safeguards and shall only be shared and/or used consistent with the Trade Secrets Act [18 U.S.C. 1905], the Privacy Act of 1974, as amended [5 U.S.C. 552a], the Freedom of Information Act [5 U.S.C. 552], the confidentiality provisions of the Food Security Act of 1985 [7 U.S.C. 2276], Section 1619 of the Food, Conservation, and Energy Act of 2008 [7 U.S.C. 8791], and other applicable Federal laws and implementing regulations, as well as with the confidentiality or non-disclosure provisions of any other agreement entered into between APHIS and a cooperator.

Recognizing EAB Adults

Howard Russell, Michigan State University

Pennsylvania Department of Conservation and Natural Resources

Emerald Ash Borer

- metallic emerald green
- long and narrow
- ⅜ to ¼” long
- tapered abdomen
- found near ash trees

University of Wisconsin–Milwaukee

Not EAB

Tiger Beetle

- bright green
- broader; definite ‘shoulders’
- ~½” long
- often walks/flies near ground (very fast)

Recognizing EAB

From afar

Woodpecker activity!!!

Crown dieback

Epicormic shoots

Recognizing EAB - Symptoms

Bark Splitting

Recognizing EAB

S-shaped Galleries

Recognizing EAB

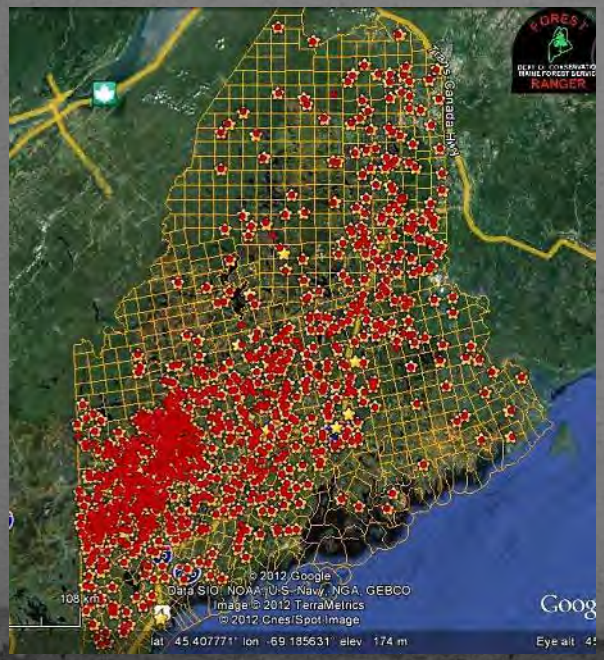
D-shaped Exit Holes

Monitoring for EAB

Trap/lure (purple traps)

- USDA-issued
- Unknown effectiveness in low populations
- Inexpensive, user-friendly

2012 – 965 traps
2013 – 852 traps
2014 – 700 traps
2015 > 970 traps
2016 > 950 traps



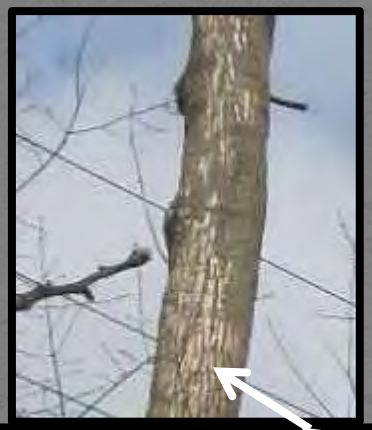
Monitoring for EAB

- Trap tree
  - Girdle to draw EAB
  - Fairly sensitive
  - Sacrifice the tree
  - Labor intensive
  - Most flexible/sensitive tool for landowners/managers

Monitoring for EAB

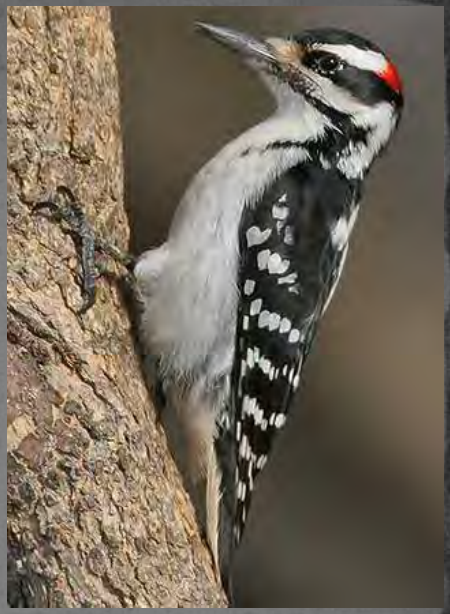
- *Sensitized public!!!!!!*

N. Andover, MA:
Detection by a customer at the restaurant across the street



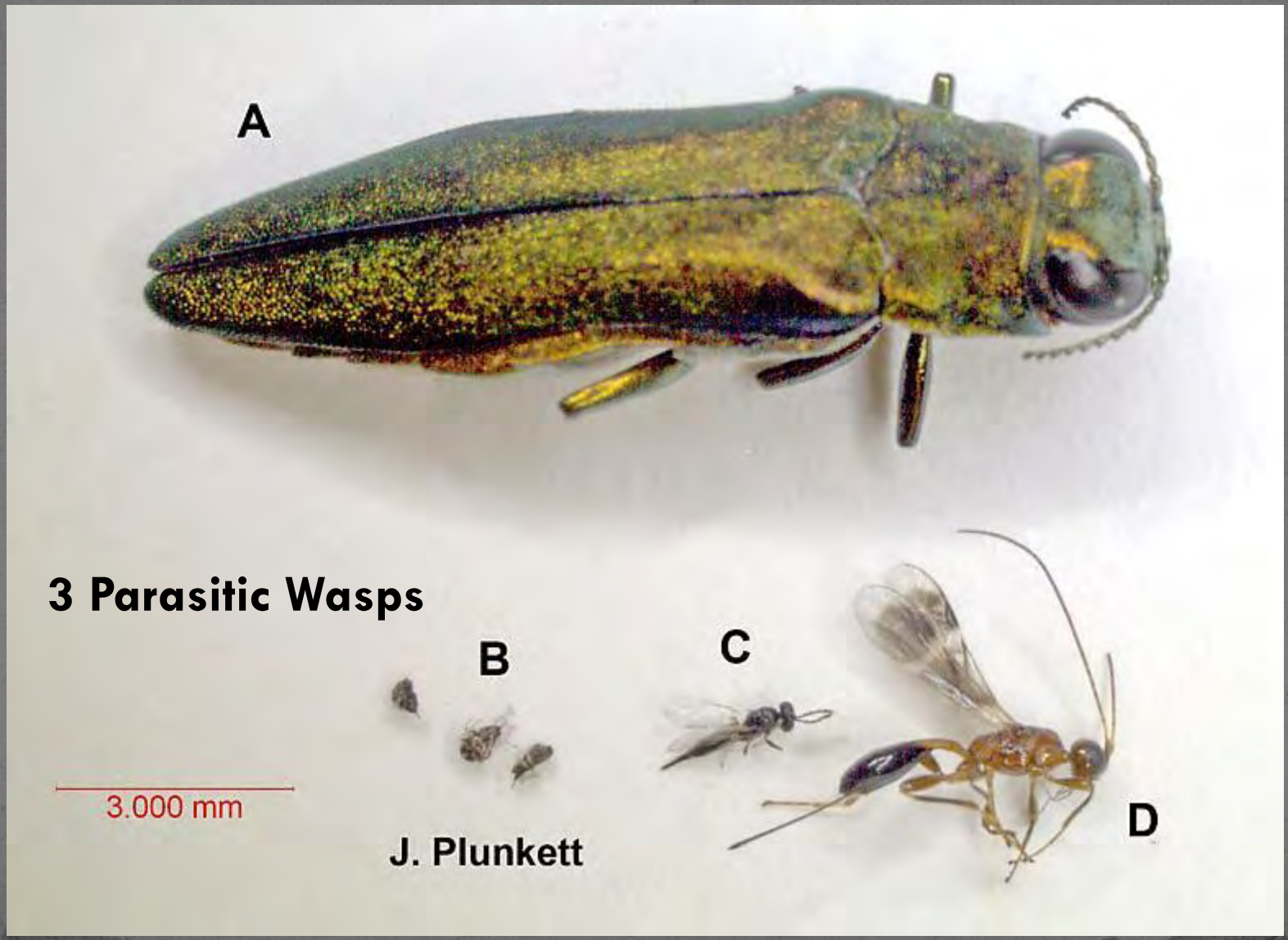
Biological Control

- Woodpeckers
  - Can cause over 90% mortality of EAB in some trees; 40% overall



Woodpecker flecking – "blonding"
a **very** good way to monitor in winter

Biological Control

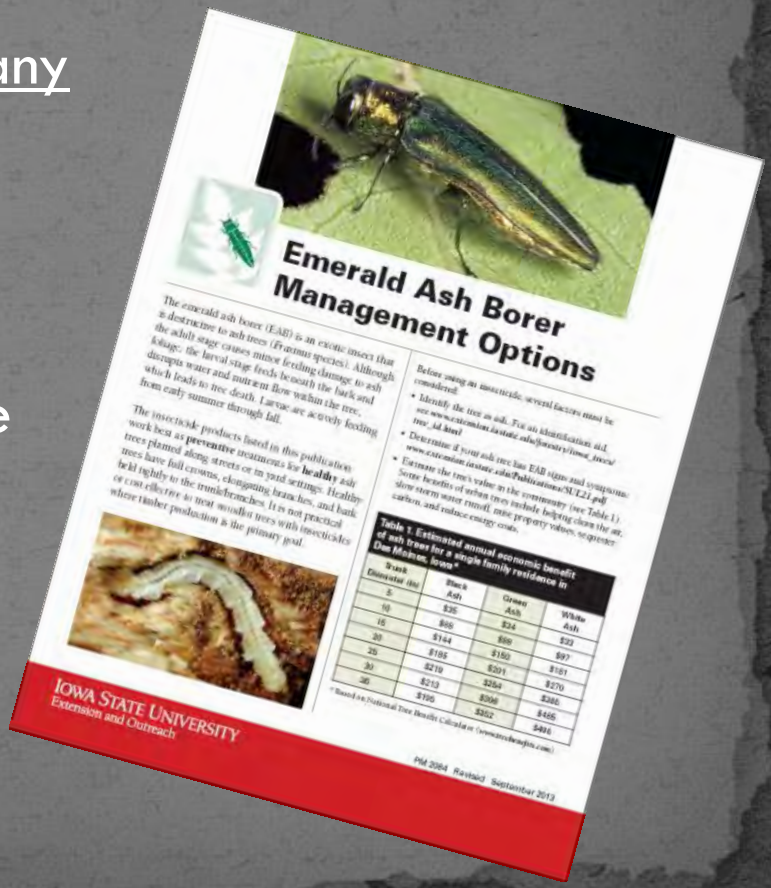


Pesticide Options

- Insecticide applications
  - Systemic - trunk injections, soil drench, lower bark spray
  - Can protect individual landscape trees
    - Requires continuous applications
  - Can reduce EAB density
    - slows tree mortality

Preparing for EAB

- **Does your town have an EAB management plan?**
  - Inventory your ash
  - Identify risky pathways, e.g. any area where out-of-state firewood may be coming in
  - Plan to monitor – early detection, e.g. set up a trap tree
  - Raise/save funds
    - Pesticide treatments
    - Tree removal
    - Tree replanting
  - etc.



Asian Longhorned Beetle (ALB)

Anoplophora glabripennis

City of Bowling Green, OH

USDA Forest Service

MA Dept. of Agricultural Resources

From: Asia

NOT FOUND IN MAINE

What is the Asian Longhorned Beetle (ALB)?

- Native to China and Korea
- ALB is a wood boring beetle.
  - Small larvae feed in the cambium and sapwood disrupting flow of nutrients
  - Larger larvae feed deeper into the tree's heartwood, weakening the tree's structure.

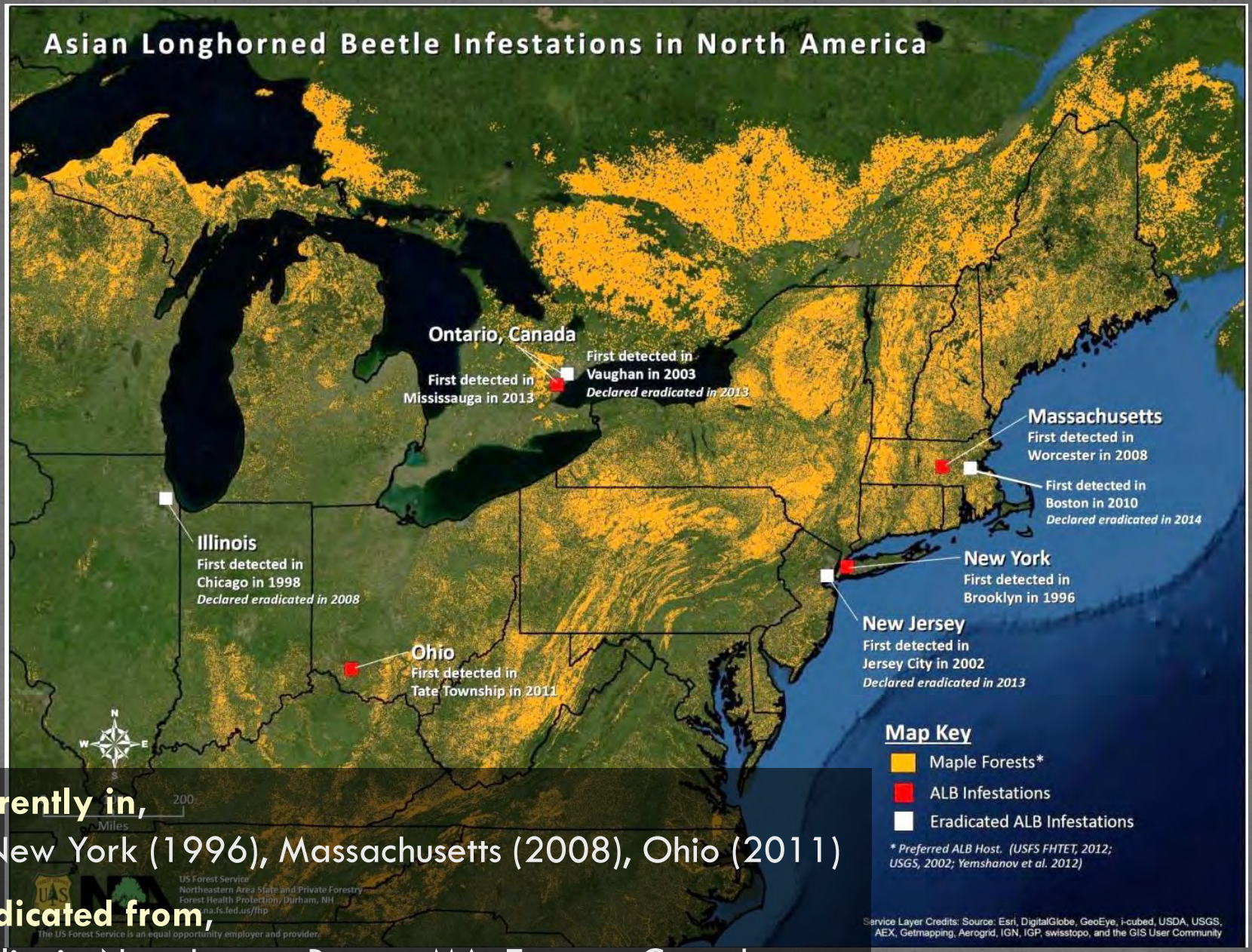
Dennis Haugen, USDA Forest Service, Bugwood.org

- ALB attacks healthy hardwood trees
- Repeated attacks lead to weakened trees and eventually death.

How did ALB get to North America?

- Solid wood packing materials (SWPM), like pallets, crates and spools, are used to transport goods from China to the U.S.

- SWPMs were infested with live ALB larvae.



Currently in,

New York (1996), Massachusetts (2008), Ohio (2011)

Eradicated from,

Illinois; New Jersey; Boston, MA; Toronto, Canada

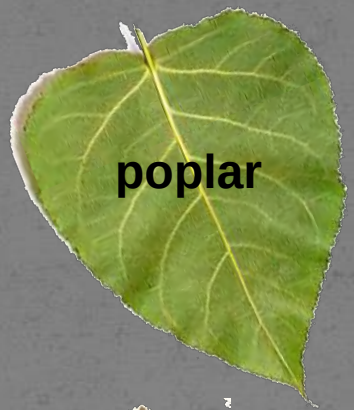
Why is ALB a problem?

- ALB attacks many hardwood tree species
- Oftentimes the trees are perfectly healthy
- Economic loss to various industries
  - Lumber
  - Nursery stock
  - Wood products
  - Maple syrup
  - Tourism

Beetle Food

aka: ALB Host Trees in Maine

- ***Maple (including boxelder)***
- Birch
- Elm
- Horsechestnut
- Mountain-ash
- Poplar
- Willow
- etc….Not softwoods



Symptoms of an ALB Infestation

Branch Dieback and Discolored Foliage

PA DCNR - Forestry Archive, Bugwood.org

Patty Douglass, USDA APHIS PPQ

Bark Problems

Cracks

Missing

Oviposition Sites
(egg niches)


Jenn Forman Orth, Mass. Department of Agricultural Resources


Jenn Forman Orth, Mass. Department of Agricultural Resources

Oviposition Sites
(egg niches)

Frass

Robert A. Haack, USDA Forest Service, Bugwood.org

Michael Bohne, US Forest Service

Exit (emergence) Holes

Adult Feeding Damage

Recognizing ALB

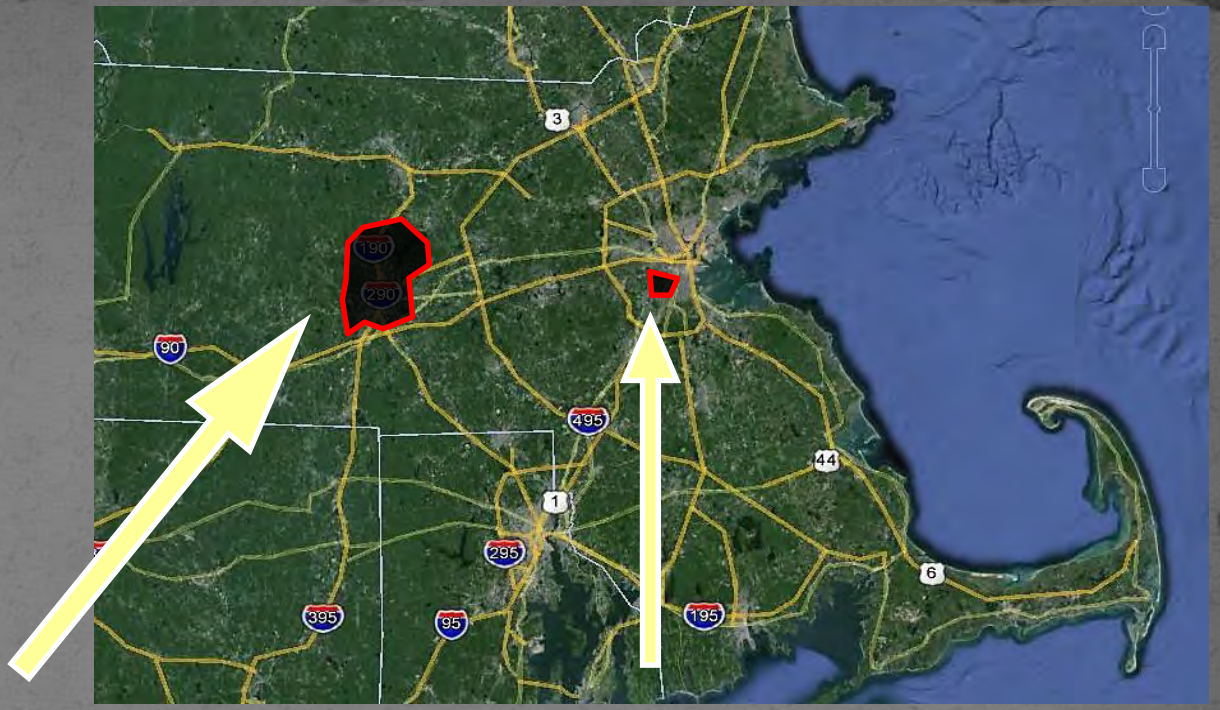
Adult Beetles

female

- **Large** over 1”; females larger than males
- **Shiny black** like patent leather shoes
- **White markings** strong alternating bands on antennae; splotches on body
- **Blue tinge** on legs

male

A Tale of Two Cities



Worcester, MA		Boston, MA
ALB reported in 2008 by a public citizen	→	ALB reported in 2010 by a trained volunteer
Infested trees date back to **1994**	→	Infested trees date back to **2008**
110 mi² quarantined	→	**10 mi²** quarantined
>34,000 trees removed to date	→	**6 trees removed** to date

How to Look for ALB

- On host trees
  - Look for signs and symptoms throughout the year
  - Look for adult beetles July – October
  - **Binoculars** are good for higher branches
  - Bucket Trucks
  - Smoke Jumpers

If You Find a Suspect ALB…

- Capture it
  - Place in a container that can be sealed
  - *Freeze ASAP*
  - or, take a picture
- Collect data
  - Date
  - Location
  - Nearby trees or tree it was on
  - Your name and contact info

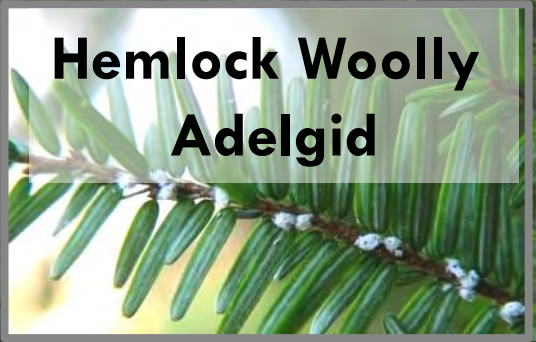
New Invasive Pests - Conifers

Hemlock

Fir

Spruce

Hemlock Woolly Adelgid



Elongate Hemlock Scale

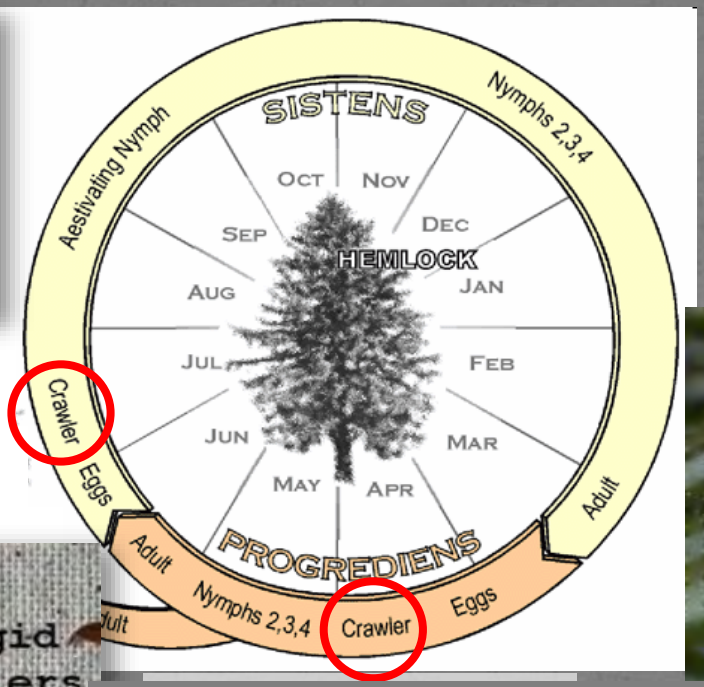
What is HWA

An aphid-like, sap-sucking insect

Feeding nymph

USDA Forest Service

Dormant in summer



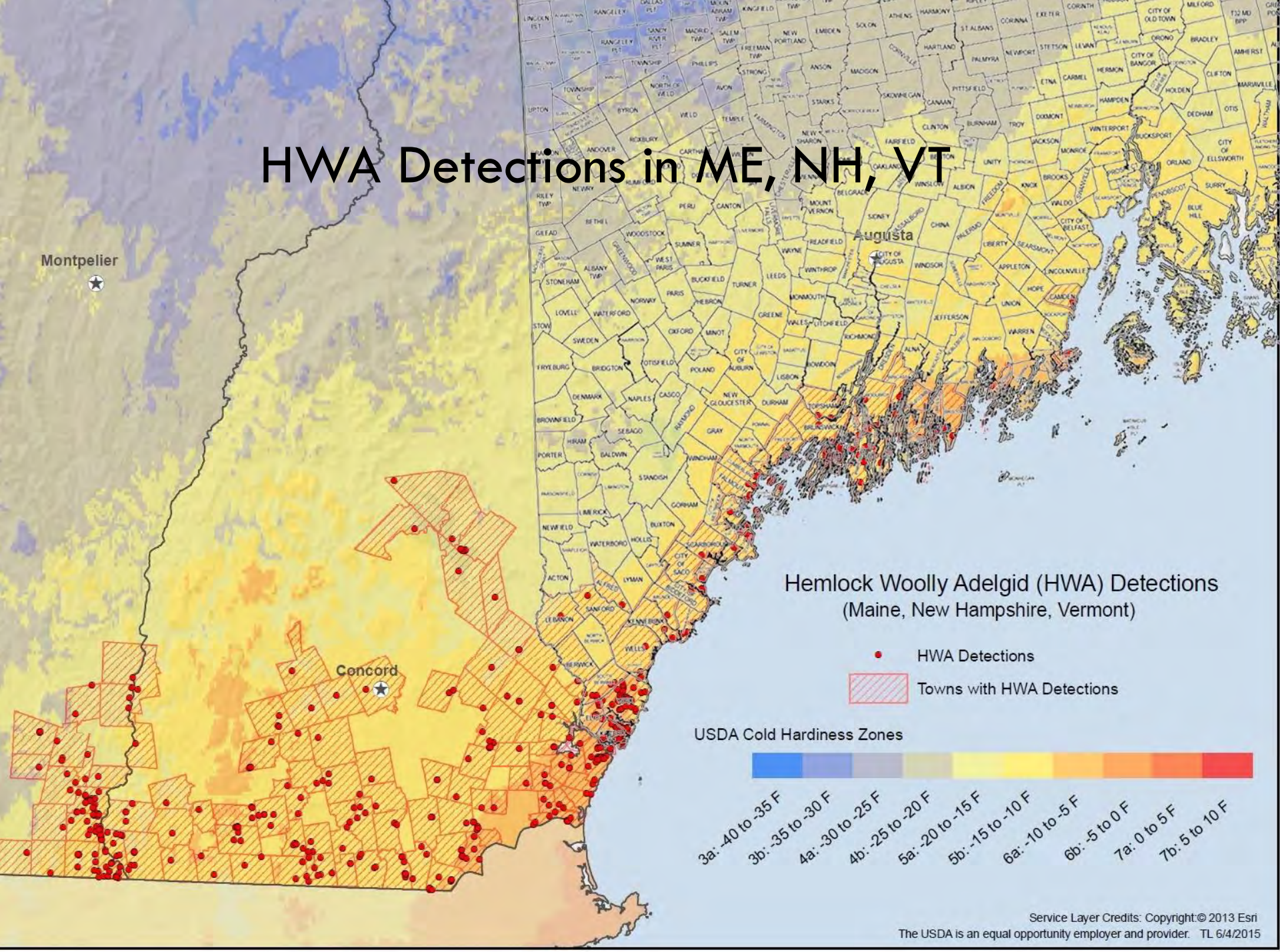
2 generations/year spreads more easily during crawler stage

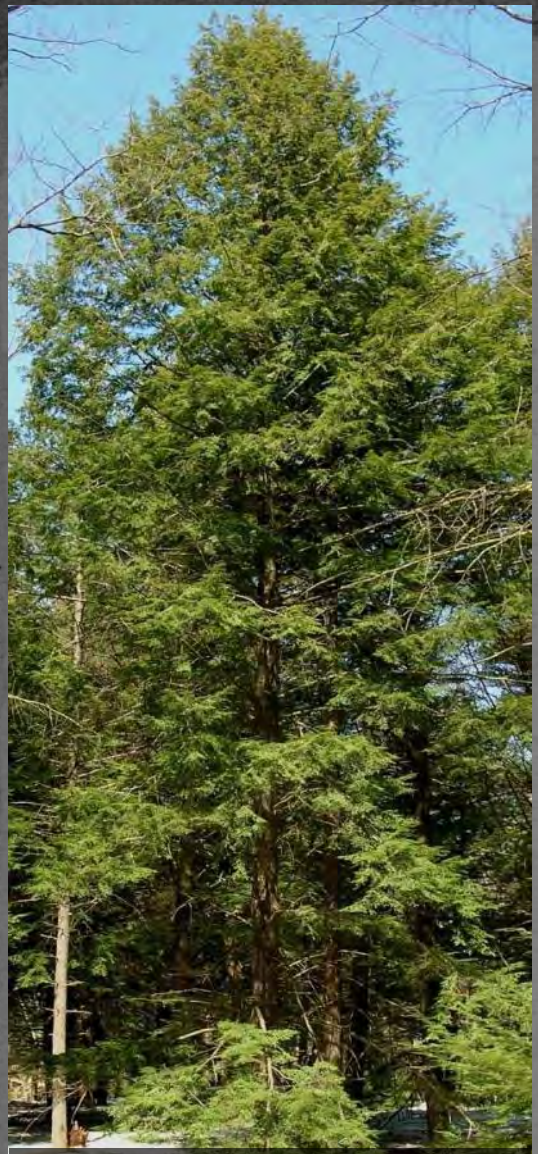
Older nymphs/adults produce "woolen" balls (fall/winter)

USDA Forest Service

Maine Dept. of Agriculture, Conservation & Forestry

HWA Detections in ME, NH, VT





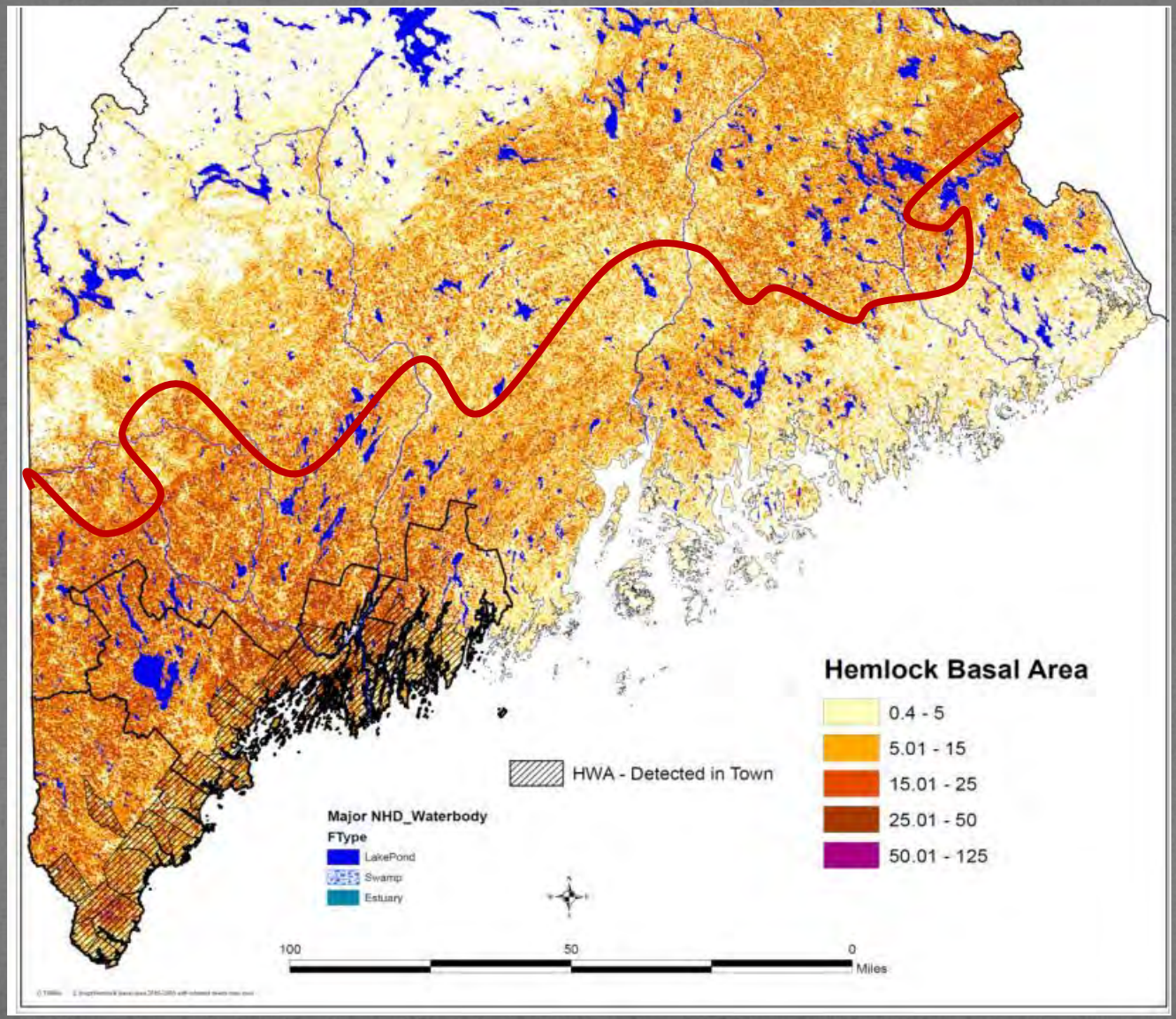
Westbrook ME
(Uninfested)
April 2008

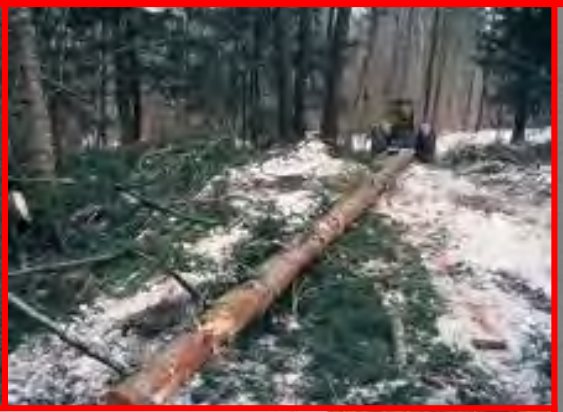
Healthy hemlock
(maybe HWA)
←

HWA infested
hemlock
→

Wolfe Neck Woods
State Park
March 2012

Hemlock Basal Area & PHZ 5 Boundary



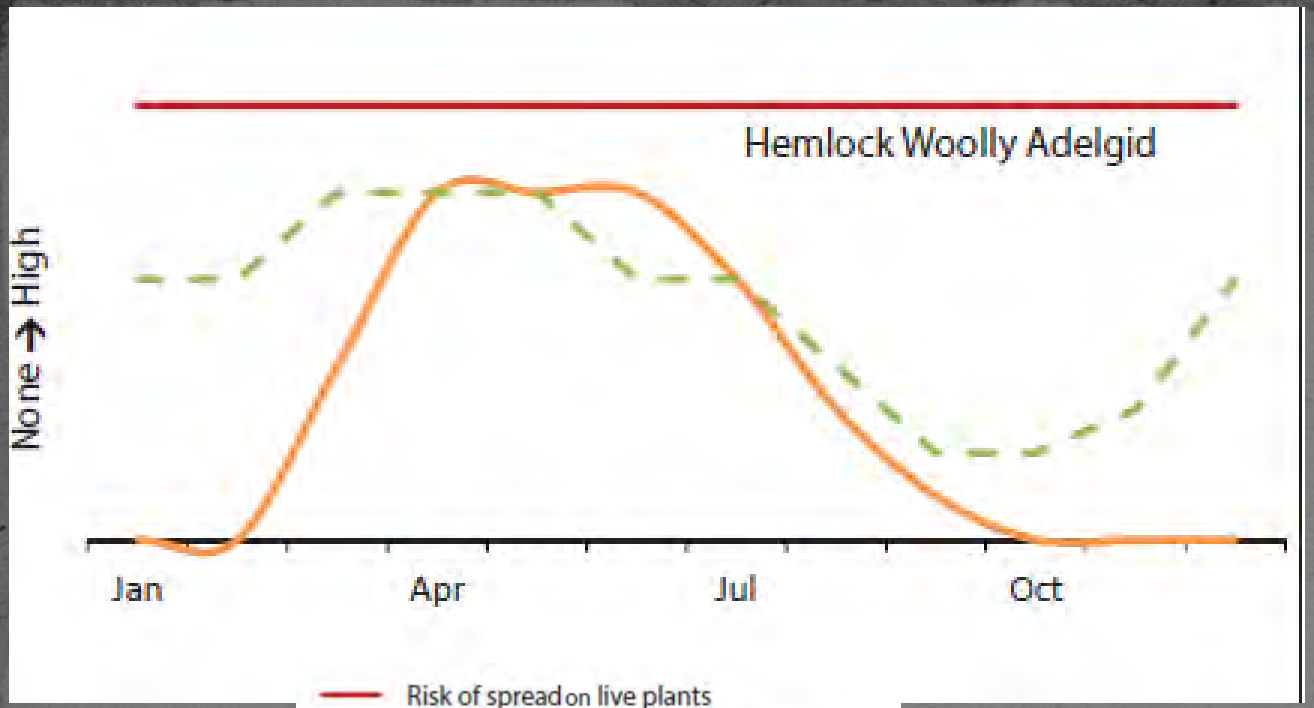


How do WE move them?

- **Year round – Live Plants**
- **March-July** (crawlers/eggs)
  - Severed hemlock
  - Clothing, machinery, etc.

What about natural spread?

- **March-July** (crawlers/eggs)
  - Wind and weather
  - Animals



CAUTION:
You can carry this pest when it is an egg or crawler
(~Mar through Early Aug)

Sometimes Hard to See!
– **crawlers are invisible, summer stage aestivates**

Recognizing HWA

Look at undersides of HEMLOCK twigs

- Discrete white cottony balls at BASE of needles
- Found on <u>newer growth</u>
- Most visible November thru July

Recognizing HWA

From Afar

- premature needle drop
- lack of new growth
- lush green color fades
- branch dieback

HWA Management
Imported Biological Control

Predatory Beetles:

- One commercial vendor for State – costly (~2.50 each)
- Long horizon
- Uncertain results
- Not compatible with insecticide-intensive settled areas

Sasajiscymnus tsugae (St)

St, a lady beetle (Coccinellidae), is an important predator of HWA in Japan. Releases of St in Maine began in 2004. It has since become established at several sites.

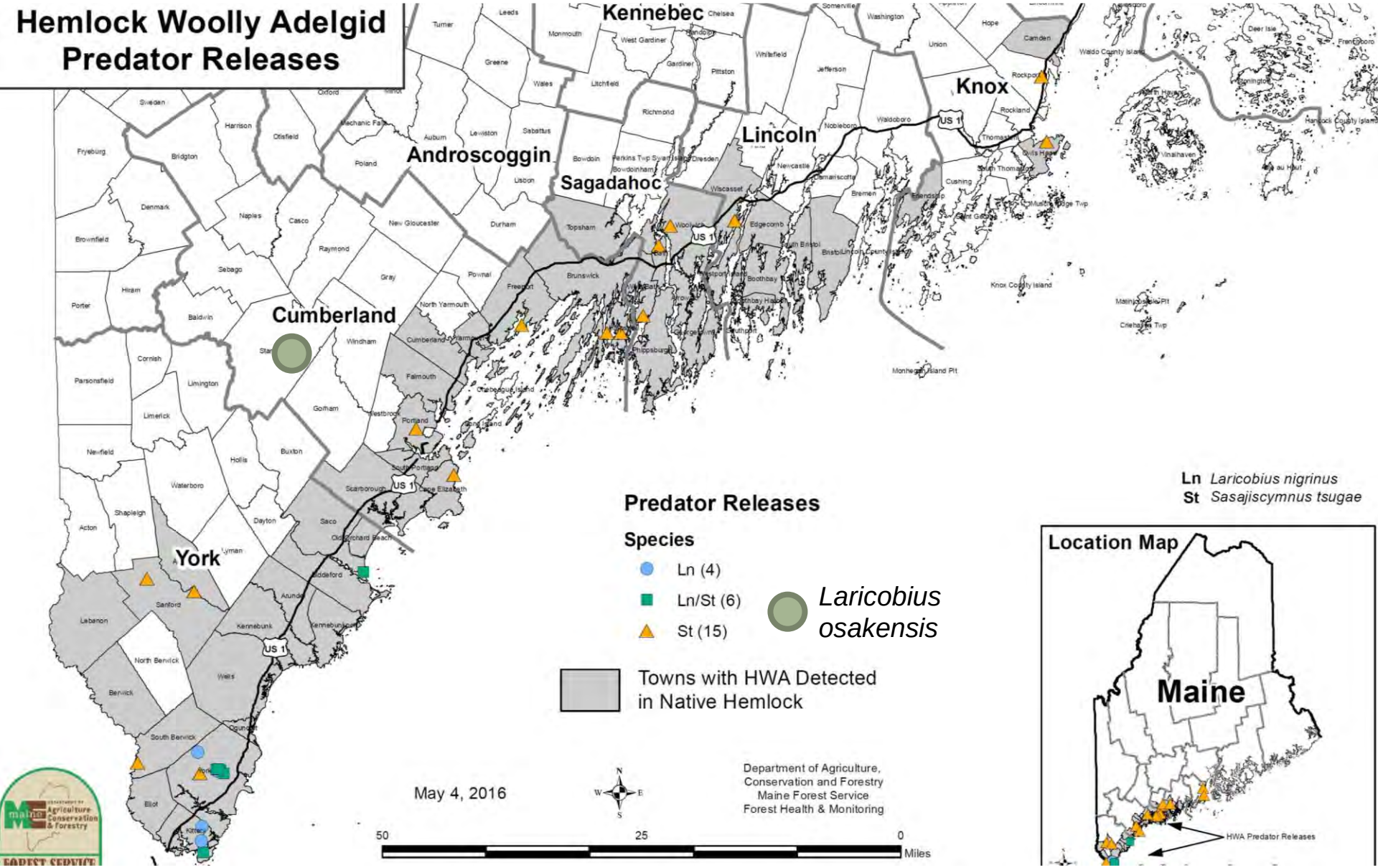
Color: Black
Shape: Oval
Size: 1/16th inch
Origin: Japan

Image: Dr. Carole Cheah, CAES, bugwood.org

Laricobius nigrinus (Ln)

Ln, a tooth-necked fungus beetle (Derodontidae), is an important predator of HWA in the Pacific Northwest. This species was first released in Maine in 2006

Color: Black
Shape: Oval
Size: 1/10th inch
Origin: Pacific Northwest


Hemlock Woolly Adelgid
Predator Releases
Kennebec
Androscoggin
Sagadahoc
Lincoln
Knox
Cumberland
York
US 1
Predator Releases
Species
Ln (4)
Ln/St (6)
St (15)
Laricobius osakensis
Towns with HWA Detected in Native Hemlock
Ln Laricobius nigrinus
St Sasajiscymnus tsugae
Location Map
Maine
HWA Predator Releases
May 4, 2016
N
W
E
S
50
25
0
Miles
Department of Agriculture, Conservation and Forestry
Maine Forest Service
Forest Health & Monitoring

Mechanical Options

- High pressure hose during crawler active period
- Cut infested material (Pref. Aug-Mar)
  - Branches
  - Whole trees (target heavily invested, definitely in Aug-Mar!)
- Cut "at risk" material (human-carrier exposure)

Chemical Options

- Foliar spray- horticultural oils/soaps; conventional pesticides
  - Repeat every 1-2 years (population dependent)
- Systemics: soil drench, soil injection, stem injection, basal bark. Repeated every 2-10 years (product, method, population dependent)

Foliar Application

Basal Bark Application of Dinotefuran (Credit NH DFL)

And, while you are looking at hemlocks . . .

Elongate Hemlock Scale

(Fiorinia externa)

- -Hemlock and Fir
- -Spruce
- -*Other Conifers*

Elongate Hemlock Scale

A Second Invasive Sucker on the Scene

- Armored scale insect
- First U.S. detection - 1908 (NY)
- First Maine detection – 2009
- Appearance:
  - Female: yellow/brown waxy coating, immobile adult
  - Male, white waxy “cocoon”
  - Threadlike “floss”
  - Along the length of needle

Elongate Hemlock Scale

- What to look for
  - Waxy deposits – "gray" colored needles on upper surface
  - Thinning foliage
  - Scale coverings/floss undersurface
- Where to look
  - Hemlock and Fir
  - Older branches
  - Planted trees
  - Forests infested w/HWA

On trees with HWA…

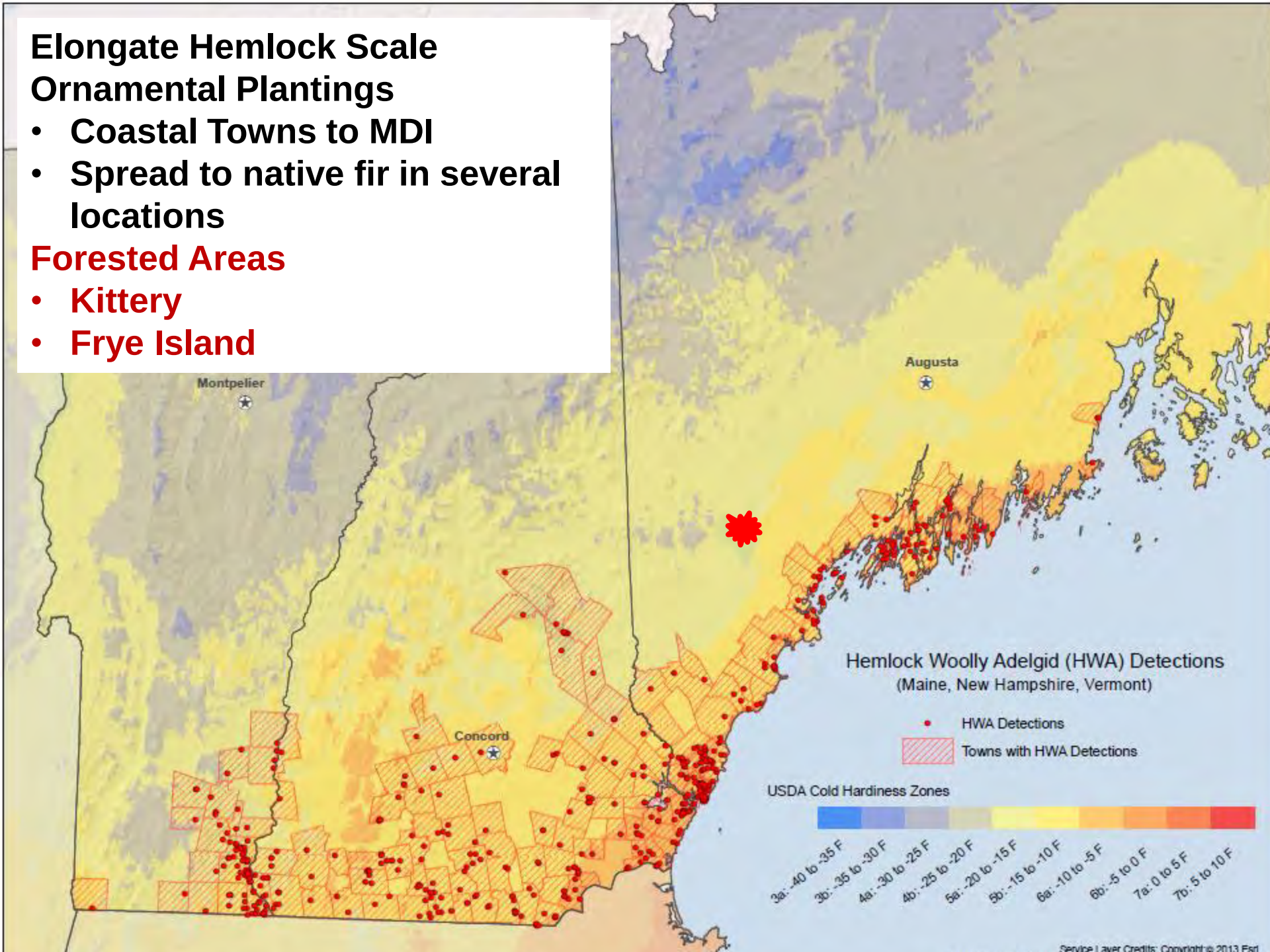
See the sneaky scales?

Elongate Hemlock Scale
Ornamental Plantings

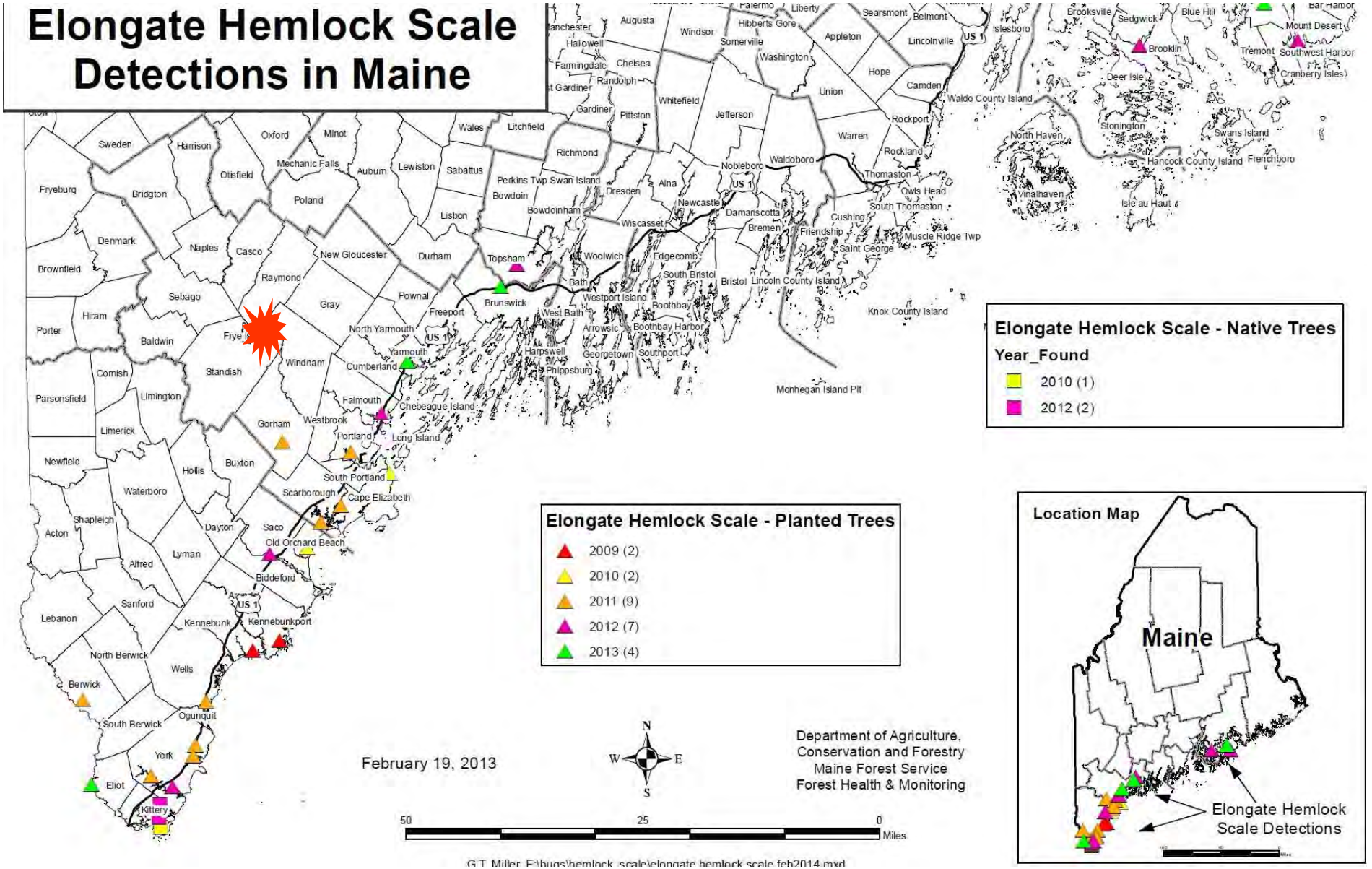
- **Coastal Towns to MDI**
- **Spread to native fir in several locations**

Forested Areas

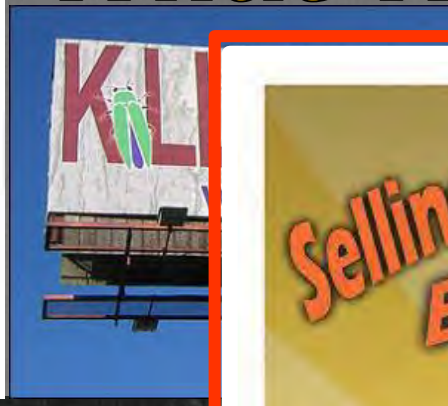
- **Kittery**
- **Frye Island**

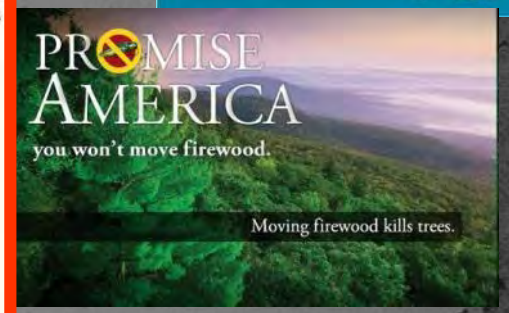


Elongate Hemlock Scale Detections in Maine



What We ALL Can Do

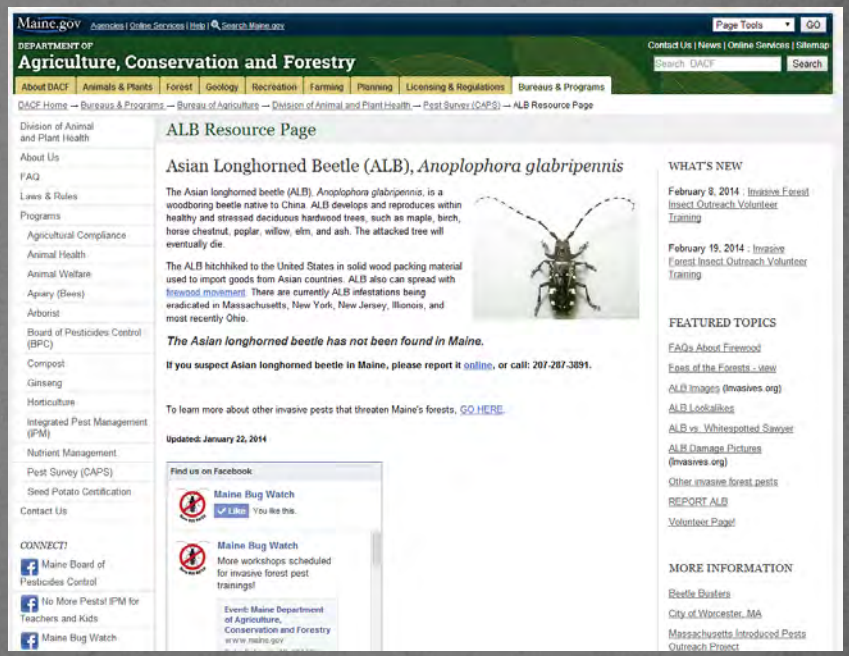




Spread the Word!

Report Your Find or Damage Signs

- **Asian Longhorned Beetle:**
  www.maine.gov/alb
- **Emerald Ash Borer:**
  www.maine.gov/eab
- **Bug Watch ME**
  - bugwatchme.agr@maine.gov
  - (207) 287-3891
- www.maine.gov/forestpests
- forestinfo@maine.gov
- **Maine Forest Service**
  (207) 287-2431



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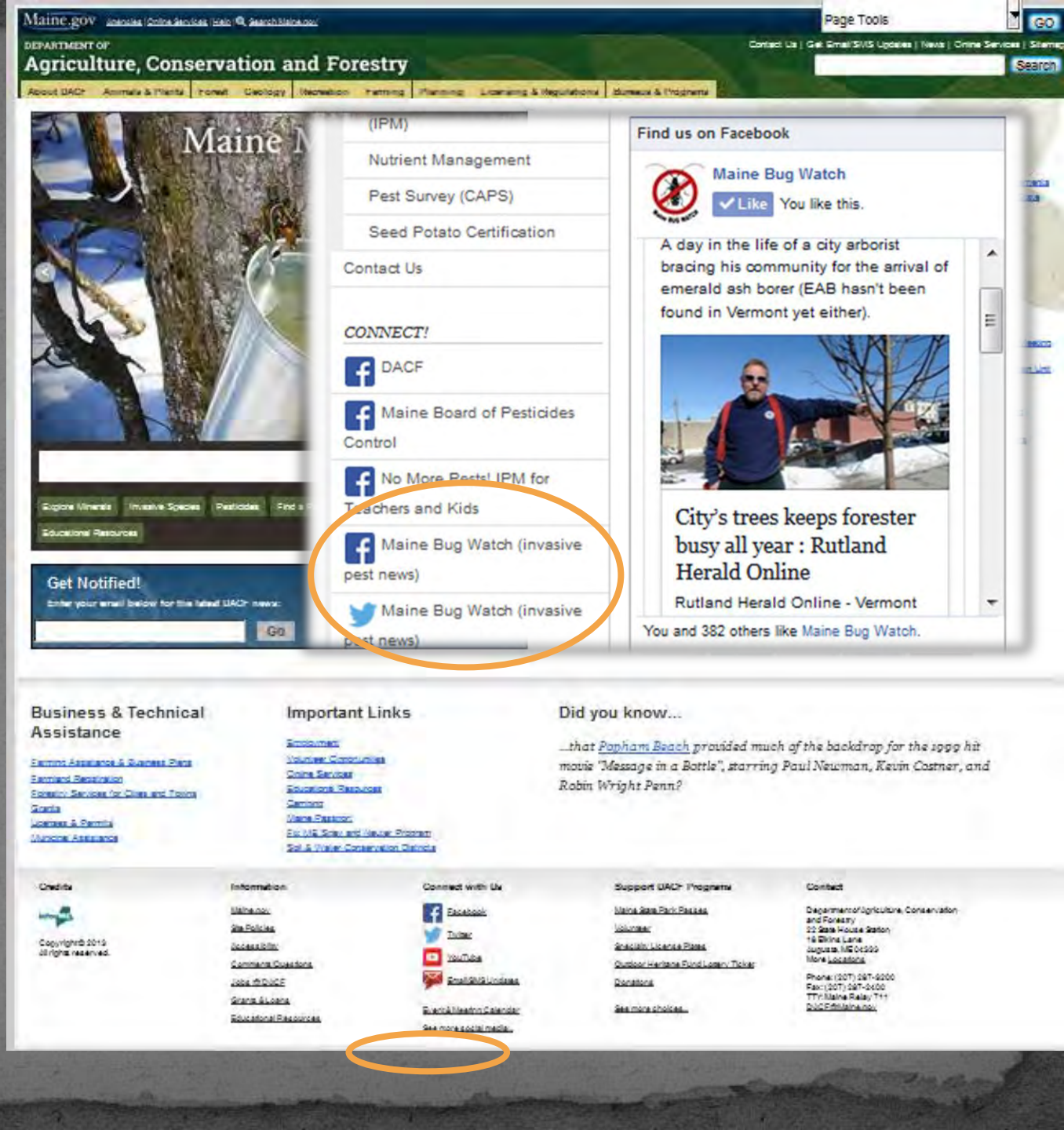
www.maine.gov/dacf

  - Bureau of Ag
  - Plant Health
  - Bureau of Forestry
  - Forest Health

- …Even USPS

  Conditions Reports (MFS)



For further information, or to report any of these insects, call:

Maine Department of Agriculture, Conservation and Forestry at 287-3891

James E. Appleby, University of Illinois

Questions?