# Mixed Oak Hickory Pests and Some management ideas

**Kyle Lombard**

**Forest Health Program**

10/30/2017

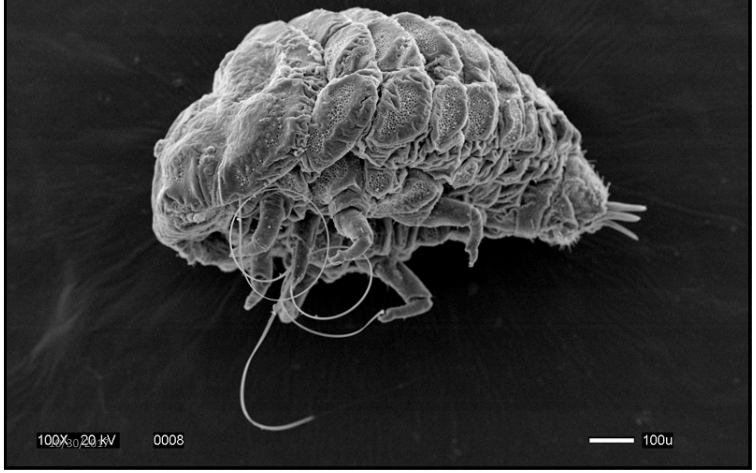

Peterson's guide to Eastern Forests

10/30/2017

10/30/2017

**Adelgid 101**

Small wingless insect with piercing/sucking mouth parts

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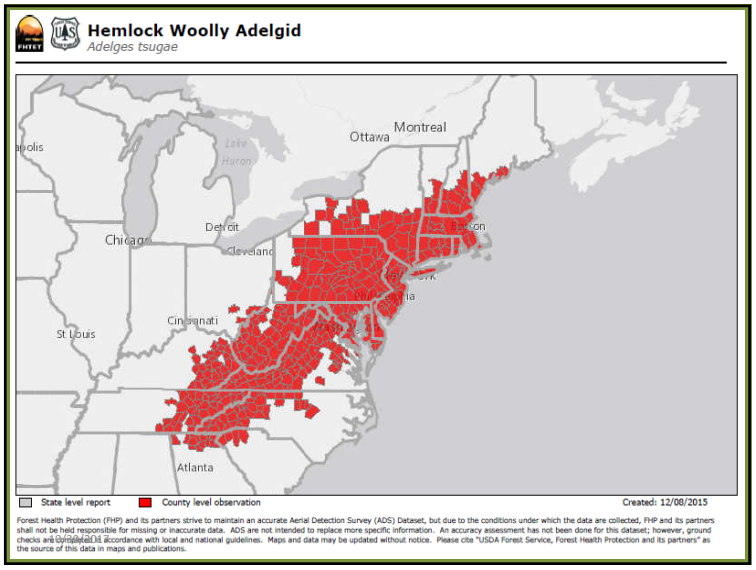
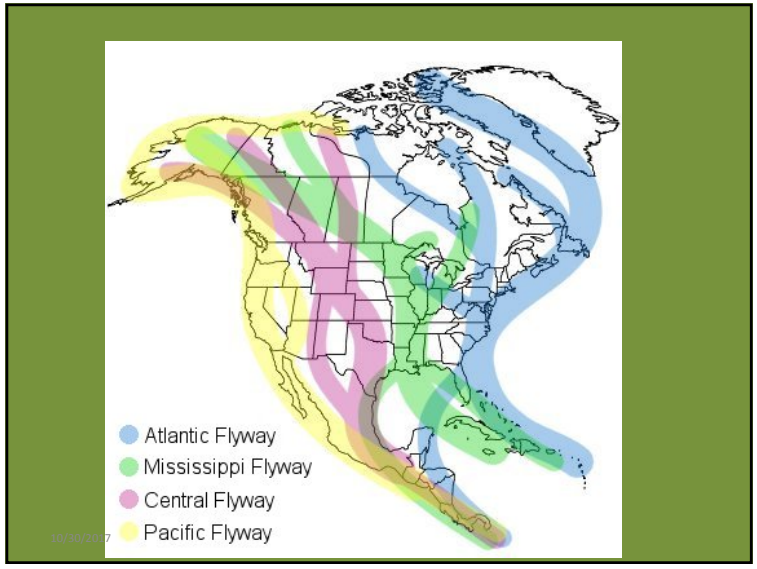

Hemlock Woolly Adelgid
Adelges tsugae
Ottawa
Montreal
Detroit
Chicago
Cleveland
Cincinnati
St Louis
Atlanta
State level report
County level observation
Created: 12/08/2015


Atlantic Flyway
Mississippi Flyway
Central Flyway
Pacific Flyway
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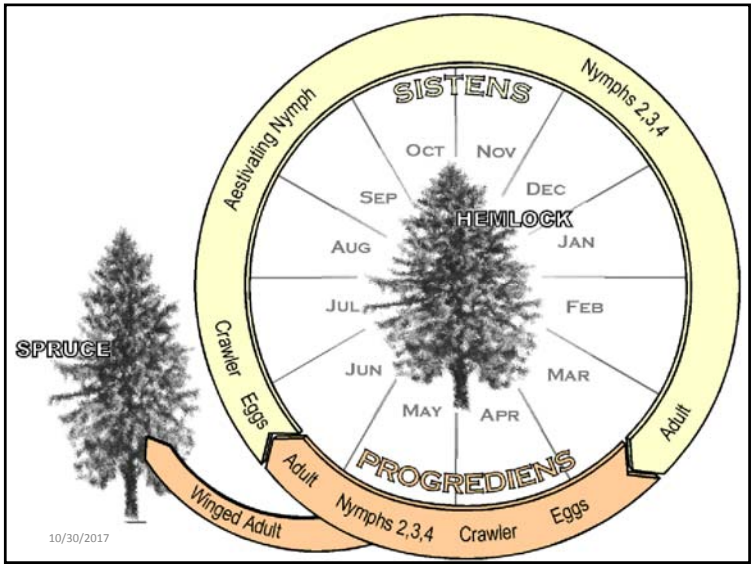

SISTENS
PROGREDIENS
HEMLOCK
SPRUCE
Aestivating Nymph
Nymphs 2,3,4
Crawler
Eggs
Adult
Winged Adult
Oct
Nov
Dec
Jan
Feb
Mar
Apr
May
Jun
Jul
Aug
Sep
10/30/2017


Pete Salmonsohn
29.06 inHg - 11F 01/22/2015 09:12AM

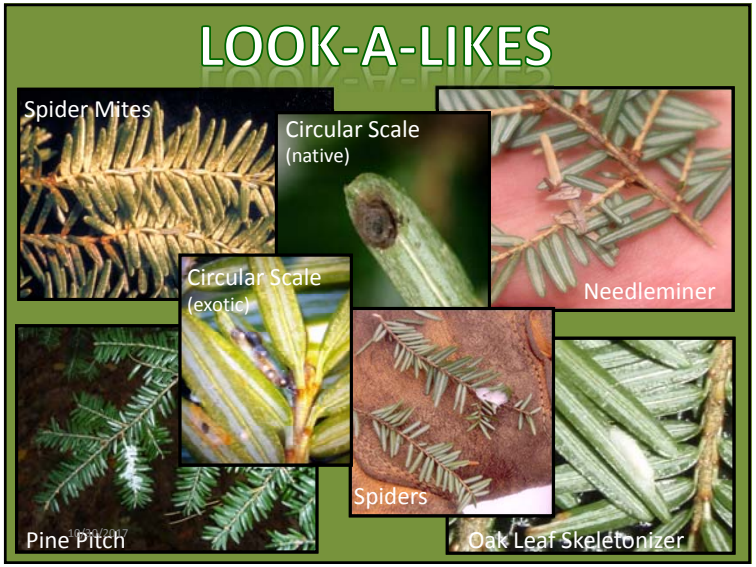

HWA QUARANTINE Established to keep infested material out of NH
10/30/2017


INTEGRATED MANAGEMENT
solo


from BC/Idaho: *Laricobius nigrinus*
Biological Contr


s for
1 tree


And now in New Ipswich


LOOK-A-LIKES
Spider Mites
Circular Scale
(native)
Needleminer
Circular Scale
(exotic)
Spiders
Pine Pitch
Oak Leaf Skeletonizer

# ELONGATE HEMLOCK SCALE

- Introduced into the United States from Japan.
- It was first observed in Queens, New York in 1908.
- Prefers hemlock, fir, spruce
- Other hosts include cedar, pine, yew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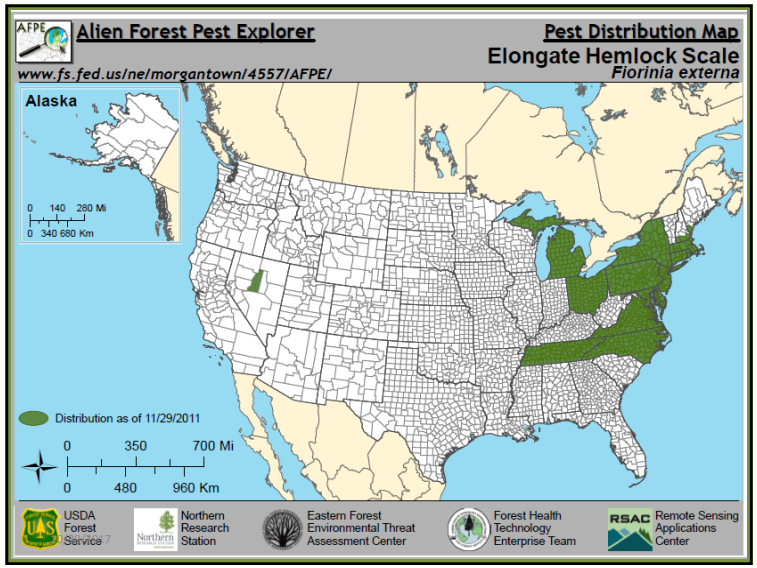


## OAK WILT

First identified in WI in 1944
No known origin
Red oak group highly susceptible and death in 1-2 years
White oak group can survive 5-10 years

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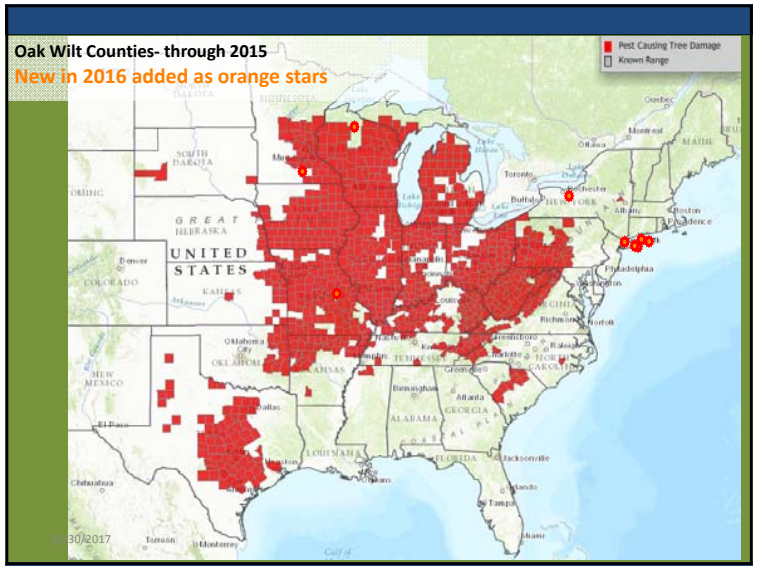
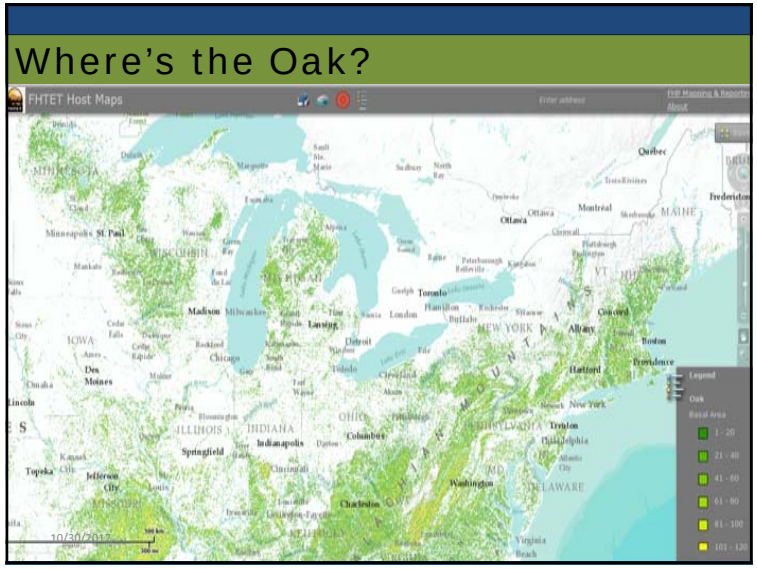
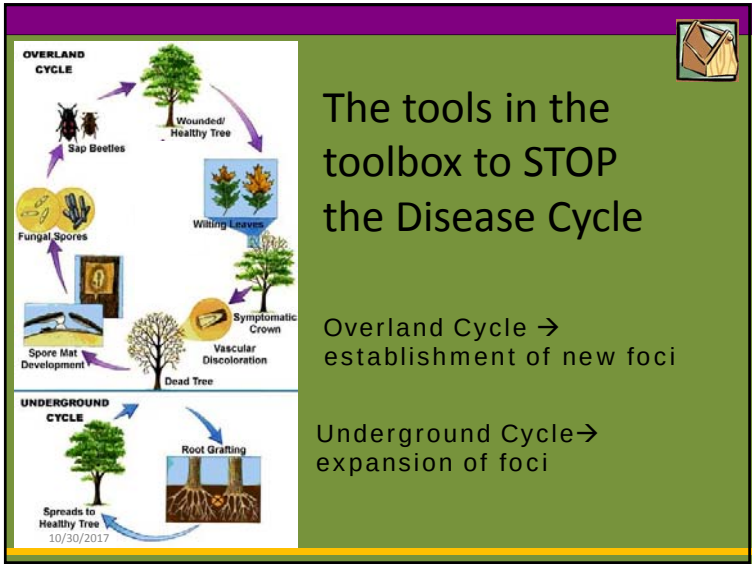

Oak Wilt Counties- through 2015
New in 2016 added as orange stars
Pest Causing Tree Damage
Known Range
UNITED STATES
10/30/2017


UGA5039095
10/30/2017


Where's the Oak?
FHTET Host Maps
10/30/2017


OVERLAND CYCLE
Wounded/ Healthy Tree
Sap Beetles
Wilting Leaves
Fungal Spores
Symptomatic Crown
Vascular Discoloration
Spore Mat Development
Dead Tree
UNDERGROUND CYCLE
Root Grafting
Spreads to Healthy Tree
The tools in the toolbox to STOP the Disease Cycle
Overland Cycle → establishment of new foci
Underground Cycle→ expansion of foci
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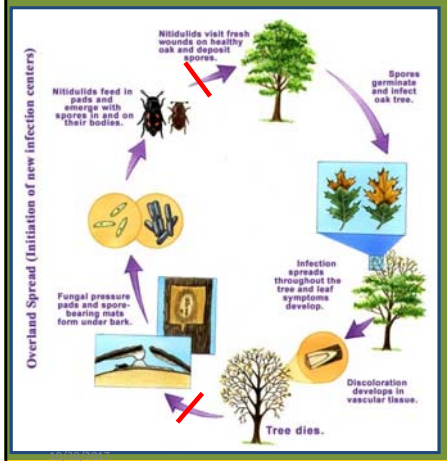
## Stop Overland Spread



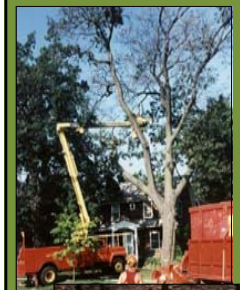

- Wound Prevention
- Sanitation





## Sanitation

Removal

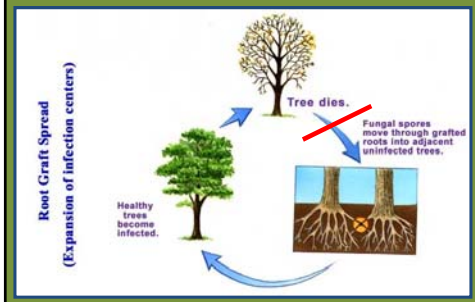


Proper disposal

Most common:
- Cut into firewood log lengths, split, then cover with plastic and seal.
- Can debark and use.
- Can chip and use.



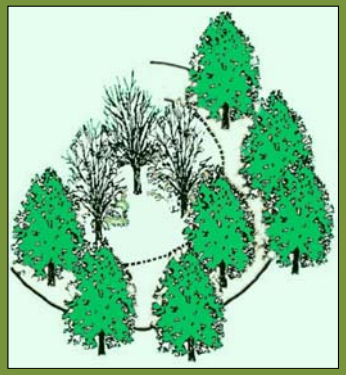
## Stop Underground Spread




- Root graft disruption

## Root graft disruption

- **Correct placement of root graft disruption lines or zones between infected and healthy trees.**
- **Several different models exist for how to place lines.**
- **Adequate cutting or treatment depth (54-60") to sever, disrupt, or kill all grafted roots.**



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## Root graft cutting tools: Vibratory plow

- Blade 54 to 60 in.
- Blade vibrates
- Plow articulated

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**"Rapid Response", with immediate herbicide treatment, followed by salvage.**

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## Fungicide

- Injectable formulation of Propiconazole (trade name Alamo)
- Does not kill the pathogen in the roots
- Not for eradication

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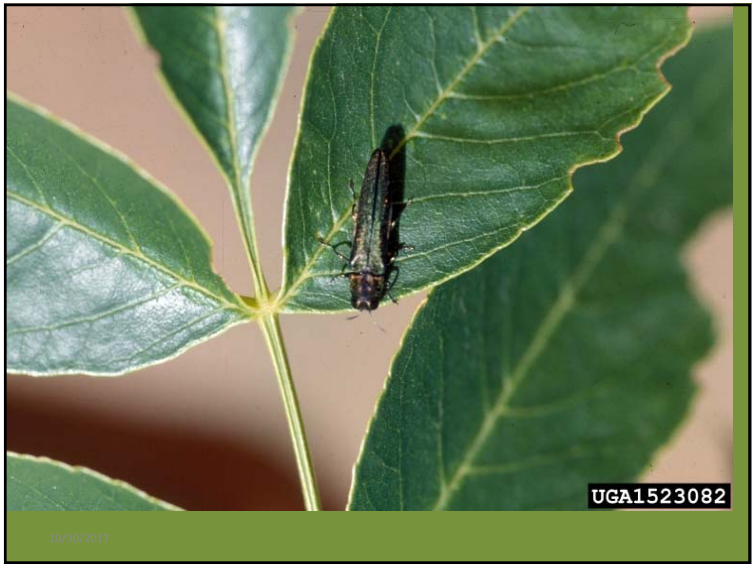
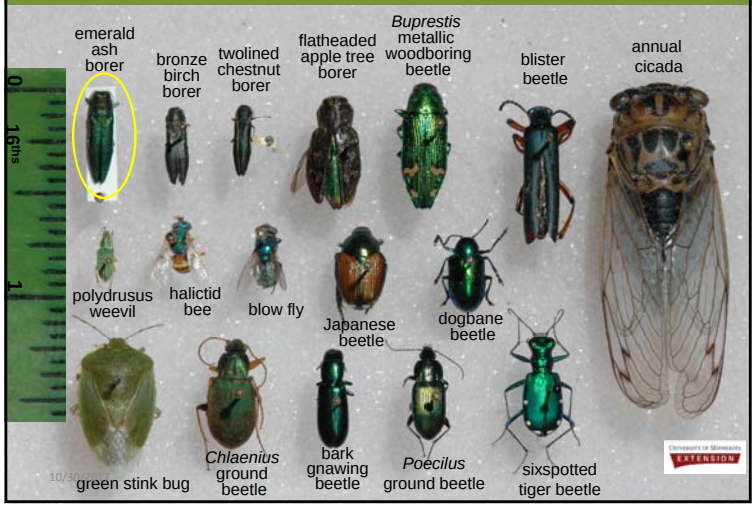
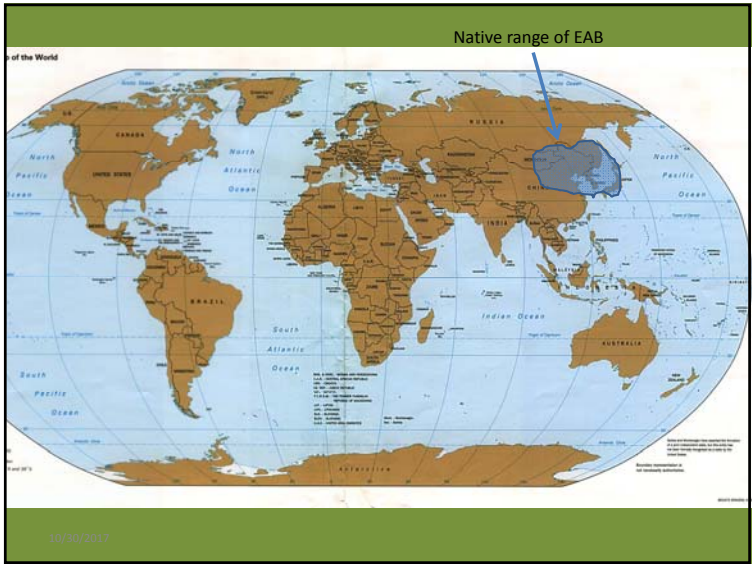
## Emerald Ash Borer

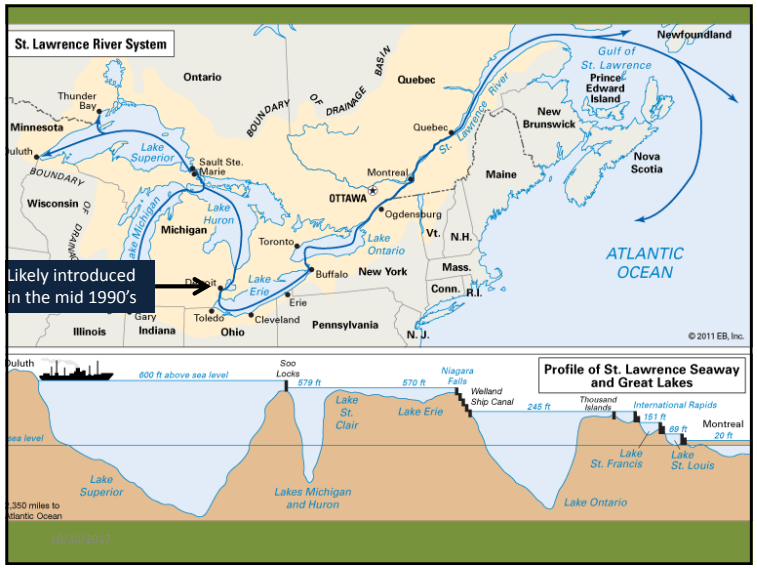
*Agrilus planipennis*


## EAB Look-a-likes




St. Lawrence River System
Likely introduced in the mid 1990's
Profile of St. Lawrence Seaway and Great Lakes
ATLANTIC OCEAN
© 2011 EB, Inc.
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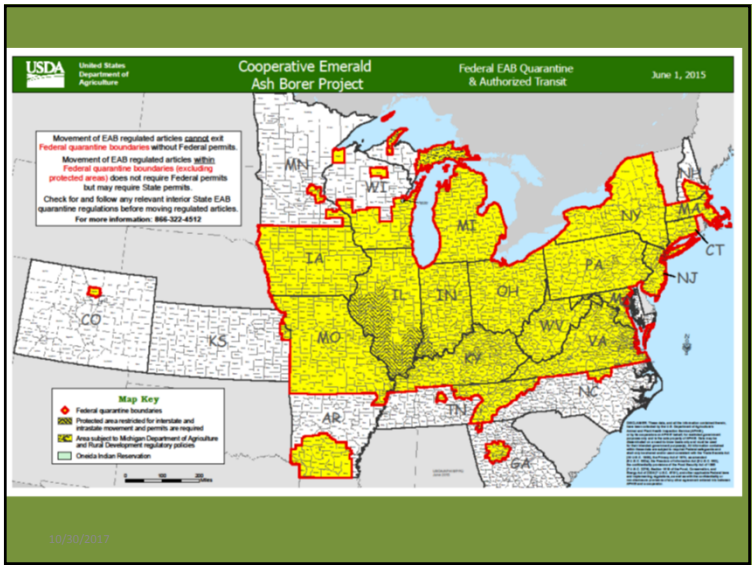
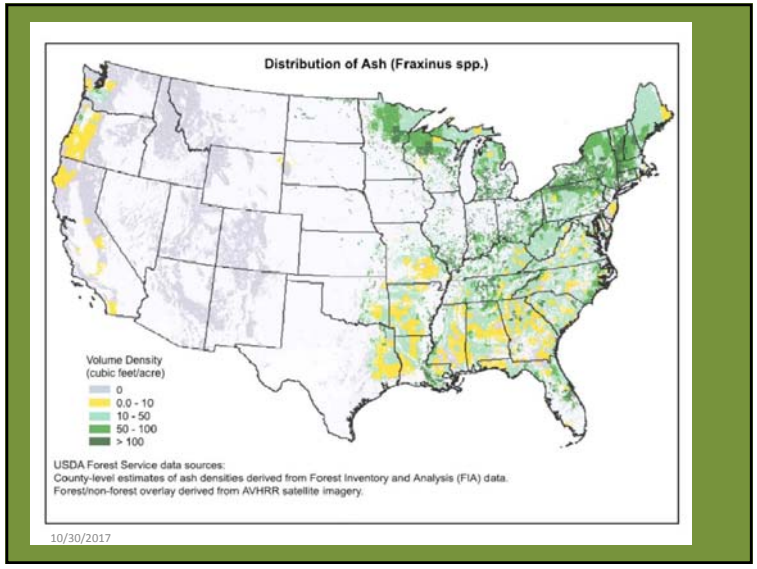
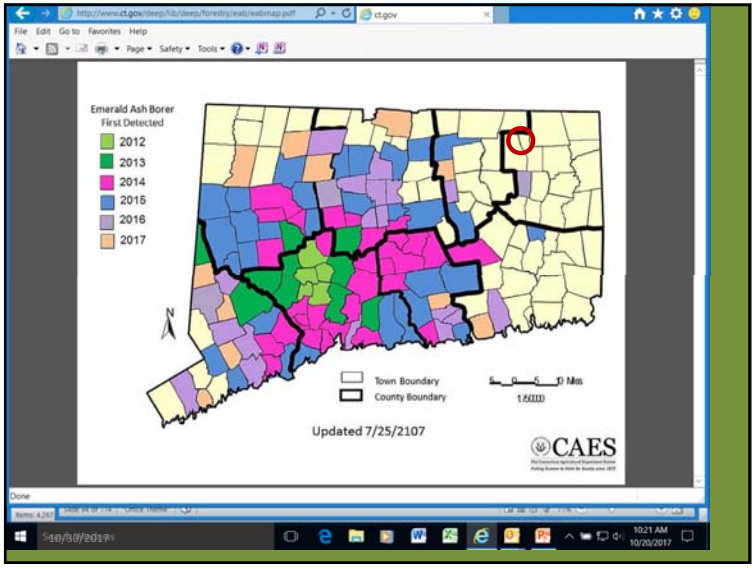

Cooperative Emerald Ash Borer Project
Federal EAB Quarantine & Authorized Transit
June 1, 2015
Map Key
10/30/2017


Distribution of Ash (Fraxinus spp.)
Volume Density (cubic feet/acre)
0
0.0 - 10
10 - 50
50 - 100
> 100
USDA Forest Service data sources:
County-level estimates of ash densities derived from Forest Inventory and Analysis (FIA) data.
Forest/non-forest overlay derived from AVHRR satellite imagery.
10/30/2017


Emerald Ash Borer
First Detected
2012
2013
2014
2015
2016
2017
Town Boundary
County Boundary
Updated 7/25/2107
CAES
10/30/2017


BL02593


Identification - Signs
Serpentine Larval Galleries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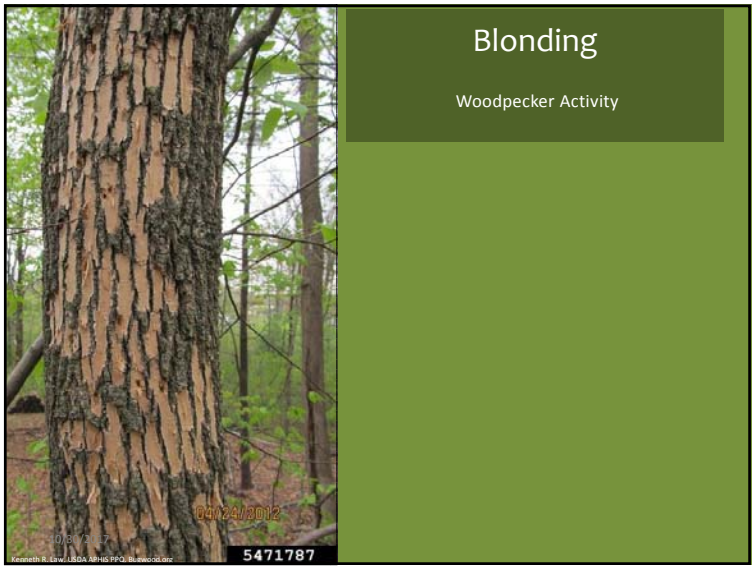
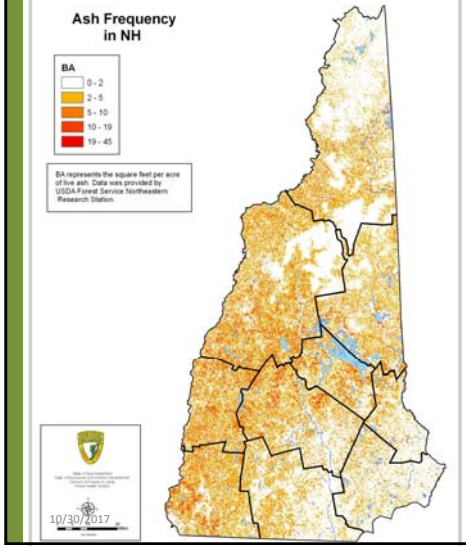

Blonding
Woodpecker Activity
04/24/2012
5471787


10/30/2017




## What's at Risk in NH?

6% of the Northern Hardwood forest (2% of all trees in NH)

800 million white and black ash trees over 1" diameter

28 million ash over 5" diameter

Total of 290 million cubic feet of ash wood (29 million cords)

80% of that total is "sawlog" quality valued at 230 million dollars to the landowner

The value added worth to the economy in NH after trucking costs, manufacturing, retail sales and distribution of ash products is in the Billions

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## What We Are Doing Statewide

Objectives
Detect new infestations quickly
Slow the spread of EAB statewide
Slow ash mortality locally
Maintain ash in the landscape

Methods
Diverse management tactics
bio control, **forest management tactics,**
pesticide trials and treatments
BMP's
Continual surveying
visual, volunteer, traps, cerceris wasps
Public outreach
UNHCE leads, target user groups, public, conservation groups
Regulations
NHDAMF lead, Quarantine,

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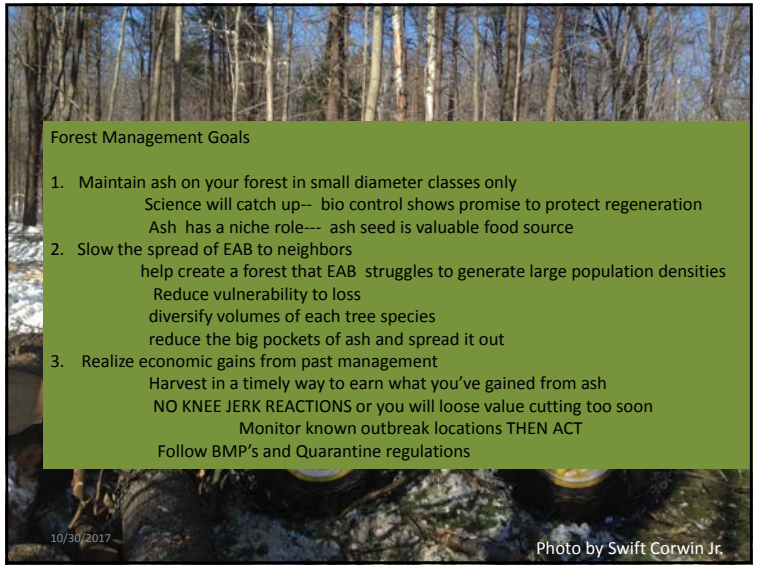

Forest Management Goals

1. Maintain ash on your forest in small diameter classes only
   Science will catch up-- bio control shows promise to protect regeneration
   Ash has a niche role--- ash seed is valuable food source
2. Slow the spread of EAB to neighbors
   help create a forest that EAB struggles to generate large population densities
   Reduce vulnerability to loss
   diversify volumes of each tree species
   reduce the big pockets of ash and spread it out
3. Realize economic gains from past management
   Harvest in a timely way to earn what you've gained from ash
   NO KNEE JERK REACTIONS or you will loose value cutting too soon
   Monitor known outbreak locations THEN ACT
   Follow BMP's and Quarantine regulations

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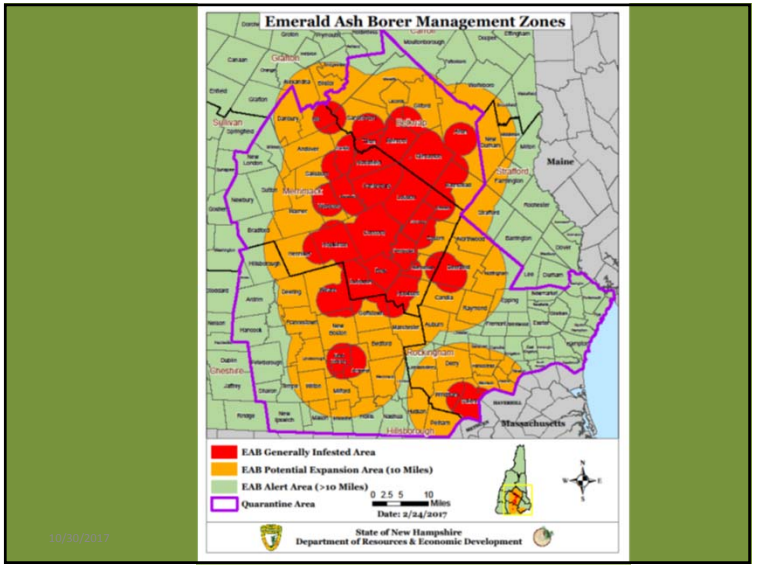
Photo by Swift Corwin Jr.

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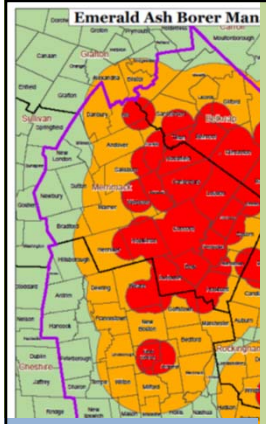



RED ZONE:
1. Identify any high value ash for pesticide treatments
2. Create sink site pre-harvest (timing and technique is everything)
3. Cut most ash leaving a small amount of 4-6" trees

We recognize the "cost" of logging is too high to enter a site for small volumes of scattered large ash.

4. Pay attention to the quarantine timing

ORANGE ZONE:
1. Identify high value trees needing pesticide treatments
2. Identify the forests with high volumes of ash (greater than 25% BA of ash) and start planning harvest
3. During regularly scheduled harvests remove large diameter ash leaving small BA's of small trees. Less than 10sq.ft/acre
4. Consider removing ash in the low density ash sites only when you're harvesting during regularly planned visits

"GREEN" ZONE:
1. Inventory and plan for being in the red or orange zone.
2. Know which properties you don't plan to harvest
3. identify which properties have rich resources of ash HOWEVER, if you're harvesting in the green area and shouldn't return to site for 15 years or more you should treat the site like you were in the orange zone.

Keeping in mind goals:
Slow spread
Keep ash on landscape
Realize ash economic value
Make yourself a small target

## Biological Control

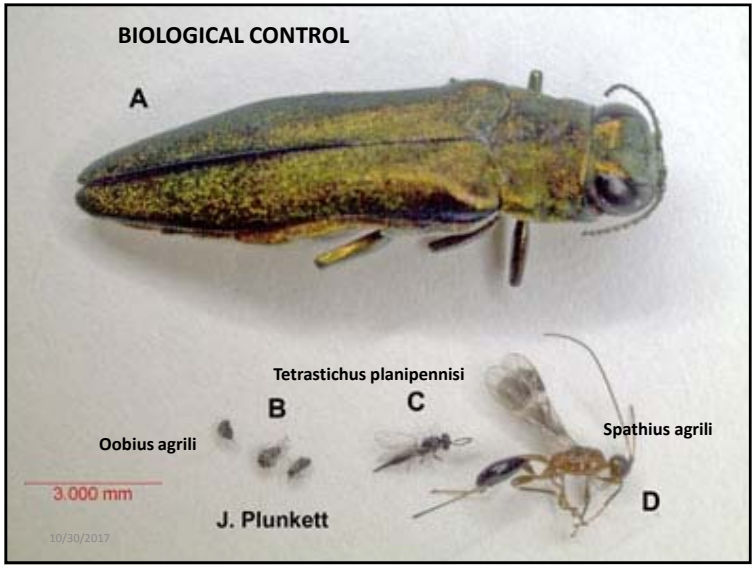
*Oobius agrili* – egg parisitoid

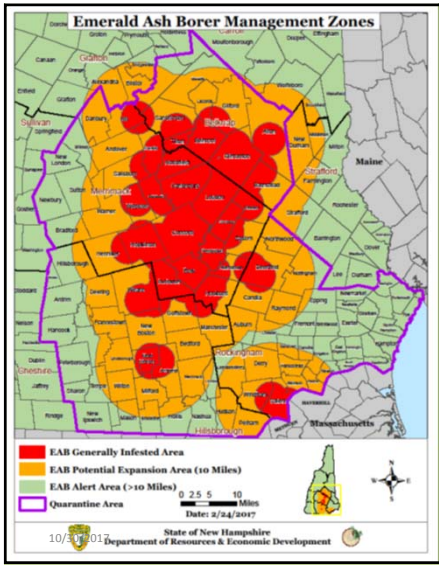
*Tetrastichus planipennisi* – larval parasitoid

| | 2014 | 2015 | 2016 | 2017 |
|---|---|---|---|---|
| Oob | 2600 | 5000 | 37,000 | 40,000 |
| Tet | 13,000 | 25,000 | 40,000 | 50,000 |
| Spathius | | | | 25,000 |



## BIOLOGICAL CONTROL




Quarantine rules:
#1 No Ash materials can leave quarantine between May 1 and September 30 unless treated.

#2 Ash materials can leave October 1 to May 1 if sent to a receiving site with a compliance agreement.

#3 No hardwood firewood can leave the zone at any time unless treated. **BUT REMEMBER "firewood" is less than 4'. Over 4' is regulated as logs. Only ash logs are restricted**

Treatment options:
1.Debark and take extra ½" of cambium.

2. Heat treat to 140 F for 60 min

3. Chip to 1" in two dimensions

Treatment timing is any time between leaf out and fall but there needs to be good uptake. Best after rains or when soil is moist. Sunny, Lightly windy. Any time there is good transpiration going on.

summary of insecticide options for professionals and homeowners).

- Insecticide Options for Protecting Ash Trees from Emerald Ash Borer

| | Ash trees are: | |
|---|---|---|
| | Less than 18 inches dbh | More than 18 inches dbh |
| Generally infested area | | |
| Ash appear healthy | Imidacloprid, dinotefuran, or emamectin benzoate products | Emamectin benzoate products |
| Ash are in decline | Emamectin benzoate products | Emamectin benzoate products |
| Ash have greater than 50% crown dieback or are dead | Tree removal – translocation ability of tree is likely insufficient to deliver chemical for effective treatment | Tree removal – translocation ability of tree is likely insufficient to deliver chemical for effective treatment |
| Potential Expansion Area (within 10 miles of known EAB infestation) | Imidacloprid, dinotefuran, or emamectin benzoate products | Emamectin benzoate products |
| Alert Area (more than 10 miles from a known EAB infestation) | Treatment is not recommended. Stay informed about new EAB information. | Treatment is not recommended. Stay informed about new EAB information. |

This information is given for educational purposes only and endorsement of insecticides use or

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http://bspm.agsci.colostate.edu/files/2014/02/EAB-control-optic

bspm.agsci.colostate.edu

File Edit Go to Favorites Help

| Application | Ingredient | | Timing* | |
|---|---|---|---|---|
| Soil drench, soil injection | imidacloprid | Merit®, Criterion®, Xytect®, Zenith®, Bandit®, several retail formulations | Around bud break | Relatively slow to move into tree so allow 4-6 weeks to reach highest levels in leaves. Soil must remain moist following application. Do not apply to any areas of soil where flowering plants that are visited by bees could pick up residues of the insecticide. Annual treatments required. |
| Soil drench, soil injection | dinotefuran | Safari®, Zylam®Transtect® | A few weeks after bud break, often mid-late May | Moves into plants faster than imidacloprid (2-3 weeks) so applications are later. Highly water soluble and should not be used if there is risk of leaching into water bodies or groundwater. Do not apply to any areas of soil where flowering plants that are visited by bees could pick up residues of the insecticide. Annual treatments required. |
| Systemic bark spray | dinotefuran | Safari®, Zylam®, Transtect® | A few weeks after bud break, often mid-late May | Moves into plants at effective levels within 2-3 weeks. Some, but not all, formulations suggest use of adjuvant. Do not allow drift onto any flowering plants that are visited by bees that could pick up residues. Annual treatments required. |
| Trunk injection | emamectin benzoate | TREE-Age® | Typically when adults are starting to emerge and lay eggs. However, long residual activity allows considerable latitude in application timing. | *Restricted Use Pesticide* due to acute toxicity. Biannual application. Has repeatedly demonstrated high level of control that can persist at least two years. Requires drilling holes into lower trunk. |
| Trunk injection | azadirachtin | TreeAzin® | Typically when adults are starting to emerge and lay eggs (May). | Natural product derived from neem tree seeds. Annual treatments likely to be required but there is some evidence of ability to control larvae in second year of |

Done

10/30/2017

IQ Tree Infuser

10/30/2017

STATE OF NEW HAMPSHIRE

## WOOD INFESTED BY THE EMERALD ASH BORER

### Best Management Practices for proper handling

Signs of EAB: "S" shaped tunnels under the bark and shallow woodpecker excavation (blonding)

We need your help to slow the spread of this devastating forest pest. Moving infested ash brings EAB to new woodlots and trees.

**The EAB quarantine** prohibits movement of hardwood firewood and all ash products out of the quarantine area unless specific conditions are met, whether or not materials show signs of infestation.

**Within the quarantine** area, movement of known infested ash products should be treated according to the recommendations on the reverse side of this sheet to reduce accidental spread of EAB.

Emerald Ash Borer Management Zones



10/30/2017

**You can help minimize the risk of spreading EAB within the quarantine by:**

1. Delivering ash wood within 5 miles of its origin; OR
2. Transporting ash firewood or logs to a kiln or mill, after October 1 for processing before May 1; OR
3. Cutting and seasoning ash at its place of origin for 12 months before distribution; OR
4. Chipping ash material to 1" size chips in two of three dimensions; AND
5. Notifying all recipients that there is a risk of infestation from this material and it should be burned, chipped, sawed into lumber, or heat treated by May 1 of the following year.

Responsible shippers may use this page for documentation of BMPs:

Shipper:_____

# of BMP employed:_____

Delivery Location:_____

Date Delivered:_____

For more details and current infestation maps please call 603-464-3016 and visit nhbugs.org


10/30/2017


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**E. Leopold Trouvelot**

1869







Naturalized in the Northeast due to EM and NPV virus

**5 minute eggmass surveys.**

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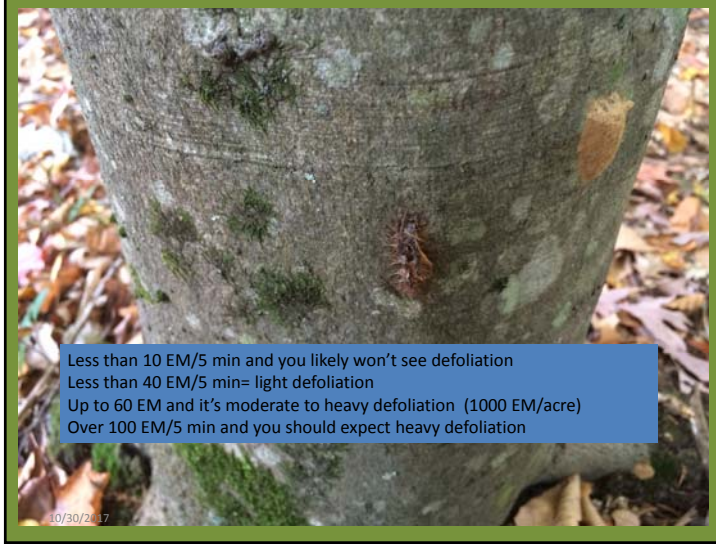

Less than 10 EM/5 min and you likely won't see defoliation
Less than 40 EM/5 min= light defoliation
Up to 60 EM and it's moderate to heavy defoliation (1000 EM/acre)
Over 100 EM/5 min and you should expect heavy defoliation

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Gypsy moth control
EM Fungus and NPV virus in nature

Forestry programs across the North Central states spray gyp-check (NPV), spread diseased caterpillars, or spray Bt

Arobrists use a variety of foliar sprays including Bt

10/30/2017

Forest Management Recommendations?

1. Do your eggmass counts
2. Consult annual aerial survey data
3. Manage alternative forest types on highly susceptible droughty soils
4. Minimize larval "refuges" like large dead trees, sign posts, damaged trees
   Basically, Keep declining stands cleaned up and practice sound periodic management to keep trees growing well
5. Mix unfavorable species at the stand level and especially at the landscape level.

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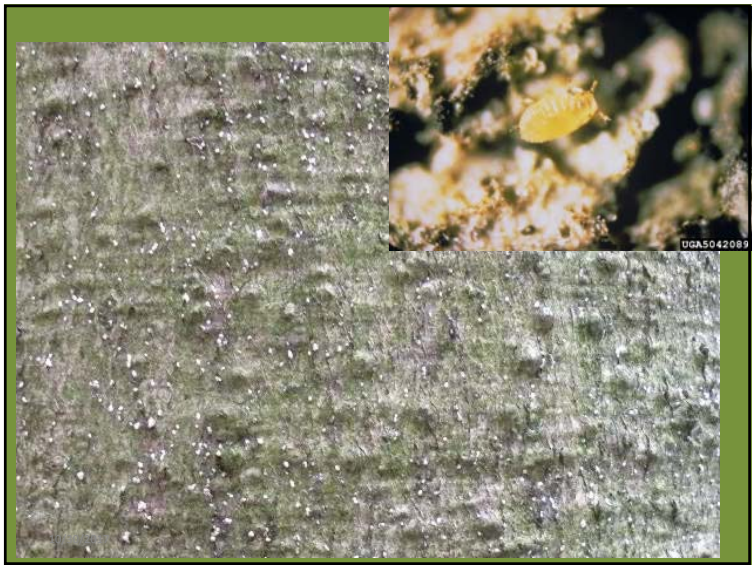
Beech Bark Disease
NICK
N
DAD
'96
DAFNE
LYNDSAY
MIKE


UGA5042089


INVADING SPECIES
10/30/2017


10/30/2017

All kinds of ideas to manage the damage:
Assuming that reducing the amount of beech regeneration and basal area volume is your goal:

1. Even age management to get less shade tolerant competing regen
2. Cut in the winter to reduce logging damage in attempt to limit sprouting
3. Leave all the partially resistant beech
4. Don't cut any beech in the harvest area

5. **Leave seemingly resistant beech, cut all of the diseased trees AND stump treat with herbicide**

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**Jeff Kotchenderfer's work on the Monongahela NF in 2003 showed:**

Cost was about $40/acre

Used 53% glyphosate undiluted
Treated the outer two inches of stump
One hour after cutting the tree

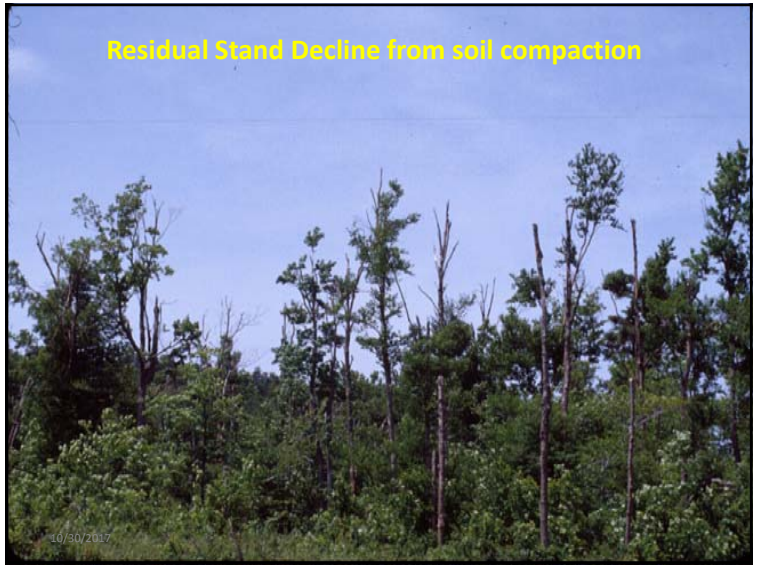
Treated around 90 stumps/ac

Complete control of beech regen (and standing beech) within 10' of small stumps

Complete control of regen and standing beech out to 30' for the large stumps (18"+)

Got "some" control out to twice the distance that they got complete control.

10/30/2017

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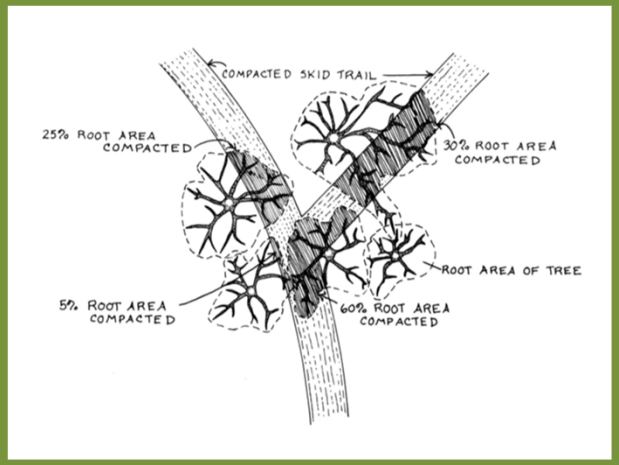
## CORRELATION OF HEAVILY COMPACTED ROOT AREA TO CROWN DIEBACK

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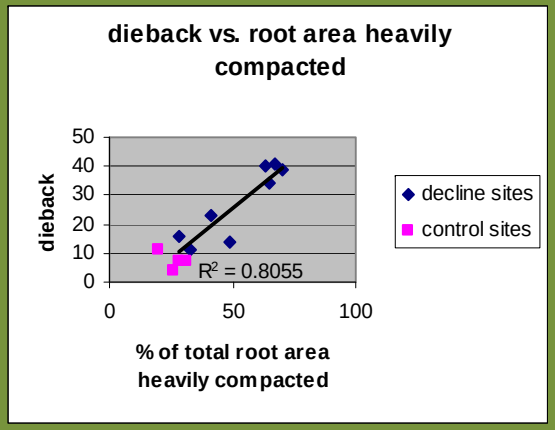
## Correlation between root area compacted and tree dieback

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## My Thoughts

lay out skid trails, work back to front, and encourage smaller equipment, especially chainsaw loggers and cable skidders

Encourage less skid steer equipment if the terrain allows it

**Be diligent about getting off the harvest area before spring break up. Don't let a good idea go bad.**

If RSD is evident don't go back in to remove declining trees. Mortality of trees with 30% dieback is not high. You'll likely just be dealing with a decade of sluggish growth

10/30/2017

# POP QUIZ



Which caterpillar makes these tents?

A. Eastern Tent caterpillar
B. Fall Webworm
C. Forest Tent caterpillar

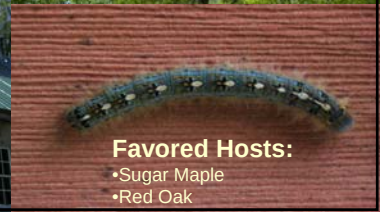




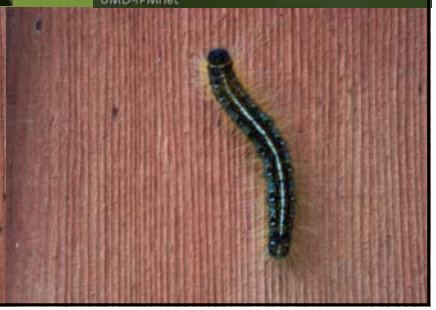
Forest Tent Caterpillar

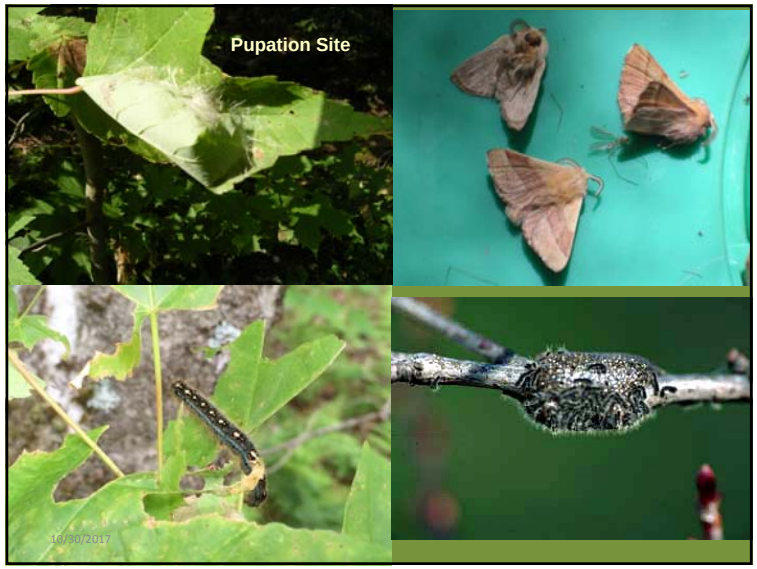
10,000 acres in 2004
66,000 acres in 2005
28,000 acres in 2006
108 acres in 2007
9,000 acres in 2016
20,000 acres in 2017





**Favored Hosts:**
- Sugar Maple
- Red Oak


Pupation Site
10/30/2017


10/30/2017


10/30/2017


10/30/2017

## FTC Biological Control

**Friendly Fly**

**And 40 other predators attack the pupae and eggs of FTC**

***Sarcophaga aldrichi***

10/30/2017


10/30/2017

**Recommendations for timber management of defoliated stands**

Postpone harvesting until two years post outbreak.

1. current outbreak will concentrate on residual trees
2. don't add soil compaction, root damage and basal wounding to already stressed trees
3. some trees will seriously decline or die from the outbreak. You don't want to leave those and take trees that resisted the outbreak
4. Predators and parasites perform way better in closed canopy situations

10/30/2017

## Asian Longhorned Beetle

*Anoplophora glabripennis*


Not in NH YET!

10/30/2017

# Exit Holes

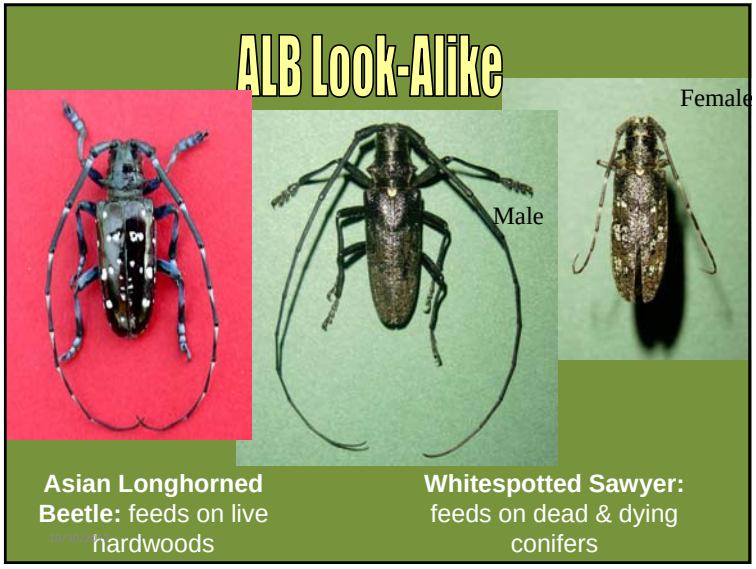
**EGG SITE**

- oval to round and can be up to ½ inch across

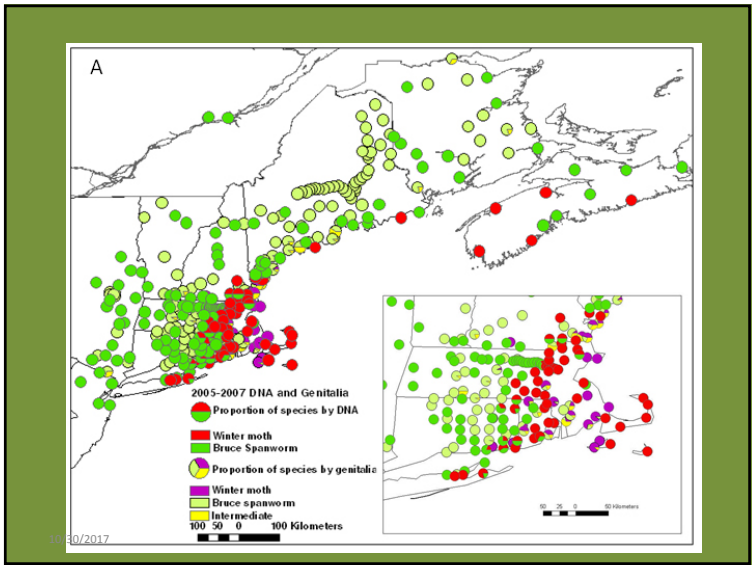

10/30/2017


10/30/2017
Mike Bohne, USDA Forest Service Northeastern Area


10/30/2017


ALB Look-Alike
Female
Male
Asian Longhorned Beetle: feeds on live hardwoods
Whitespotted Sawyer: feeds on dead & dying conifers


Winter Moth
Adults out in December
Lay eggs on trees
Larvae feed in April/May
Drop to soil to pupate


A
2005-2007 DNA and Genitalia
Proportion of species by DNA
Winter moth
Bruce Spanworm
Proportion of species by genitalia
Winter moth
Bruce spanworm
Intermediate
100 50 0 100 Kilometers