

Hemlock Woolly Adelgid



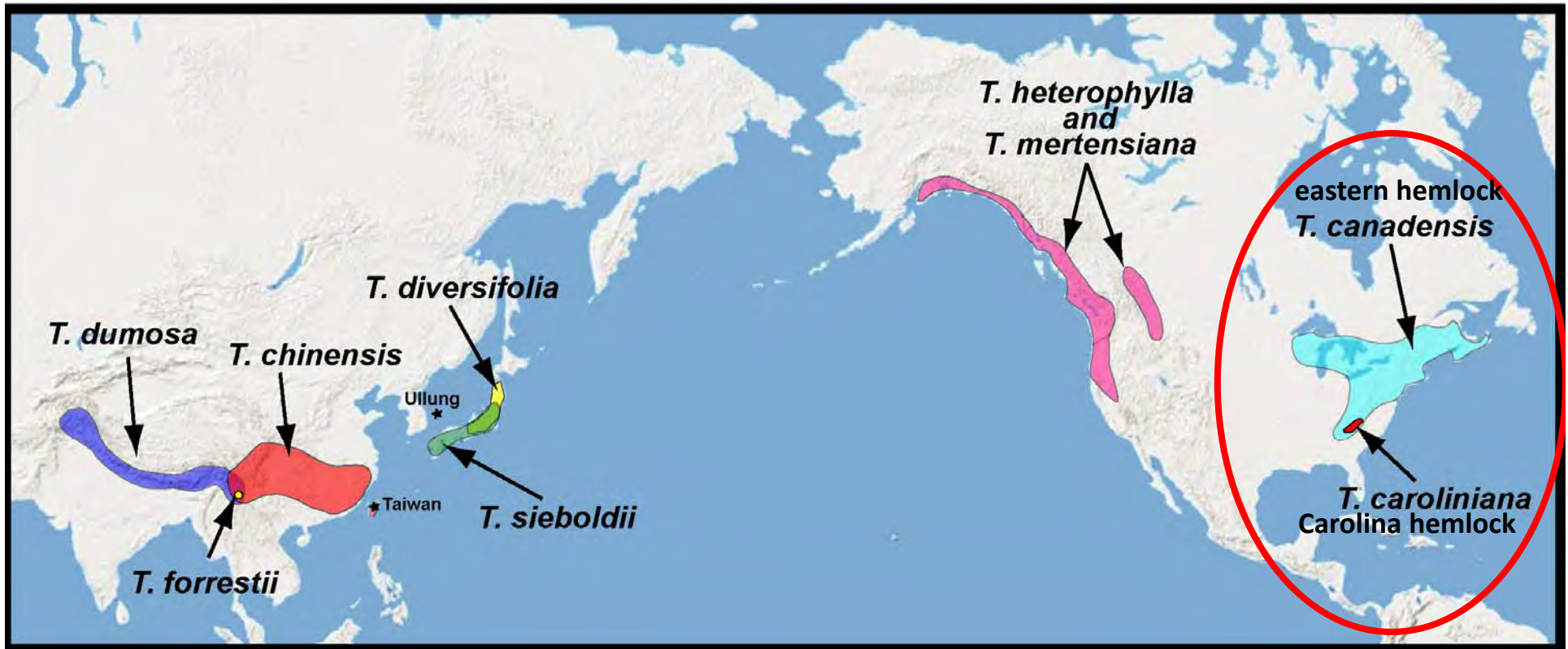
Elizabeth McCarty, Warnell School of Forestry
and Natural Resources, University of Georgia
Lynne Womack, Georgia Forestry Commission

Outline

- ▶ Hemlock forests
- ▶ Hemlock woolly adelgid (HWA)
- ▶ Hemlock management



World Distribution of *Tsuga* (hemlock) species



- Nine species of hemlock worldwide
- HWA is present in China, Japan, Taiwan, and eastern & western North America
- Western North American HWA population – endemic
- Eastern North American HWA population – introduced from Japan

What is the Resource?

Eastern hemlock - *Tsuga canadensis*

- ▶ Range from Canada to northern Alabama
- ▶ Distinctive ecological niche
- ▶ Slow growing, long-lived
- ▶ Shade tolerant
- ▶ Provides and conditions habitat
- ▶ Ecological role cannot be replaced by another species



What is the Problem?

Hemlock Woolly Adelgid (HWA) - *Adelges tsugae*

- ▶ Native to Japan
- ▶ Likely introduced in 1920s
- ▶ Detected in the 1950s
- ▶ Rapid spread in 1980s
- ▶ Two generations each year
- ▶ Females lay 50 – 300 eggs
- ▶ No effective native natural enemies
- ▶ Widespread hemlock mortality



Mark Whitmore, Cornell University

Progreiens generation in blue

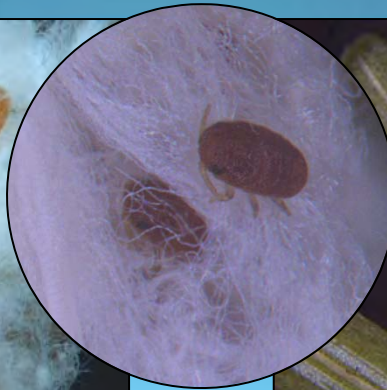
Sistens generation in green



HWA eggs



Crawler



Settled HWA



Adult with eggs



Adult HWA



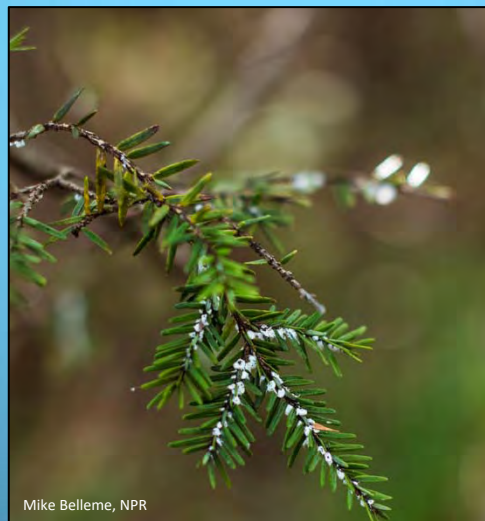
Invasive HWA

Hemlock forests

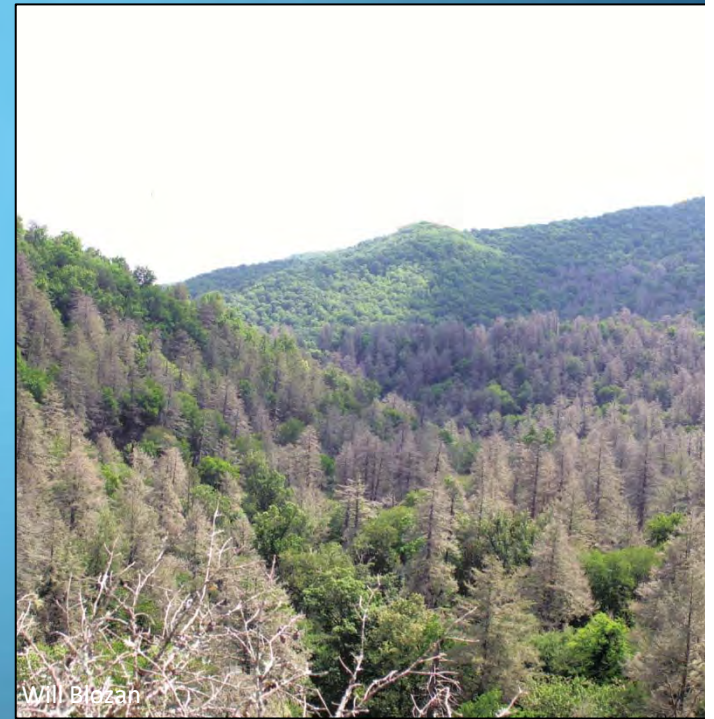


A landscape of dead trees

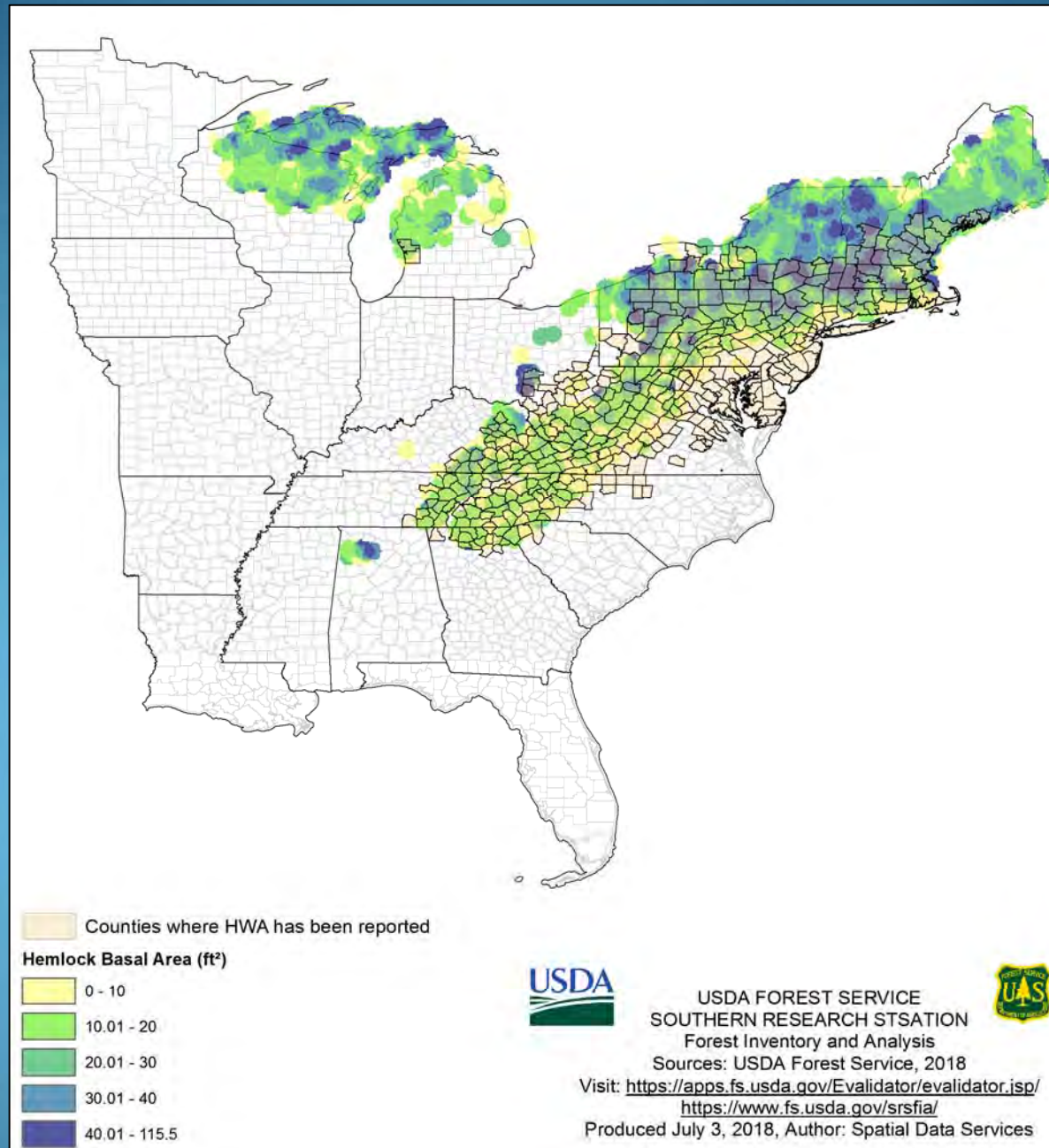
HWA feeding kills trees



Mike Belleme, NPR



Will Brezan



Hemlock woolly adelgid distribution map in the eastern U.S. Different colors represent different amounts of hemlock basal area, while counties where the adelgid has been reported are outlined in black. HWA present in Alabama as of 2020.

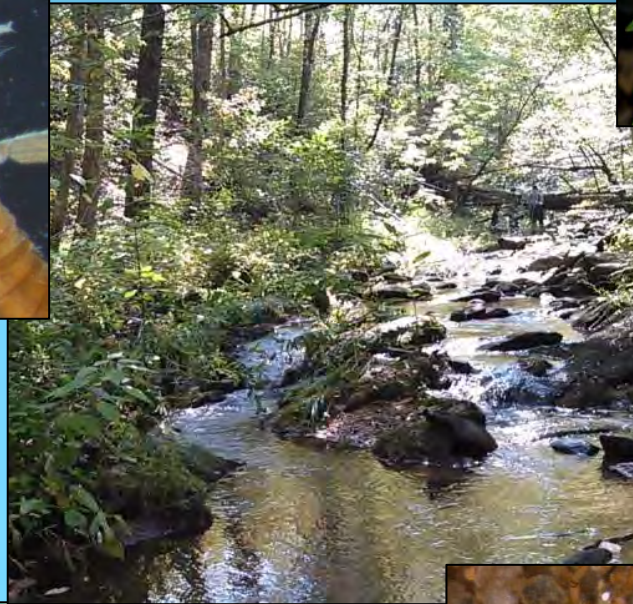
Post-HWA Forests

What do we see in forests after HWA-induced mortality?

- ▶ Opens canopy gaps
- ▶ Rapid vegetation response
- ▶ Changing plant communities
- ▶ Changes in soil nutrients
- ▶ Altered wildlife habitat
- ▶ Forest fire intensity
- ▶ Increased Rhododendron density in the south



Healthy Hemlock Forests

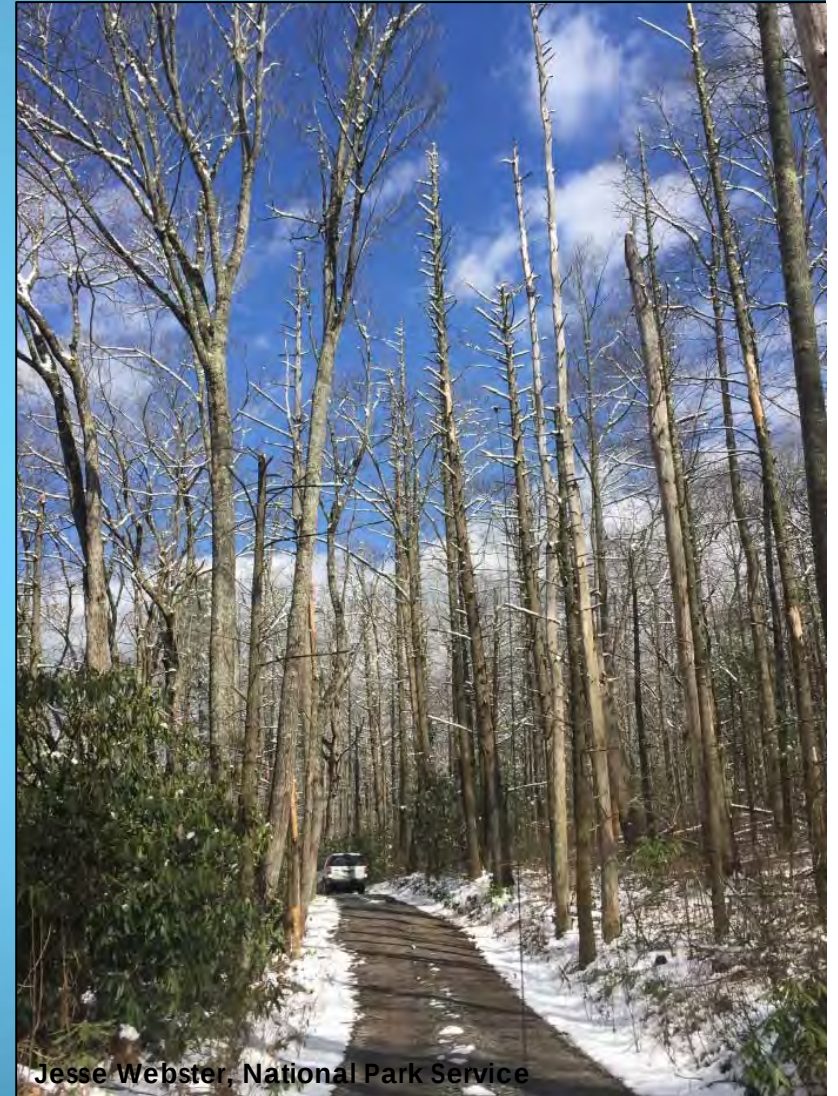


What is the management goal?

- ▶ Eradication
- ▶ Suppression
 - ▶ Lowest possible HWA abundance
 - ▶ HWA populations low enough to maintain hemlock crown health
 - ▶ HWA populations high enough to support predator complexes
- ▶ Not sure

What tools are available?

► Do nothing



Jesse Webster, National Park Service



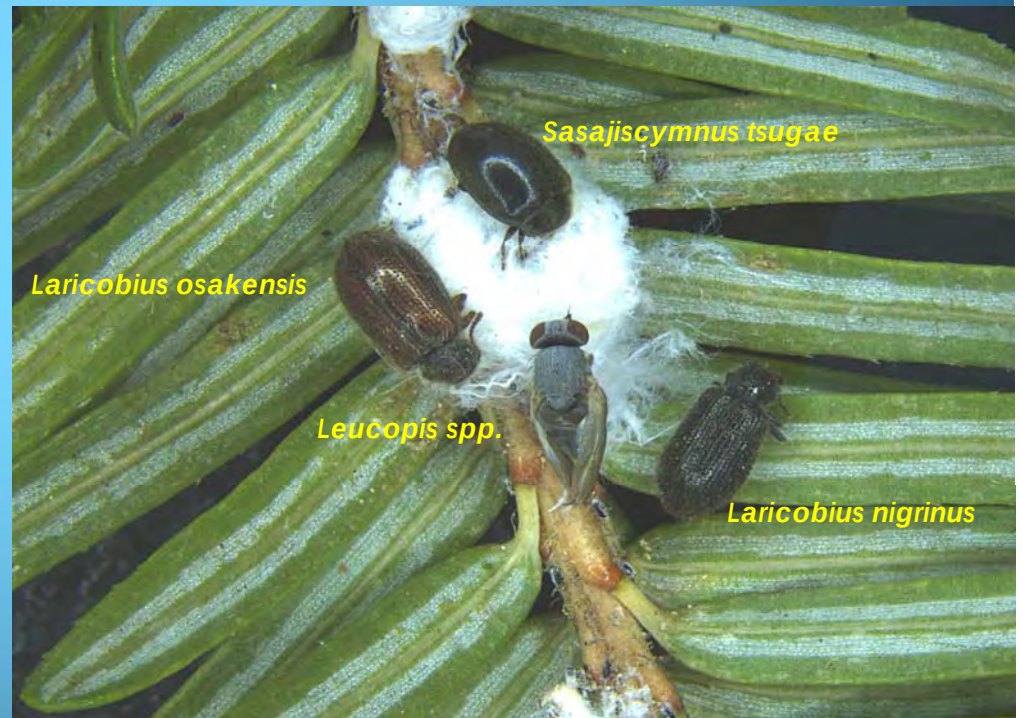
What tools are available?

- ▶ Do nothing
- ▶ Contact insecticides
 - ▶ Horticultural oil



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- ▶ Biological control





Neil Pederson

What tools are available?

- ▶ Do nothing
- ▶ Contact insecticides
 - ▶ Horticultural oil
- ▶ Biological control
- ▶ Neonicotinoids
 - ▶ Dinotefuran
 - ▶ Imidacloprid



Dinotefuran

- ▶ Moves to the canopy quickly

Imidacloprid

- ▶ Moves to the canopy slowly

Dinotefuran

- ▶ Moves to the canopy quickly
- ▶ Effective 1 - 2 years

Imidacloprid

- ▶ Moves to the canopy slowly
- ▶ Effective 5 - 7+ years

Dinotefuran

- ▶ Moves to the canopy quickly
- ▶ Effective 1 - 2 years
- ▶ Quick short-term reduction of HWA

Imidacloprid

- ▶ Moves to the canopy slowly
- ▶ Effective 5 - 7+ years
- ▶ Provides longer-term reduction of HWA

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- ▶ Best for heavy infestations

Imidacloprid

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- ▶ More expensive

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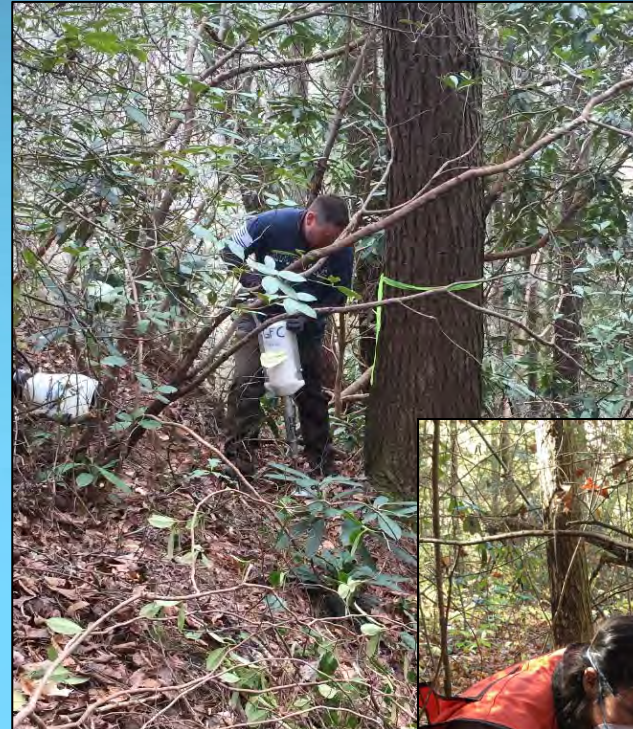
Dinotefuran Application Methods

- ▶ Soil drench
- ▶ Soil injection
- ▶ Trunk injection
- ▶ Bark spray



Imidacloprid Application Methods

- ▶ Soil drench
- ▶ Soil injection
- ▶ Trunk injection
- ▶ Bark spray
- ▶ CoreTect Pellets





SOIL DRENCH TREATMENT FOR HEMLOCK WOOLLY ADELGID

Using Imidacloprid WSP or 2F

MIXING INSTRUCTIONS:

Wear rubber gloves and eye protection. ALWAYS FOLLOW LABEL DIRECTIONS.

- **Water Soluble Packets (WSP):** Add one 1.6 oz. WSP to the Nalgene bottle. Fill with water to form a final volume of 48 fl. oz. Close container and continue to agitate to make sure imidacloprid remains suspended in fluid.
- **Imidacloprid 2F (flowable):** Add 4.75 ounces of Imidacloprid 2F to the Nalgene bottle. Fill with water to form a final volume of 48 fl. oz. Close container and continue to agitate to make sure imidacloprid remains suspended in fluid.

**For other types of imidacloprid, follow label instructions for mixing or contact your county agent.*

APPLICATION INSTRUCTIONS:

1. Measure the diameter (width) of the tree to be treated at breast height (DBH, 4.5 feet above ground) to the nearest inch. Using the included diameter tape, measure the width of the tree, making sure to use the side of the tape calibrated for diameter.
2. Soil drench rate is 1 ounce of chemical suspension (the mixture created above) per inch of diameter. As an example, an 8-inch DBH tree will require 8 ounces of chemical suspension.
3. Brush away the top layer of organic material (the "duff" layer) in the immediate area where the soil drench is being applied. The imidacloprid suspension should be applied to the soil within 18 inches of the hemlock trunk. Using the included measuring cup, measure the correct amount of suspension. Pour the suspension evenly around the base of the tree. Do not pour the suspension all in one location. Do not pour the suspension on the hemlock trunk.

****Caution:** *Soil applications should NOT be made within 10 feet of a stream channel, lake, pond, or wetland. Do not use soil applications on rocky outcrops where there is very little soil around the base of the hemlock. Do not make soil applications immediately after rainfall or during a drought. The soil should be moist, not saturated, for maximum effectiveness.*

When finished treating trees, triple rinse the measuring cup and bottle, pouring the rinse water around treated trees (there is still usable chemical there).

Google: UGA Warnell
hemlock drench



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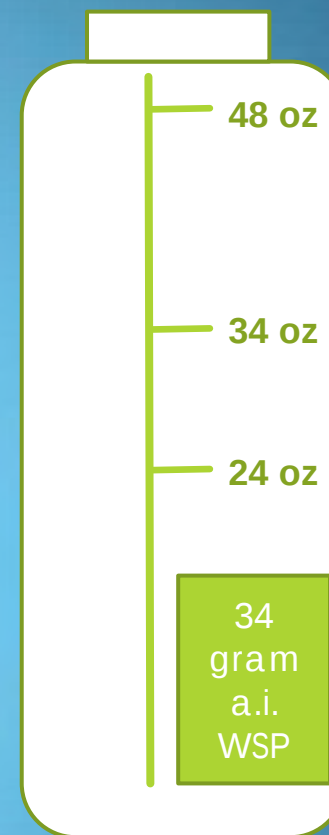
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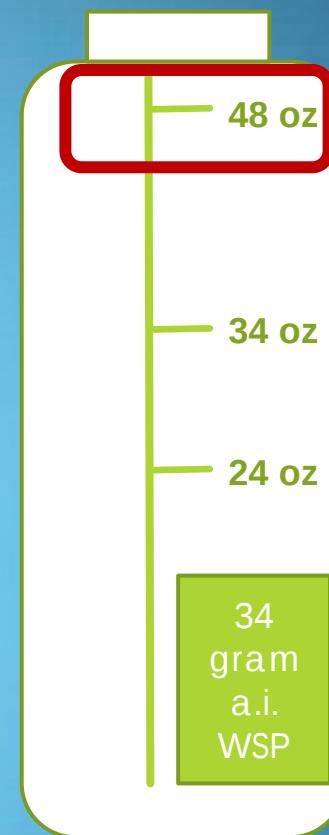
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Start with insecticide



Add water to final
suspension volume



Soil Drench

Remove the “duff” layer



Fine roots around trunk
are exposed

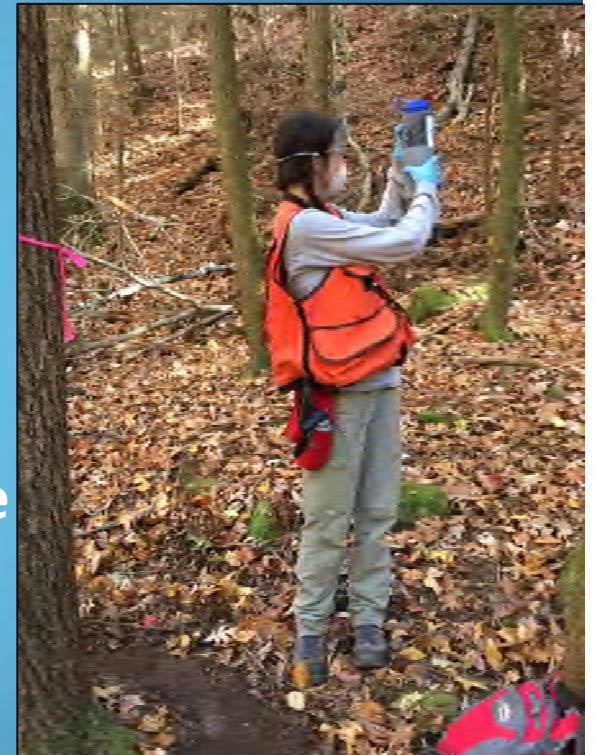


Soil Drench



Pour suspension

Check volume



CoreTest Pellets

Make holes in soil

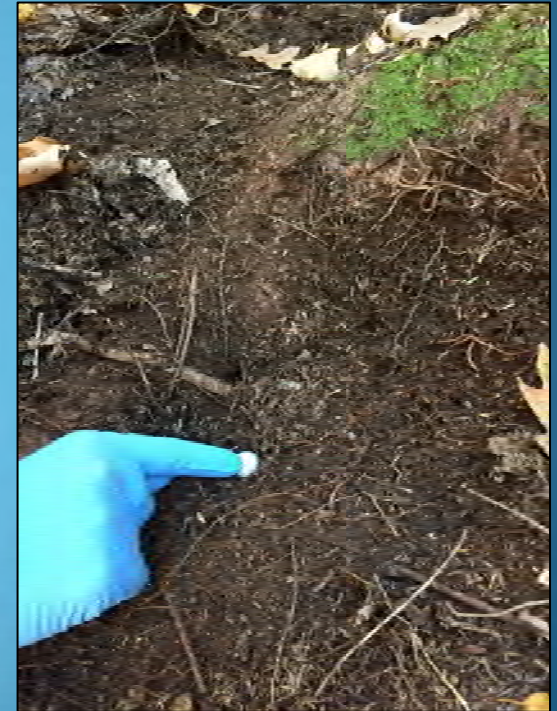


2 – 3 pellets/in DBH



Label rate

Place pellets in holes





Outreach

Warnell School of Forestry & Natural Resources

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Optimized Insecticide Dosage for Hemlock Woolly Adelgid Control in Hemlock Trees

Elizabeth P. Benton¹ and Richard S. Cowles²

¹Warnell School of Forestry and Natural Resources, University of Georgia, Tifton, GA

²The Connecticut Agricultural Experiment Station, Windsor, CT

Overview

Hemlock woolly adelgid (HWA) (*Adelges tsugae*) is killing hemlock trees in the eastern United States (Figure 1, 2). This invasive insect is native to Japan and has been in the eastern United States since the 1950's. HWA feed by sucking fluids from hemlock twigs just at the base of the needles (Figure 3), depleting the tree of needed energy reserves. Large swaths of hemlock forests have been decimated by HWA, and millions of hemlocks have died (Figure 4).

Both eastern (*Tsuga canadensis*) and Carolina (*Tsuga caroliniana*) hemlock are susceptible to HWA attack. The few native HWA predators are not impacting populations, although work continues with classic biocontrol of HWA to establish more effective predators. In addition, hemlocks in the eastern US lack resistance to HWA. As a result, HWA populations can increase very quickly. A hemlock twig can have hundreds of HWA covering it. Tree death can occur in as little as three years as trees are overwhelmed by unrestrained growth of adelgid populations.



Figure 1. HWA on eastern hemlock.



Figure 2. HWA on eastern hemlock branches.
USDA Forest Service, Region 8, Bugwood.org

Google: UGA Warnell
optimized dose

Optimal Imidacloprid Dose

CoreTect™

Inches DBH	Number of Pellets	Inches DBH	Number of Pellets
4	3	20	32
5	4	21	34
6	5	22	37
7	7	23	39
8	8	24	42
9	10	25	44
10	11	26	47
11	13	27	49
12	15	28	52
13	17	29	54
14	19	30	57
15	21	31	60
16	23	32	62
17	25	33	65
18	27	34	68
19	30	35	71
Maximum pellets per acre		362	

CoreTect™ application instructions: Brush away the top layer of organic material. Bury CoreTect pellets in the soil 2 - 5 inches below the soil surface within 6 – 24 inches of the trunk. Space the pellets evenly around the hemlock trunk. Completely cover the pellets with soil.

CoreTect Dosage Comparison

DBH (in)	Label (2 pellets per inch DBH)	Label (2 pellets per inch DBH)	Optimized Dosage
5	10	15	4
10	20	30	11
15	30	45	21
20	40	60	32
25	50	75	44
30	60	90	57
35	70	105	71

**New USFS guidance on
integrating insecticides
with biocontrol**

**For use by state and
federal resource
management programs**



United States Department of Agriculture

**TECHNOLOGY
TRANSFER**

**INTEGRATED
PEST MANAGEMENT**

INTEGRATING CHEMICAL AND BIOLOGICAL CONTROL OF THE HEMLOCK WOOLLY ADELGID:

A RESOURCE MANAGER'S GUIDE



**ALBERT E. MAYFIELD III, SCOTT M. SALOM, KENTON SUMPTER,
TOM MCAVOY, NOEL F. SCHNEEBERGER, AND RUSTY RHEA**

UGA-GFC Hemlock Resources

- ▶ County Agent trainings in 2019 and 2020
- ▶ A jointly published HWA fact sheet
- ▶ Drench kits for extension offices
- ▶ Soil injectors at GFC County offices
- ▶ One page soil drench and soil injection handouts
- ▶ Soil drench YouTube video
 - ▶ <https://www.youtube.com/watch?v=s1snHNI4GZ0>
 - ▶ Google “HWA soil drench treatment”



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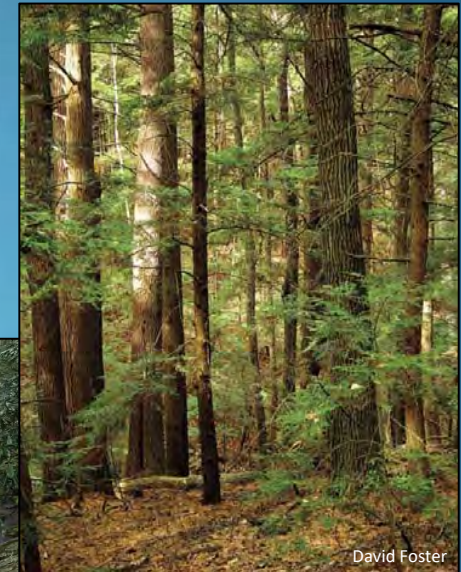
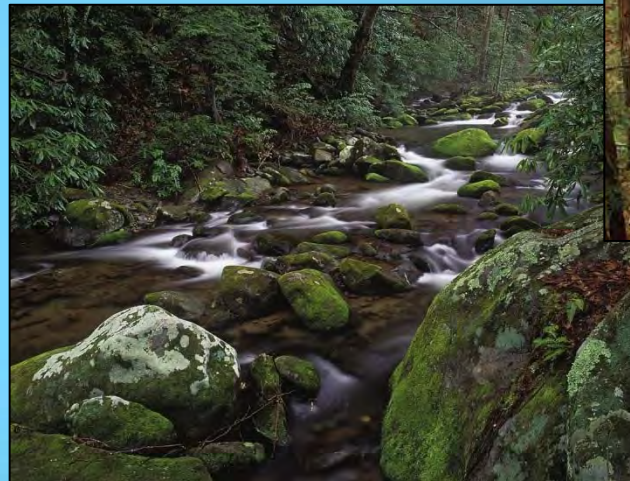
Publication WSFNR-19-41
November 2019

Homeowner HWA Management Tips

- ▶ Avoid planting hemlock trees, unless you plan treat them with insecticides approximately every 5 years
- ▶ Treat hemlocks with insecticide once you detect HWA
- ▶ Avoid treating hemlocks during the summer
- ▶ Do not use soil or spray applications within 10 feet of a stream, pond, or wetland.



Thank you for helping to preserve hemlock forest resources.



David Foster

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McCarty, E. and L. Womack. 2020. Hemlock Woolly Adelgid PowerPoint Presentation. Warnell Outreach Publication WSFNR-20-71A. 39 Slides.

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