

The Gypsy Moth

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State Entomologist

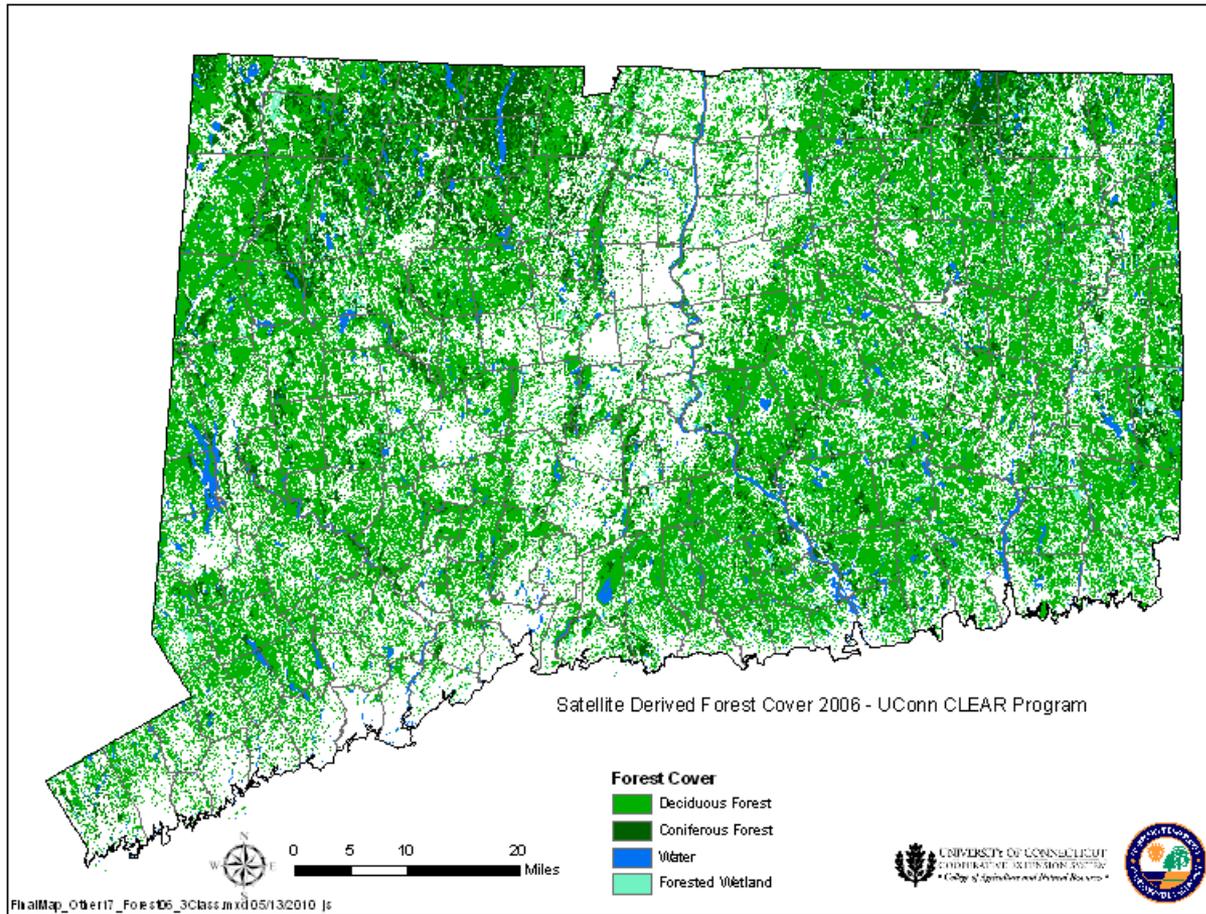
The Connecticut Agricultural Experiment Station



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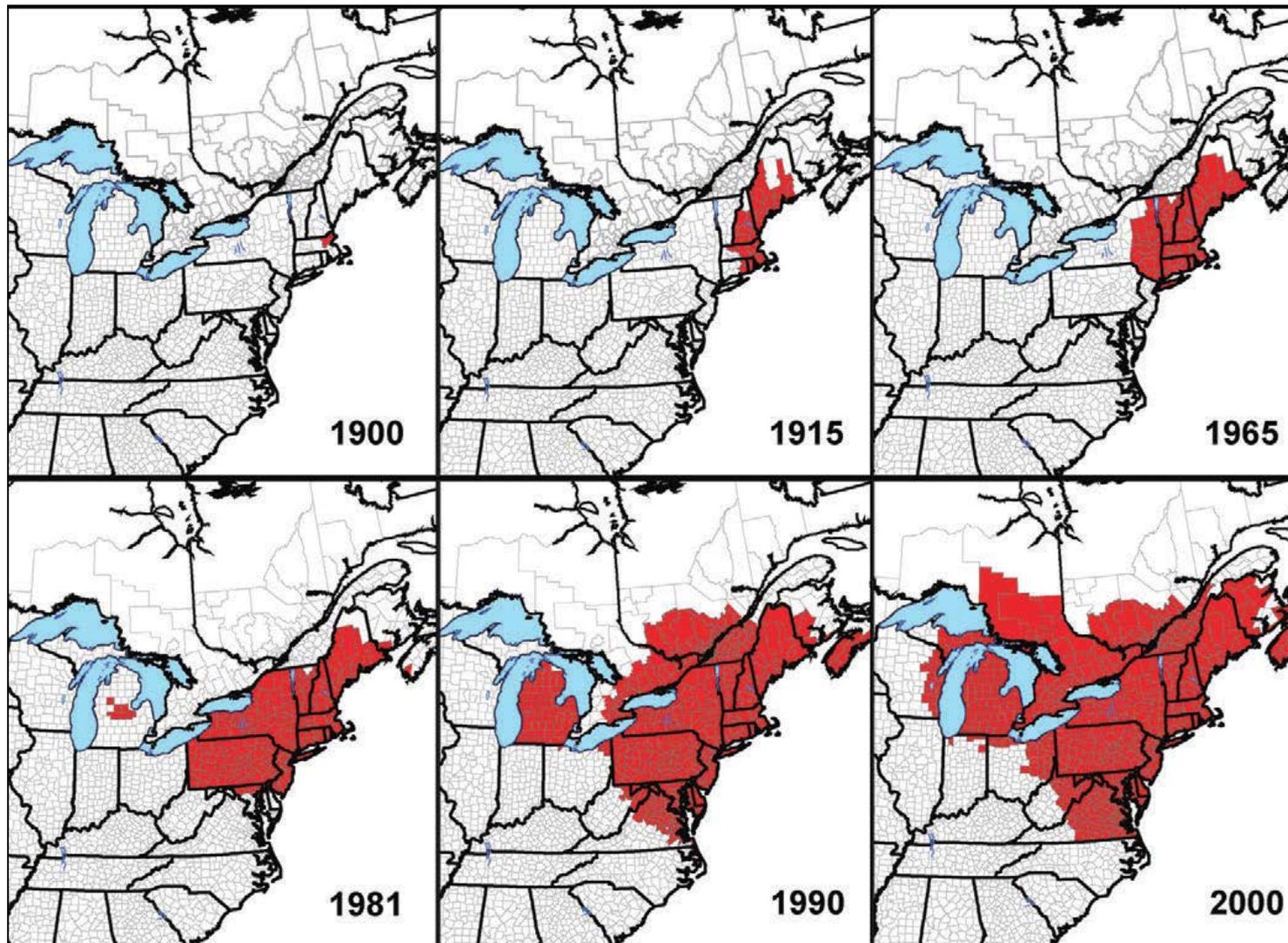
Connecticut contains approximately 3,179,254 acres of land, of which approximately 1,870,055 acres, or 59%, is forested. Ironically, CT is also one of the most densely populated states and we are slowly losing forest to urban sprawl. Our urban tree canopy is highly variable but covers 49.3% urban land area. Our forest and trees add immensely to the quality of life in Connecticut.

Gypsy Moth Arrival in Connecticut

- Gypsy moth, *Lymantria dispar*, was first brought into the US (Medford, MA) from France around 1869 by Etienne Leopold Trouvelot. He was interested in silk production.
- In 1882, larvae escaped and spread on Medford Street and the infestation grew in size.
- In 1889, the Massachusetts State Board of Agriculture began a campaign to eradicate the gypsy moth.
- Gypsy moth was first discovered in CT in Stonington in July, 1905.
- By 1923, it had spread to 100 towns.
- By 1952, it was present in all 169 Connecticut towns.

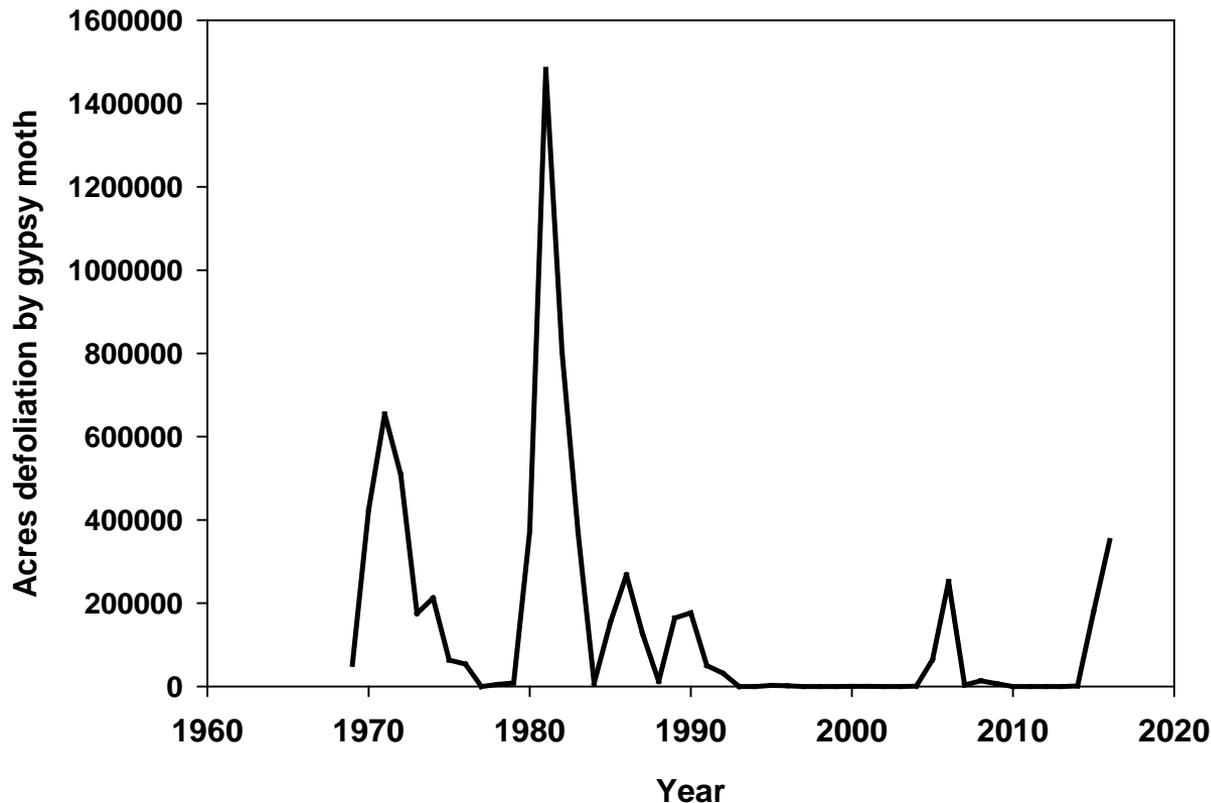


Spread of the Gypsy Moth



From: Slow the Spread: A National Program to Manage the Gypsy Moth, USDA Tech Report NRS-6, April 2007

Gypsy Moth Defoliation, CT 1969-2016* (acres)

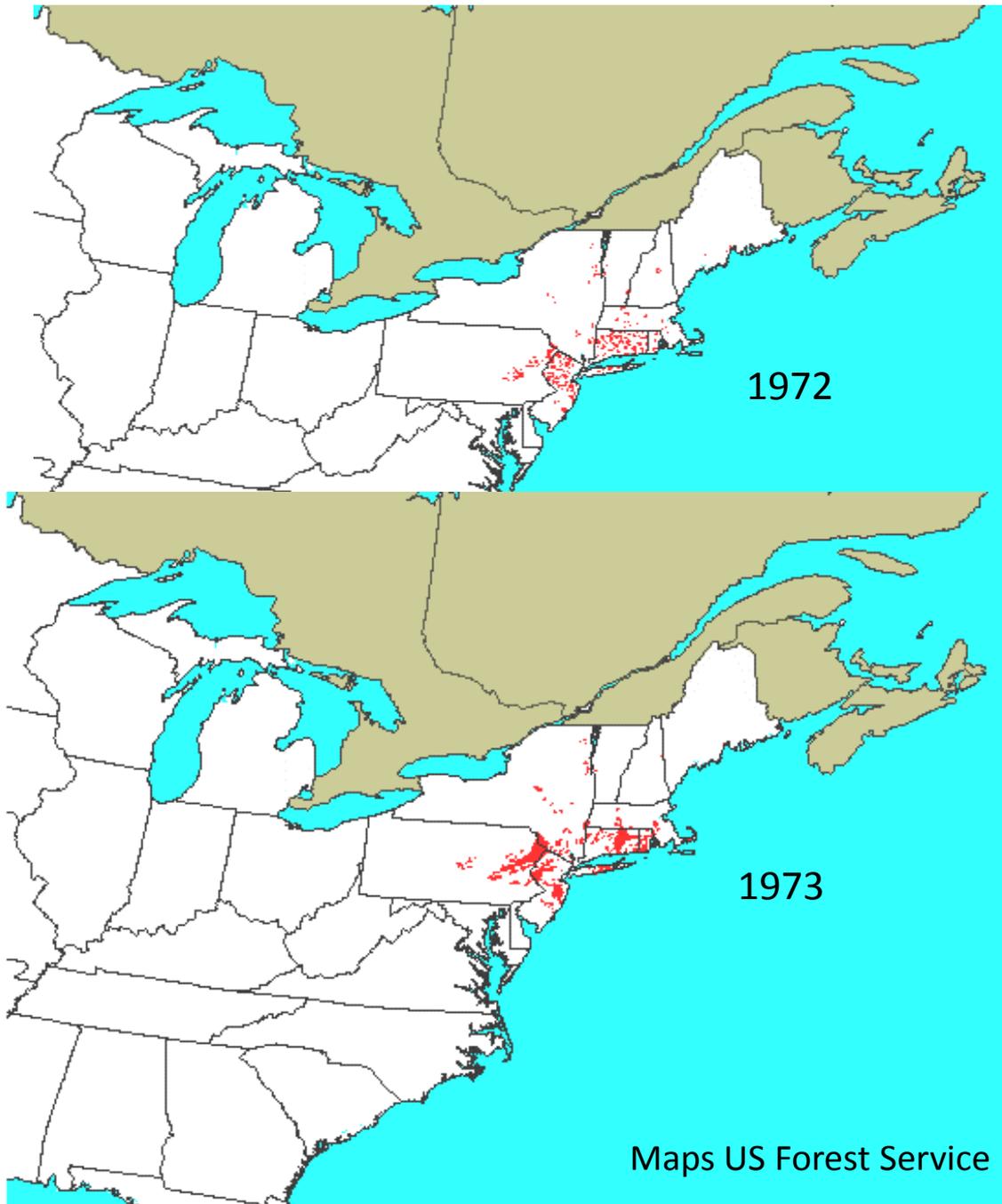


*2016 acreage estimated, final data pending.

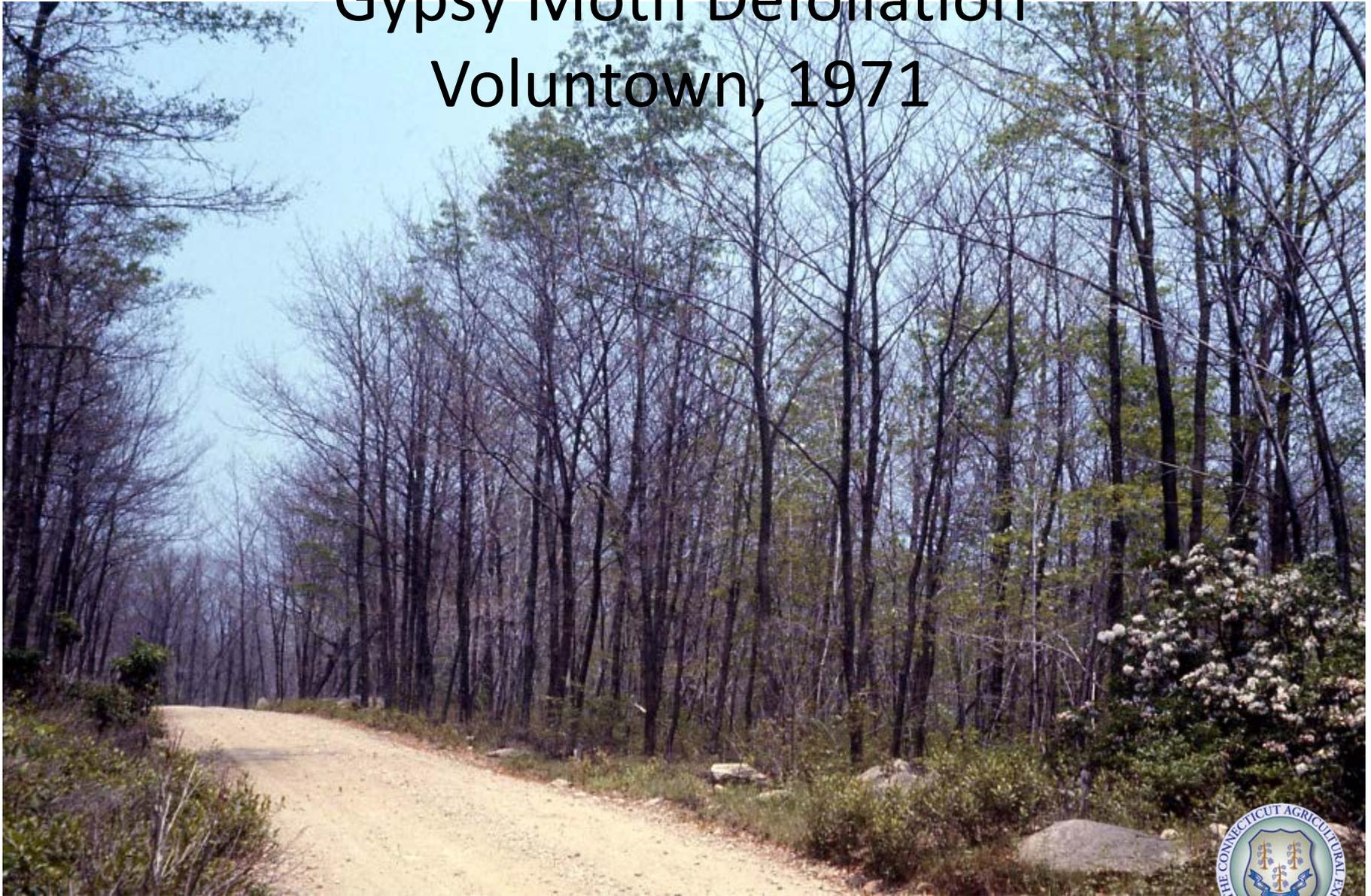
1st Large Recorded Outbreak

From 1970-1973, gypsy moth defoliated several hundred thousand acres of Connecticut forest each year.

1970 – 425,039 acres
1971 – 654,102 acres
1972 – 508,460 acres
1973 – 333,215 acres
1974 – 212,315 acres



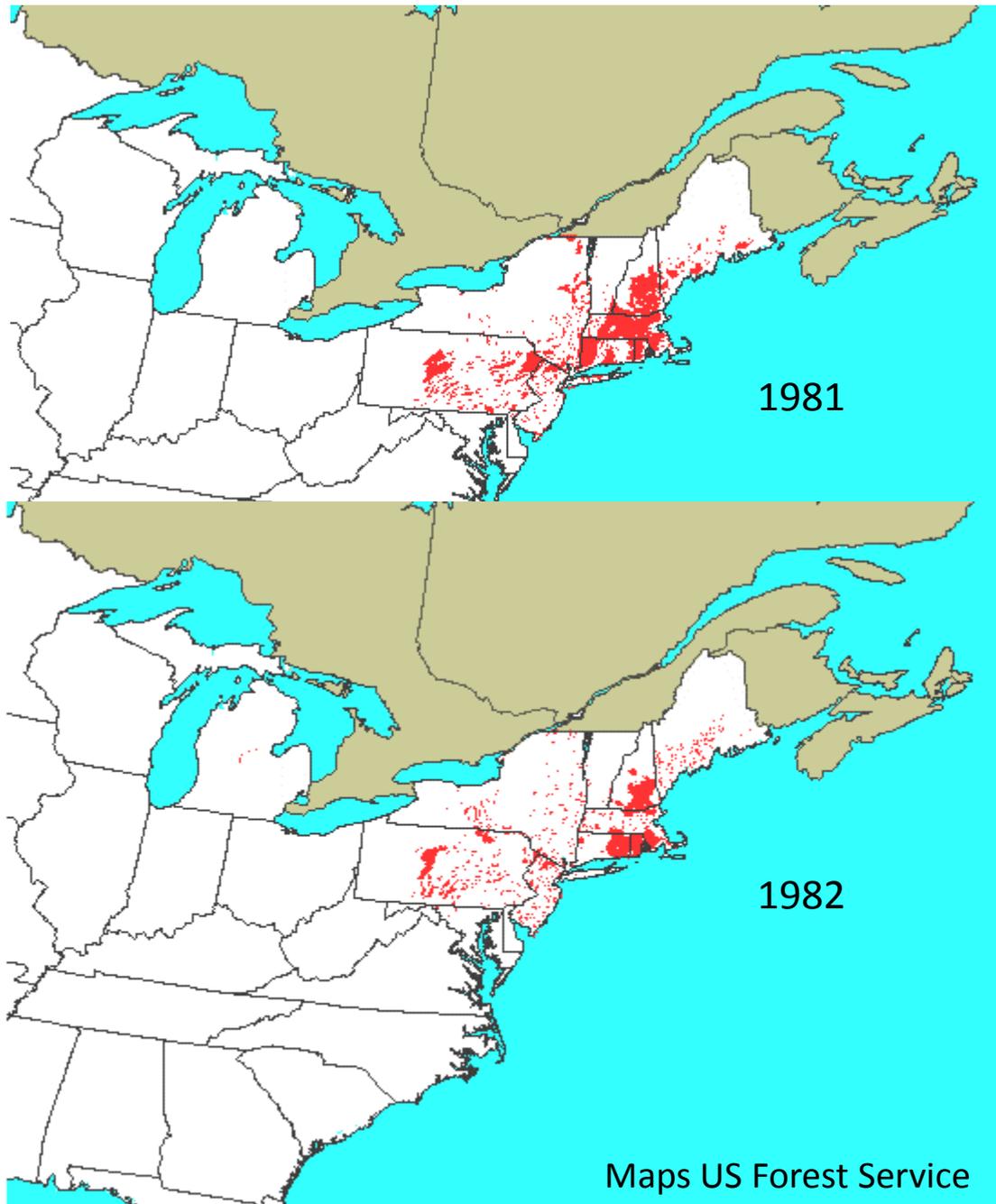
Gypsy Moth Defoliation Voluntown, 1971



2nd Large Recorded Outbreak

Through 1980s, gypsy moth defoliated several hundred thousand to over a million acres of Connecticut forest each year.

1980 – 381,868 acres
1981 – 1,482,216 acres
1982 – 803,802 acres
1983 – 369,267 acres



Heavy Defoliation 1981



Photo: Ted Andreadis

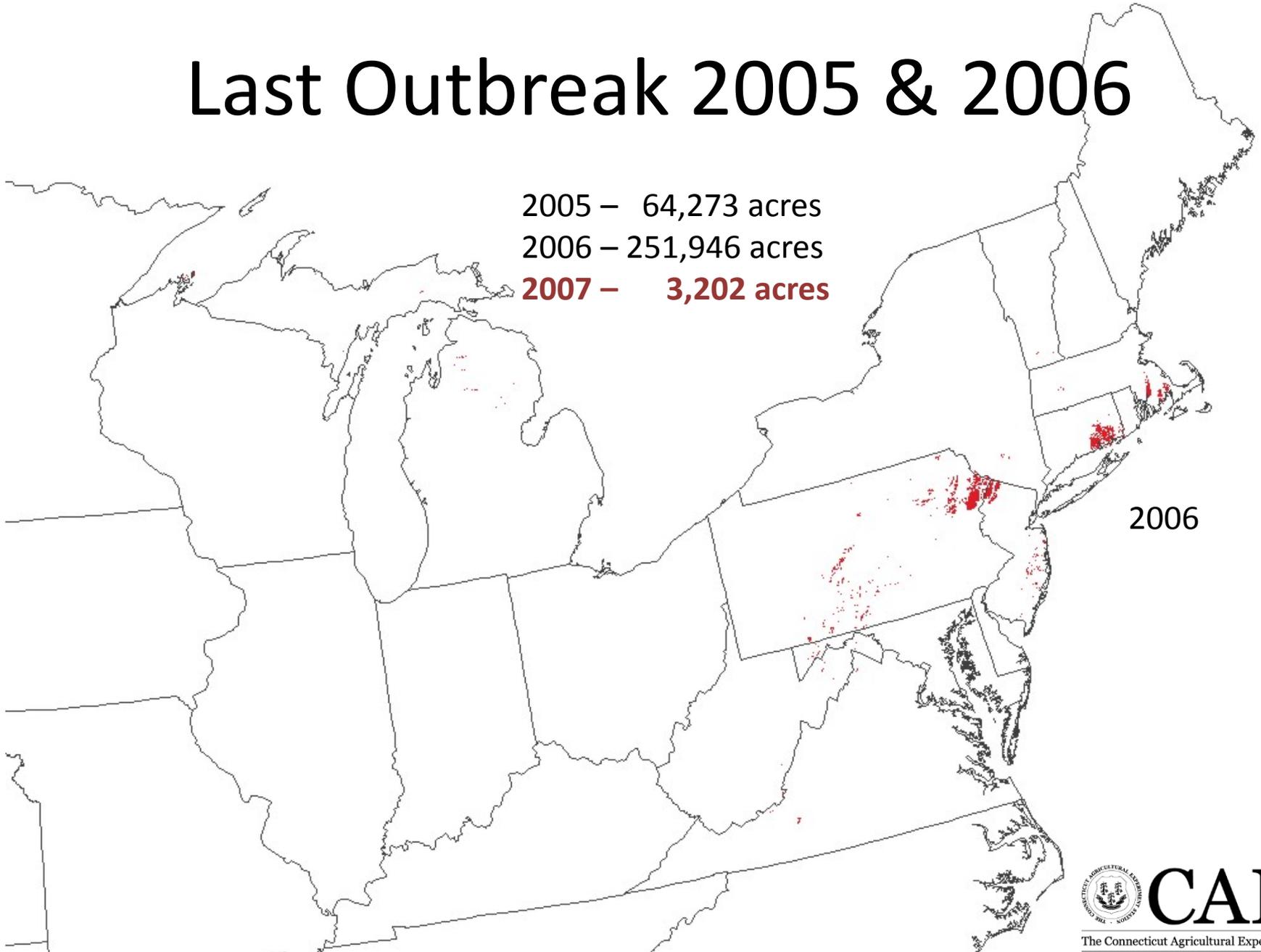


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Last Outbreak 2005 & 2006

2005 – 64,273 acres
2006 – 251,946 acres
2007 – 3,202 acres



2006



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Gypsy Moth Defoliation 2005



Photos by Plant Inspector Peter Trenchard

Gypsy Moth Defoliation, 2006

Lyme, CT



Nehantic State Forest

Connecticut's Forest Aerial Survey

- Connecticut's forest health assessment is conducted each year from late June to early August or as events and weather dictate (need clear skies, no haze).
- This aerial survey has been conducted since the late 1960's. Funded by the U.S. Forest Service.
- The survey originally focused on Gypsy Moth defoliation, but with increased use of technology, (Digital Aerial Sketch mapping) it has expanded to include all types of forest damage.
- Now includes forest defoliation (Gypsy Moth, Winter moth, Emerald Ash borer, Orange striped oak worm), discoloration (Anthracnose, Hemlock Woolly Adelgid), storm related damage and fire.



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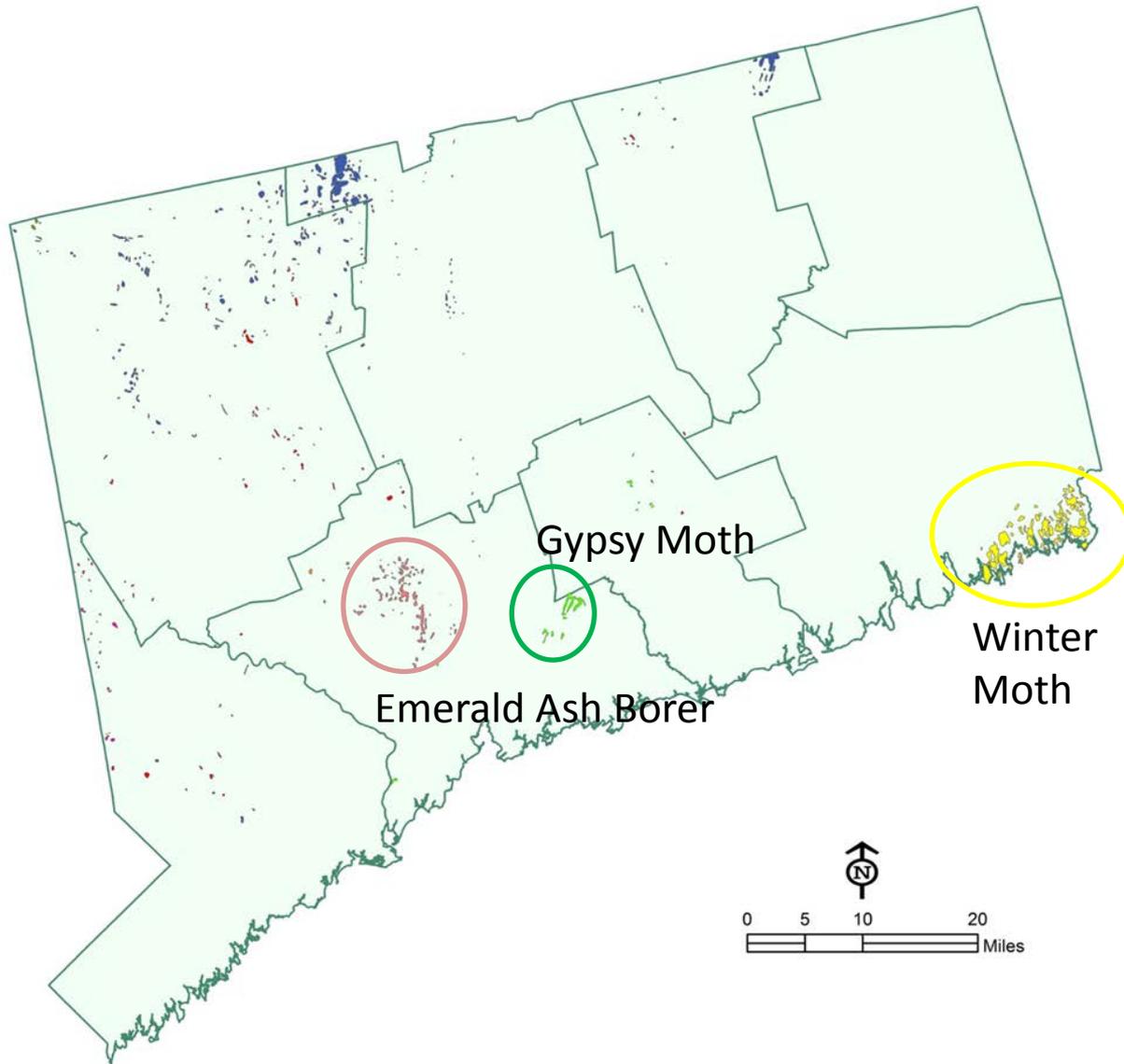
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Deputy State Entomologist Victoria Smith and Inspector Peter Trenchard conducted previous forest health surveys. 2016 aerial survey conducted by Victoria Smith and Tia Blevins



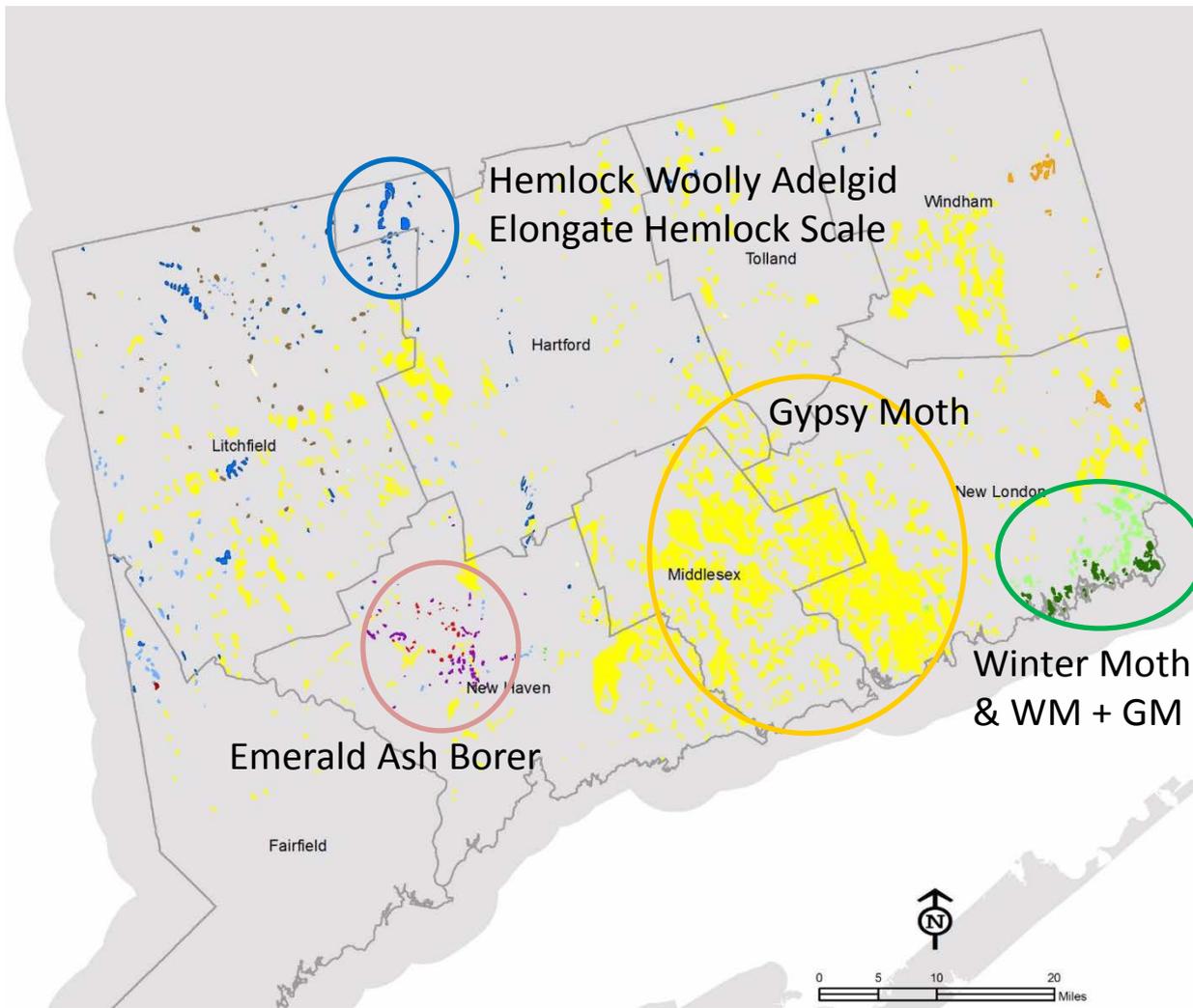
Aerial Survey Map for 2014



- Gypsy Moth
- Locust Leafminer
- Winter Moth
- Hemlock Woolly Adelgid
- Elongate Hemlock Scale
- Red Pine Scale
- Emerald Ash Borer
- Ash Decline/Yellows
- Hail Damage
- Wind Damage

1,337 acres
defoliated by
gypsy moth in New
Haven County

Aerial Survey Map for 2015



Gypsy Moth Defoliation
175,273 acres

Gypsy Moth Defoliation, 2015



Photos by Plant Inspector Peter Trenchard

Acres Defoliated 2015

Damage Causing Agent	Acres
Anthracnose Diseases of Hardwoods	2,011
Ash Decline/Ash Yellows	193
Drought Stress	2,367
Emerald Ash Borer Defoliation	1,362
Emerald Ash Borer Mortality	464
Fire Damage	80
Gypsy Moth	175,273
Gypsy Moth and Winter Moth	4,166
Hemlock Woolly Adelgid and Elongate Hemlock Scale	6,060
Orange Stripped Oak worm	1,763
Red Pine Scale	8
Storm Damage	29
Winter Moth	<u>3,109</u>
Total	196,885

Aerial Survey Map for 2016

Aerial defoliation data processing for 2016 acreage and state map in progress, but we estimate the area defoliated is at least twice or more than in 2015. The 2016 gypsy moth defoliation is likely somewhere between 360,000 to 400,000 acres. It was also more intense, with greater proportion of trees with 75-100% defoliation. Conifers (e.g., spruce, pine, hemlock), less favored species, were also heavily attacked in many areas.

Gypsy Moth Life History

- Egg clusters laid in the summer hatch the following spring. (Approx. May 1)
- There can be from 150 to 1000 eggs per cluster.



GM Hatching April 27, 2016



John Triana, SCRWA



John Triana, SCRWA

Gypsy Moth Life History



Peter Trenchard, CAES



Peter Trenchard, CAES

- After hatching the caterpillars begin feeding.
- They feed on a large variety of trees and shrubs. Oak is their favorite food.
- If populations are heavy enough, they will feed on conifers.
- After about 40 days (Late June) the larva are fully grown and go to protected places to pupate.

Gypsy Moth Life History



Peter Trenchard, CAES

Gypsy moth pupae on White Oak

Gypsy Moth Life History

- Adults emerge in 10-14 days.
- The female is a large bodied white moth.
- Females cannot fly.
- The male is smaller and darker in color (brownish) and flies about.
- They begin mating shortly after emerging.
- Adults do not take food and live a short time.



Peter Trenchard, CAES



Peter Trenchard, CAES

Gypsy Moth Life History



Gypsy moth will lay eggs on anything, trees, fence posts, cars, rocks, firewood

Gypsy Moth Pupae, Female and Male Moths



Photo courtesy Jack D. Morris, Salmon River State Forest

Gypsy Moth Control

- Since gypsy moth was discovered in Connecticut in 1905, many different control measures have been tried.
- They included: quarantine zones, removing egg masses, creosoting egg masses, removing caterpillars, banding trees, ground spraying, aerial spraying (DDT, Sevin, *Bacillus thuringiensis* (*Bt*)), imported parasites, biological controls and natural predators.



Removing egg masses
Wallingford, CT 1910.

Undated Photo (Probably 1910): Searching for Egg Masses



Gypsy Moth Control

- Physical controls (barriers, remove egg masses)
- Quarantines
- *Bacillus thuringiensis* kurstaki (B.T.k.)
- Nucleopolyhedrovirus (NPV) product - Gypchek
- Insecticides like Spinosad, Sevin, and several pyrethroids and growth regulators.
- Application made after bud-break or leaf-out depending on whether treatment is for apple trees or landscape trees to prevent continued feeding and defoliation.
- Oils (soybean, canola, mineral) to suffocate egg masses (e.g., 50% soybean oil and 50% water)



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Gypsy Moth Control



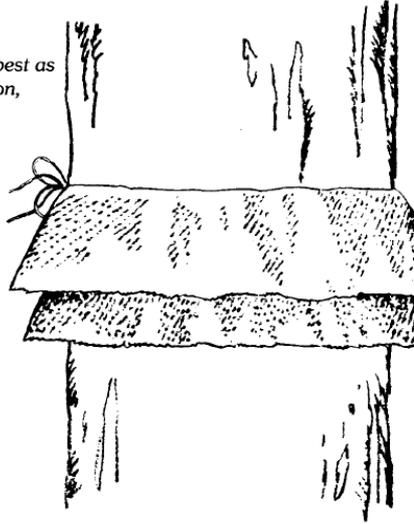
Peter Trenchard, CAES

Remnants of tree banding with burlap and tanglefoot.

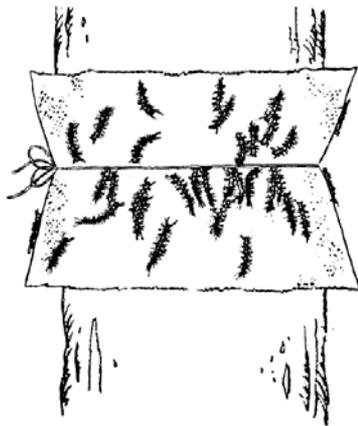
Tree Banding (Burlap, Barrier)

Workers are exposed to allergenic hairs.

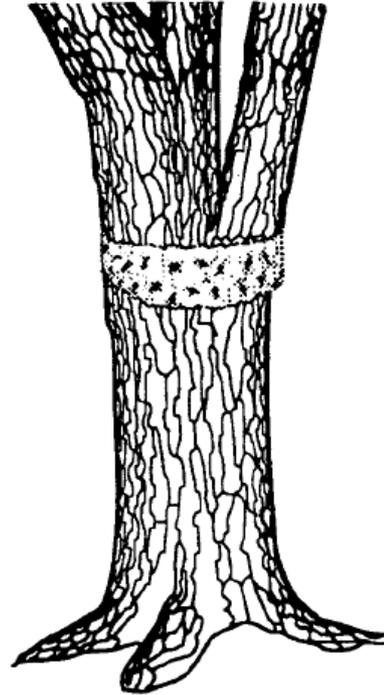
Burlap bands can serve best as a control in early detection, particularly in areas not previously infested.



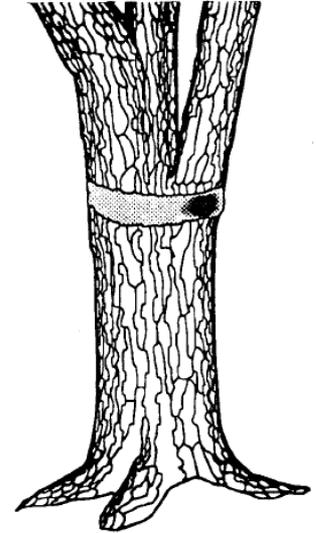
Burlap Bands are an excellent refuge for caterpillars.



Sticky bands trap the caterpillars.



Slippery bands keep caterpillars from climbing trees.



From Grafton & Webb. Homeowner's Guide to Gypsy Moth Management. WVU Extension.

Tree Banding & Egg Mass Removal

- Late instar larvae tend feed at night and rest during the day at low to moderate densities
- Burlap bags can make excellent refuge, but doesn't work when caterpillars feed day and night. They take work and larvae must be disposed of (in soapy water).
- Barrier (sticky) bands can reduce caterpillar movement and prevent rescinding a tree, but young caterpillars spread by ballooning. Don't put sticky material directly on the tree trunk.
- Removing egg masses very helpful, but hairs of caterpillars contain histamine and are highly allergenic. Don't leave egg masses on ground, still viable.
- Pheromone traps and bug zappers do not work.



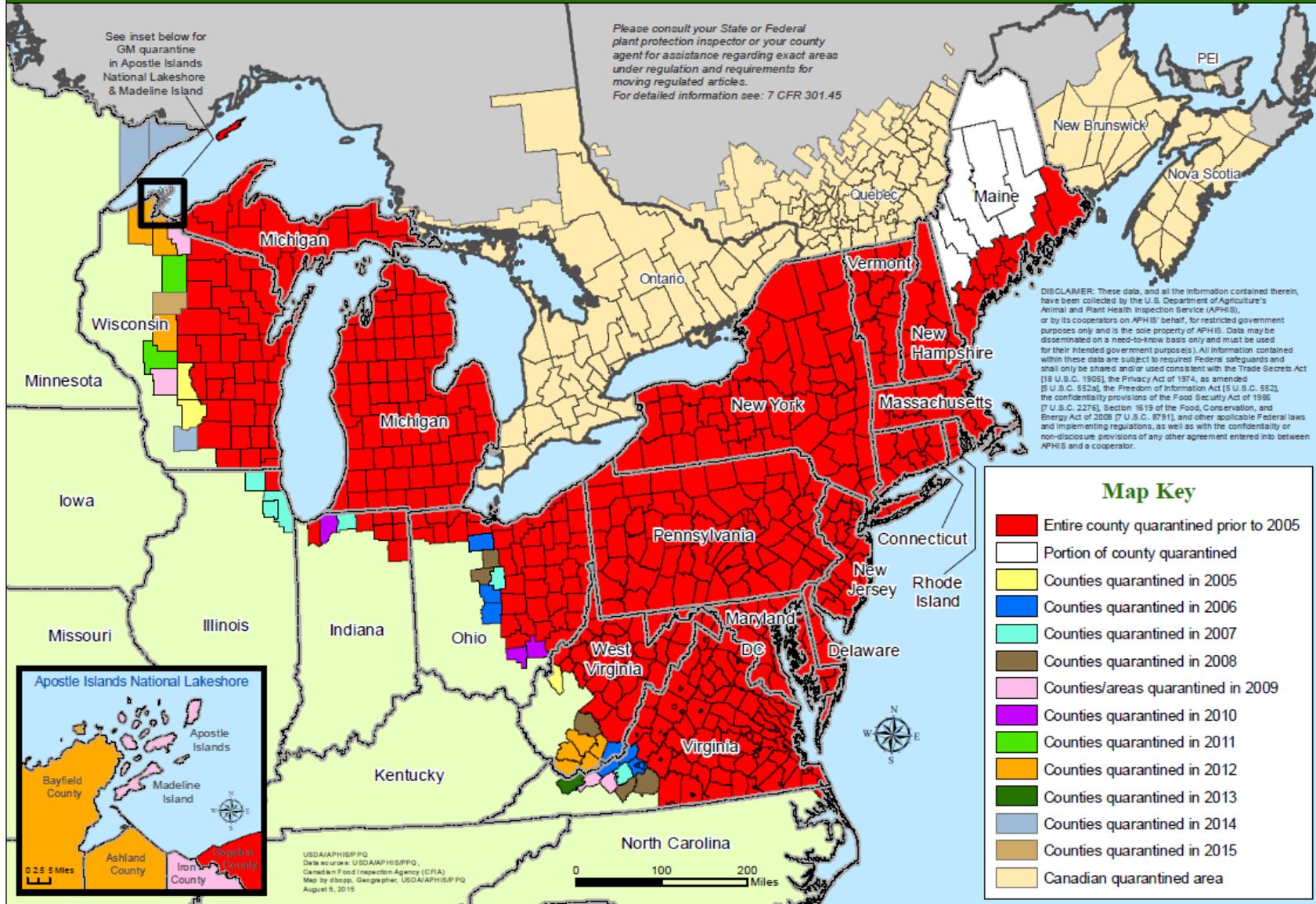
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European Gypsy Moth (*Lymantria dispar*) North America quarantine



Gypsy Moth Quarantine

- Gypsy moth hitchhikers are most commonly egg masses.
- Nursery stock shipped out of a quarantine by a nursery or dealer must be treated or visually inspected and certified pest-free. Shippers must be operating under a compliance agreement with state or federal agriculture agencies prior to moving stock.
- Shippers of logs, posts, bark, operating under a compliance agreement must document all loads leaving the quarantine and specify the destination.
- For homeowners, self-inspection (checklist available) is allowable while packing up household goods to move. Those using a moving company or portable storage must include the completed checklist with the shipment. Qualified Certified Applicators or state/federal agriculture agencies may provide inspection. **There have been detections on shipping pods.**
- RVs, Campers, Mobile Homes: Inspection and documentation are required prior to moving outside of the quarantine. Qualified Certified Applicators or state/federal agriculture agencies may provide inspection assistance. Treat or remove any life stages found upon inspection.
- Shipping containers of household goods infested with gypsy moth egg masses have been detected outside the quarantine zone and sent back to Connecticut in 2016.

Gypsy Moth Checklist

USDA United States Department of Agriculture Animal and Plant Health Inspection Service Program Aid No. 2147



day, if possible. If you cannot complete the inspection on moving day, you must protect the items from the possibility of infestation by sealing them under a tarp or keeping them indoors or in a closed moving truck.

For self-inspection, follow these steps:

- Carefully inspect all surfaces and crevices of your outdoor household articles such as patio furniture, lawn equipment, toys, grills, trailers, and vehicles for gypsy moth egg masses.
- Remove and destroy any egg masses you find. Scrape them off with a putty knife, stiff brush, or similar hand tool. Dispose of egg masses and other life stages in a container of hot, soapy water, or place them in a plastic bag, seal it, and set it in the sun.
- Check each item off on your checklist as you go, and complete the requested information.

If a qualified certified applicator performs the inspection, be sure you get a copy of the completed, signed checklist.

2) During your move, keep a copy of the completed checklist in the vehicle moving the goods in case a U.S. Department of Agriculture (USDA) or State official requests it at any point during your trip. If you are not driving, provide a copy to the driver. This completed checklist is an official certificate that will satisfy the requirements of all non-infested States.

3) Once your move is completed, you may want to keep the checklist filed with your moving materials for at least 5 years in case you need it in the future.

What Does the Law Require?
If you are moving from a gypsy moth quarantine area to a non-quarantine area, you must inspect your outdoor household items for the gypsy moth and remove all life stages of this destructive insect before you move. You and your moving company may face penalties if you are required to inspect but fail to do so. Fortunately, this inspection is easy to do, and you will protect your new neighborhood from a voracious leaf eater that can attack 300 kinds of trees and shrubs.

How Do I Know if I Live in a Gypsy Moth Quarantine Area?
Visit www.YourMoveGypsyMothFree.com and click on the U.S. map to find out if you live in a quarantine area. If you do, you will need to inspect your outdoor household items for gypsy moth if you're moving to a non-quarantine area. If you do not live in a quarantine area, this law does not apply to you.

I Live in a Quarantine Area and Am Moving to a Non-Quarantine Area. How Do I Meet This Legal Requirement?

- Use the self-inspection checklist on the back of this flyer or hire a qualified certified applicator to inspect your outdoor household articles. If you are moving between April and August, you should complete the inspection on moving

USDA is an equal opportunity provider and employer.
This publication supersedes Program Aid No. 2066, "Your Next Move Gypsy Moth-Free," which was published in October 2010.
Issued October 2019

CHECKLIST

IMPORTANT: Make sure this checklist goes with your outdoor household items when you move!

Checklist and Record of Your Self-Inspection
Date: _____
Originating property address: _____

Recreational or Camping Items		
<input type="checkbox"/> Backpacks	<input type="checkbox"/> Ice chests	<input type="checkbox"/> Tarps
<input type="checkbox"/> Basketball backboards	<input type="checkbox"/> Motorcycles	<input type="checkbox"/> Tents
<input type="checkbox"/> Bicycles	<input type="checkbox"/> Motor homes	<input type="checkbox"/> Waders or boots
<input type="checkbox"/> Boats	<input type="checkbox"/> Recreational vehicles	<input type="checkbox"/> Other: _____
<input type="checkbox"/> Boat trailers	<input type="checkbox"/> Snowmobiles	
<input type="checkbox"/> Campers	<input type="checkbox"/> Sports equipment	
Household Items		
<input type="checkbox"/> Air conditioners	<input type="checkbox"/> Ladders	<input type="checkbox"/> Tanks for propane and oil
<input type="checkbox"/> Barrels	<input type="checkbox"/> Outdoor doormats	<input type="checkbox"/> Television antennas
<input type="checkbox"/> Cardboard and wooden boxes	<input type="checkbox"/> Outdoor thermometers	<input type="checkbox"/> Trash cans
<input type="checkbox"/> Clothesline poles	<input type="checkbox"/> Refrigerators	<input type="checkbox"/> Washing machines
<input type="checkbox"/> Clothespin bags	<input type="checkbox"/> Sheets of plastic	<input type="checkbox"/> Water hoses
<input type="checkbox"/> Empty plant containers	<input type="checkbox"/> Shutters	<input type="checkbox"/> Weather vanes
<input type="checkbox"/> Firewood	<input type="checkbox"/> Storage sheds	<input type="checkbox"/> Window awnings
<input type="checkbox"/> House plants (taken outside during the summer)	<input type="checkbox"/> Storm/screen doors and windows	<input type="checkbox"/> Other: _____
Building Materials		
<input type="checkbox"/> Bricks	<input type="checkbox"/> Roofing materials	<input type="checkbox"/> Welding equipment
<input type="checkbox"/> Cement mixing tubs	<input type="checkbox"/> Sewer pipes	<input type="checkbox"/> Workbenches
<input type="checkbox"/> Cinder blocks	<input type="checkbox"/> Tools and toolboxes	<input type="checkbox"/> Other: _____
<input type="checkbox"/> Lumber	<input type="checkbox"/> Water pipes	
Yard and Garden Items		
<input type="checkbox"/> Animal houses (doghouses, rabbit hutches, etc.)	<input type="checkbox"/> Fertilizer spreaders	<input type="checkbox"/> Storage sheds
<input type="checkbox"/> Barbicue grills	<input type="checkbox"/> Flagpoles	<input type="checkbox"/> Swimming pools
<input type="checkbox"/> Bid baths	<input type="checkbox"/> Garden filters	<input type="checkbox"/> Tractors and trailers
<input type="checkbox"/> Bird feeders	<input type="checkbox"/> Garden tools	<input type="checkbox"/> Trees, shrubs, and plants
<input type="checkbox"/> Bird houses	<input type="checkbox"/> Lawnmowers	<input type="checkbox"/> Trellises
<input type="checkbox"/> Bug lights	<input type="checkbox"/> Mailboxes	<input type="checkbox"/> Wheelbarrows
<input type="checkbox"/> Carts	<input type="checkbox"/> Picnic tables	<input type="checkbox"/> Yard decorations
<input type="checkbox"/> Cold frames	<input type="checkbox"/> Porch or patio furniture	<input type="checkbox"/> Other: _____
<input type="checkbox"/> Driftwood	<input type="checkbox"/> Signs and posts	
<input type="checkbox"/> Fencing	<input type="checkbox"/> Snowblowers	
Children's Playthings		
<input type="checkbox"/> Bicycles, tricycles	<input type="checkbox"/> Stools, toboggans	<input type="checkbox"/> Wagons
<input type="checkbox"/> Playhouses	<input type="checkbox"/> Swing sets	<input type="checkbox"/> Other outside toys (like trucks or sand molds)
<input type="checkbox"/> Sandboxes	<input type="checkbox"/> Tire swings	<input type="checkbox"/> Other: _____
Other Items		
<input type="checkbox"/> Cars or trucks	<input type="checkbox"/> Car ramps	<input type="checkbox"/> Stored tires (snow tires)
<input type="checkbox"/> Car parts	<input type="checkbox"/> Farm implements	<input type="checkbox"/> Other: _____

Please inspect anything that was stored outside!

By signing this document you are affirming that you have inspected all outdoor household articles, whether included on this checklist or not, for all life stages of gypsy moth in accordance with the procedures on this sheet, as required by Title 7, *Code of Federal Regulations*, part 301.45-46).

Signature: _____ Phone number: _____
Printed Name: _____ Company Name: _____
(if applicable)

* To avoid spreading other tree pests, move only USDA- or State-certified, treated, and labeled firewood.



Gypsy moth egg masses on a lawn mower (USDA/APHIS, Susan Lane)



Gypsy moth egg mass on a padlock (USDA/APHIS, Susan Lane)



Gypsy moth caterpillar (larva) (Daniel Heims, The Ohio State University, Bugwood.org)



Gypsy moth pupae (Pennsylvania Department of Conservation and Natural Resources, Forestry Archive, Bugwood.org)



Female (top) and male adult gypsy moths (USDA APHIS PPD Archive, USDA APHIS PPD, Bugwood.org)

Egg masses can be virtually anywhere!



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Biological Control

Nuclear Polyhedrosis Virus (NPV)



Photo John Ghent, Bugwood.org

Gypsy moth killed by NPV

- NPV (Nuclear polyhedrosis virus) was accidentally introduced from Europe. Was first observed in Connecticut in 1907.
- NPV was studied extensively in the 1960s at the Experiment Station.
- NPV was one of the main causes for collapse of large populations of gypsy moths until the gypsy moth fungus was discovered in 1989.
- NPV (Gypchek) applied by Forest Service for control in areas edge GM population (STS) and by government entities.

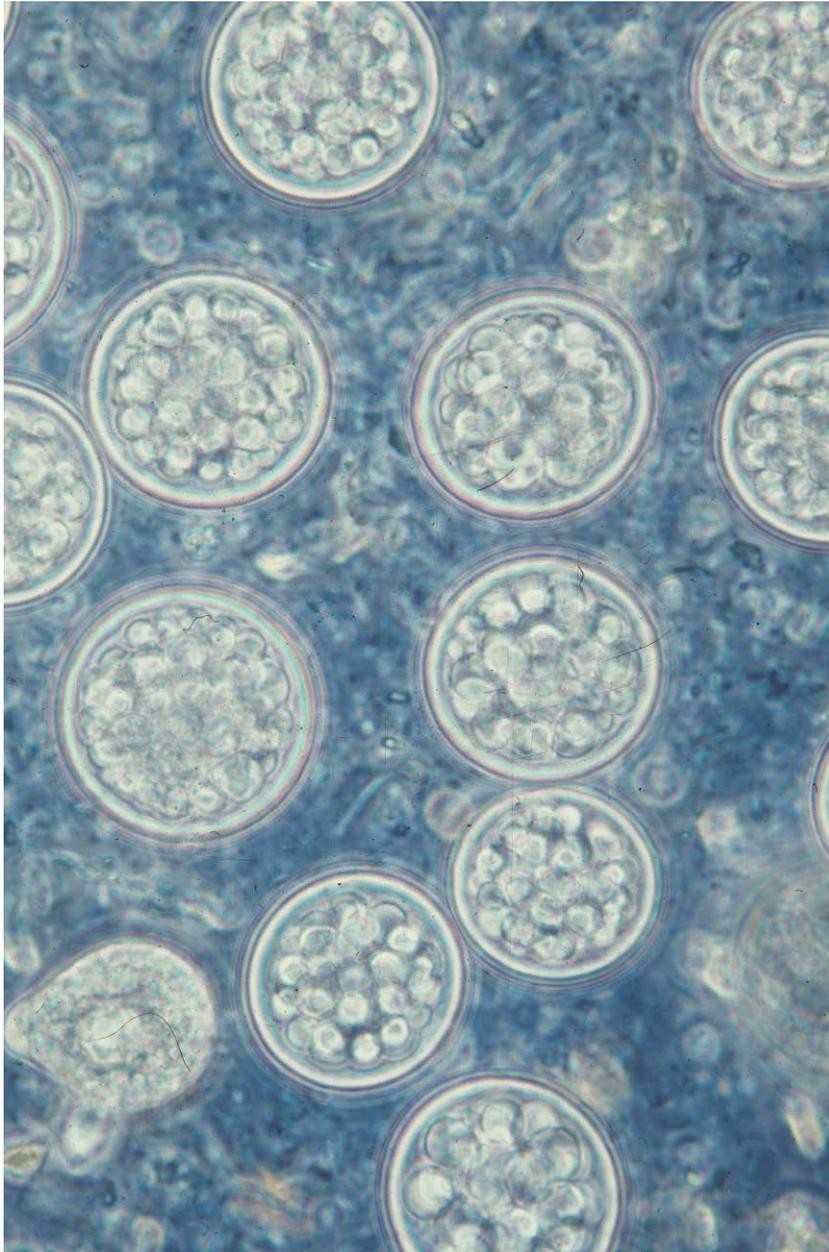
Entomophaga maimaiga



Gale Ridge, CAES

Larvae killed by *Entomophaga maimaiga* in 2015
Bethany and Hamden, CT

- In June 1989, several Experiment Station personnel noticed that dead and dying gypsy moth larvae were clinging to the sides of trees.
- The cause of the death of larvae was determined to be *Entomophaga maimaiga*, a fungus.
- *Entomophaga maimaiga* had been introduced from Japan into the Boston area in around 1910.
- It failed to establish because of an outbreak of NPV, which caused the collapse of the gypsy moth population.
- The fungus was never recovered despite numerous surveys until 1989.
- The fungus can be weather dependent. Dry springs can affect germination and infection.



Gypsy Moth Fungus

Entomophaga maimaiga

- Resting spores survive over 10 years
- Largely responsible for controlling gypsy moth from year to year
- However, requires rain (moisture) for infection of caterpillars and propagation of the spores.
- Specific to gypsy moth



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Gale Ridge, CAES



Larvae killed by *E. maimaigi*, 2015

Gypsy Moth Outbreak 2015 & 2016

- Gypsy moth fungus, *Entomophaga maimaiga* largely responsible for controlling gypsy moth since discovery by CAES in 1989.
- However, requires rain (moisture) in May and June for infection and propagation in the caterpillars.
- Some fungal activity in western CT in 2015 and observed few locations in 2016, but eastern CT received little or no rain, gypsy moths were not controlled, and CT has had two years of a major outbreak without control by the fungus.



Oak Defoliated & Dying Caterpillars, Hadlyme, CT 2016

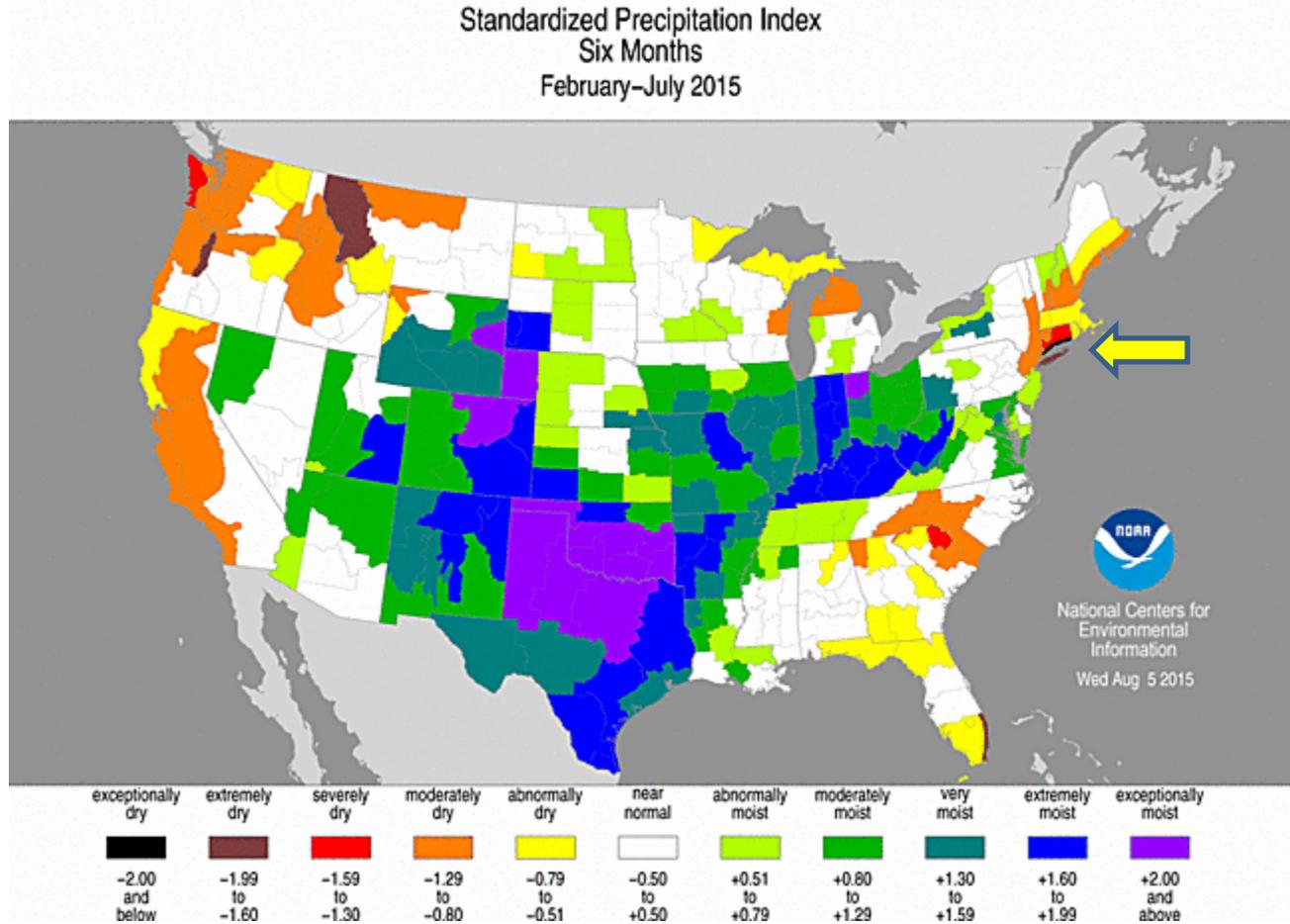


Photos courtesy Bob Standish

Caterpillars were killed by *Entomophaga maimaiga*
There was very limited fungal activity in 2016

Moisture and Drought Indices

Lack of Precipitation is Reason for No or Little Fungus Activity

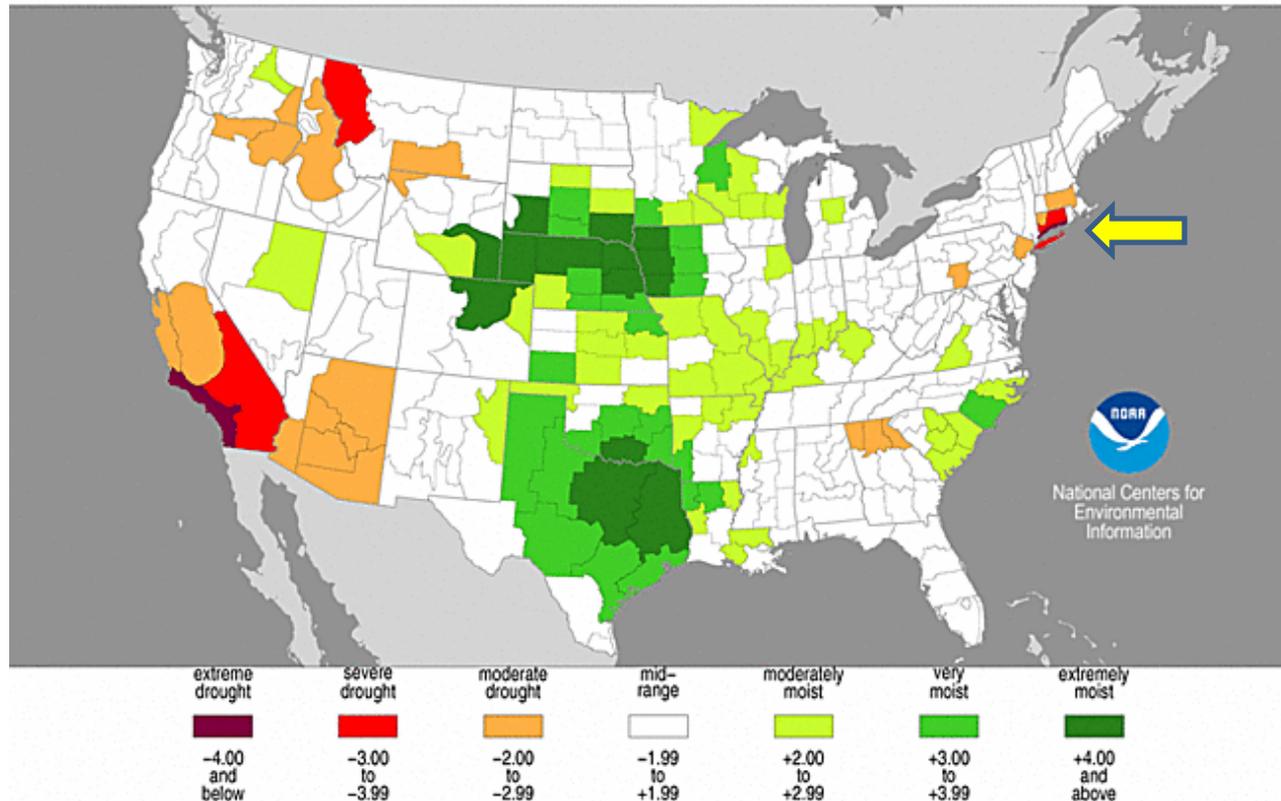


The Standardized Precipitation Index (SPI) measures moisture supply.

Moisture and Drought Indices

Palmer Hydrological Drought Index

May, 2016

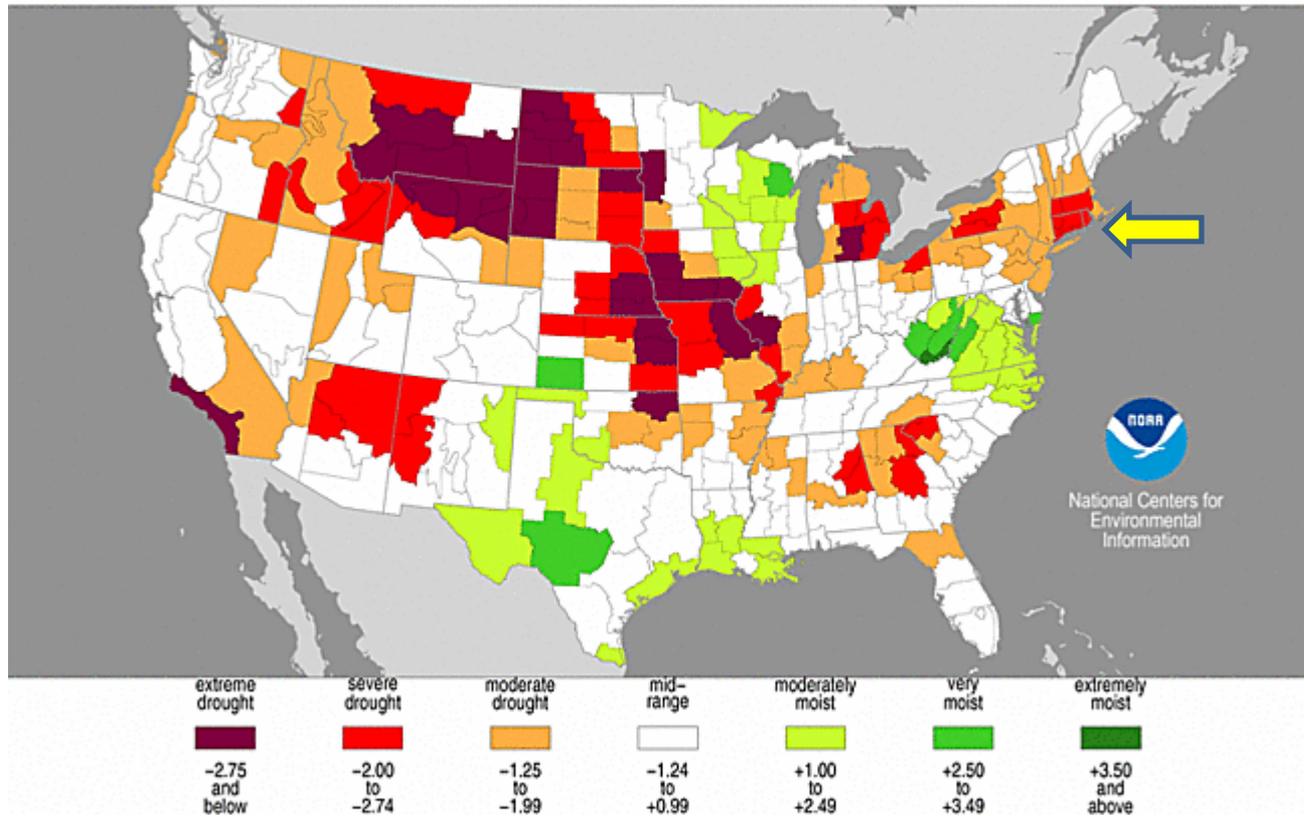


The [Palmer Z Index](#) depicts moisture conditions for the current month, while the [Palmer Hydrological Drought Index](#) (PHDI) and [Palmer Drought Severity Index](#) (PDSI) depict the current month's cumulative moisture conditions integrated over the last several months.

Moisture and Drought Indices

Palmer Z-Index

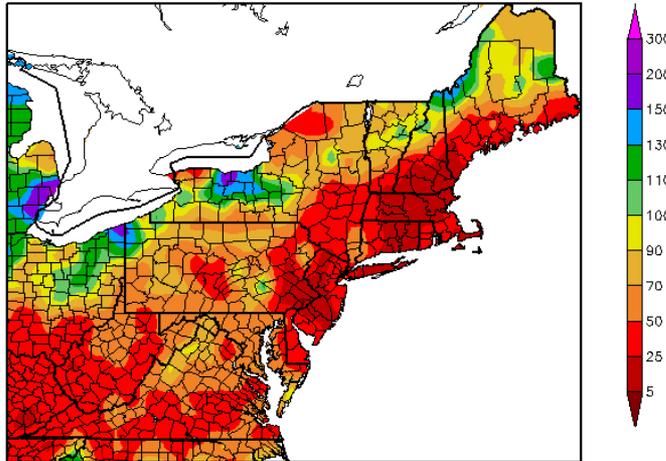
June, 2016



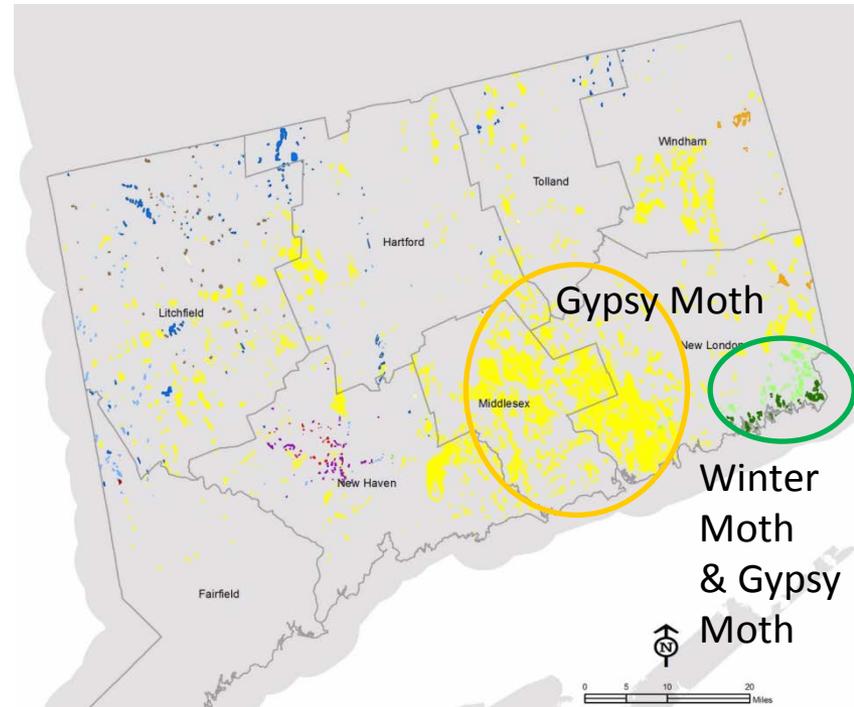
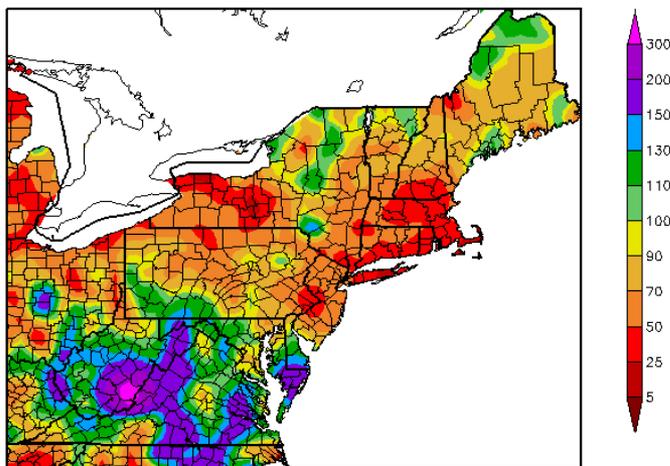
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Gypsy Moth Outbreak 2015 & 2016

Percent of Normal Precipitation (%)
5/1/2015 – 5/31/2015



Percent of Normal Precipitation (%)
6/1/2016 – 6/30/2016



The 2015 aerial survey map for Connecticut showing defoliation; 175,273 acres impacted by gypsy moth (yellow), 4,166 acres combined winter moth and gypsy moth (light green).

Parasitoids and Other Natural Enemies

- Gypsy moth parasite introduction program began 1905 by the USDA and Massachusetts
- Ten insect parasitoids and one predator from Europe and Asia were established in Connecticut by 1981. Over 20 insect parasitoids and predators that were introduced over the last 100 years from Asia and Europe.
- The egg parasitoid *Ooencyrtus kuvanae* is a small black wasp that parasitizes gypsy moth egg masses.

Ooencyrtus kuvanae

- Female wasps overwinter in the leaf litter, emerge mid-April and attack egg masses prior to the emergence of the larvae in late May.
- New adult wasps will emerge between mid-July and mid-August to attack the new gypsy moth egg masses.
- While up to 20-30% of the egg masses may be parasitized, the little wasp's short ovipositor only can reach the outermost eggs in a mass.



Photographs courtesy Henry E. Rosenberg, Ph.D.
Killingworth, CT (2016)

Chemical Control

- *Homeowner and Arborist Applications*
- *Roadside Applications*
- *Aerial Applications*
- Labeled options for aerial application include Btk (DiPel[®] 8L, Foray[®] 48F, Foray[®] 48B, Foray[®] 76B), and IGRs tebufenozide (Mimic[®] 2LV) and diflubenzuron (Dimilin[™] 25W).
- However, only Btk (e.g., DiPel[®] & Foray[®]) is approved for residential gypsy moth control in Connecticut.
- DiPel is a paraffinic oil-based formulation
Foray is an aqueous flowable formulation

Historical Chemical Control - Spraying



Spray Wagon - 1915



Spraying in New Haven – 1925



Aerial Spraying by
helicopter – 1960's

Chemical and biological insecticide compounds labeled for the control of the gypsy moth (from GM Fact Sheet)

In Connecticut, neonicotinoids will be classified as restricted use on January 1, 2017
(Public Act 16-17)

Chemical (active ingredient)	Representative Trade Names	Chemical class or type	Stage	Comments
General use				
Acephate	Orthene®	Organophosphate	L	
Azadirachtin	Azatrol®, Azatin®, Azamax®, Ornazin®, Neemix® 4.5, Safer Bioneem®	Insect growth regulator (IGR)	L	Neem-based Insecticide Organic, OMRI listed
<i>Bacillus thuringiensis</i> var. <i>kurstaki</i>	DiPel®8L, Foray®48B, Foray®76B, Biobit® HP, Safer® Tree, Shrub Conc. Thuricide® BT, Javelin®	Biological	L	A bacterium that kills when ingested, OMRI listed
Carbaryl	Sevin® SL and others	Carbamate	L, A	
Methoxyfenozide	Entrepid® 2F	Diacylhydrazine (IGR)	L	Molting hormone agonist, relatively non-toxic honey bees
Pyrethrins plus piperonyl butoxide (PBO) sulfur, or insecticidal soap, etc.	Pyrenone®, Garden Safe	Pyrethrin	L, A	Natural insecticide compounds from chrysanthemum flower. Most products other uses.
Insecticidal Soap	M-Pede®, Safer® Bayer Advanced Natria®	Potassium salts of fatty acids	E, L	Products with synergist PBO are not considered organic
Spinosad	Entrust® SC, Conserve® SC Bull's-Eye™ Bioinsecticide	New chemical class spinosyn A & spinosyn D	L	Bacterial fermentation product, OMRI listed
Canola oil	Bayer Natria® Ortho® Elementals™ (with pyrethrin)	Oil	L, A	Combined with pyrethrin in many homeowner products
Mineral (petroleum oil)	Ortho® Volck® Oil Spray	Oil	E	
Soybean oil	Golden Pest Spray Oil™	Oil	E	or 50% solution oil and water

Note: Gypchek, the NPV product is not listed.

General or restricted use depending on product				
Cyfluthrin	Tempo [®] , Bayer Lawn & Garden	Pyrethroid	L	Some products restricted use; some general use
Bifenthrin	Onyx [™] , Talstar [®] , Mence [™] Ortho [®] Bug-B-Gon [®]	Pyrethroid	L	Many products restricted use; some general use
Dinotefuran	Transtect [™] (soil application)	Neonicotinoid	L	Dinotefuran and other neonicotinoids will classified as restricted use in Connecticut by January 1, 2018 (Public Act 16-17)
Imidacloprid	Bayer Advanced Tree & Shrub Bayer Advanced (other names)	Neonicotinoid	L	Imidacloprid and other neonicotinoids will classified as restricted use by January 1, 2018 (Public Act 16-17)
Permethrin	Astro [®] , Evercide [®] , Permanone [®] Bee Gone [®] Insecticide	Pyrethroid	L, A	Some products restricted use; most general use
Fluvalinate; tau-fluvalinate	Mavrik [®] , Bayer Advanced	Pyrethroid	L	Some products restricted use; some general use

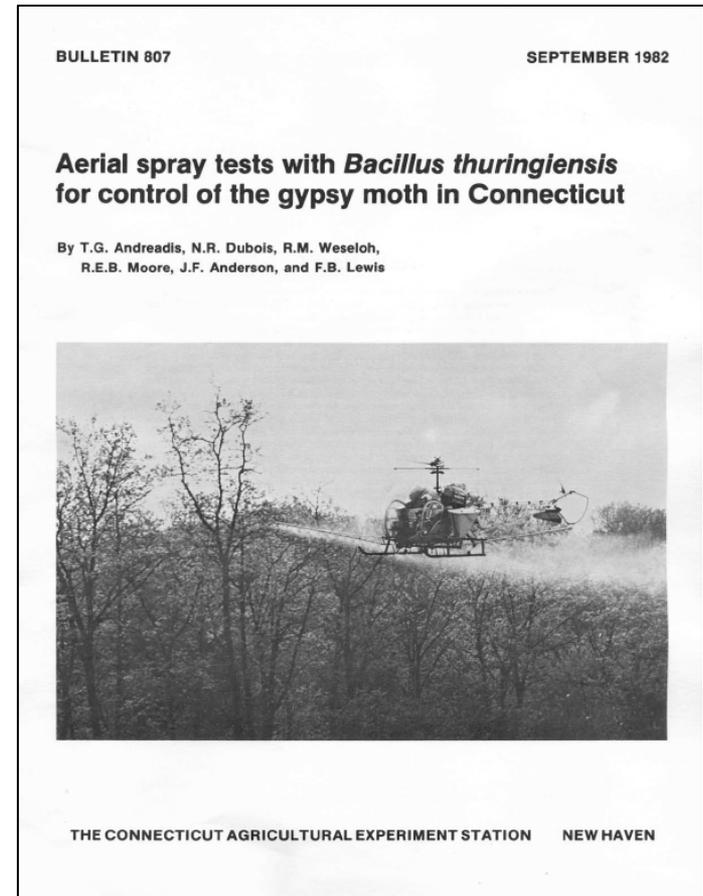
Restricted (Commercial) use				
Chlorantraniliprol	Acelepryn [®]	Anthranilic diamide	L	Commerical use only
Cypermethrin	Cyper TC	Pyrethroid	L, A	Trunk, structural use
Chlorpyrifos	Dursban 50W	Organophosphate	L, A	Certified applicators only
Deltamethrin	Deltagard [®] T&O, Suspend SC	Pyrethroid	L	Commercial use only
Diflubenzuron	Dimilin [™] 25W	Benzophenyl urea (an IGR)	L	Certified applicators only
Lamda-cyhalothrin	Demon [®] Max, Simitar [®] CS	Pyrethroid	L, A	Commercial use only, General use products not labeled for GM
Tebufenozide	Mimic [®] 2LV	Insect growth regulator (IGR)	L	Specific to Lepidoptera, apply to 1 st , 2 nd , or 3 rd instars

The list of active ingredients in products labeled for the control of gypsy moth is for informational use only and is based on searches of registry databases (e.g., kellysolutions.com/CT) and other sources. List is not comprehensive. Active ingredients and products may change over time. Not all trade names (252 products registered in Connecticut alone) can be mentioned. A list of specific products acceptable by OMRI for organic use is available at <https://www.omri.org/>. Mention of an insecticide does not constitute a claim of effectiveness or an endorsement by The Connecticut Agricultural Experiment Station. The product label is the legal document for use and homeowners and others applying an insecticide should read and follow the label directions.

Bacillus thuringiensis kurstaki (Btk)



- Study CAES in Harwinton, CT with 3 strains BT (incl. DiPel® 4L)
- Applied May 21, 1981 for 1st & 2nd instars; second app on May 28th with 2nd and 3rd instars equally present
- Significant larval reductions with one application, but better foliage protection with two applications
- Most effective for 1st and 2nd instars, around 30-40% leaf expansion.
- Btk kills gypsy moth as well as other selected non-target lepidopteran larvae



CAES

The Connecticut Agricultural Experiment Station
Putting Science to Work for Society since 1875

Aerial Spraying is Complex

In Connecticut, permit required from DEEP



Permit Application for Pesticide and/or Fertilizer Application by Aircraft

Please complete this form in accordance with section 22a-54(e) CGS, sections 22a-54-1, 22a-66-7 RCSA and the instructions (DEP-PEST-INST-100) to ensure the proper handling of your application. Print or type unless otherwise noted. You must submit the *Permit Application Transmittal Form* (DEP-APP-001) and the initial fee along with this form.

DEP USE ONLY
Application No. _____
Permit No. _____

Part I: Permit Type and Fee Information

Size of area to be treated (check one of the following):	Fees:
<input type="checkbox"/> 10-49 acres	\$ 200.00
<input type="checkbox"/> 50-149 acres	\$ 285.00
<input type="checkbox"/> ≥ 150 acres	\$ 565.00

Part II: Applicant Information

1. Fill in the name of the applicant(s) as indicated on the *Permit Application Transmittal Form* (DEP-APP-001):

Applicant:

Phone:

Check here for information

2. List primary contact:

Name:

Mailing Address:

City/Town:

Business Phone:



Instructions for Completing the Permit Application for Pesticide and/or Fertilizer Application by Aircraft

Use these instructions to: 1) complete the permit application form DEP-PEST-APP-100 and 2) prepare supporting documents. These instructions are not a substitute for the requirements of the relevant statutes and any regulations thereunder. You should review all applicable laws prior to completing this application. Remember, it is your responsibility to comply with all applicable laws.

Introduction

This permit program is administered by the Pesticide Management Division of the Department of Environmental Protection (DEP). In accordance with Section 22a-66a of the Connecticut General Statutes (CGS), and Sections 22a-66-7 and 22a-54-1 of the Regulations of Connecticut State Agencies (RCSA), this program authorizes the application of pesticides and/or fertilizers by a certified aircraft applicator. Information regarding certified aircraft applicators may be obtained by calling DEP Pesticide Control 860-424-3369.

There are different requirements depending on whether the application is for agricultural use or

application of pesticides and/or fertilizers by a certified aircraft applicator. Homeowner's associations and other voluntary associations may also apply.

In addition the following restrictions are applicable:

- No pesticide may be applied from the air to a tract of land less than 10 acres in size unless the tract of land to be treated is part of a larger parcel of land that is at least 10 acres in size.
- No pesticidal dust may be applied within 100 feet of a public highway.



Aerial spraying in Ledyard with *Bacillus thuringiensis* - 1985

Basic Aerial Spraying Requirements

- No pesticide may be applied from the air to tract > 10 acres in size
- No pesticide may be applied from the air for agricultural purposes within 200 feet of a watercourse, pond, or lake.
- Signatures must be obtained from those property owners whose property is less than 200 feet from the flight path (300 feet airplane). Roads are considered abutting property.
- Permits will be granted for aerial spraying by helicopter only, except for extenuating circumstances and isolated fields.

So What to Expect in 2017?

- There was a lot of gypsy moth fungus around in southcentral CT 2015, some in 2016, but not in most areas.
- Parts of eastern CT will likely see another round of significant moth activity, defoliation, and early treatment of trees probably should be considered.
- Even with a wet spring, there will be areas of high gypsy moth activity. There are a lot of egg masses.
- If plan to spray, line up arborist now (most are already booked).
- So destroy egg masses this fall if you have them.



Allen Fenner



Kriby Stafford

Acknowledgements

- Plant inspector Peter Trenchard (retired) for many photographs and his contribution of material for this presentation.
- Plant inspectors Peter Trenchard and Tia Blevins, and Dr. Victoria Smith who conduct the aerial surveys.
- Various citizens for submitting photographs.
- Dr. Gale Ridge for some of the pictures of the gypsy moth caterpillars.
- U.S. Forest Service for support for forest health surveys, maps past outbreaks, and other material.

The Gypsy Moth
Dr. Kirby C. Stafford III
Department of Entomology
The Connecticut Agricultural Experiment Station

Introduction:

The gypsy moth, *Lymantria dispar*, was introduced into the US (Medford, MA) around 1869 by Etienne Leopold Trouvelot. Some larvae escaped and small outbreaks became evident in the area around 1882. Populations increased rapidly and by 1889, the Massachusetts State Board of Agriculture began a campaign to eradicate the moth. It was first detected in Connecticut in Stonington in 1905 and had spread to all 169 towns by 1952. In 1981, 1.5 million acres were defoliated in Connecticut (Fig. 1). During an outbreak in 1989, CAES scientists discovered that the entomopathogenic fungus *Entomophaga maimoniga* was killing the caterpillars. Since then, the fungus has been the most important agent suppressing gypsy moth activity.

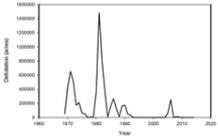


Figure 1. Number of acres defoliated by the gypsy moth in Connecticut, 1962-2014.

However, the fungus cannot prevent all outbreaks and hot spots in some areas continue to be reported. There was an outbreak in 2005-2006 and again in 2015.

Life Cycle:

There is one generation of the gypsy moth each year. Caterpillars hatch from buff-colored egg masses in late April to early May. An egg mass may contain 100 to more than 1000 eggs and are laid in several layers.



Figure 2. Egg mass of gypsy moth on a tree branch, and an inset showing a close-up of the egg mass.

A few days after hatching, the ¼ inch long, buff to black-colored caterpillars (larvae) ascend the host trees and begin to feed on new leaves. These young caterpillars lay down silk safety lines as they crawl and, as they drop from branches on these threads,



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**PDF version available at
www.ct.gov/caes**