

Invasive Species Management in Our Forests – *Lymantria dispar dispar*

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Conservation & Natural Resources
Bureau of Forestry
Division of Forest Health

October 20, 2023



Agenda

- **Division of Forest Health**
- **Forest Health in Pennsylvania**
- **Local Forest Pests and Diseases**
- **Local Hot Spots for LLD**
- **Treatment plan on Public Lands 2024**
- **PA DCNR's Spongy Moth Website**



Division of Forest Health

Division of Forest Health

Forest Health Activities

- **General Pest Surveys**
- **Detection Surveys**
- **Invasive Species**
- **Data Management**
- **Suppression Programs**
- **Biological Control**
- **Training**
- **Education & Outreach**
- **Cooperative Research**
- **Management Recommendations**



Working Across Pennsylvania



www.dcnr.state.pa.us

Control/Suppression

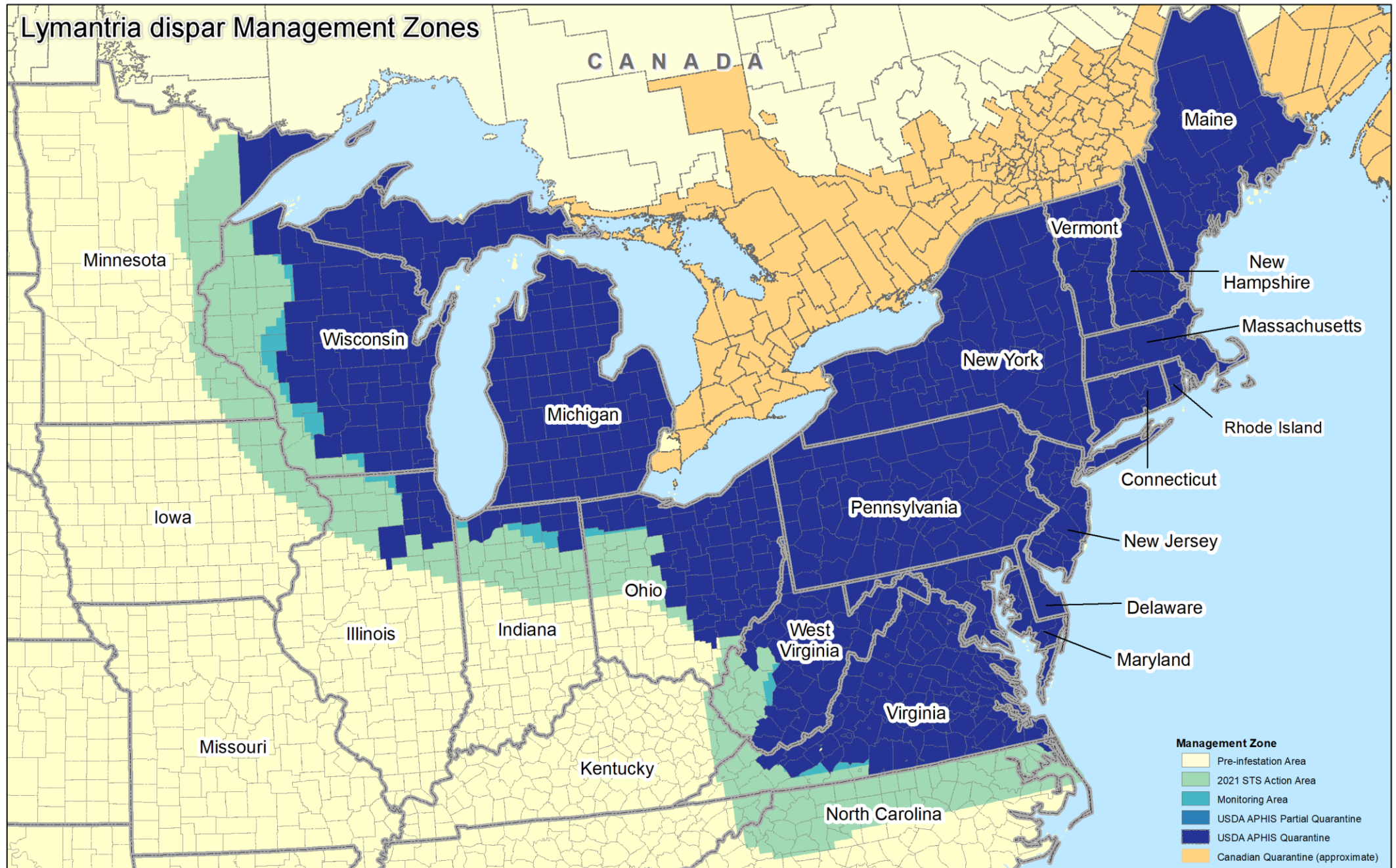
Lymantria dispar dispar (spongy moth)



Lymantria dispar dispar (Spongy Moth) aka Gypsy moth



Lymantria dispar Management Zones



Quarantine Information Source: <https://www.aphis.usda.gov/aphis/maps/plant-health/european-gypsy-moth-quarantine>

Spongy Moth Egg Mass Surveys

[Guide to Spongy Moth Egg Mass Surveying \(psu.edu\)](#)



A forester counts egg masses through binoculars in an oak forest.

- From the "center" tree you choose, you should search for and count all visible egg masses within a circular plot with a radius of 18.6 feet. This plot size is one-fortieth of an acre.
- **25 egg masses per 1/40 acre x 40 = 1,000 egg masses per acre.**

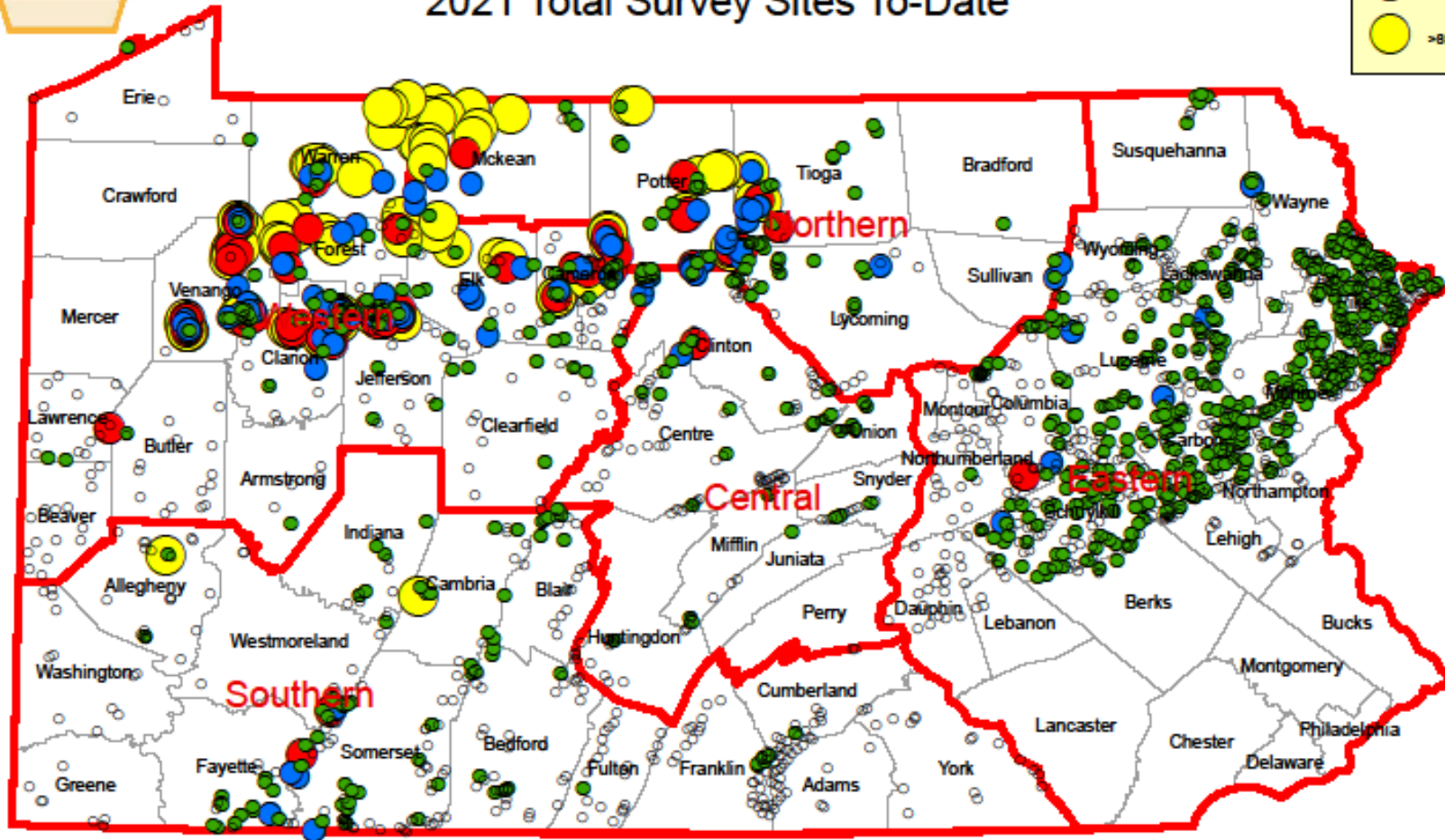




2013 Gypsy Moth Egg Mass Surveys

(egg masses that will hatch in 2013)

2021 Total Survey Sites To-Date

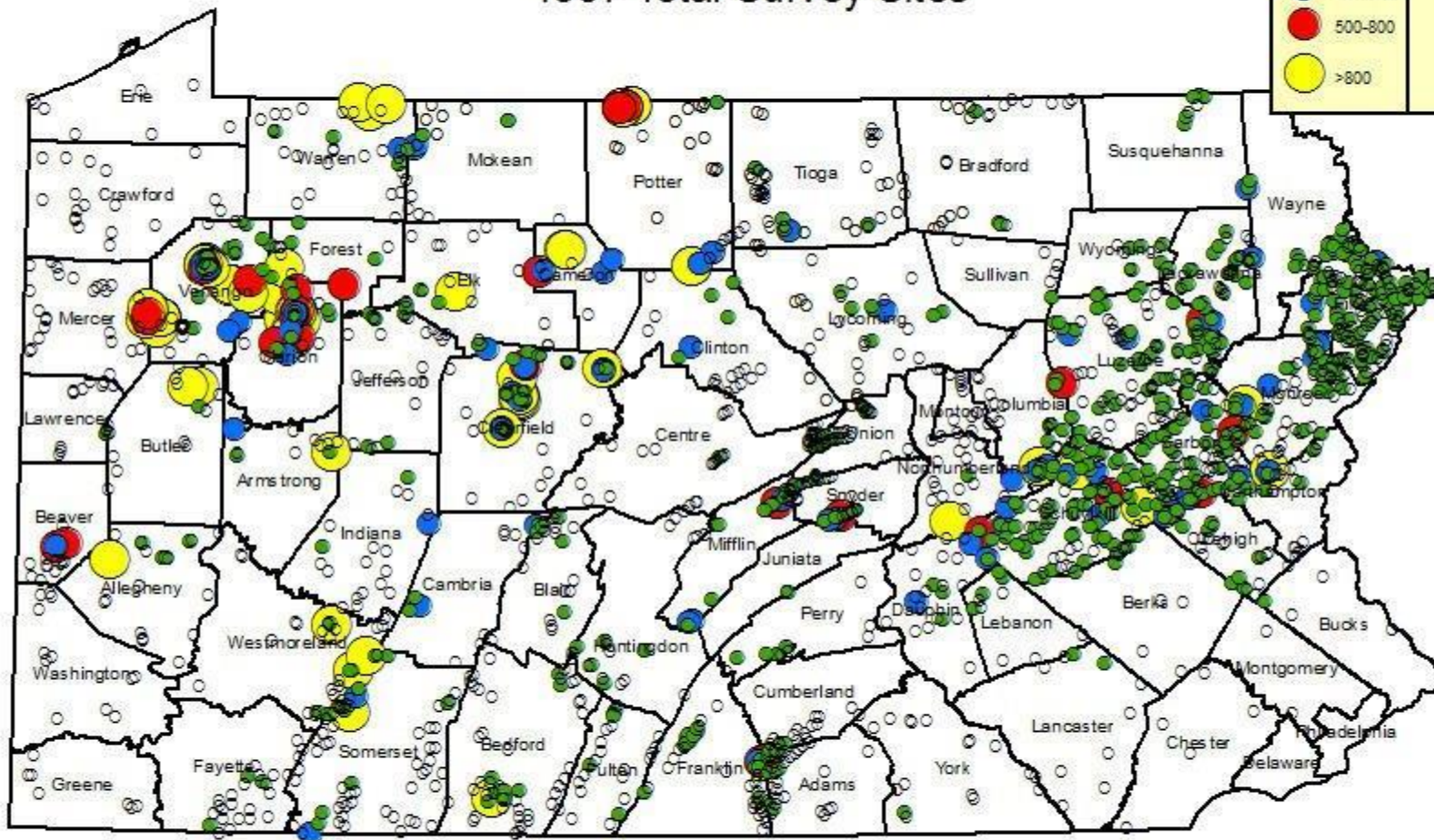


2014 Gypsy Moth Egg Mass Surveys

(egg masses that will hatch in 2014)

1957 Total Survey Sites

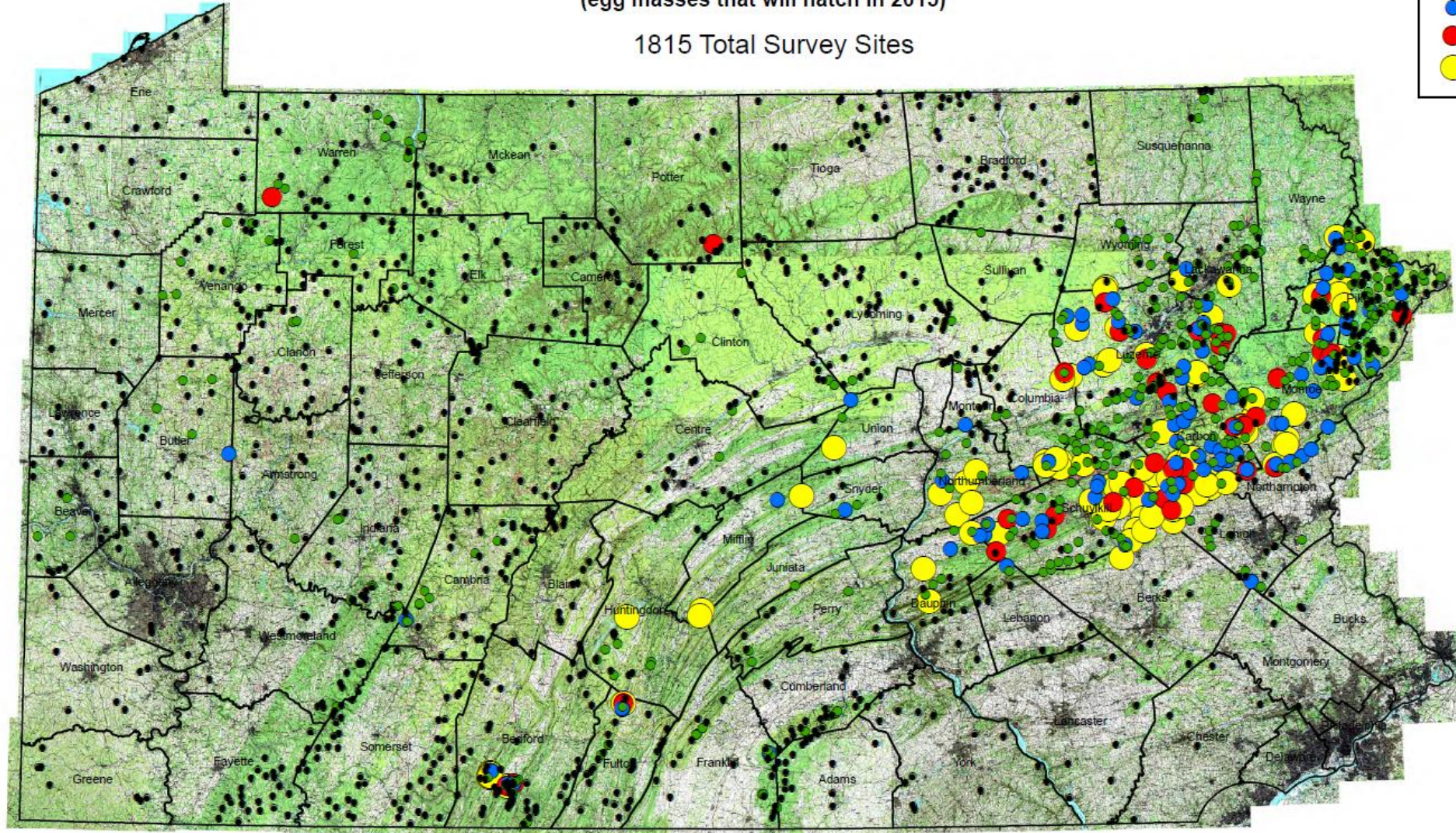
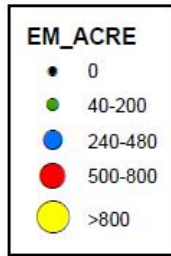
EM_COUNT	
○ 0	1172
● 40-200	586
● 240-480	104
● 500-800	27
● >800	68



2015 Gypsy Moth Egg Mass Surveys

(egg masses that will hatch in 2015)

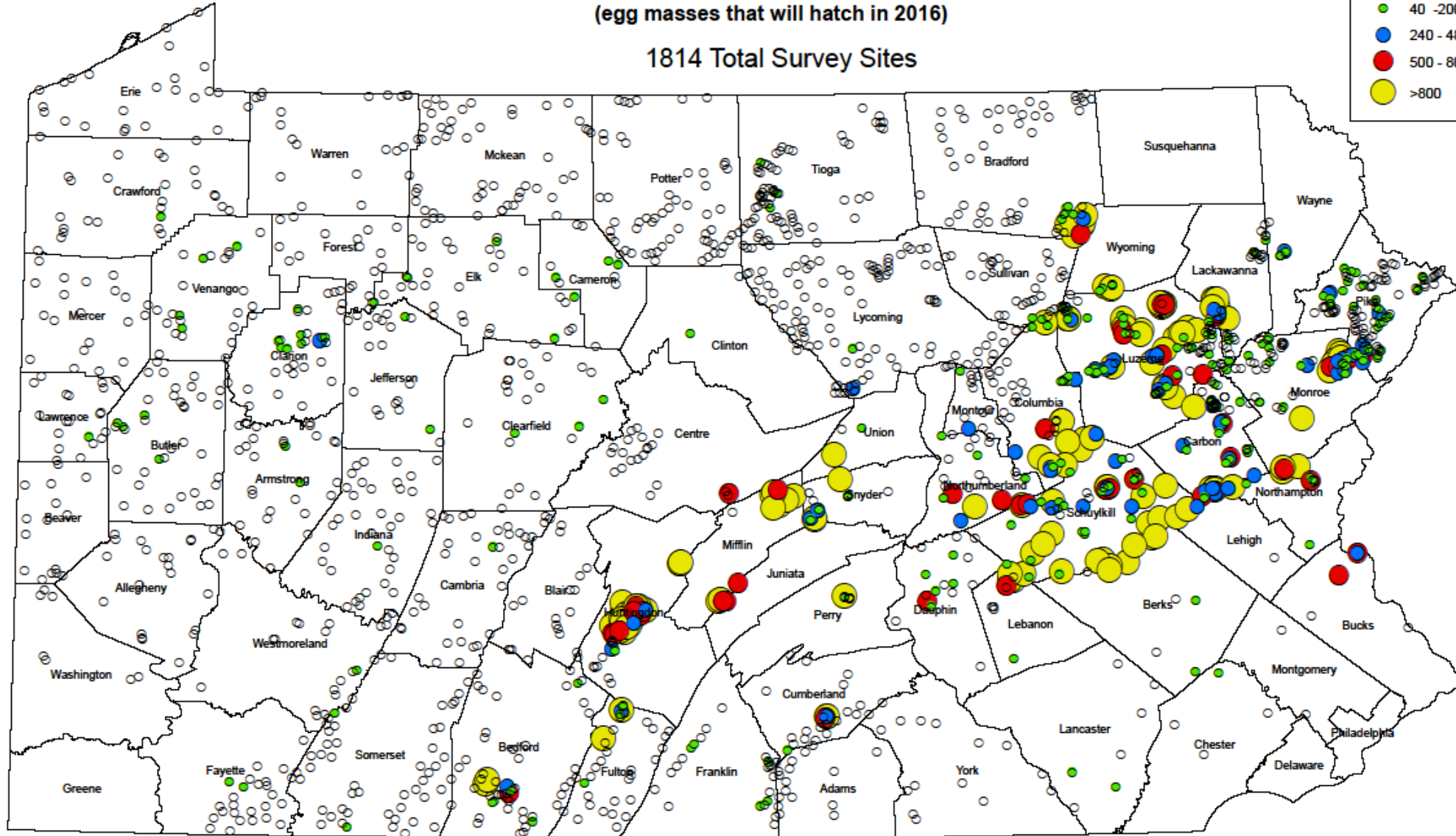
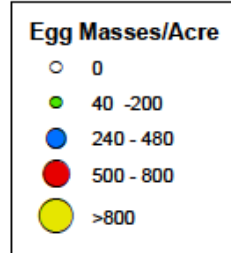
1815 Total Survey Sites



2016 Gypsy Moth Egg Mass Surveys

(egg masses that will hatch in 2016)

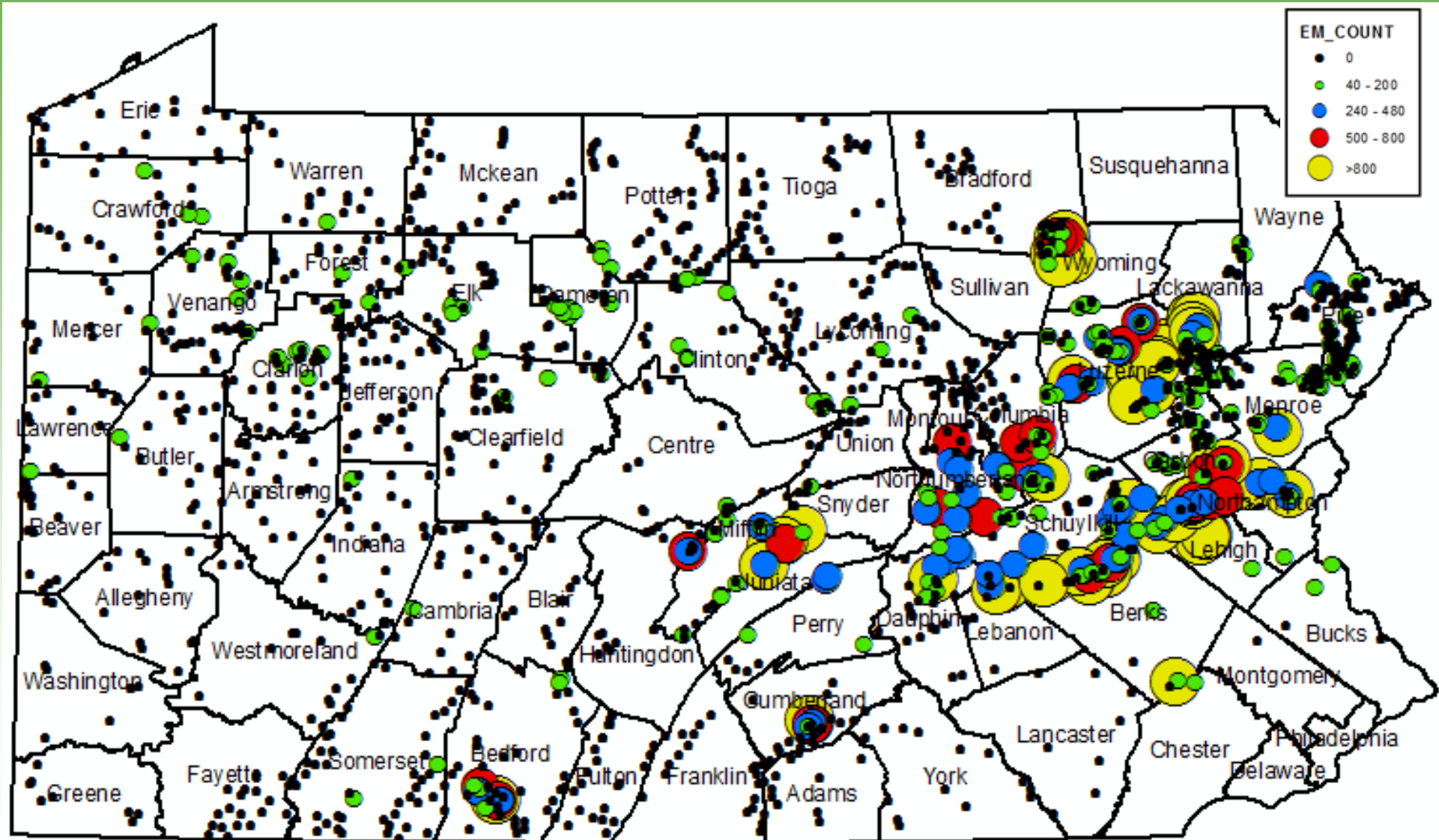
1814 Total Survey Sites



2017 *Lymantria dispar* Egg Mass Surveys

(Egg Masses that will hatch in 2017)

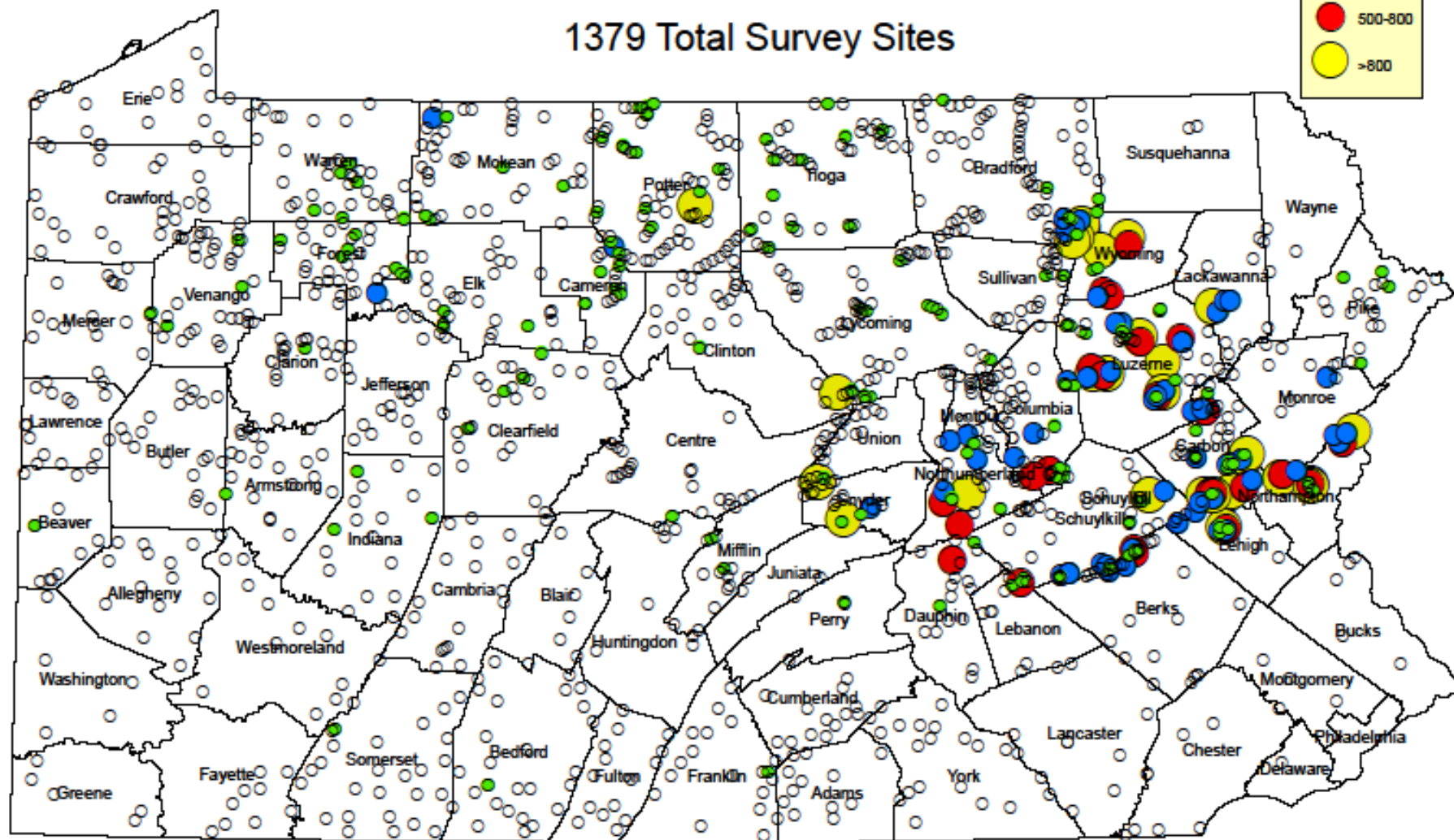
1697 Total Survey Sites, 371 Positives



2018 Gypsy Moth Egg Mass Surveys

(egg masses that will hatch in 2018)

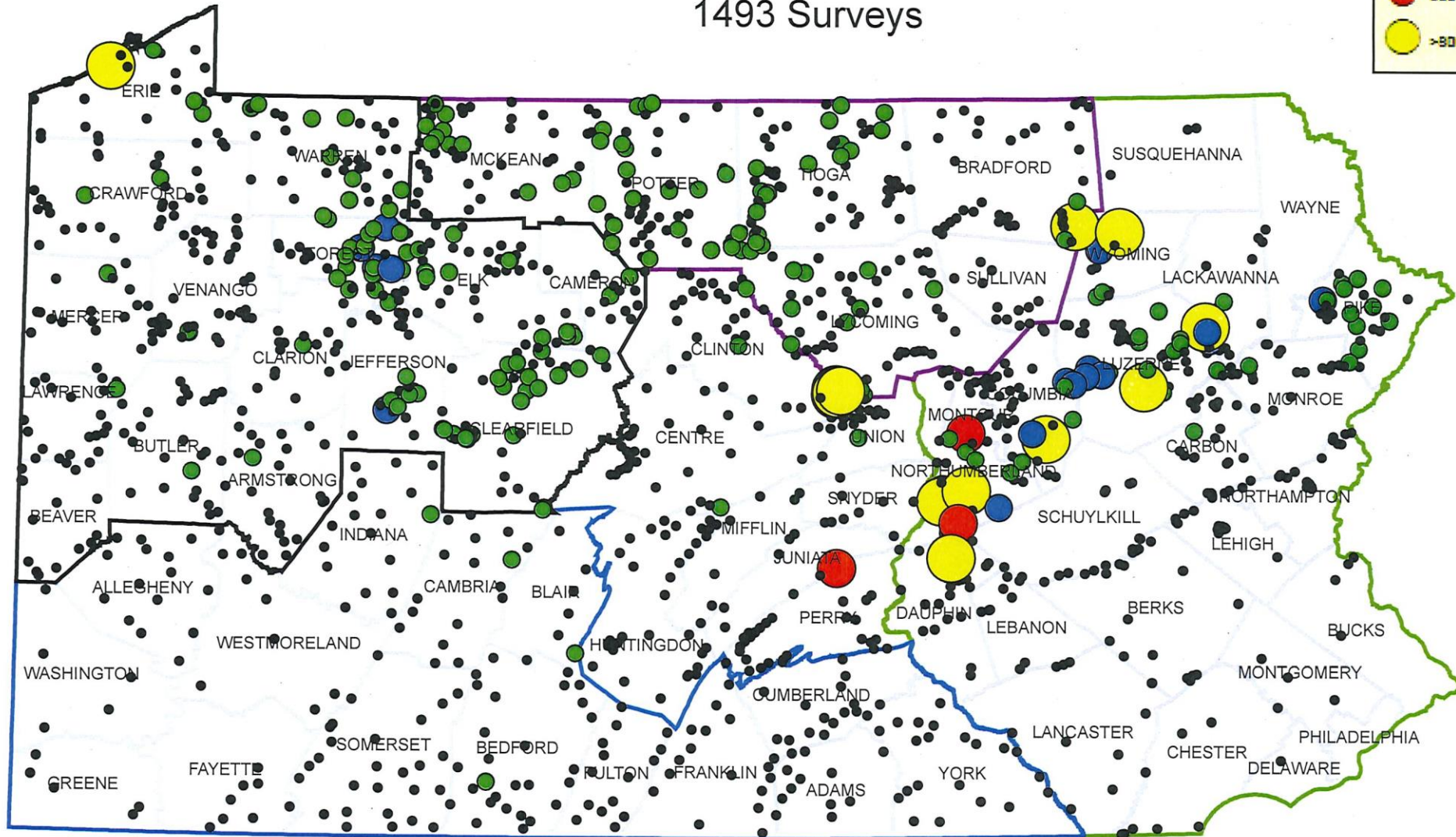
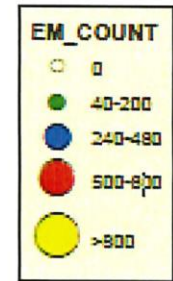
1379 Total Survey Sites



2019 Gypsy Moth Egg Mass Surveys

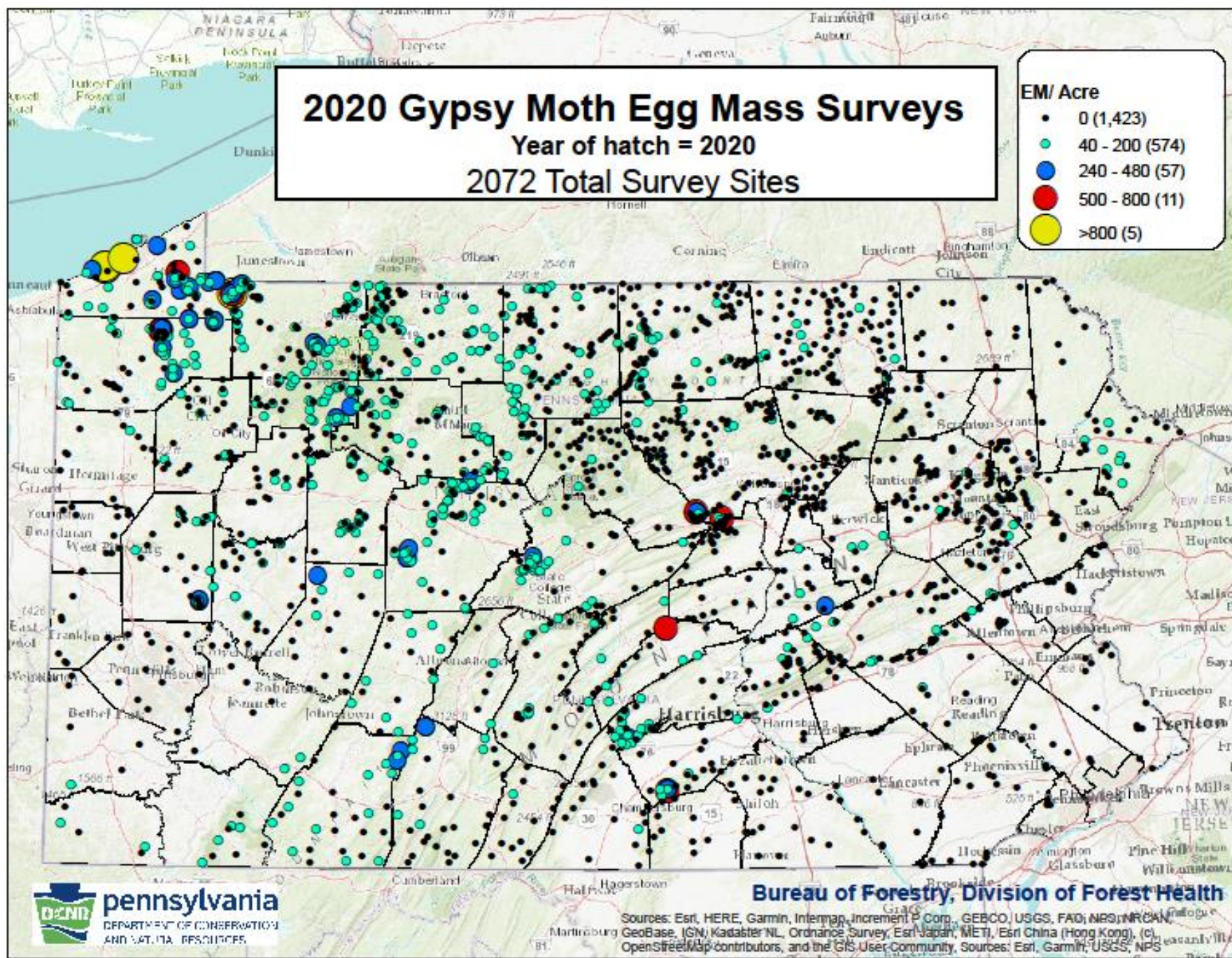
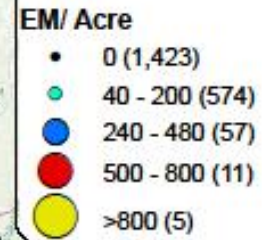
As Of - March 6, 2019

1493 Surveys



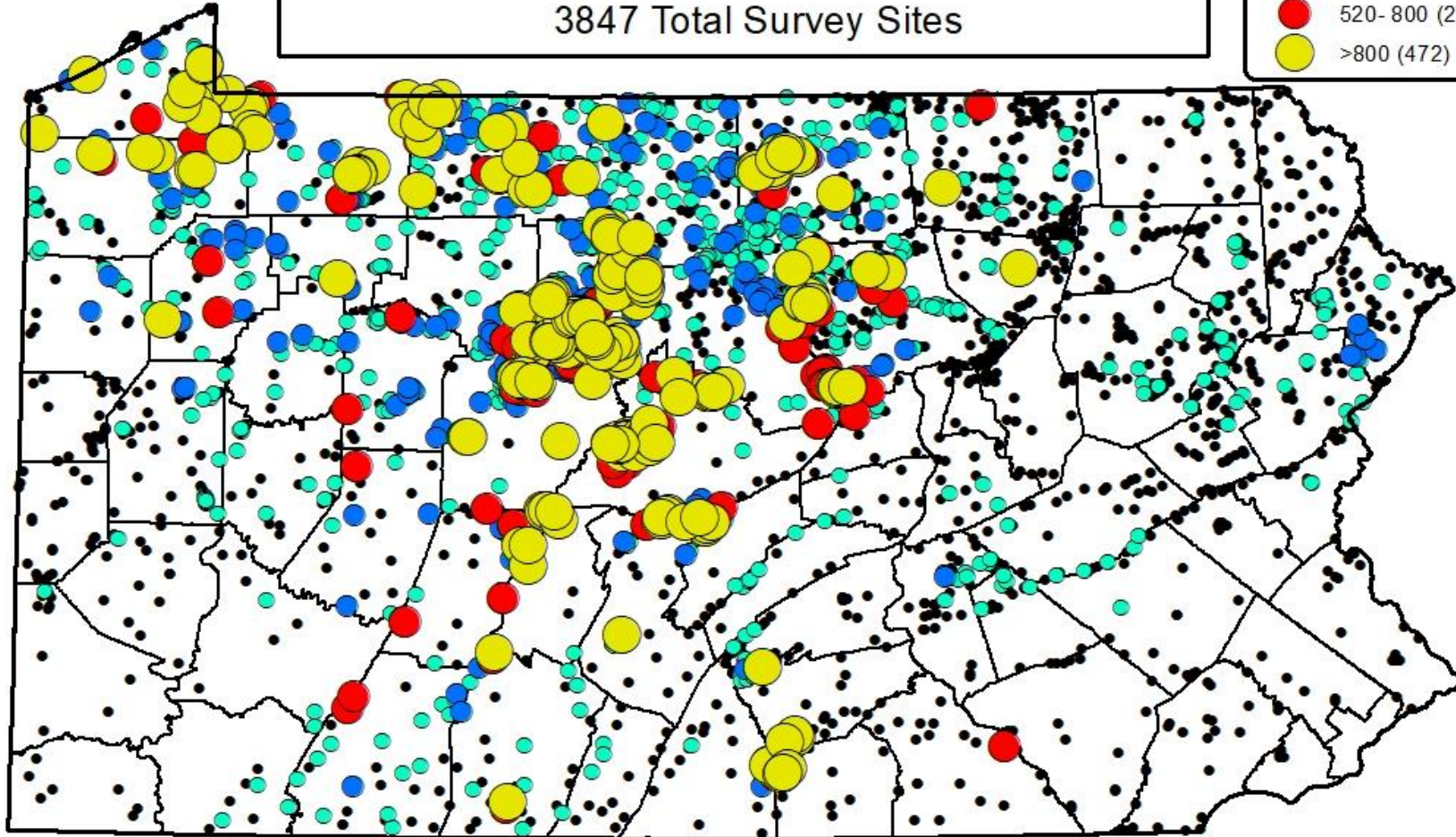
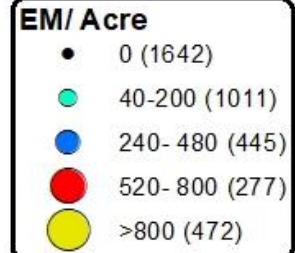
2020 Gypsy Moth Egg Mass Surveys

Year of hatch = 2020
2072 Total Survey Sites



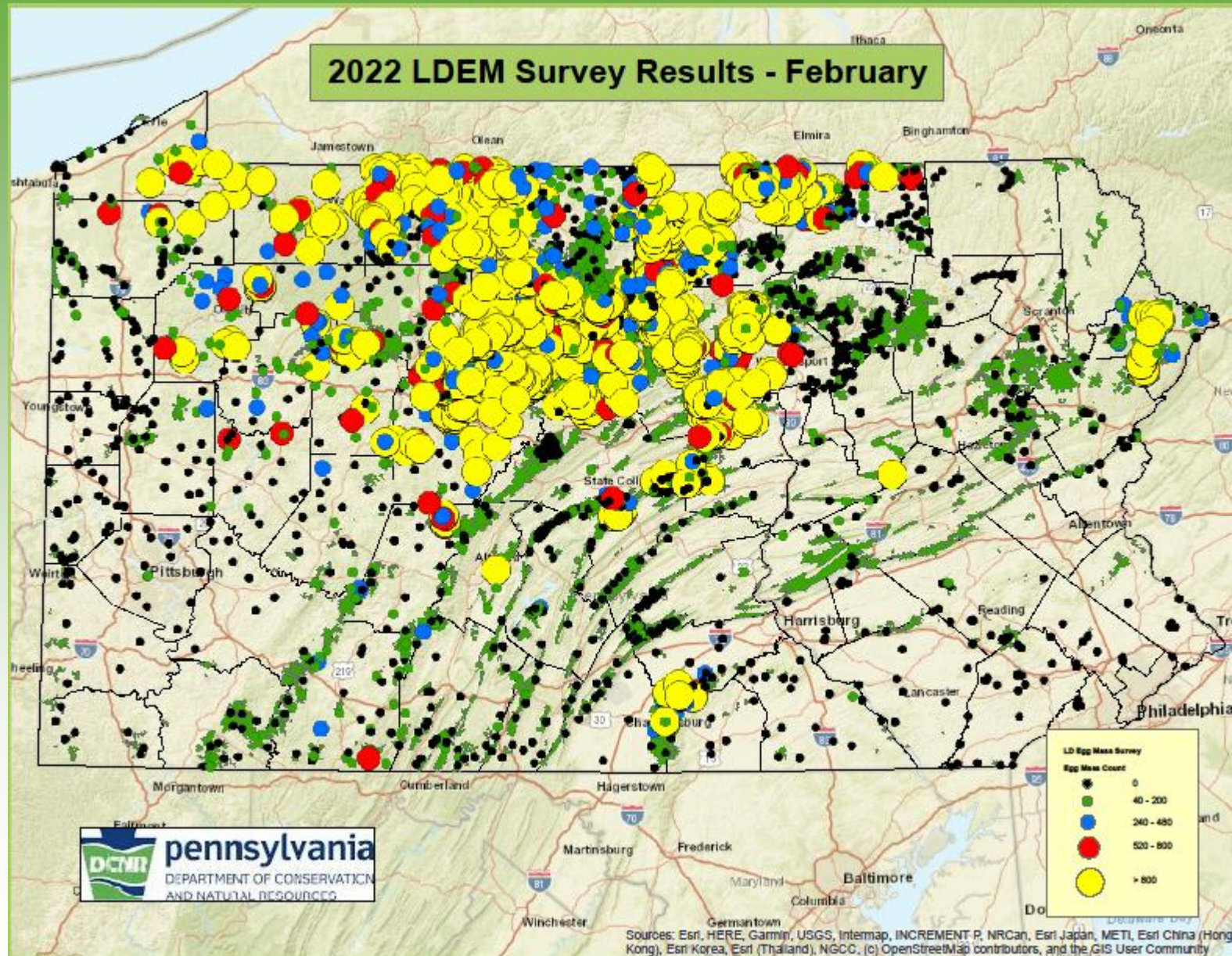
2021 Gypsy Moth Egg Mass Surveys

Year of hatch = 2021
3847 Total Survey Sites



(Created by 04/06/2021)

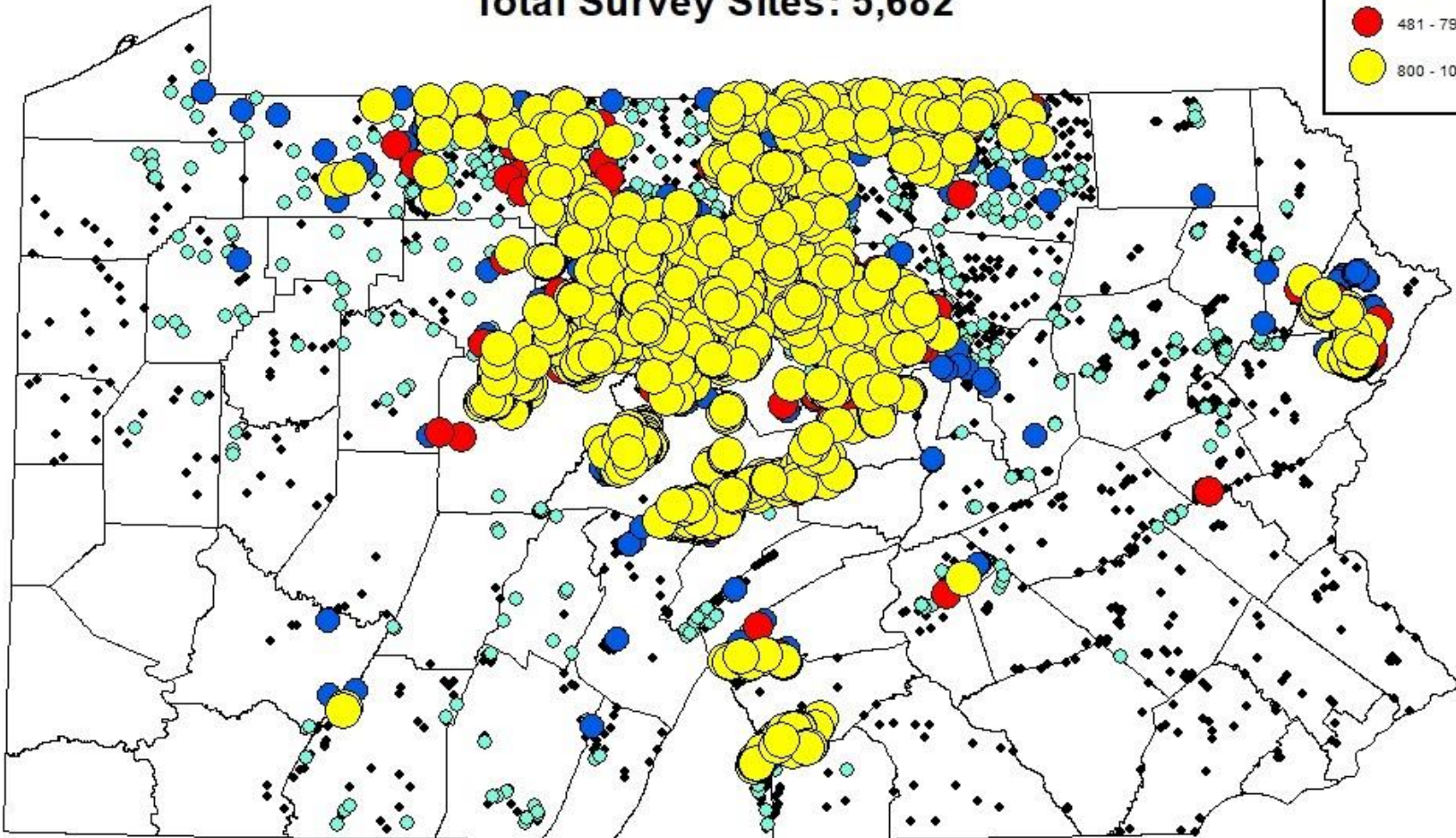
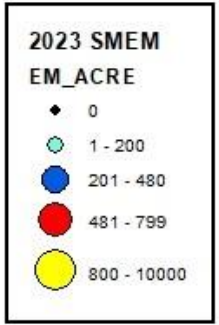
L. dispar dispar Egg Mass Survey



2023 Spongy Moth Egg Mass Surveys

Year of hatch: 2023

Total Survey Sites: 5,682



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Spongy Moth Program Objective

Reduce spongy moth populations to a level where defoliation in the areas treated is prevented from exceeding 30 percent on 80 percent or more of the highly favored host trees during the year of treatment.



Pennsylvania Game Commission Spongy Moth Spraying Video

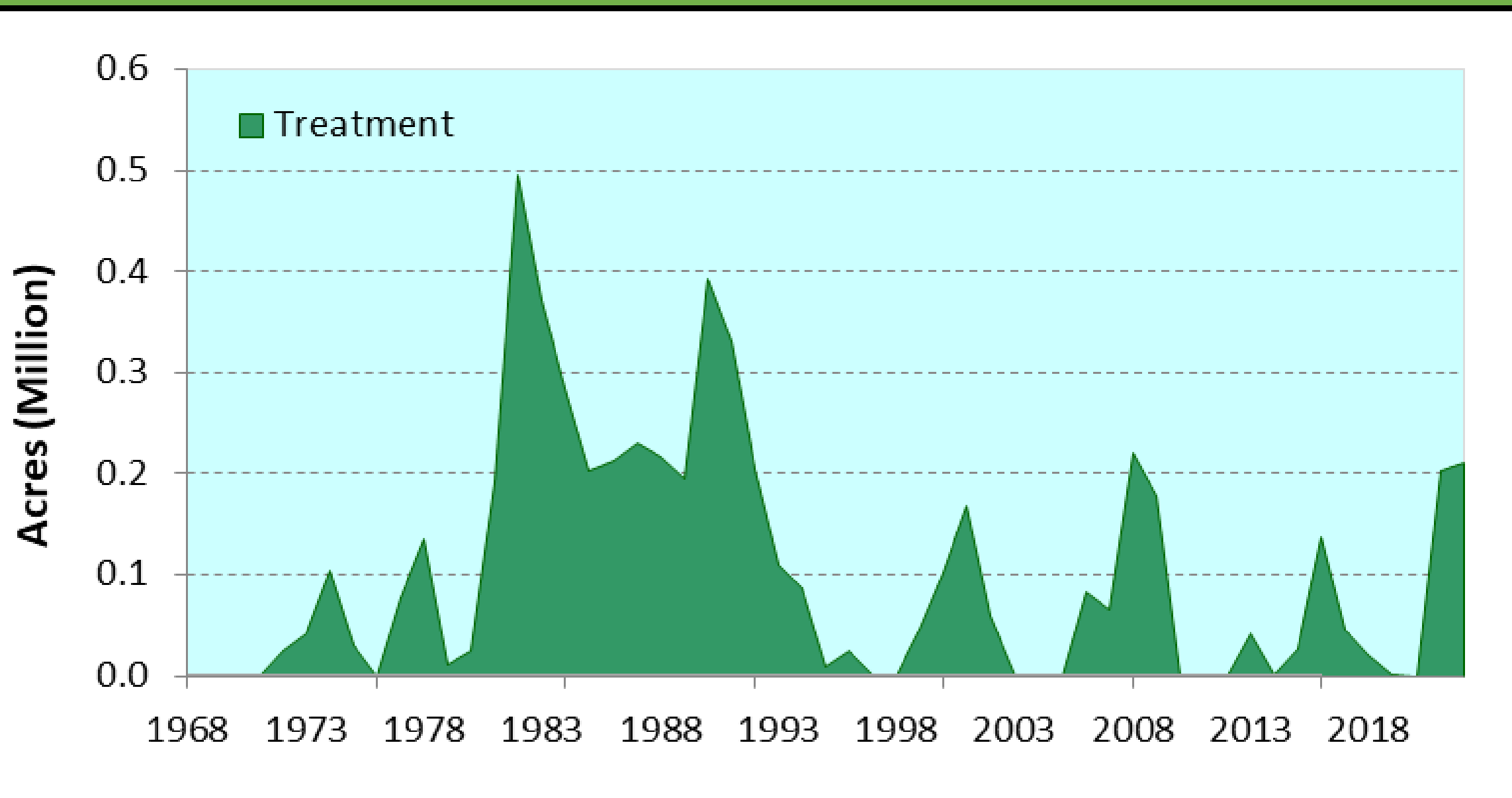
- <https://www.pgc.pa.gov/Wildlife/HabitatManagement/Pages/Spongy-Moth.aspx>



Pennsylvania Forests

- 16,917,000 acres of forest land in PA
- Nearly 11 million acres contain oak and other spongy moth preferred hosts
- 2.2 million acres – DCNR State Forests
- 200,000 acres – DCNR State Parks
- 1.1 million acres – State Game Commission
- 11.5 million acres – Non-industrial Private Forest Lands
- 517,000 acres – Allegheny National Forest
- 1.4 million acres – Other Federal/State/County/Municipal/Private Lands
- Spray Program Logistical Capacity is 210,000 acres per year

Lymantria dispar dispar treatment acres from 1968 to 2022



Lymantria dispar dispar Treatments 2013-2023

- 42,014 acres treated 2013
- 1,901 acres treated in 2014
- 26,433 acres treated 2015
- 135,898 acres treated 2016
- 46,345 acres treated 2017
- 19,527 acres treated 2018
- 1,490 acres treated in 2019
- 0 acres treated in 2020
- 203,569 acres treated in 2021
- 209,838 acres treated in 2022
- 209,838 acres DCNR; 63,000 acres PA Game Commission (PGC) in 2022 were treated
- 290,752 acres DCNR; 109,181 PGC in 2023 were treated
- 2024 Estimate ~ TBD

Lymantria dispar dispar: Egg Mass Surveys



Adult Females Laying Egg Masses



Egg Hatch in April – Larval Dispersal



Hole Feeding by Small Caterpillars



1st and 2nd Instar Larvae



Burlap Bands



Large Caterpillars: 90+% of the Feeding





Fungus

Entomophaga maimaiga



Virus

NPV nucleopolyhedrosis virus



Forest Damage Aerial Survey



- June / July Peak Defoliation
- Cessna 172 Skyhawk

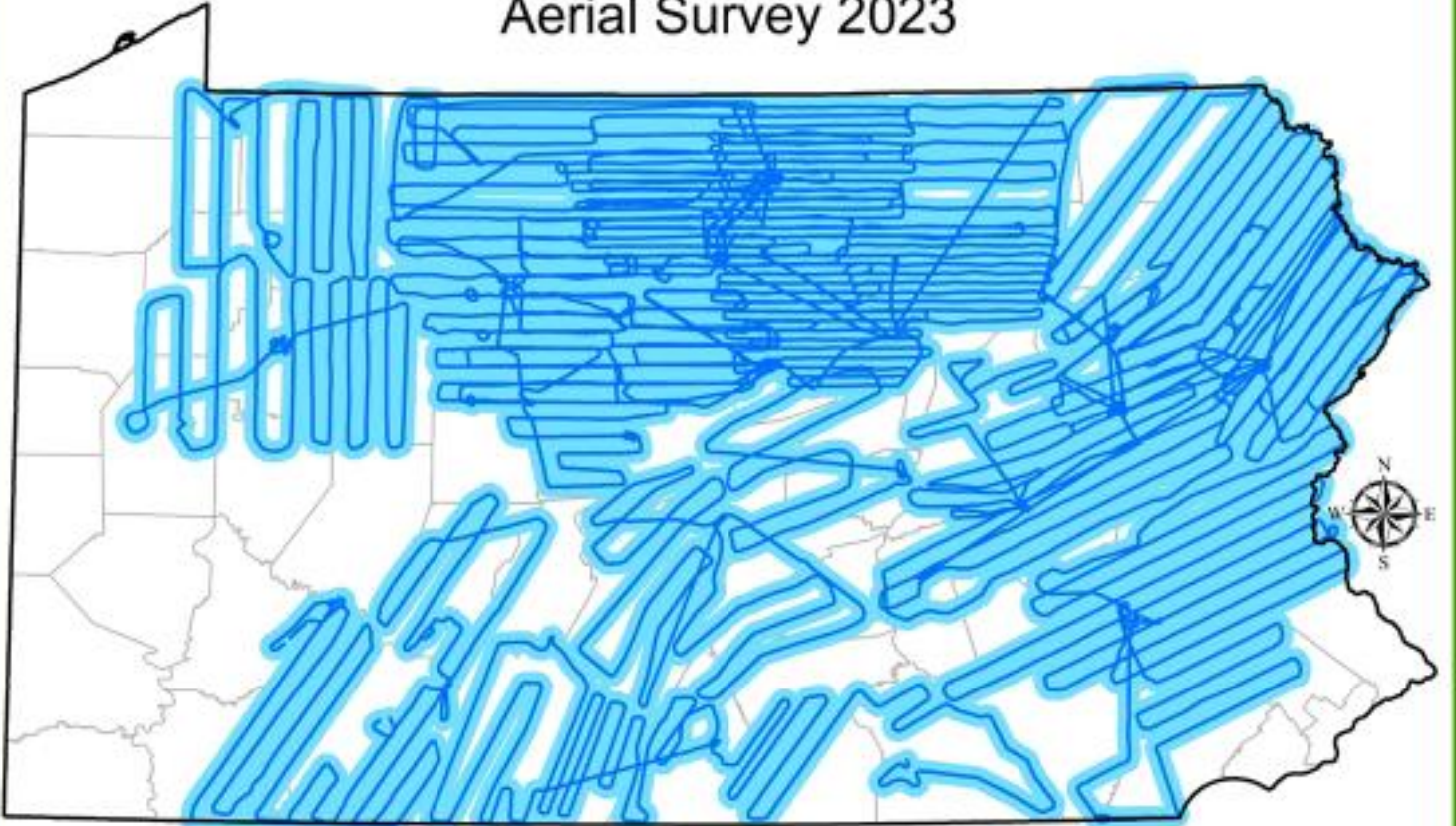


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Created by Aug. 17, 2023

Flight Lines and Coverage

Aerial Survey 2023

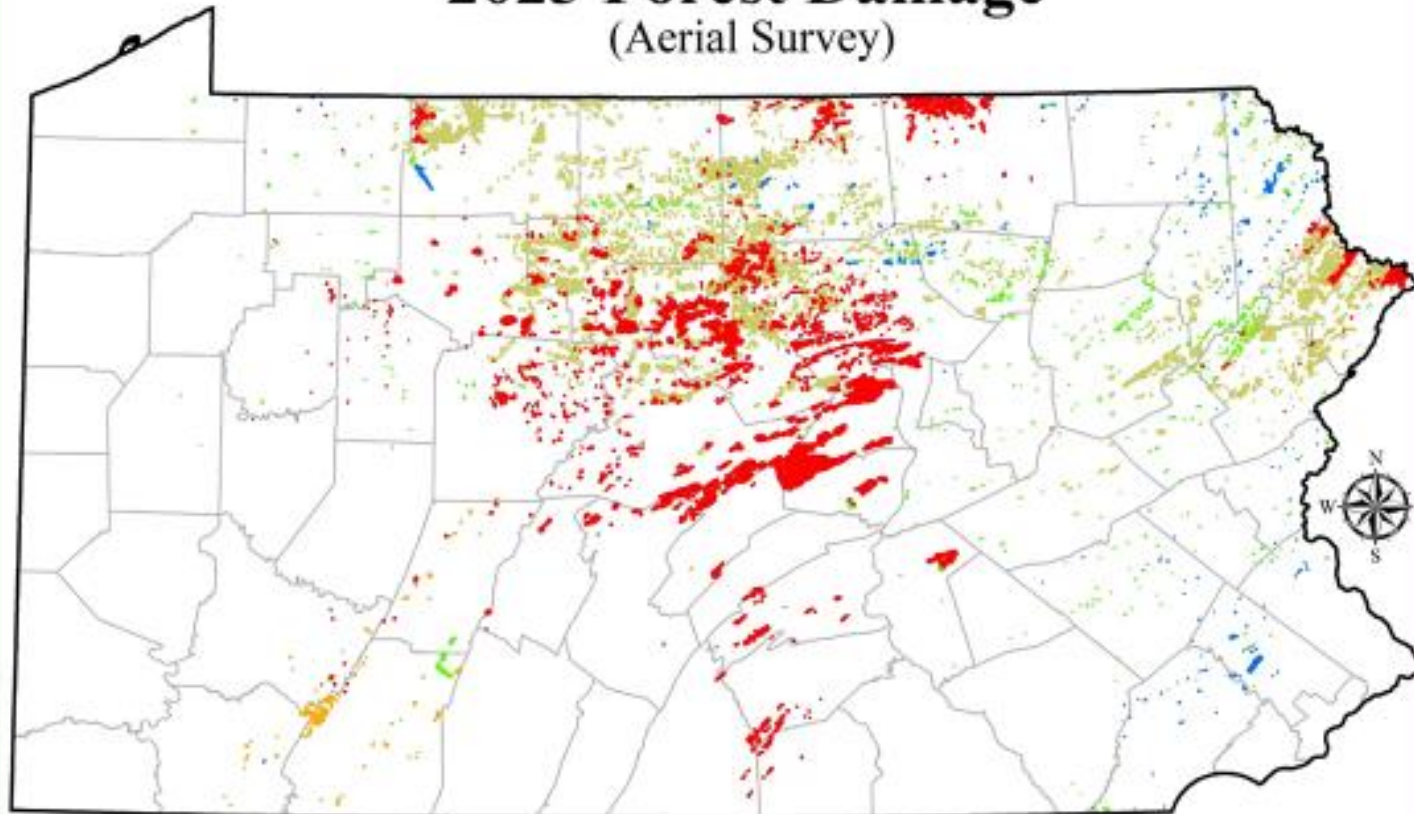


— Flight Line
■ 2-Mile Buffer

Time = 150.4 hours
Distance = 13,239 miles
Coverage = 18.8 million acres



Pennsylvania 2023 Forest Damage (Aerial Survey)

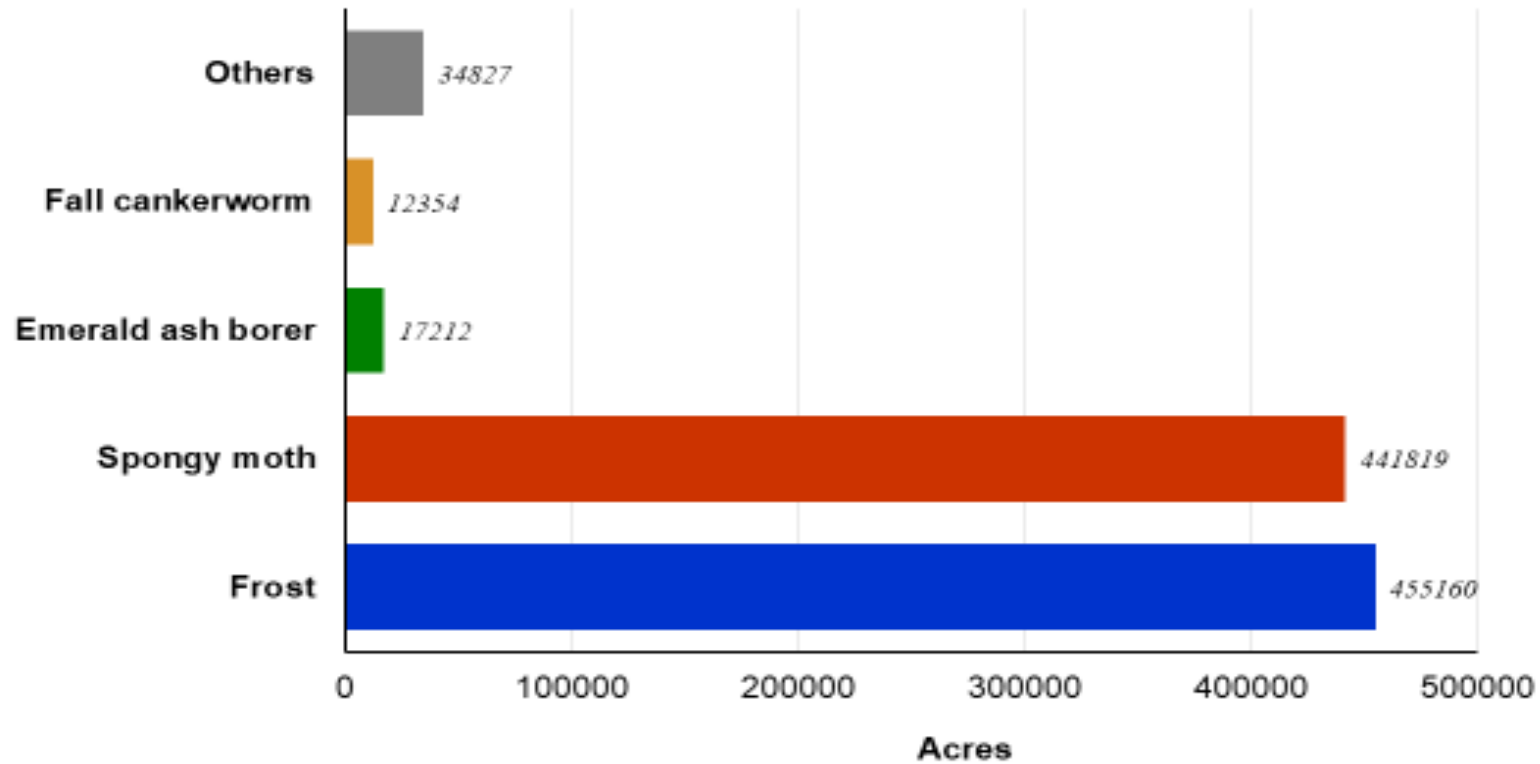


- Spongy Moth
- Frost
- Emerald Ash Borer
- Others
- Fall Cankerworm

Created by Sep. 21, 2023



Primary Causal Agents

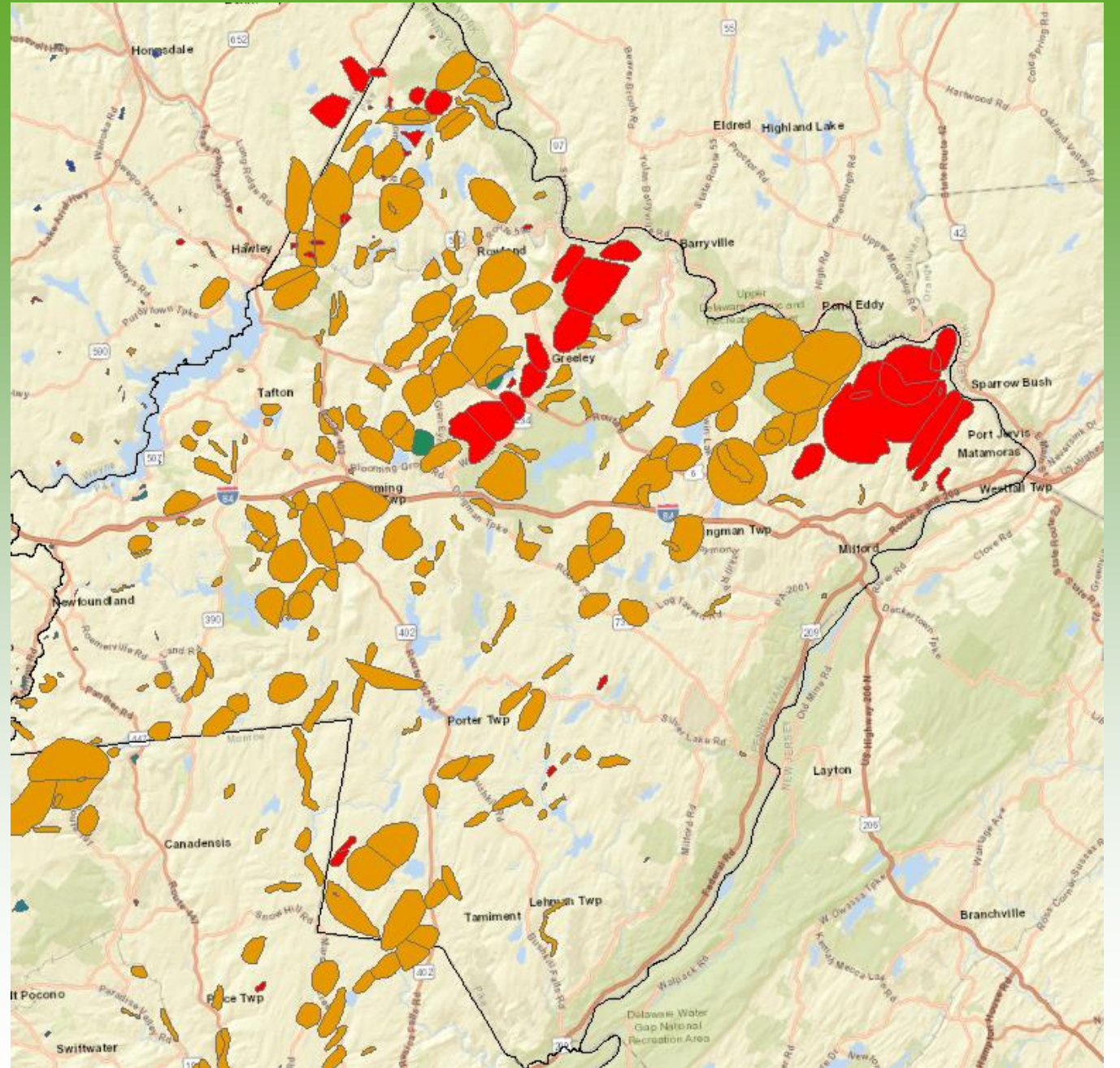


Acres by Causal Agents

Forest Pest	Damage Acre	%
Emerald Ash Borer - 15087	17,212	2
Fall Cankerworm - 12014	12,354	1
Frost - 50005	455,160	47
<i>Lymantria dispar dispar</i> - 12089	441,819	46
Others	34,827	4
Total	961,372	100

Other Pest	Damage Acre
Anthracnose - 25025	1,939
Beech Bark Disease Complex - 22042	806
Beech Leaf Disease - 25092	21,257
Drought - 50003	125
Fire - 30000	278
Hemlock Woolly Adelgid - 14004	1,163
Locust Leafminer - 12119	4,840
Needlecast - 25005	521
Oak Decline - 29004	16
Oak Shothole Leafminer - 12800	203
Rhizosphaera Needle Cast (spp. <i>Kalkhoffii</i>) - 25083	148
Southern Pine Beetle - 11003	540
Sycamore Anthracnose - 25010	562
Unknown - 90000	993
Unknown Defoliator - 12900	11
White Pine Needle Damage - 25084	504
Wind-Tornado/Hurricane - 50013	600
Yellow Poplar Weevil - 16038	321
Total	34,827

L. dispar Defoliation 2023



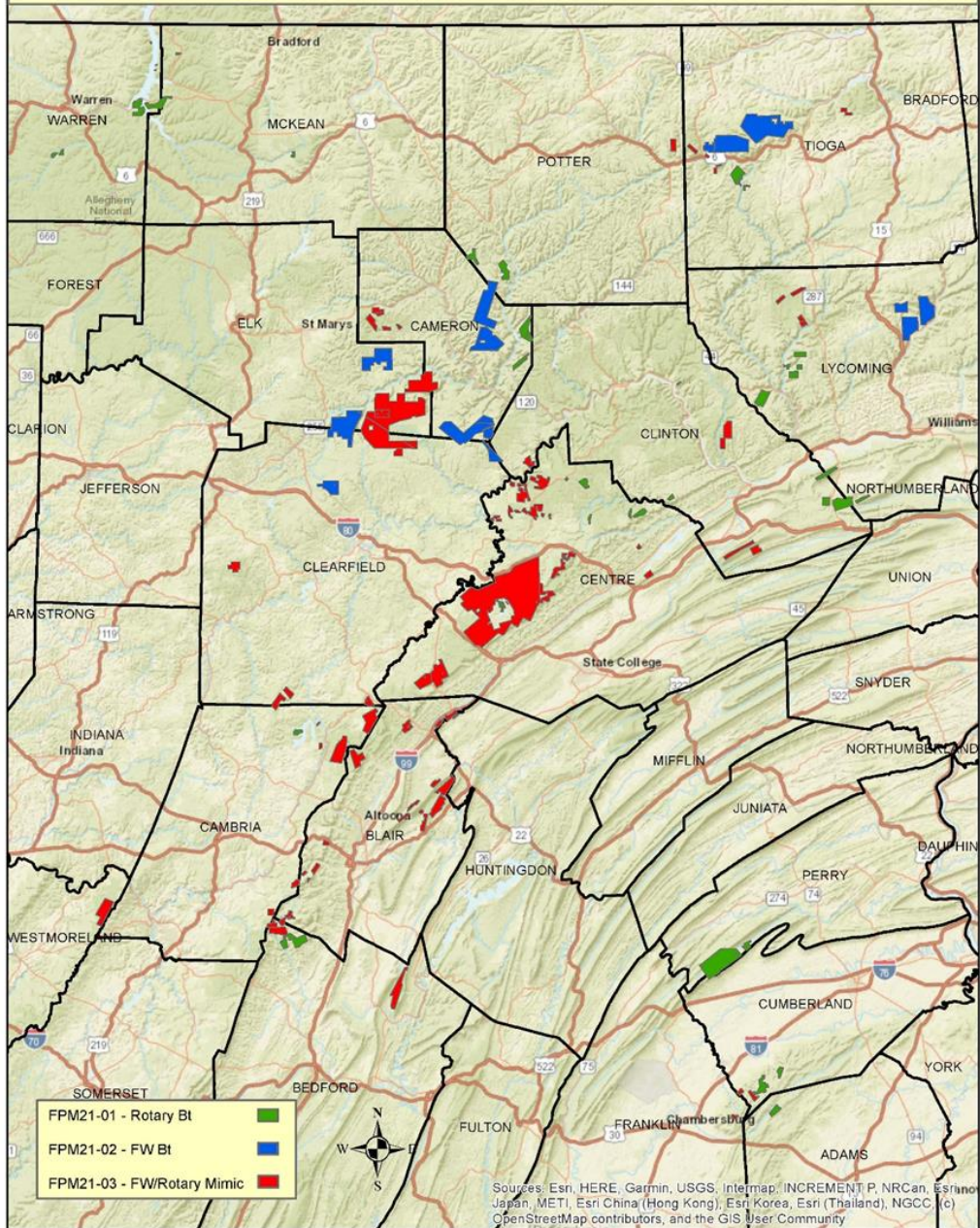
Spongy Moth Suppression Programs

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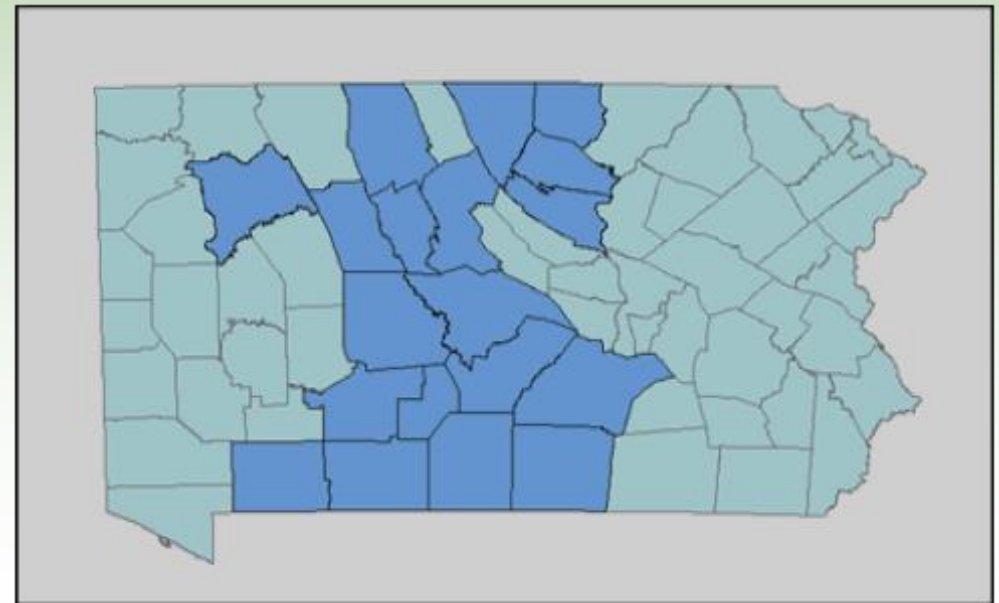


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PA Gypsy Moth Suppression Program 2021 by Contract



L. dispar dispar Suppression - 2021

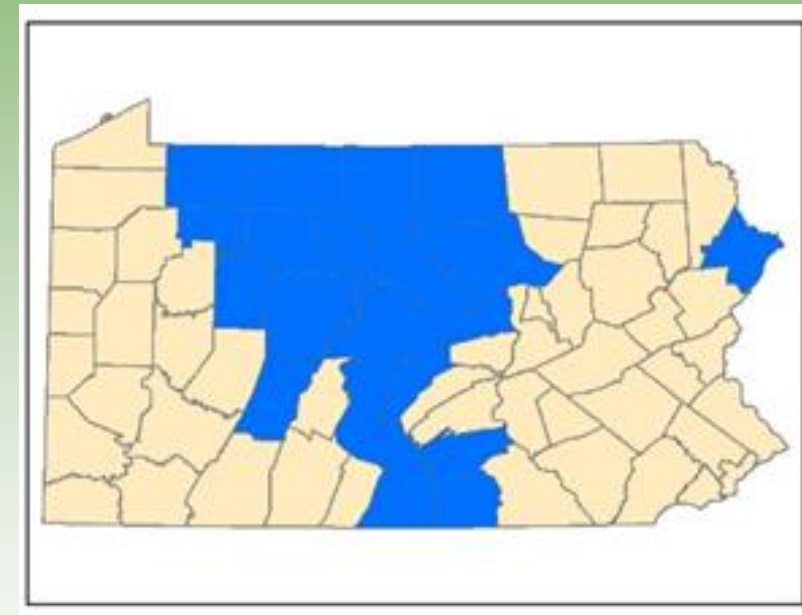
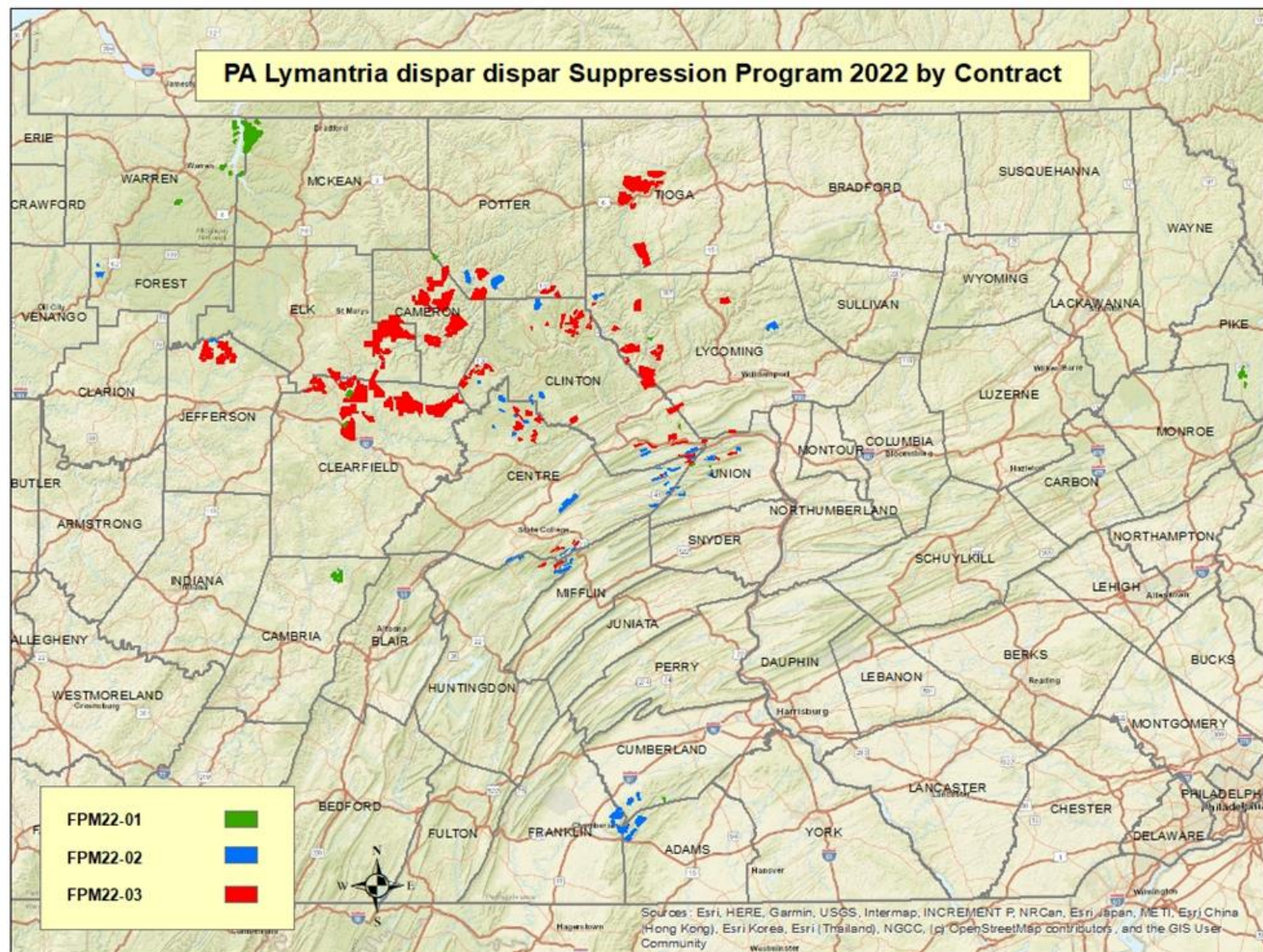


L. dispar dispar Suppression - 2021

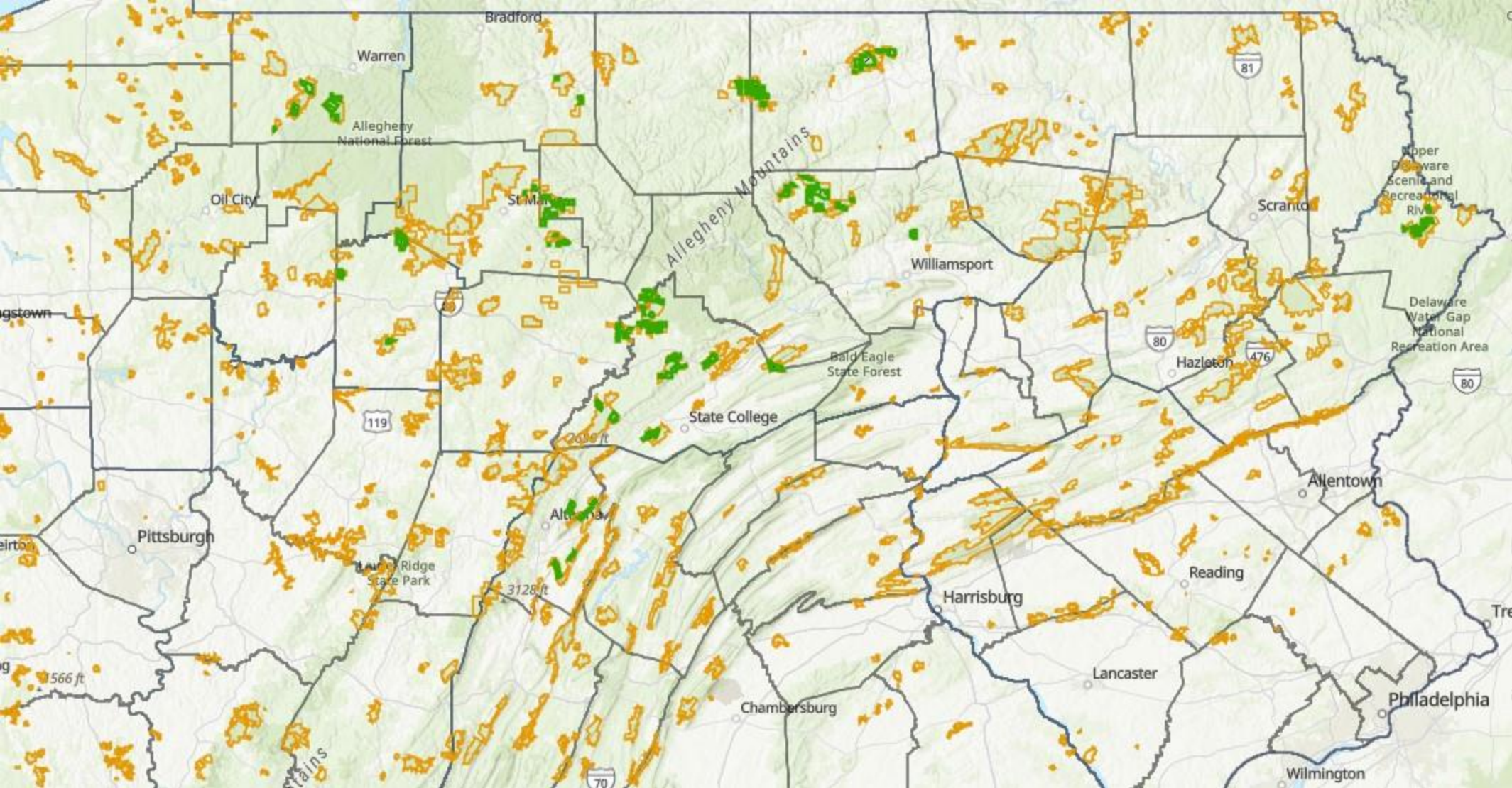
2021 Gypsy Moth Suppression by Acreage and Ownership								
Ownership	Rotary Bt		Fixed Wing Bt		Fixed Wing Mimic		Total	
	Blocks	Acres	Blocks	Acres	Blocks	Acres	Blocks	Acres
State Forest	25	23,917	18	58,366	9	64,995	52	147,278
State Parks	14	4,041					14	4,041
PGC					74	49,400	74	49,400
Fed	6	2,850					6	2,850
Totals	45	30,808	18	58,366	83	114,395	146	203,569

Contract	Product & Formulation	Cost /Acre	Total Cost
Bt Rotary	Foray 76B, 38 BCLU/acre; 0.5 gal/acre	\$56.14	\$1,729, 561
Bt Fixed Wing	Foray 76B, 38 BCLU/acre; 0.5 gallons/acre	\$35.45	\$2,069,075
Mimic Fixed Wing	Mimic 2LV, 6 fl. oz./acre; 0.75 gal/acre	\$16.61	\$1,900,101

DCNR *L. dispar dispar* Suppression 2022



PA Game Commission *L. dispar dispar* Suppression 2022



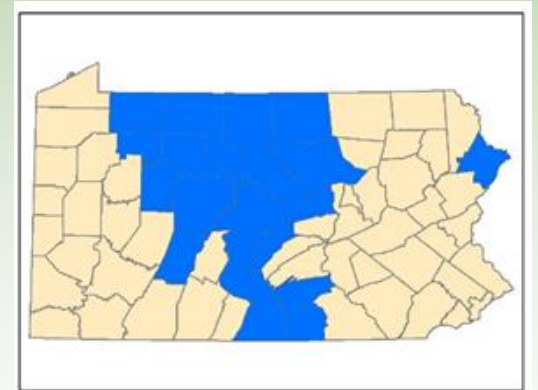
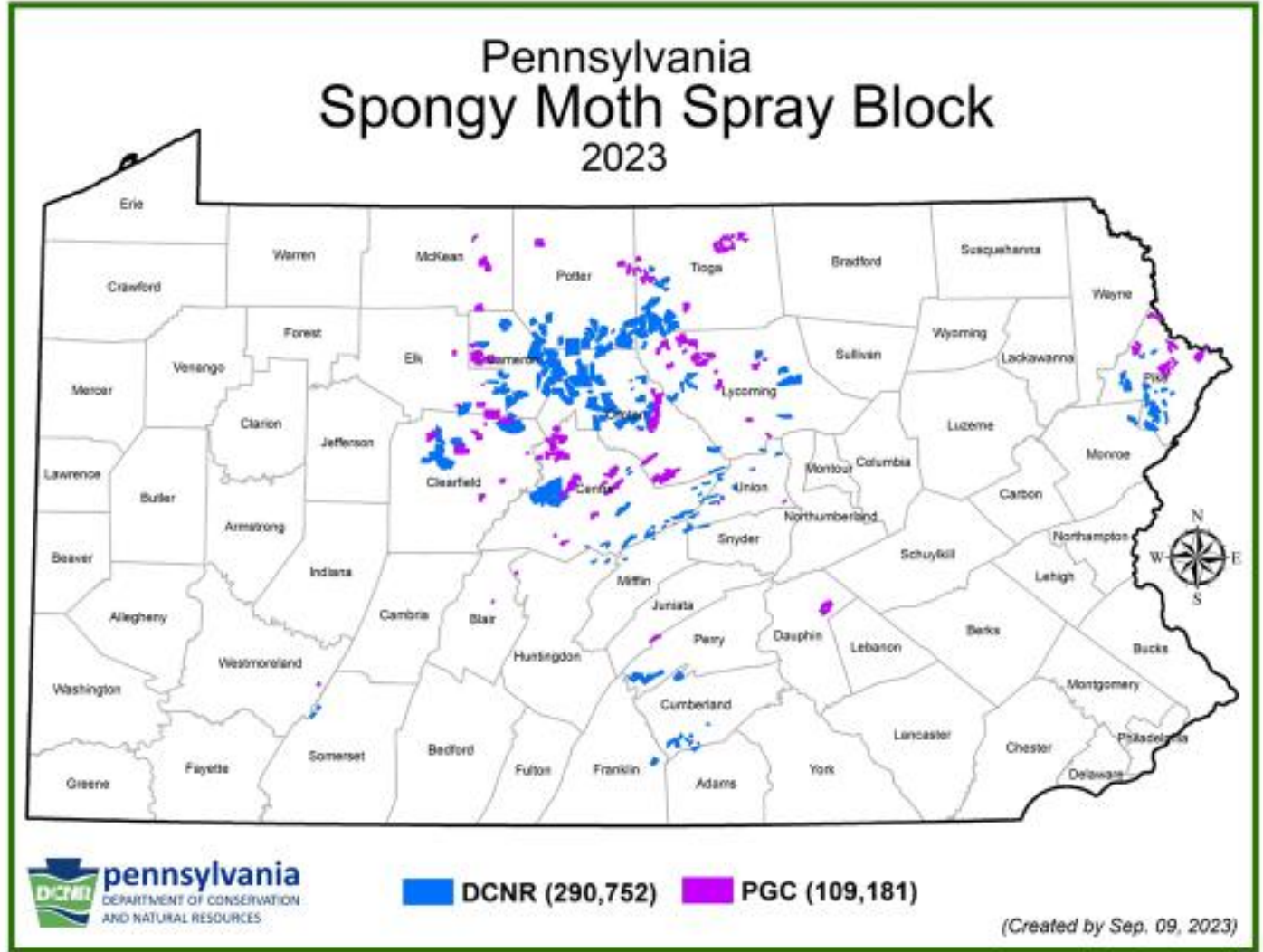
L. dispar dispar Suppression 2022

2022 L. DISPAR SUPPRESSION BY ACREAGE AND OWNERSHIP

Ownership	Rotary Btk		Fixed Wing Btk		Fixed Wing Mimic		Total	
	Blocks	Acres	Blocks	Acres	Blocks	Acres	Blocks	Acres
State Forest	5	1,247	71	26,128	113	165,981	189	193,356
State Parks	19	4,608					19	4608
Fed	12	11,874					12	11,874
Totals	36	17,729	71	26,128	113	165,981	220	209,838

Contract	Product & Formulation	Cost per Acre	Total Cost
Btk Rotary	Foray 76B, 38 BCLU/acre; 0.5 gal/acre	\$48.44	\$858,793
Btk Fixed Wing	Foray 76B, 38 BCLU/acre; 0.5 gallons/acre	\$38.85	\$1,015,073
Mimic Fixed Wing	Mimic 2LV, 6 fl. oz./acre; 0.75 gal/acre	\$18.28	\$3,035,120

DCNR and PGC *L. dispar dispar* Suppression 2023



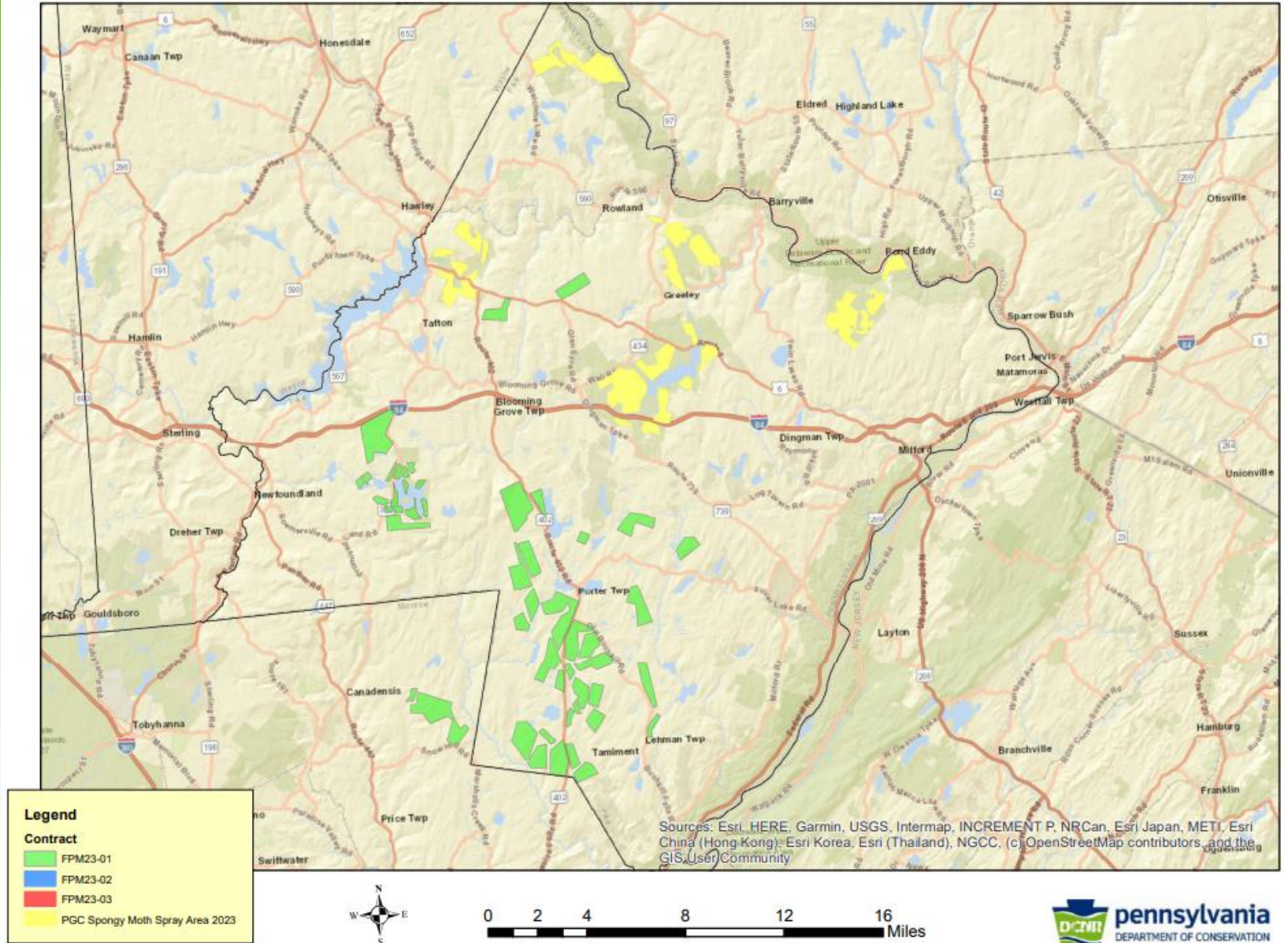
L. dispar dispar Suppression 2023

Ownership	Rotary Btk		Fixed Wing Btk		Fixed Wing Mimic		Total	
	Blocks	Acres	Blocks	Acres	Blocks	Acres	Blocks	Acres
State Forest	42	15,234	29	20,353	162	250,721	233	286,308
State Parks	41	4,444					41	4,444
Fed								
Totals	83	19,678	29	20,353	162	250,721	274	290,752

<i>Contract</i>	<i>Product and Formulation</i>	<i>Cost / Acre</i>	<i>Total Cost</i>
Btk Rotary	Foray 76B, 38 BCLU/acre; 0.5 gallons / acre	\$49.89	\$981,735.42
Btk Fixed Wing	Foray 76B, 38 BCLU/acre; 0.5 gallons / acre	\$40.02	\$814,527.06
Mimic Fixed Wing	Mimic 2LV, 6 fl oz / acre; 0.5 gallons / acre	\$18.83	\$4,721,076.43

Local Look

2023 Spongy Moth Suppression Program



Aerial Application – Late April/Early May



L. dispar Suppression



L. dispar dispar Suppression Biological Insecticides

- **Foray 76B** – *Bacillus thuringiensis* subsp. *kurstaki* strain ABTS-351
- **Foray 48B** – Organically Certified
- **Mimic 2LV** – Tebufenozide



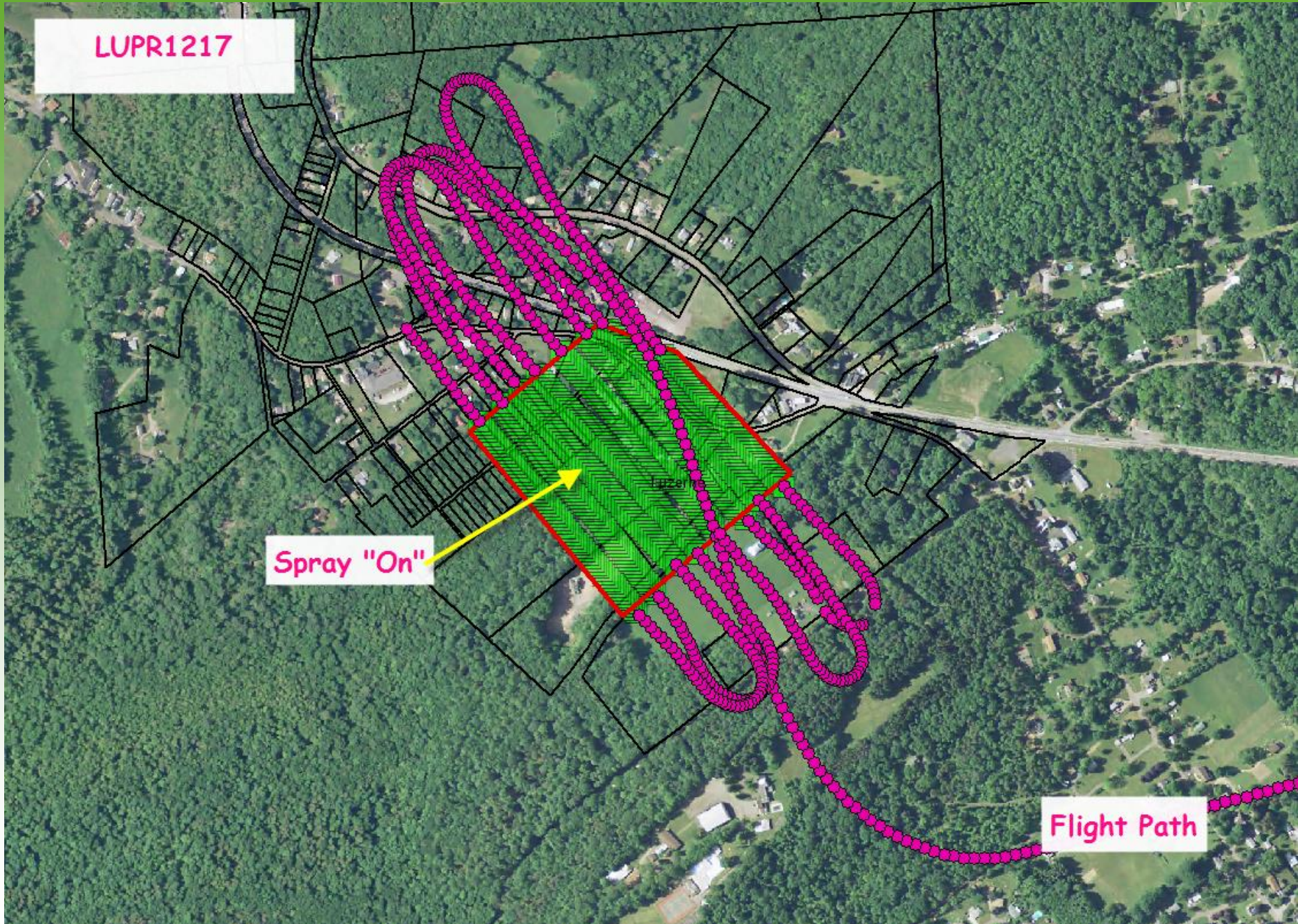
Spray Application



LUPR1217

Spray "On"

Flight Path



http://track.verifygps.com/?_=map VeriFly - Track

File Edit View Favorites Tools Help

VeriFly - Login AFF Log In

VeriFly

Aircraft

Online	N802KD	Greg/Garret
Spray	Working: 340839 - 900782 - JUSF 10	14 minutes ago
Online	N4944R	Justin
Spray		12 hours ago
Online	N602GE	Garrett
Spray		one day ago
Online	N502DE	Mike/Greg/C
Spray		5 days ago
Online	N602RE	Greg/Mike
Spray		10 months ago
Online	N802CL	Mike

Map Satellite

Map data ©2017 Google

https://www.aff.gov/maps/2d.aspx Automated Flight Following

File Edit View Favorites Tools Help

VeriFly - Login AFF Log In Check Point Mobile - Sign...

Set Home Terrain Street Satellite GPS Wx CLD TFR ALF Find Aircraft

08:52:53

Ramp List

Call sign: T-487
 Status: In flight
 Lat: 40°34' 34.32"
 Long: -76°11' 9.48"
 Heading: 270° true
 Altitude: 1,220 msl
 Speed: 134 knots
 Time: 05/09/2017 08:51:08 GMT-0400

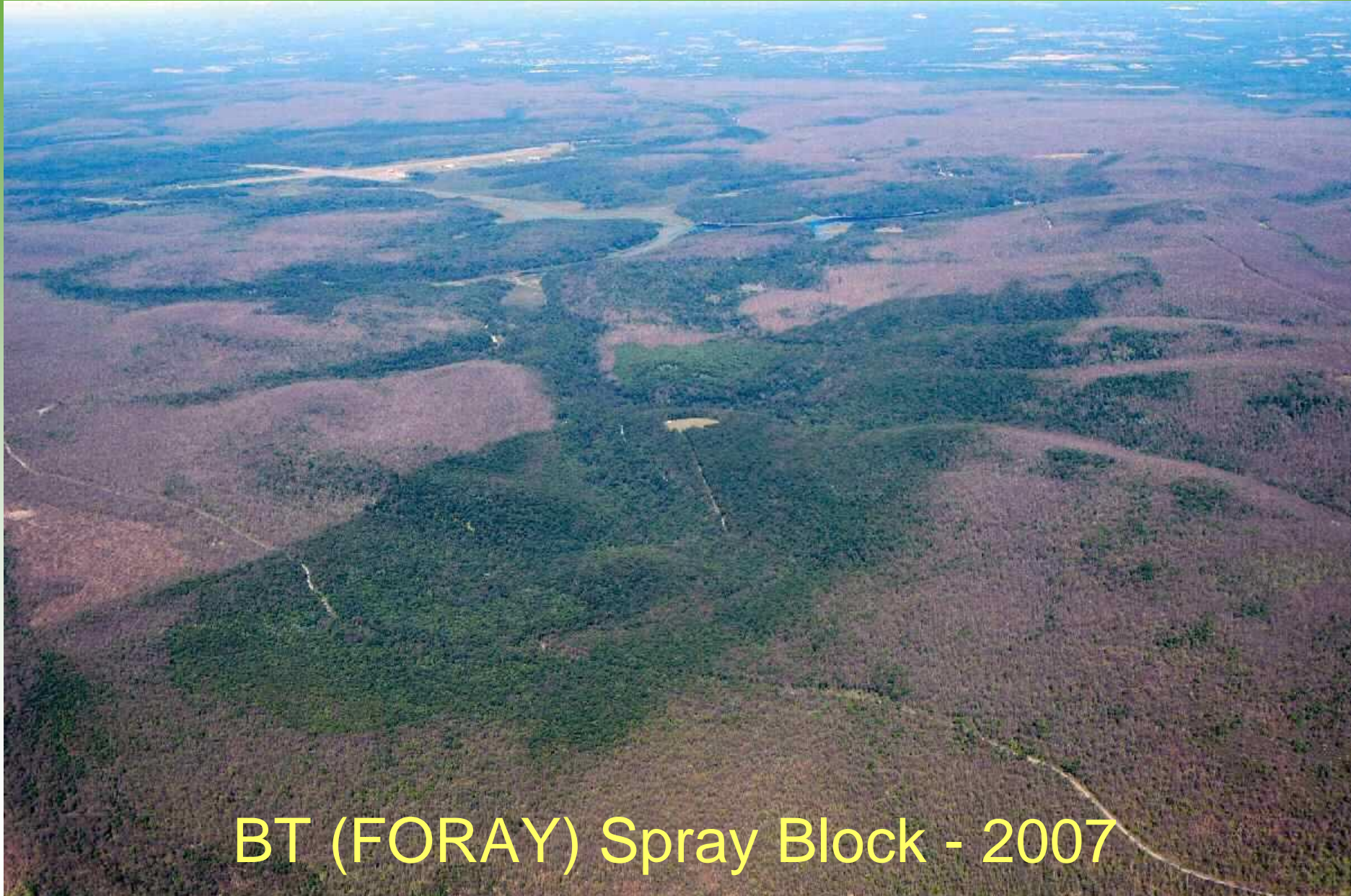
Search Results

40°38' 1.66" -76°53' 46.35"

Map data ©2017 Google


8:52 AM 5/9/2017

Is Btk effective??




BT (FORAY) Spray Block - 2007

Foray Biological Insecticide Valent BioScience Forest Health



Foray[®] 48B
BIOLOGICAL INSECTICIDE
FLOWABLE CONCENTRATE

For Commercial Forestry and Wide-Area
Pest Treatment—Aerial Application Only

 FOR ORGANIC PRODUCTION



Foray[®] 76B
BIOLOGICAL INSECTICIDE
FLOWABLE CONCENTRATE

Foray Biological Insecticide

Valent BioScience Forest Health



Foray 76B is a biological insecticide for the control of lepidopterous larvae. It contains the spores and endotoxin crystals of *Bacillus thuringiensis kurstaki*. Foray 76B must be ingested by the larvae to be effective. For consistent control, apply at first sign of newly hatched larvae (1st and 2nd instar larvae). Susceptible larvae that ingest Foray 76B cease feeding within a few hours and die within 2-5 days.

Recommended application time: At least 50% second instars and foliage at 20%

Foray® 76B – Valent BioSciences – Forest

<https://www.valentbiosciences.com/foresthealth/products/foray/76b/>

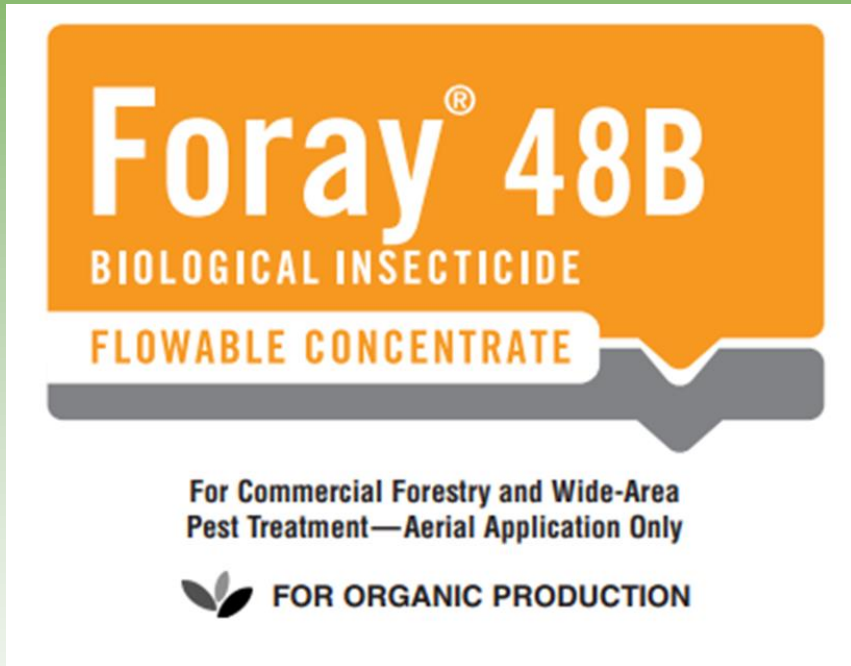
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Foray Biological Insecticide

Valent BioScience Forest Health



- Foray 48B is OMRI certified for Organic Production.
- Btk is highly selective in its activity.
- It has minimal environmental impacts, and it will not harm other types of insect, fish, birds, or mammals.

Foray® 48B – Valent BioSciences – Forest

<https://www.valentbiosciences.com/foresthealth/products/foray/48b/>

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PA DCNR's Website for Spongy Moth

- <https://www.dcnr.pa.gov/Conservation/ForestsAndTrees/InsectsAndDiseases/SpongyMoth/Pages/default.aspx>

PA An Official Pennsylvania Government Website Translate

Pennsylvania Department of Conservation & Natural Resources Recreation **Conservation** Communities Business Education Q

DCNR > [Conservation](#) > [Forests and Trees](#) > [Insects and Diseases](#) > Lymantria dispar dispar (Spongy Moth)

Lymantria dispar dispar (Spongy Moth)

Spongy moth (*Lymantria dispar dispar*) -- formerly known as gypsy moth -- is a serious forest pest and is responsible for killing millions of oak and other species of trees across the state.

Although oak species are preferred, spongy moth caterpillars feed on hundreds of other tree and shrub species, including:

Additional Information

- [2023 Spongy Moth Spraying Program Documents](#)
- [2023 Spongy Moth Spraying Program Overview \(PDF\)](#)
- [2023 Spongy Moth Spraying... \(PDF\)](#)

State Parks Reservations State Forests Find a Trail Grants Geology Find Local Park Events

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Guide to Conducting a Spray Program

Purpose/Objective:

- The spongy moth has been a destructive forest and tree pest in Pennsylvania since 1932. Infestations are cyclic and regional, so different portions of the state may be affected during each cycle. Counties, municipalities and landowner/homeowner associations have the option of organizing suppression programs aimed at protecting their trees and minimizing nuisance.

Guide to Conducting a Spray Program

- The following guidelines are intended to provide a framework for conducting efficient and effective aerial spray programs, while also minimizing misuse of insecticides.
- To help facilitate a program, a project coordinator should first be designated. The coordinator assists in assessing the need for treatment, implements an application and collection of funds process, and acts as a liaison between property owners and the spray contractor.

Assessing the Need For Treatment

Does the property contain species favored by spongy moth? The following is a listing of common tree species arranged by spongy moth feeding preference:

Favored / High: Fed upon by all size larvae – alder, apple, aspen, basswood, beech, birches (gray, white, and river), boxelder, hawthorn, larch, oaks (all species), willows, and witch-hazel.

Favored / Moderate: Fed upon by only large larvae – chestnut, eastern hemlock, and all species of pine and spruce.

Favored / Low: Only fed upon by large larvae when preferred foliage is not available – birches (black and yellow), butternut, cherry, cottonwood, elms, black gum, hackberry, hickories, hornbeam, maples, pear, sassafras, sweetgum, and walnut.

Unfavored: Rarely fed upon – ashes (all species), catalpa, dogwood, American holly, honey locust, horsechestnut, juniper, locust, striped maple, mulberry, persimmon, eastern red cedar, sycamore, and tulip poplar.

Assessing the Need For Treatment

Do egg mass levels warrant a treatment program?

It is very important that the estimate of egg mass densities be based upon new, current-year egg masses only.

Experience has shown that 250 healthy spongy moth egg masses per acre is the threshold at which noticeable defoliation begins to appear.

Consideration should be given that larvae blow-in may occur in surrounding areas downwind of heavily infested areas.

Hiring a Licensed Aerial Applicator

An aerial applicator can help you to determine what is best for each situation by: assessing the need for treatment, selecting the right insecticide, timing and project planning, and determining the area to be treated.

Important considerations before hiring a contractor include:

- Their proximity to the area(s) considered for treatment (this can impact cost).
- Availability.
- Insecticide options: *Bacillus thuringiensis* subspecies *kurstaki* (Foray 48B or Foray 76B); and tebufenozide (Mimic 2LV) are most commonly used.
- Cost comparisons.

A list of Aerial Applicators licensed to work in Pennsylvania is provided on the DCNR website.

Make arrangements with an aerial applicator in the early fall – by September 30.

Timeline – Things to Do

- Appoint a Project Coordinator for your Community
- Determine area and number of acres to be treated – make a map
- Conduct an egg mass survey August to September
- Inform community of survey results and potential need for spraying – determine if you have any objectors
- Contact multiple aerial applicators to get quotes – fixed-wing aircraft (\$) or helicopter (\$\$); Mimic 2LV (\$), Foray 48B (\$\$), or Foray 76B (\$\$\$)
- Have aerial applicator selected by October 1
- Keep community informed of approaching spraying
- Provide aerial applicator times for school buses
- Spraying is done in May – mid-to-late May for Pike County – when caterpillars are at least 50% second instars and white oak foliage is at least 25% of full size



Questions



Contact Information

DCNR website [Lymantria dispar dispar \(Spongy Moth\)](http://www.dcnr.pa.gov/Conservation/ForestAndTrees/InsectsAndDisease/SpongyMoth/Pages/default.aspx) :

<http://www.dcnr.pa.gov/Conservation/ForestAndTrees/InsectsAndDisease/SpongyMoth/Pages/default.aspx>

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