



Pennsylvania

**Department of Conservation
and Natural Resources**

Native Forest Pests: Endemic Or Epidemic Forest Health Impacts and How to Tell The Difference

Forest Health, Insect, and Disease Briefing

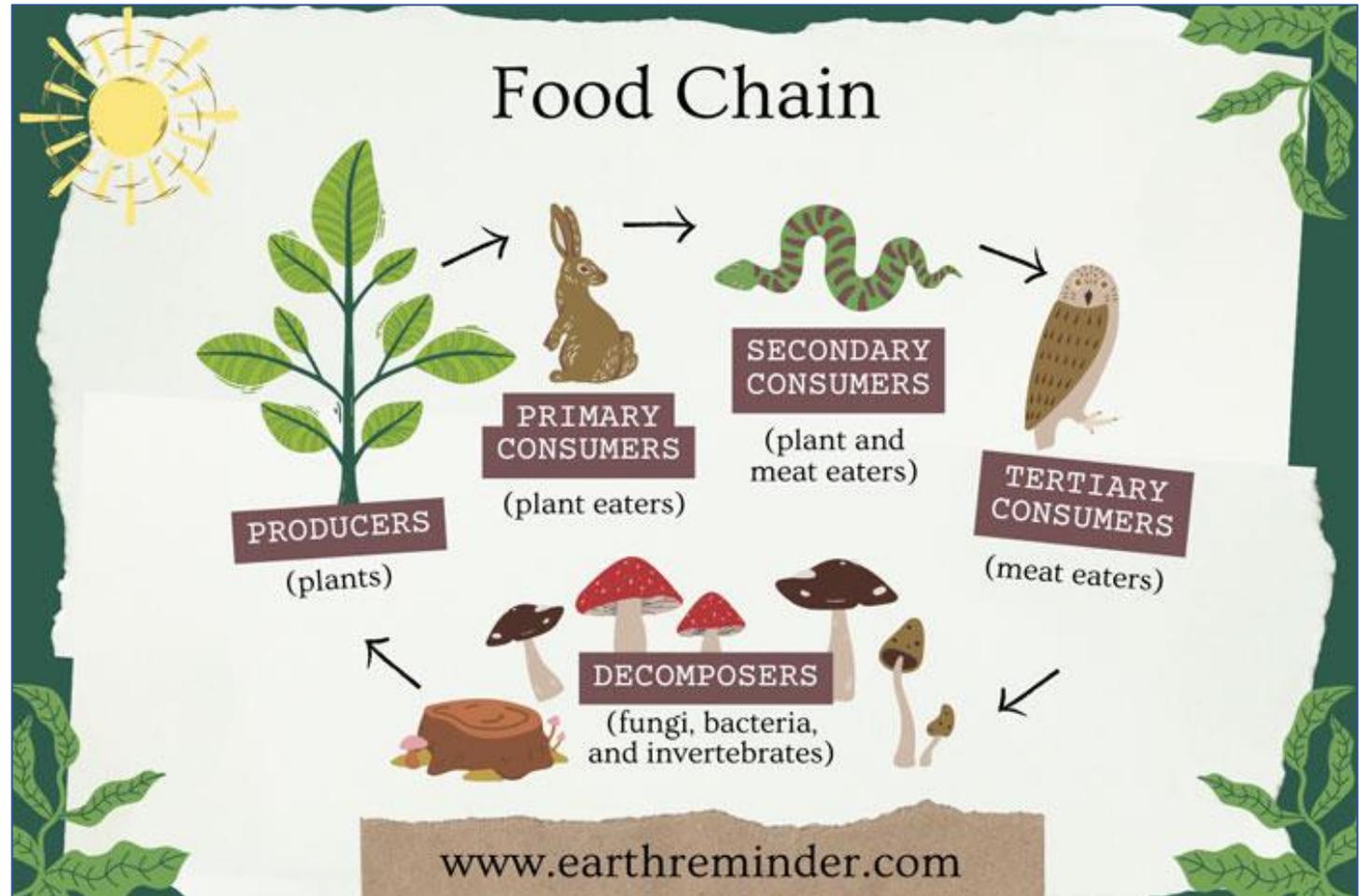
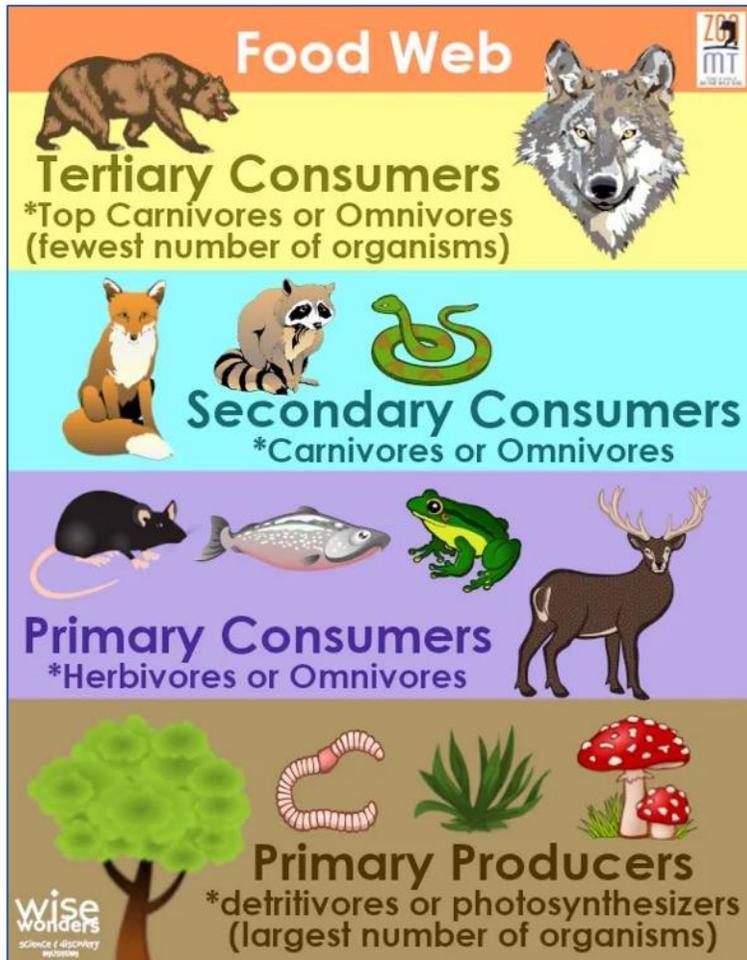
March 6, 2025

The Penn Stater Hotel and Conference Center, State College, PA

Rosa Yoo, Forest Health Manager

PA DCNR, Bureau of Forestry, Division of Forest Health

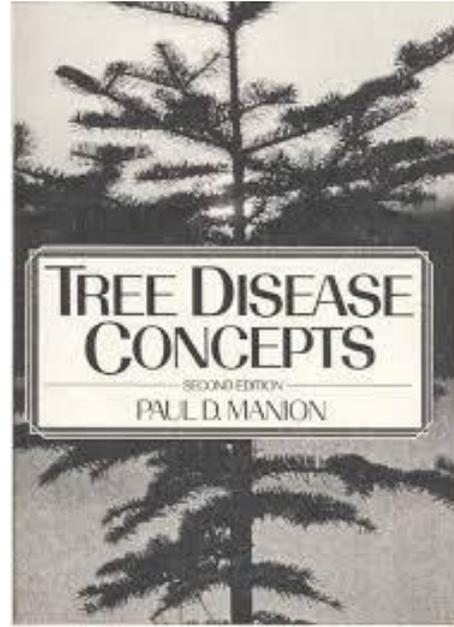
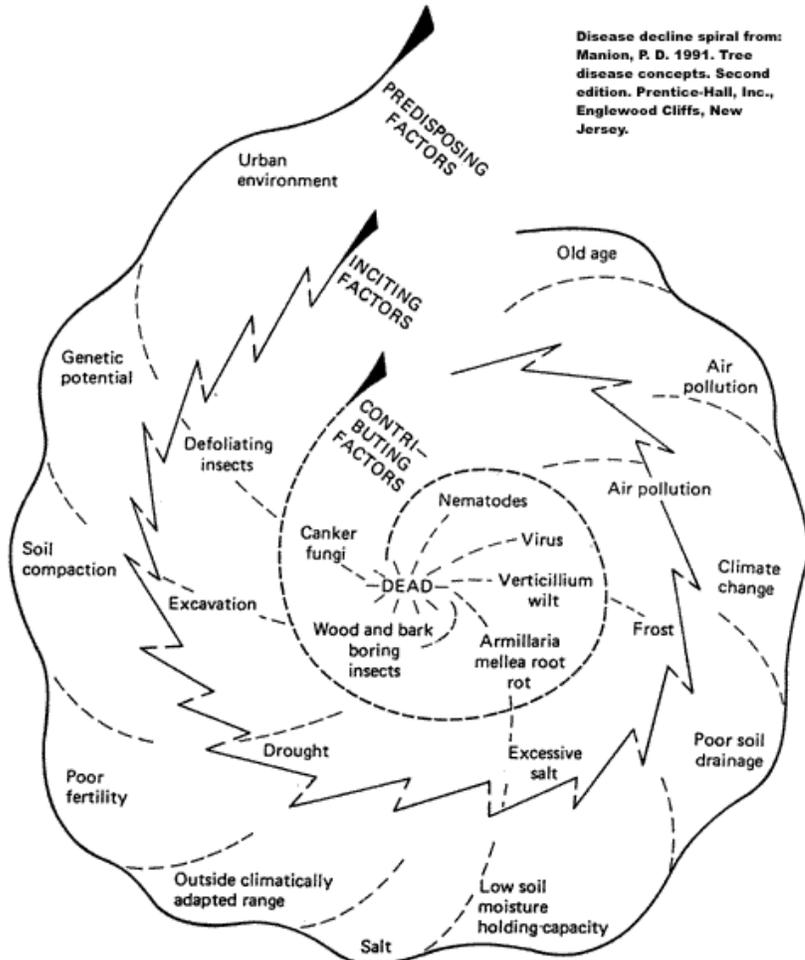
Death is Part of Life



Decline Spiral



Disease decline spiral from:
Manion, P. D. 1991. *Tree disease concepts*. Second edition. Prentice-Hall, Inc., Englewood Cliffs, New Jersey.



Forest Health is impacted by multiple factors

1 in 5 must die for a tree to grow 1" in diameter

Native systems have built in defenses for native pests

Non-native pests usually have a more direct impact

Native Forest Pests



SPRING CANEY WORM
TWO-LINED CHESTNUT BORER
SADDLED PROMINENT
FALL STICK CANEY WORM
WALKING
COTTONY MAPLE SCALE
HEMLOCK LOOPER
OAK LEAFY SPANWORM
EASTERN TENT CATERPILLAR
IMPOXYON CANKER
ANTHRACNOSE
BACTERIAL LEAF SCORCH
RSH YELLOWS
BROWN SPOT
VARIABLE OAK LEAF CATERPILLAR
LOCUST BORER
ORANGE OAK WORM
CHERRY SCALLOP SHELL MOTH
DIPLODIA TIP BLIGHT
STRIPED OAK WORM
CHERRY SCALLOP SHELL MOTH
SOUTHERN PINE BEETLE
ELM YELLOWS
BRUCE
MAPLE SPANWORM
TRUMPET SKELETONIZER
WHITE PINE DECLINE
YELLOW POPLAR WEEVIL
RED HEADED ASH BORER
SCARLET OAK SAWFLY
CEDAR APPLE RUST
WHITE OAK DECLINE
FALL WEBWORM



Native Forest Pests

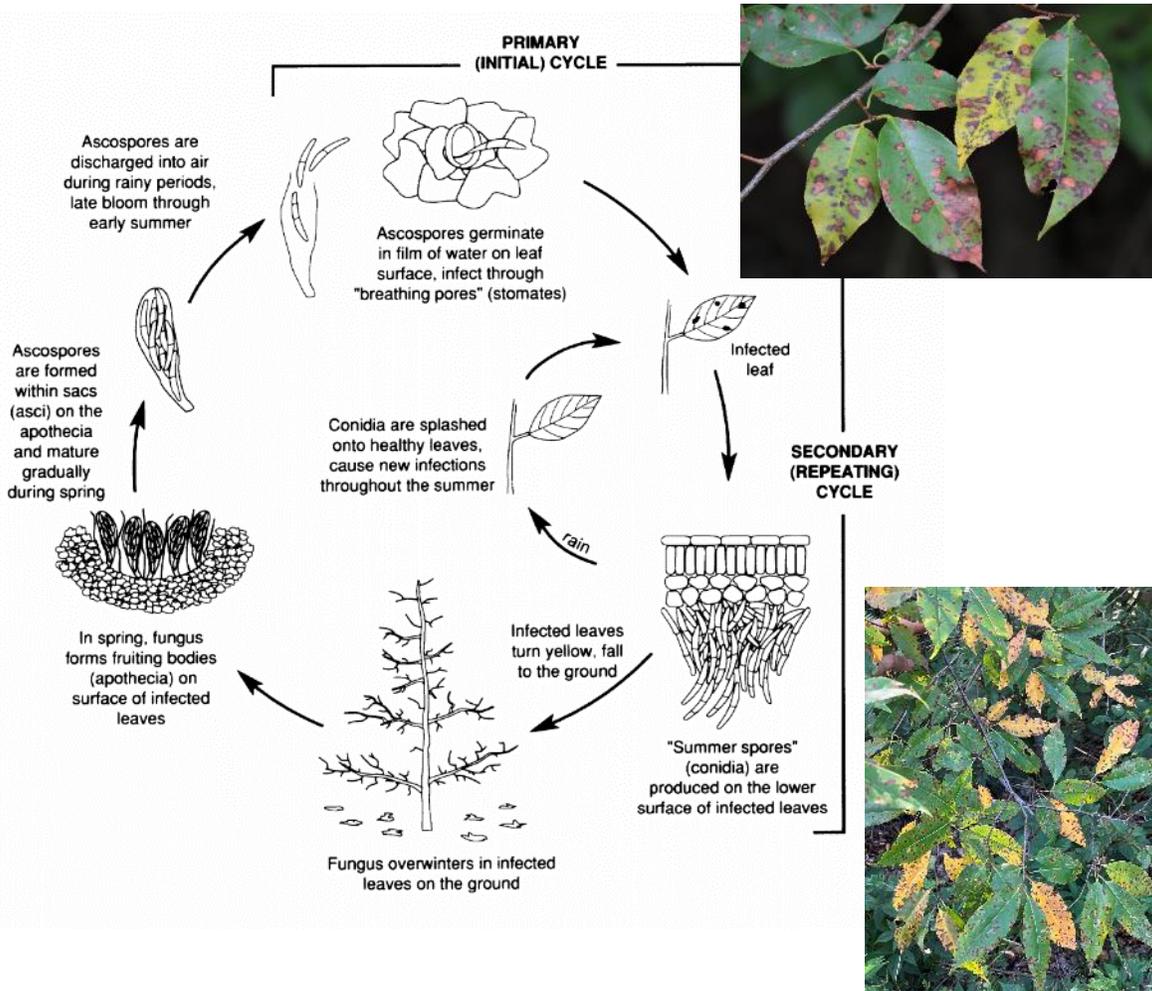


SOUTHERN
PINE BEETLE
CHERRY
FALL LEAF SPOT
CANKERWORM
WALKING
STICK



Cherry Leaf Spot (CLS)

Blumeriella jaapii



Cherry Leaf Spot (CLS) is a fungus that causes purple spots on leaves

Overwinters in buds and infected leaves on the forest floor

Infects new leaves in spring/summer. CLS spores from infected overstory leaves "rain" down on regeneration

Most CLS research and information is for cherry orchards

Cherry Leaf Spot (CLS)

Blumeriella jaapii



In 2015 started to notice CLS impacts

Nearly 100% black cherry regeneration mortality

Silvicultural practices that once successfully regenerated cherry are no longer effective

Nitrogen and sulfates deposited in the soil from industrial processes benefited black cherry

High density cherry stands are most susceptible

Weather also seem to play a role in CLS infection levels

Cherry Leaf Spot (CLS)

Blumeriella jaapii



Research



Fungicide treatments



Silvicultural Practices



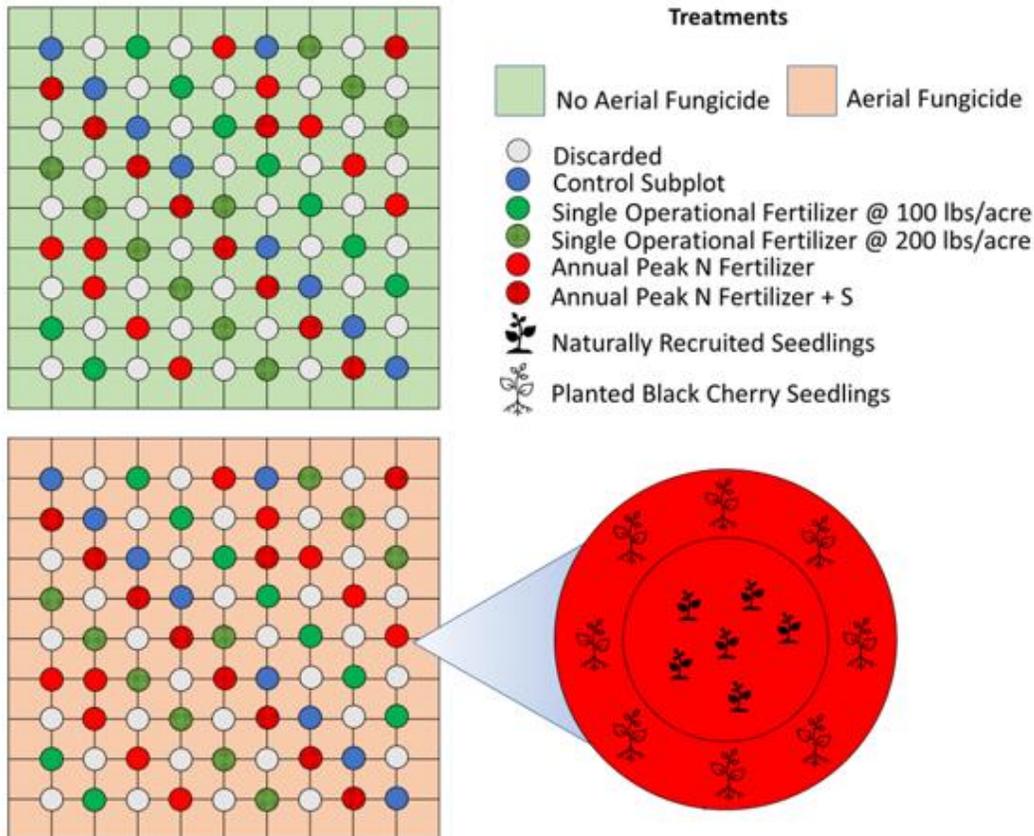
Soil Testing

Cherry Leaf Spot (CLS)

Blumeriella jaapii



Figure 3. Schematic of one site of the experimental design. Sites are split into ~ 10-acre halves with aerial fungicide treatments randomly applied to a half. Within each half, are 50, 10' radius subplots within which we will randomly apply our fertilization treatments.



Research Project

- Collaboration with PGC, USDA FS, University of Kentucky
- Pre-treatment data 2024/2025
- Treatments 2026 and 2027

FUNGICIDE	CONTROL
FUNGICIDE/ FERTILIZER	FERTILIZER

Fall Cankerworm (FCW)

Alsophila pometaria



Fall Cankerworm Biology and Life Cycle



FCW is an “inchworm”

Prefer maples but will feed on oaks, ash, basswood, beech, and black cherry, among many other hardwoods

Larvae hatch from late April to early May and feed in the spring

Adults are active in the fall, which is how this species gets its name

Female “crawlers” are flightless

When populations become high they usually collapse within 2 years due to natural controls (entomopathogens, parasitoids, and insect predators)

Fall Cankerworm (FCW)

Alsophila pometaria



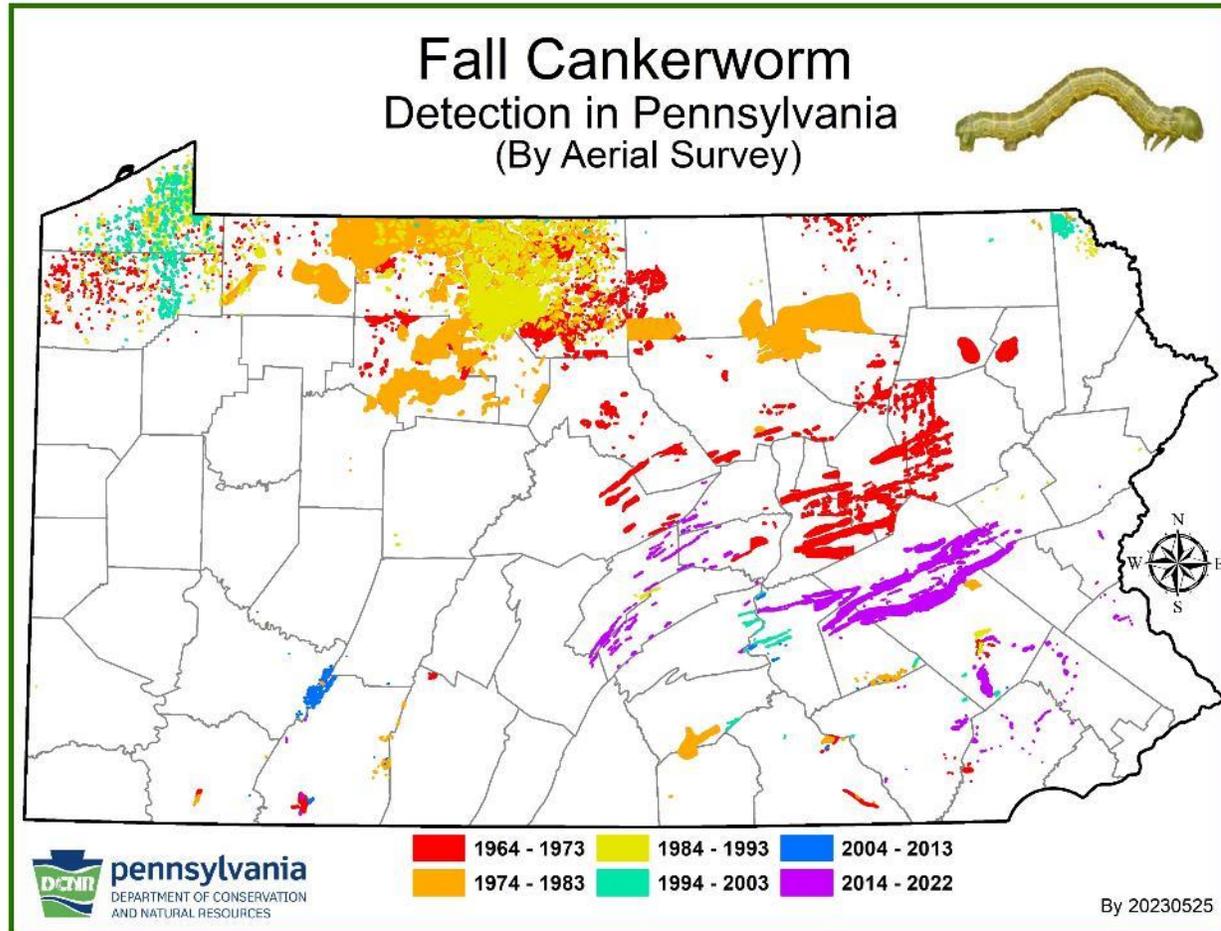
Defoliation in maple

- Native throughout PA
- Localized outbreaks is a normal occurrence
- An increased number of dark fall cankerworm larvae can be a sign of a heavier infestation

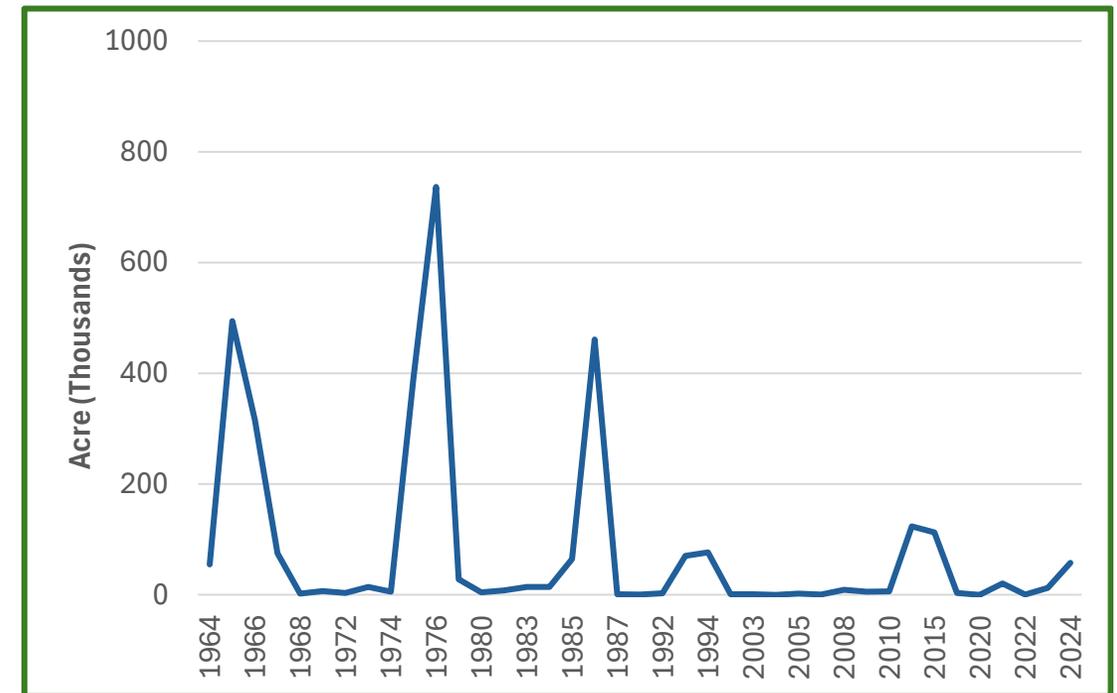


Fall Cankerworm (FCW)

Alsophila pometaria



Graph: Forest Defoliation by FCW 1964 - 2024



Fall Cankerworm (FCW)

Alsophila pometaria



Pennsylvania Aerial Detection
Forest Damages by Fall Cankerworm
 (1964 - 2024)

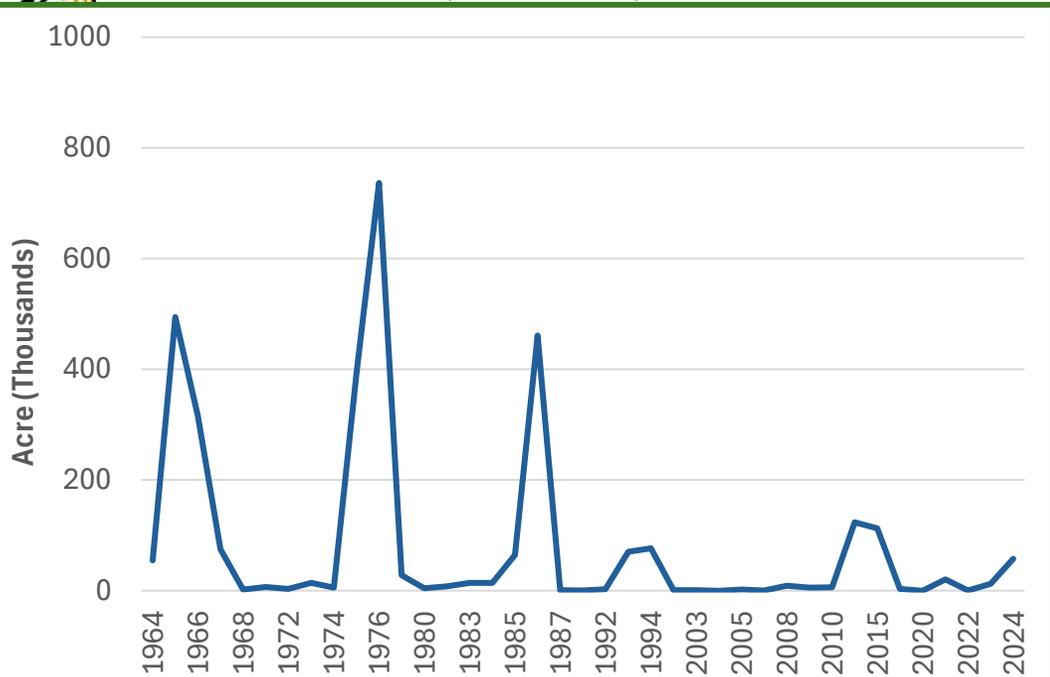


Table: Forest Mortality by FCW (1964 – 2024)

County	1968	1969	1986	2010	Total
Cambria				10	10
Carbon			141		141
Crawford	636	524			1,160
Erie	732				732
Fayette				17	17
Warren	2,419	182			2,601
Total	3,787	705	141	27	4,661

Notes:

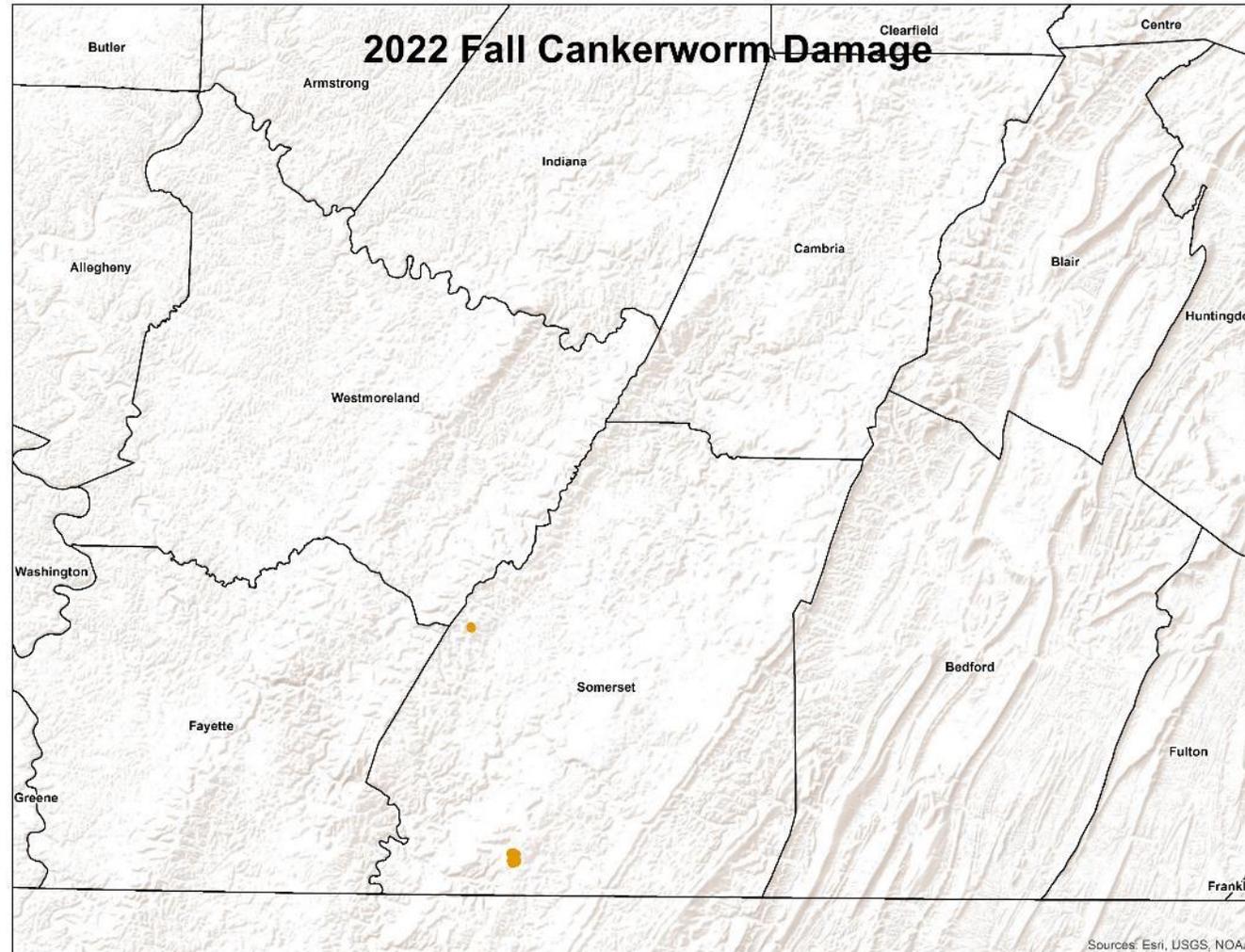
Tree mortality due to Fall Cankerworm was mapped primarily in the northwestern Pennsylvania (see map). The table above shows the mortality acreage by Fall Cankerworm by year and county.

Fall Cankerworm (FCW)

Alsophila pometaria



200 acres defoliated

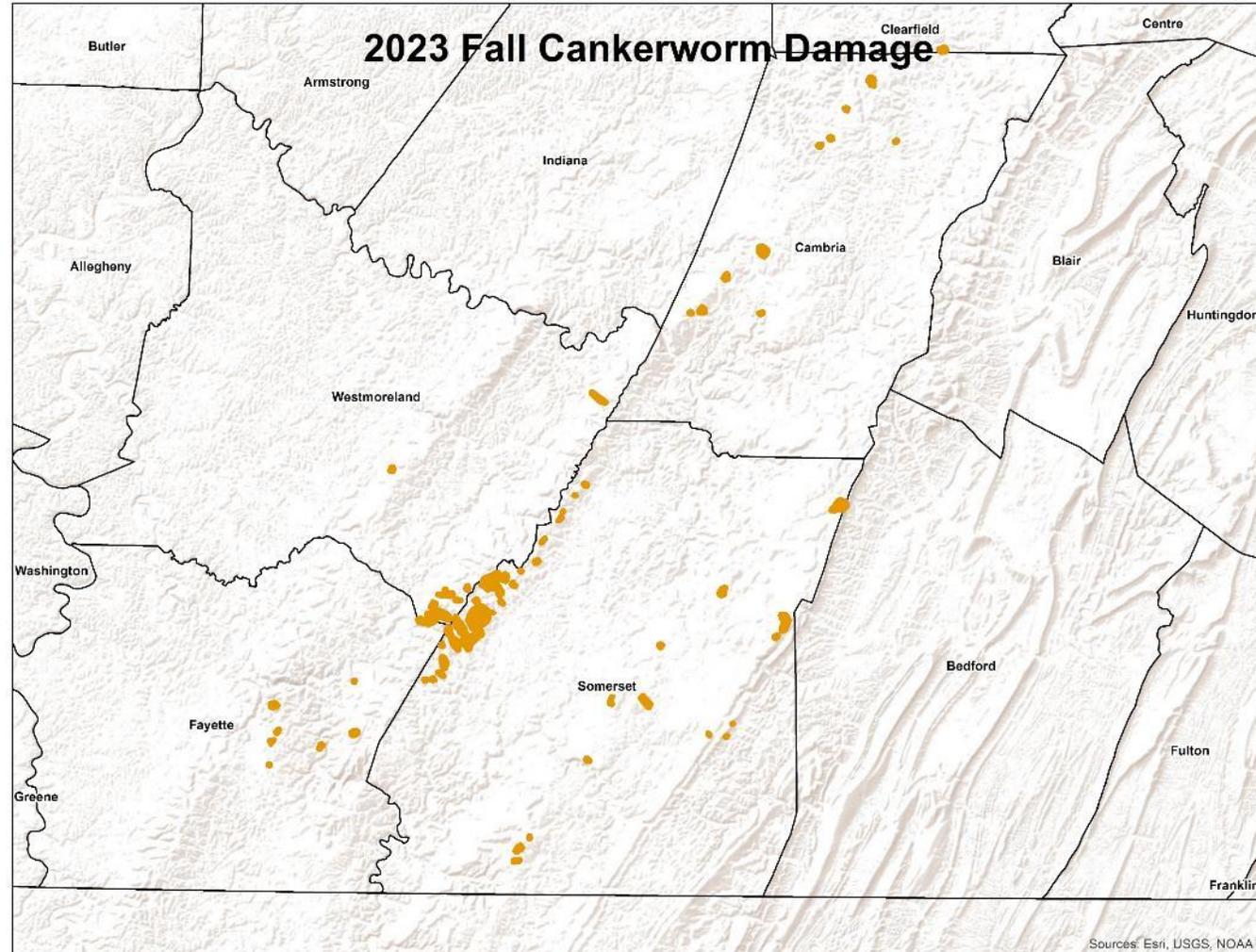


Fall Cankerworm (FCW)

Alsophila pometaria

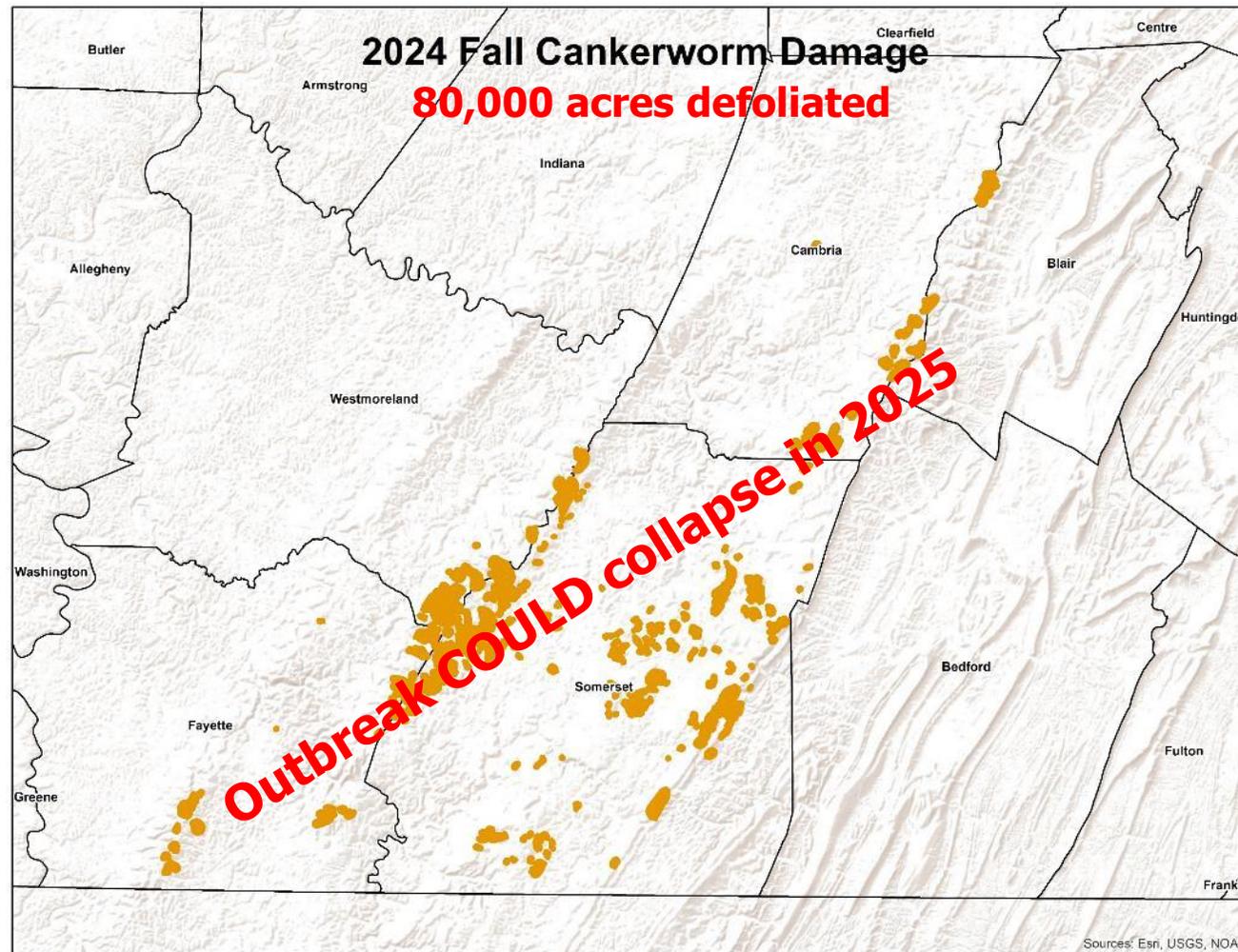
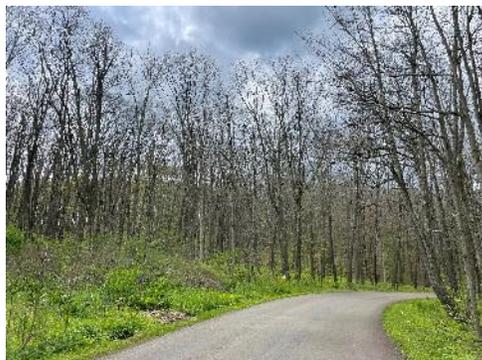


1,200 acres defoliated



Fall Cankerworm (FCW)

Alsophila pometaria



Fall Cankerworm (FCW)

Alsophila pometaria



- June 2024 – mass caterpillar die off
- Fusarium fungus – colonize in digestive system and can cause 100% mortality in larvae



Fall Cankerworm (FCW)

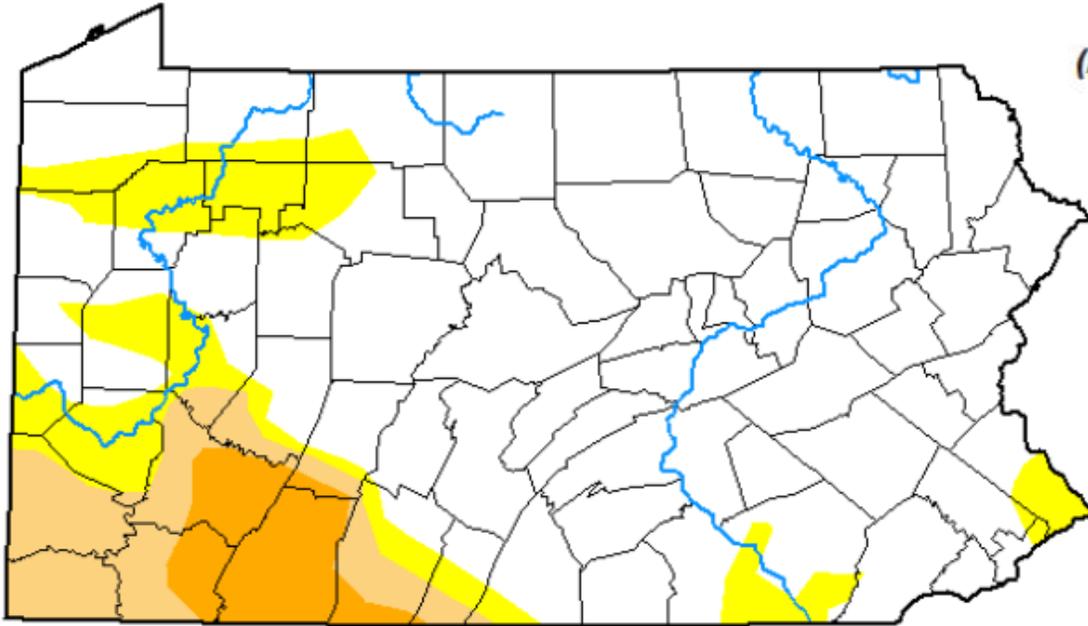
Alsophila pometaria



August 13, 2024

(Released Thursday, Aug. 15, 2024)

Valid 8 a.m. EDT



Intensity:



The Drought Monitor focuses on broad-scale conditions. Local conditions may vary. For more information on the Drought Monitor, go to <https://droughtmonitor.unl.edu/About.aspx>

Author:

Curtis Riganti
National Drought Mitigation Center



- Defoliation, possibly repeat defoliation, coupled with 2024 drought impacts has made trees especially vulnerable to additional stress

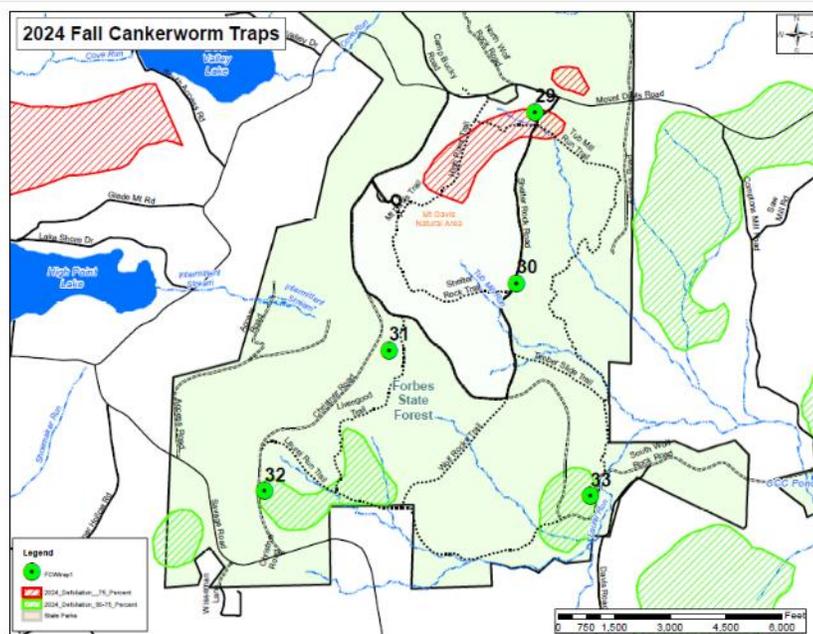
droughtmonitor.unl.edu

Fall Cankerworm (FCW)

Alsophila pometaria



- Fall 2024 trapping locations
- 38 sticky bands at 6 locations
- Deployed in Oct/Nov



Fall Cankerworm (FCW)

Alsophila pometaria



2024 Trap catches

- Oct/Nov - Dec
- Ranged from 70-1500 adults per trap
- Avg 600 crawlers per trap
- Southern states use 45-100/trap as a threshold



2024 Fall Cankerworm Traps - FD4

Date	Trap #	Site Name	Tree Sp	DBH	GPS Coordinate	Insp Date	F Cnly	Insptr Name	Notes (Bycatch)
10/25/24	1	LM - N. Branch Sale	RO	26	40 7 31.3 -79 13 5.3	12/10/24	700	Wentzel	
10/25/24	2	LM - Hickory Flats Rd	RO	23	40 5 57.9 -79 11 55.4	12/10/24	900	Wentzel	
10/30/24	3	LM - Marsall Fields Tr	RO	20	40 6 37.4 -79 13 4.7	12/10/24	350	Wentzel	
10/30/24	4	LM - Kuhntown Rd	RO	21	40 6 1.3 -79 13 26.6	12/10/24	800	Wentzel	
10/30/24	5	LM - Tunnel Rd	RO	16	40 5 35.9 -79 15 6.1	12/10/24	300	Wentzel	
10/30/24	6	LM - Mt. Str. Loop Tr	RO	27	40 5 18.6 -79 14 42.8	12/10/24	365	Wentzel	
10/30/24	7	Kooser SP	RO	19	40 3 19.1 -79 13 28.1	12/10/24	500	Wentzel	
10/30/24	8	KS - Pollinator Field	RO	15	40 3 38.4 -79 16 29.6	12/10/24	350	Wentzel	
10/30/24	9	KS - RRNA Monument	RM	17	40 3 40.6 -79 17 43.2	12/10/24	400	Wentzel	
10/30/24	10	KS - RRNA Homestead	BC	26	40 3 44.2 -79 18 22.1	12/10/24	500	Wentzel	2 spotted lanternfly
11/1/24	11	KS - Fire Tower Rd	BC	23	40 2 57.8 -79 18 5.6	12/10/24	550	Wentzel	1 spotted lanternfly
11/1/24	12	KS - Jones Mill Run Rd	RO	24	40 3 8.2 -79 15 48.0	12/10/24	400	Wentzel	
11/1/24	13	KS - Jones Mill Run Sale	RO	27	40 2 3.4 -79 15 47.6	12/10/24	700	Wentzel	
11/1/24	14	LHSP - Beltz Rd East	RO	23	40 1 43.8 -79 14 39.6	12/4/24	640	Peck	
11/1/24	15	LHSP - Beltz Rd West	RO	21	40 1 26.5 -79 15 25.7	12/4/24	520	Peck	spiders, stink bugs
11/4/24	16	LHSP - office	RO	25	40 0 34.0 -79 13 31.4	12/4/24	730	Peck	
11/4/24	17	LHSP - entrance	RO	21	40 0 32.4 -79 13 8.8	12/4/24	750	Peck	spiders
11/4/24	18	LHSP - Buck Run Rd 1	RO	22	40 0 34.7 -79 14 32.7	12/4/24	810	Peck	
11/4/24	19	LHSP - Martz Tr	RO	23	40 0 47.0 -79 14 41.9	12/4/24	670	Peck	
11/4/24	20	LHSP - Buck Run Rd 2	RO	20	40 1 13.0 -79 14 35.8	12/4/24	320	Peck	
11/4/24	21	LHSP - Jones Mill Rd 1	RO	27	40 0 29.7 -79 15 35.0	12/4/24	410	Peck	
11/4/24	22	LHSP - Jones Mill Rd 2	RO	30	40 1 7.5 -79 15 51.6	12/4/24	340	Peck	spiders, wasp
11/4/24	23	BH - Glade Rd 1	BC	25	40 0 59.6 -79 18 23.9	12/10/24	450	Wentzel	
11/4/24	24	BH - Glade Rd 2	RO	21	39 59 29.4 -79 17 42.6	12/10/24	800	Wentzel	
11/4/24	25	BH - Glade Rd 3	RO	25	39 59 3.5 -79 17 18.6	12/10/24	950	Wentzel	
11/4/24	26	BH - Cole Run Rd	RO	22	39 59 3.4 -79 17 56.6	12/10/24	750	Wentzel	
11/4/24	27	BH - Actual Blue Hole	RO	23	39 58 25.0 -79 17 59.7	12/10/24	700	Wentzel	
11/4/24	28	BH - Pletcher Rd	RO	20	39 57 51.9 -79 19 28.8	12/10/24	850	Wentzel	
11/7/24	29	MD - Shelt. Rock Rd N	RO	17	39 47 33.5 -79 9 49.1	12/10/24	1,000	Hosselrode	
11/7/24	30	MD - Shelt. Rock Rd S	RO	24	39 46 47.7 -79 9 54.4	12/10/24	850	Hosselrode	
11/7/24	31	MD - Big Burn Sale	RO	20	39 46 29.6 -79 10 37.8	12/10/24	1,200	Hosselrode	
11/7/24	32	MD - Christner Rd	RO	18	39 45 51.8 -79 11 19.6	12/10/24	350	Hosselrode	
11/7/24	33	MD - S. Wolf Rock Rd	RO	27	39 45 51.7 -79 9 28.1	12/10/24	1,010	Hosselrode	
11/8/24	34	PD - Skyline Dr Lick Rn	RO	19	39 49 51.7 -79 40 46.1	12/4/24	650	Yoder	
11/8/24	35	PD - Skyline Dr Shp Rd	RO	20	39 49 24.2 -79 40 49.8	12/4/24	750	Yoder	
11/8/24	36	PD - Skyline Dr	RO	21	39 49 12.4 -79 40 54.9	12/4/24	1,000	Yoder	
11/8/24	37	PD - Skyline Dr Krby Rd	RO	21	39 48 48.7 -79 41 15.1	12/4/24	1,500	Yoder	
11/8/24	38	PD - Kirby Rd	RO	20	39 47 53.0 -79 40 36.0	12/4/24	70	Yoder	

Will it collapse in 2025?

Fall Cankerworm (FCW)

Alsophila pometaria

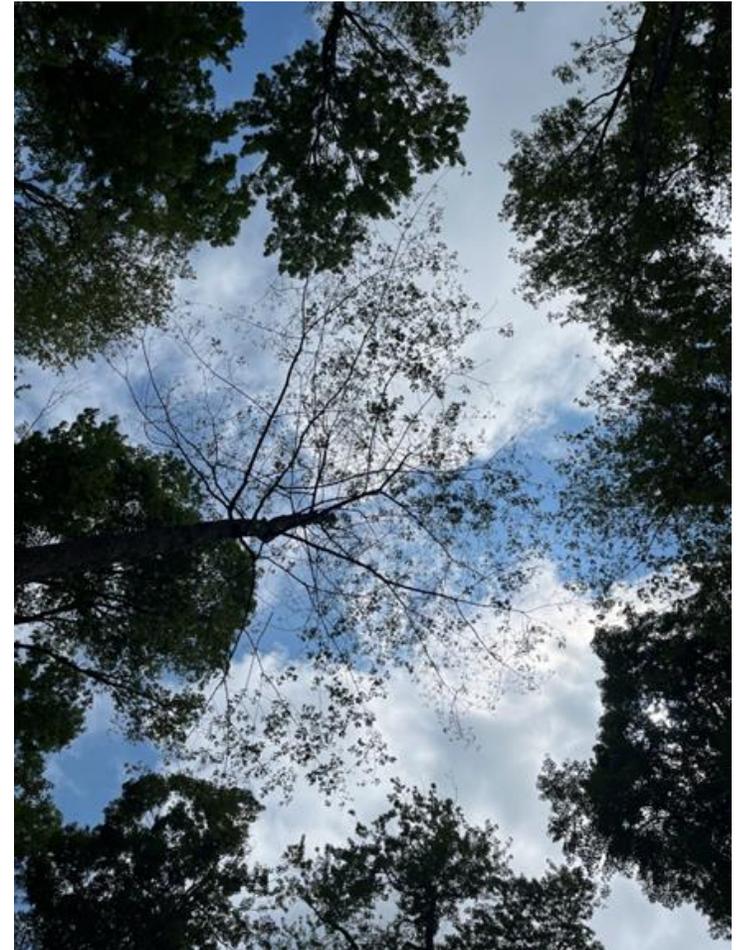


2025 plans

- Conduct egg mass survey in March
- Identify if egg parasitoids are present
- Trap/monitor adult populations
- Continue to learn more about FCW in PA

Management options:

- Historically not needed
- Pesticide treatments with BtK
- Sticky bands in the fall to catch female crawlers also may be somewhat effective on individual trees if vigilant and replaced often.

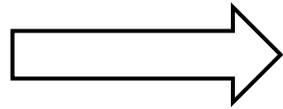


Northern Walkingstick

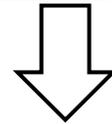
Diaperomera femorata (Say)



Egg (2×1.5 ×1.2 mm)
September - May



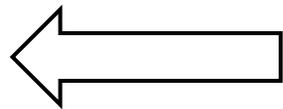
Nymph (5 instars) (11-46 mm)
May - August



Life Cycle

Adult

August - October



Female
(95 mm)



Male
(75 mm)



- There are 43 species of walking stick species in North America
- The northern walking stick is the only stick insect of economic importance in North America

Northern Walkingstick

Diaperomera femorata (Say)



- Nocturnal herbivore
- Non-functioning wings
- Facultative parthenogenesis
- Species-specific eggs

Northern Walkingstick

Diapheromera femorata (Say)



Table 1. Reported host species of *Diapheromera femorata* in North America

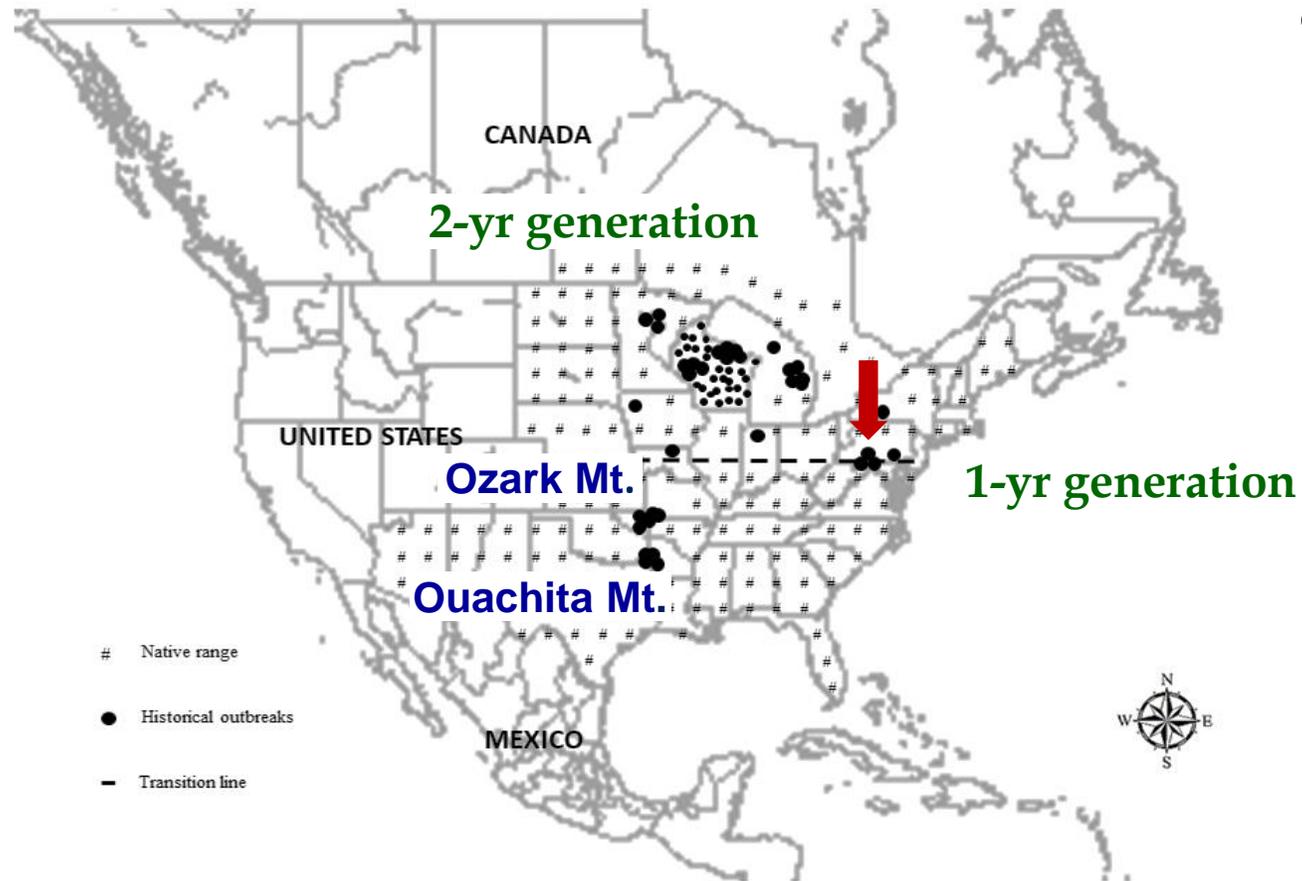
Family	Species	Common name	Preference ^a	Reference	
Altingiaceae	<i>Liquidambar styraciflua</i> L.	Sweetgum	**	Terry (1972)	
Betulaceae	<i>Betula papyrifera</i> Marshall	Paper birch	***	WIDNR (1957), Wilson (1971)	
	<i>Corylus americana</i> Marshall	American hazelnut	****	Severin & Severin (1911b)	
	<i>Corylus cornuta</i> Marshall	Beaked hazel	****	Wilson (1971)	
Cannabaceae	<i>Celtis occidentalis</i> L.	Hackberry	****	CSLP (1973)	
Cornaceae	<i>Cornus florida</i> L.	Flowering dogwood	**	Wilson (1971)	
Ericaceae	<i>Vaccinium</i> sp.	Blueberry	****	Wilson (1971)	
Fabaceae	<i>Gleditsia triacanthos</i> L.	Honey locust	***	Terry (1972)	
	<i>Robinia pseudoacacia</i> L.	Black locust	***	Anonymous (1887b), Wilson (1971), CSLP (1973), Hargrove (1987)	
Fagaceae	<i>Castanea sp.</i>	Chestnut	****	Wilson (1971)	
	<i>Quercus sp.</i>	White oak	**	Terry (1972), Anonymous (1887a)	
	<i>Quercus empyrealis</i> (L.) Mill.	Northern pin oak	**	WIDNR (1957, 1967)	
	<i>Quercus marilandica</i> Muenchh.	Blackjack oak	****	Terry (1972)	
	<i>Quercus montana</i> Willd.	Chestnut oak	****	Anonymous (1887a)	
	<i>Quercus rubra</i> L.	Northern red oak	****	Anonymous (1887a)	
	<i>Quercus stellata</i> Wangenh.	Post oak	**	Terry (1972)	
	<i>Quercus velutina</i> Lam.	Black oak	****	Wilson (1971), Graham (1937), Anonymous (1887a)	
	Hamamelidaceae	<i>Hamamelis virginiana</i> L.	Witch-hazel	****	Graham (1937)
	Juglandaceae	<i>Carya</i> spp.	Hickory	***	Wilson (1971), Anonymous (1887a)
	Lauraceae	<i>Sassafras albidum</i> (Nutt.) Nees	Sassafras	**	Terry (1972)
	Malvaceae	<i>Tilia americana</i> L.	Basswood	****	Wilson (1972), Severin & Severin (1911b), WIDNR (1957)
Myricaceae	<i>Comptonia peregrina</i> (L.) Coult.	Sweet fern	****	Wilson (1971), Graham (1937)	
Nyssaceae	<i>Nyssa sylvatica</i> Marshall	Black gum	**	Terry (1972)	
Oleaceae	<i>Fraxinus</i> spp.	Ash	**	Wilson (1971)	
Pinaceae	<i>Pinus rigida</i> Mill.	Pitch pine	*	Wilson (1971)	
Platanaceae	<i>Platanus occidentalis</i> L.	American sycamore	**	Terry (1972)	
Rosaceae	<i>Amelanchier</i> sp.	Juncberry	****	Wilson (1971)	
	<i>Fragaria</i> sp.	Strawberry	****	Wilson (1971)	
	<i>Malus domestica</i> Borkh.	Apple	***	Wilson (1971)	
	<i>Prunus cerasus</i> L.	Sour cherry	****	Oatman (1965)	
	<i>Prunus persica</i> (L.) Batsch	Peach	***	Anonymous (1887b)	
	<i>Prunus serotina</i> Ehrh.	Black cherry	****	Wilson (1971), Graham (1937)	
Salicaceae	<i>Rosa</i> sp.	Rose	****	Wilson (1971)	
	<i>Populus grandidentata</i> Michaux	Bigtooth aspen	**	Wilson (1971)	
	<i>Populus tremuloides</i> Michx.	Quaking aspen	***	Wilson (1971)	
Ulmaceae	<i>Ulmus americana</i> L.	American elm	**	Terry (1972)	
Vitaceae	<i>Vitis</i> sp.	Wild grape	**	Wilson (1971)	

^a based on relative feeding observed in the field. **** highly preferred, *** preferred, ** less preferred, * rarely used.

Cherries and Red Oaks

Northern Walkingstick

Diaperomera femorata (Say)



- First infestations reported in 1874 in Yates County, NY and Cumberland County, PA

Northern Walkingstick

Diaperomera femorata (Say)

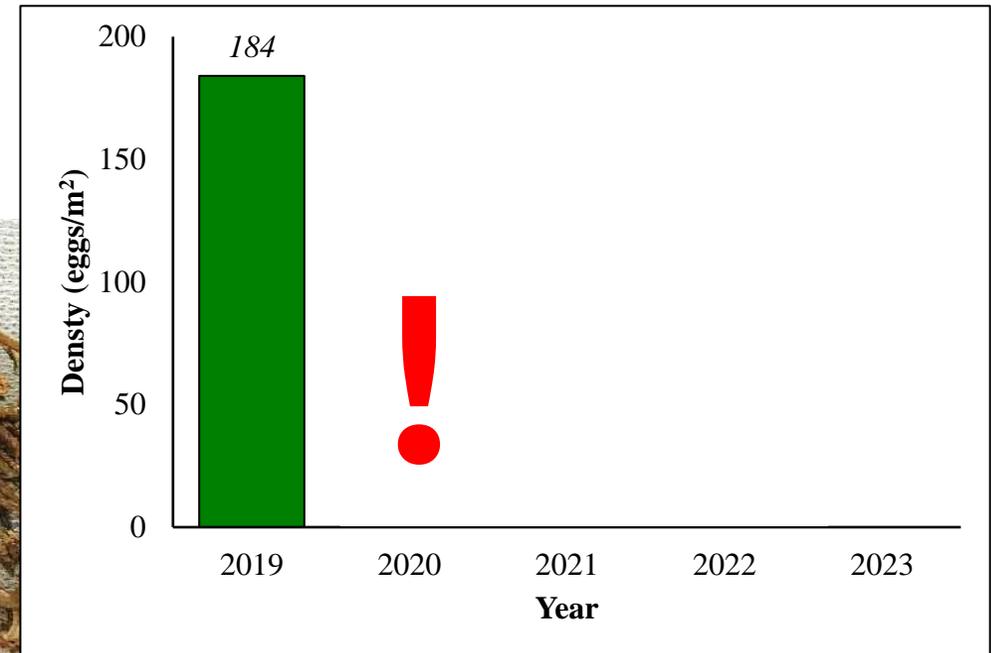


- Scattered infestations reported in 2017 & 2018
- Bedford County



Northern Walkingstick

Diaperomera femorata (Say)



Northern Walkingstick

Diaperomera femorata (Say)



- 2020 - Cherry and oak defoliated
- Adjacent maples and non-host trees not defoliated
- Historical outbreak area
- Two additional areas on PGC lands experienced outbreak in the same area



UAS image (2020)

Northern Walkingstick *Diaperomera femorata* (Say)



- Oak and cherry defoliation in summer 2020



Northern Walkingstick

Diaperomera femorata (Say)

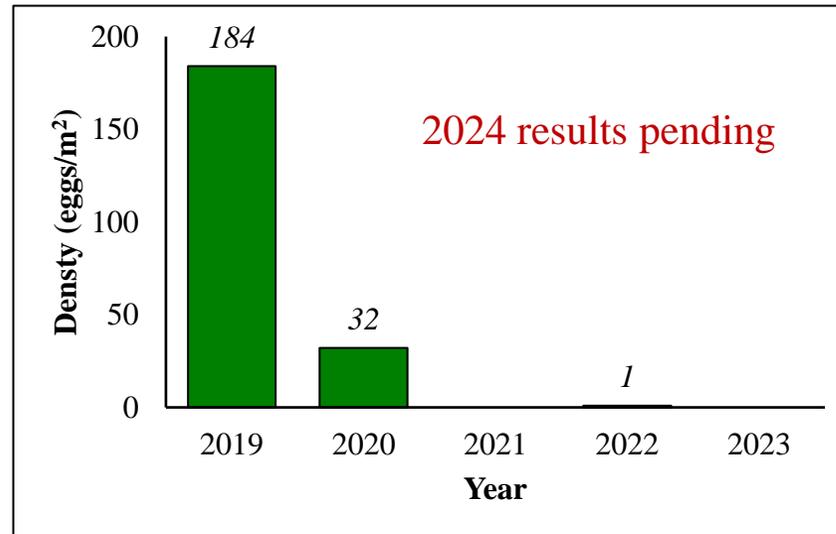


- High population levels
- Eggs “rain” down
- Adults will drop from branches



Northern Walkingstick

Diaperomera femorata (Say)



2024 Survey

- No defoliation on cherry or oak observed
- Egg Survey <math><1 \text{ egg/m}^2</math>
- No egg trapping in 2025

Management

- Control rarely required
- Shift species composition to less preferred species
- Prescribed fire

Northern Walkingstick *Diaperomera femorata* (Say)



- 1-year post defoliation event



Liu (2021) *Journal of Applied Entomology*
<https://doi.org/10.1111/jen.12902>

Southern Pine Beetle

Dendroctonus frontalis



- Native to US & Central America
- On pines (loblolly, shortleaf, etc.)
- Major pest (\$43 m/year) in the south
- Southern PA in 1932 (north range)
- New Jersey & New England expansion

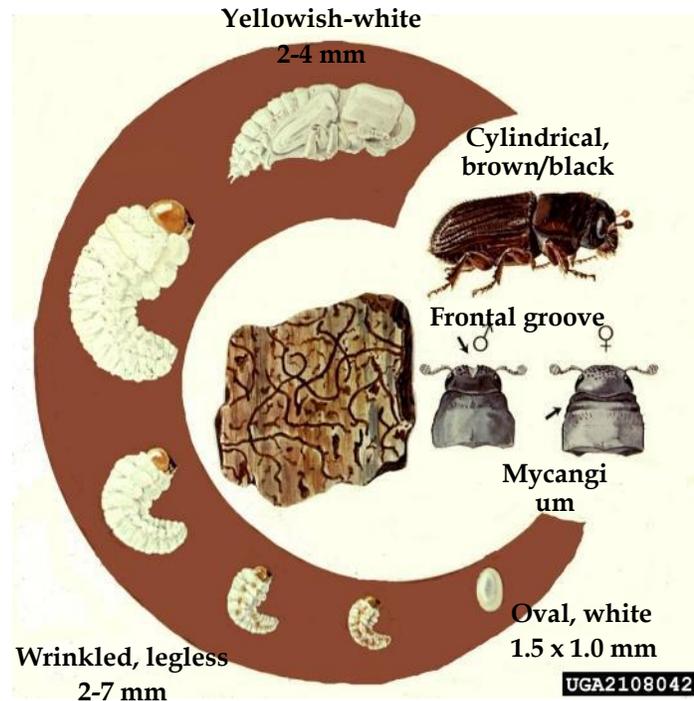


Southern Pine Beetle

Dendroctonus frontalis



Life Cycle



- 3-9 generations/year
- 26-60 days/generation
- Overwinter in all stages
- Emerge as dogwood flowers
- 6-12 year outbreak cycle
- Outbreak lasts for 2-3 years

Southern Pine Beetle

Dendroctonus frontalis



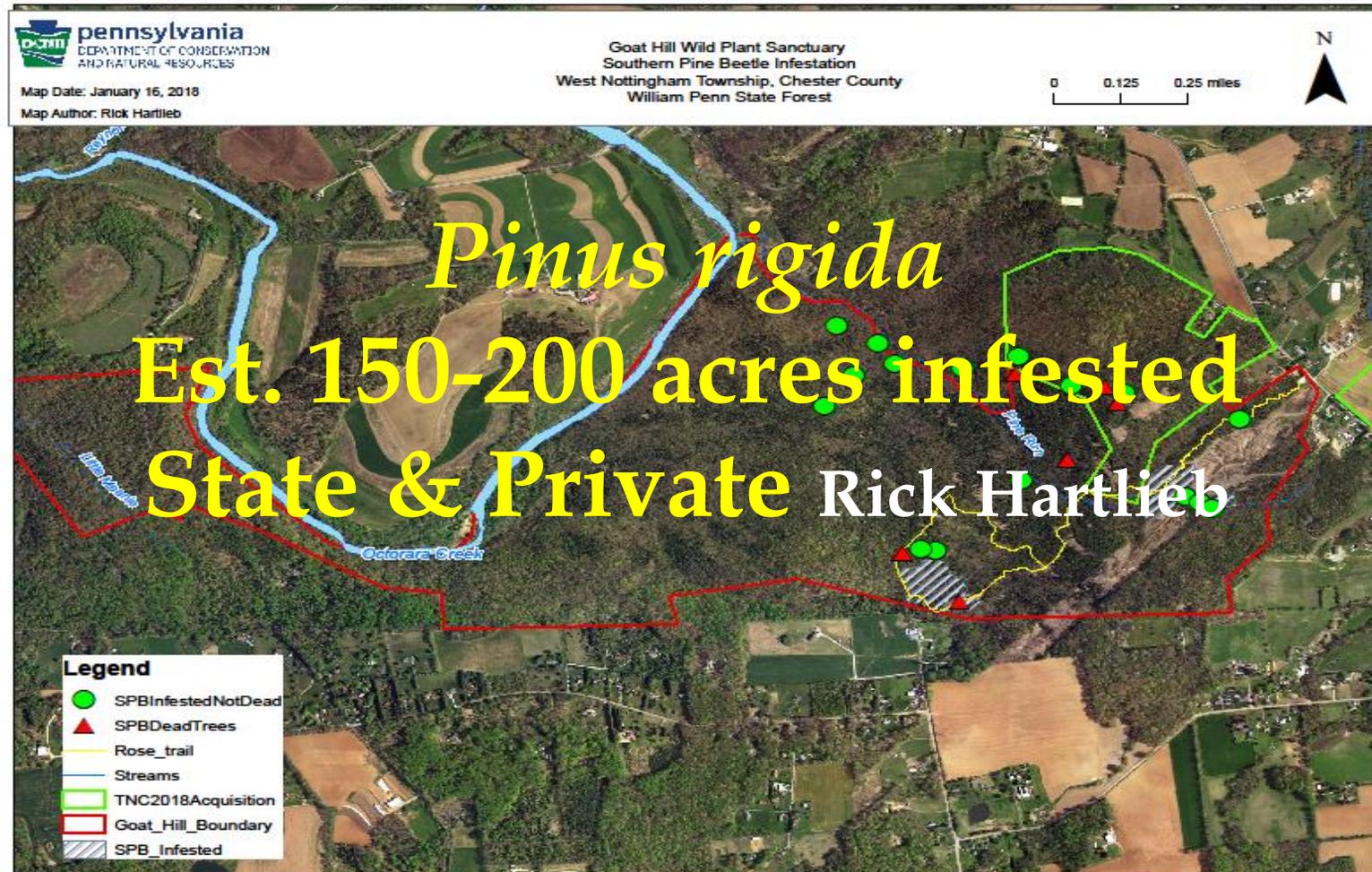
Infestation at Nottingham Park



Southern Pine Beetle *Dendroctonus frontalis*



Infestation at Goat Hill



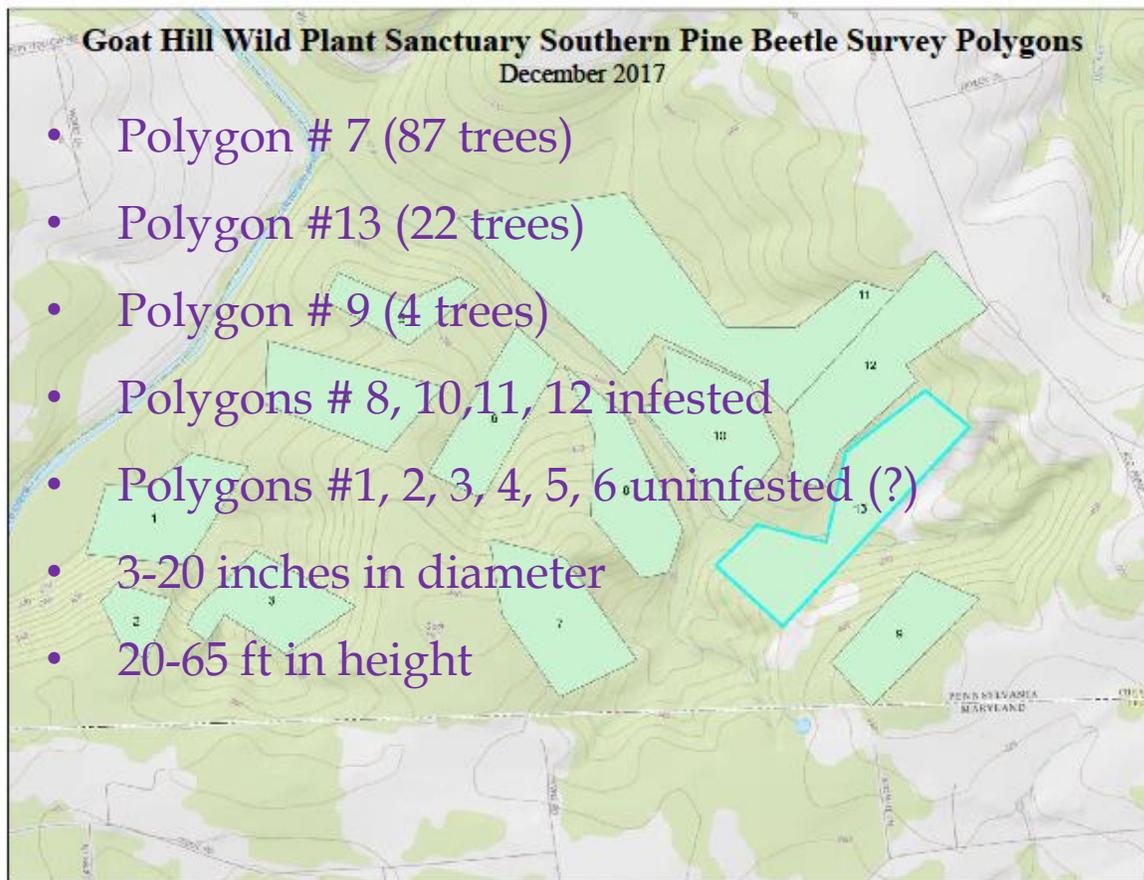
Southern Pine Beetle

Dendroctonus frontalis



Infestation at Goat Hill

Appendix 6



Southern Pine Beetle

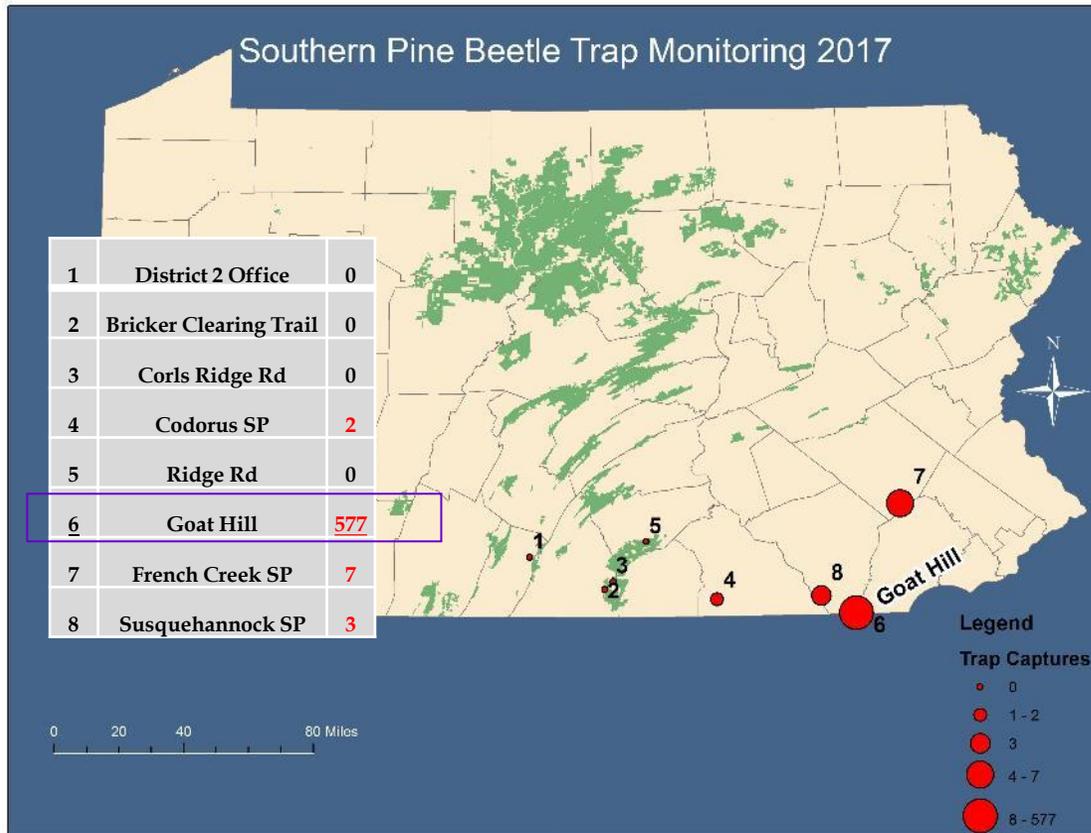
Dendroctonus frontalis



Ground Monitoring

12-unit Lindgren funnel trap (April-June)

Aerial Detection



Southern Pine Beetle

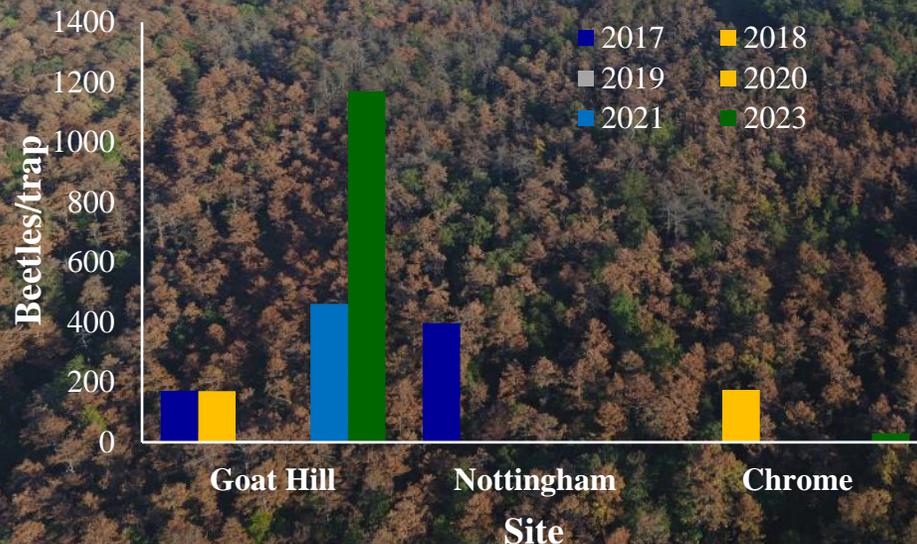
Dendroctonus frontalis



Outbreaks (2017-present)

Nottingham (380 acres – cut & remove)
Goat Hill (>100 acres – draft plan)

Monitoring (yearly since 2017)



Southern Pine Beetle

Dendroctonus frontalis



Spot Suppression

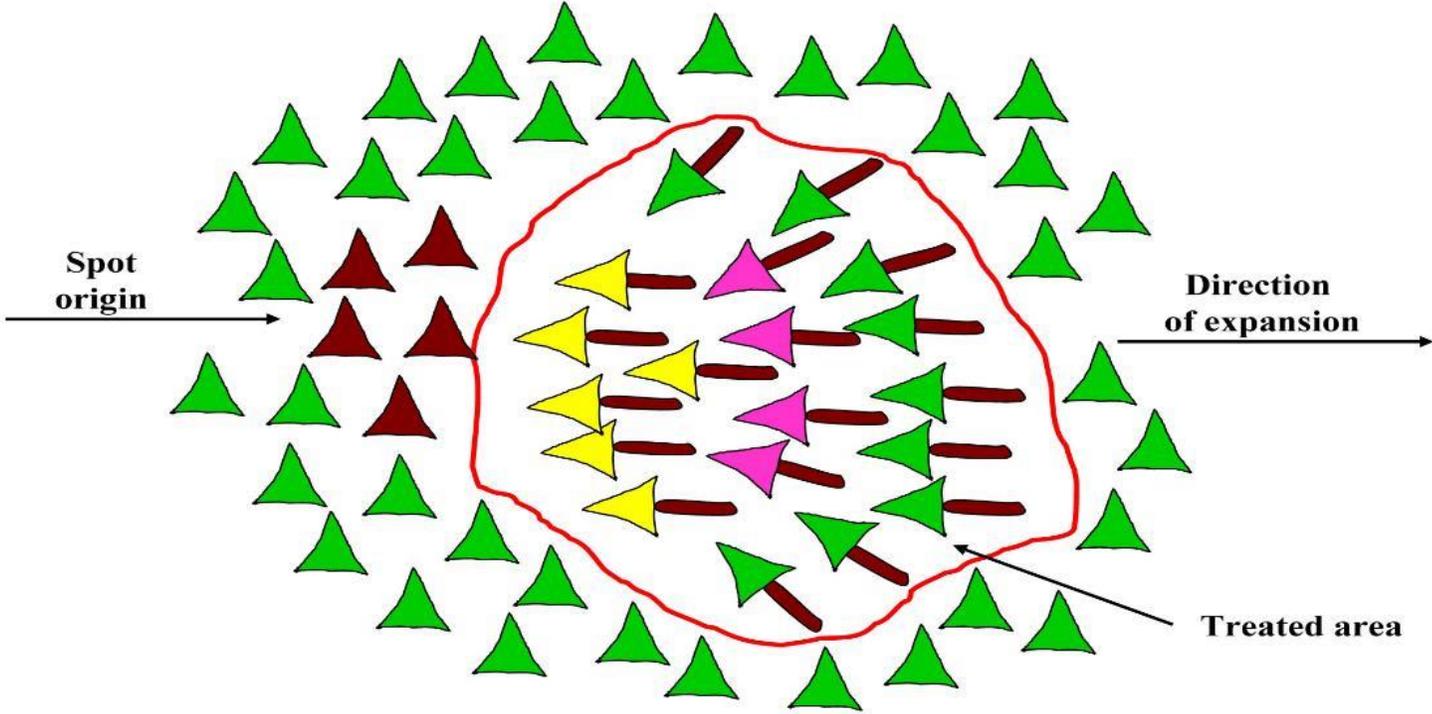
(C) SPB spot controlled by salvage



(D) SPB spots controlled by cut-and-leave



How to Apply Cut-and-leave



- Uninfested pine standing
- Stage 3 standing
- Stage 2 felled
- Stage 1 felled
- Uninfested pine felled

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Natural Enemies

Thanasimus dubius Fabricius
(Coleoptera: Cleridae)



Heydenia unica Cook & Davis
(Hymenoptera: Pteromalidae)



Spathius pallidus Ashmead
(Hymenoptera: Braconidae)



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Preventive Thinning

< 80 ft² stand basal area

> 20 ft planting space



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SPB Research

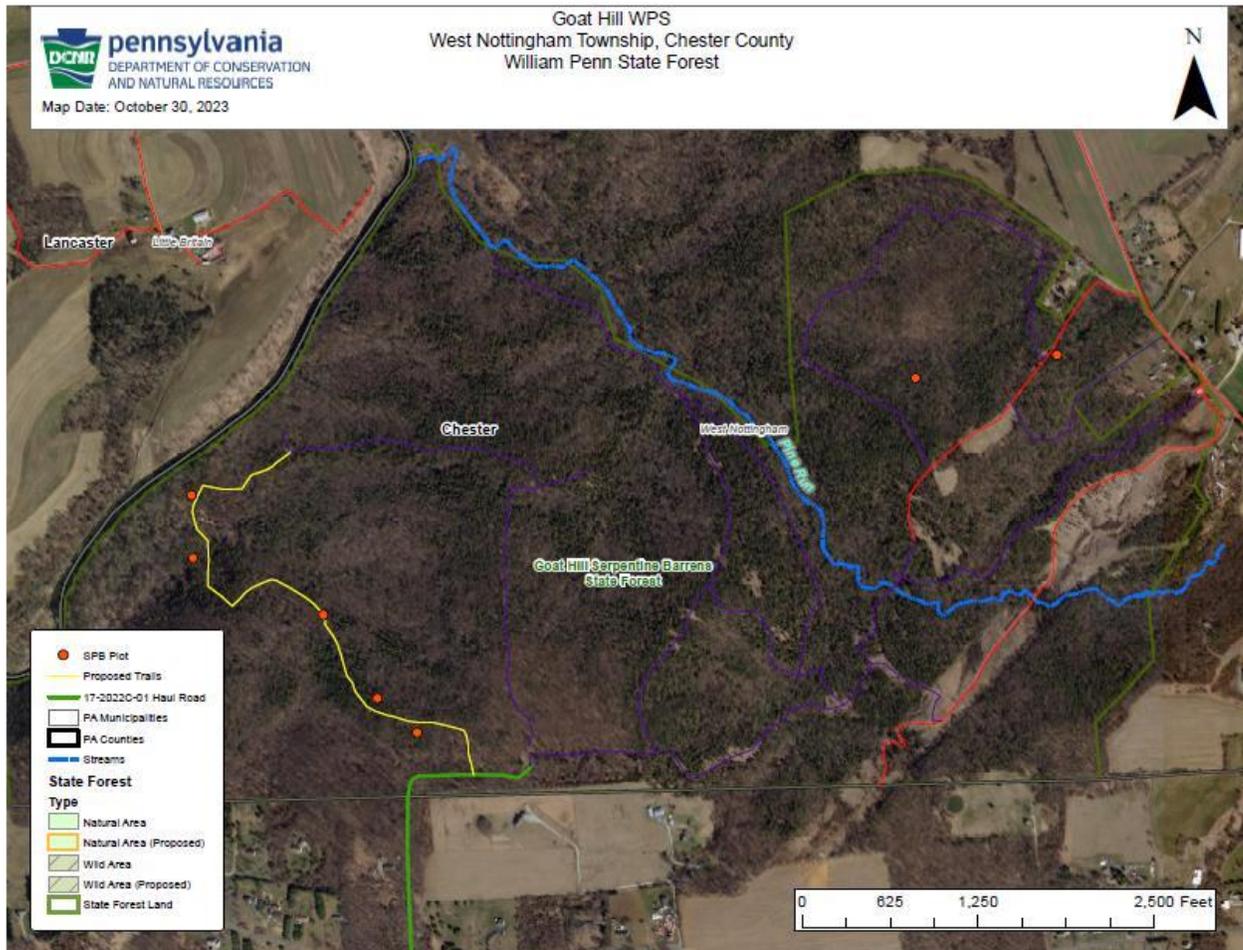
Impact On Forest Ecosystem

- Increased fuel and fire risk (-)
- Changes in forest composition (+/-)
- Changes in understory vegetation (+)
- Impact on associated wildlife species (-/+)
- Impact on endangered & concerned species (-)
- Impact on invasive species (-)
- Impact on soil & plant pathogens (+/-)
- Impact on forest hydrology (-)



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Study Design

Started in 2024

5 sites

Goat Hill (3), Nottingham (1), Chrome (1)

3 treatments

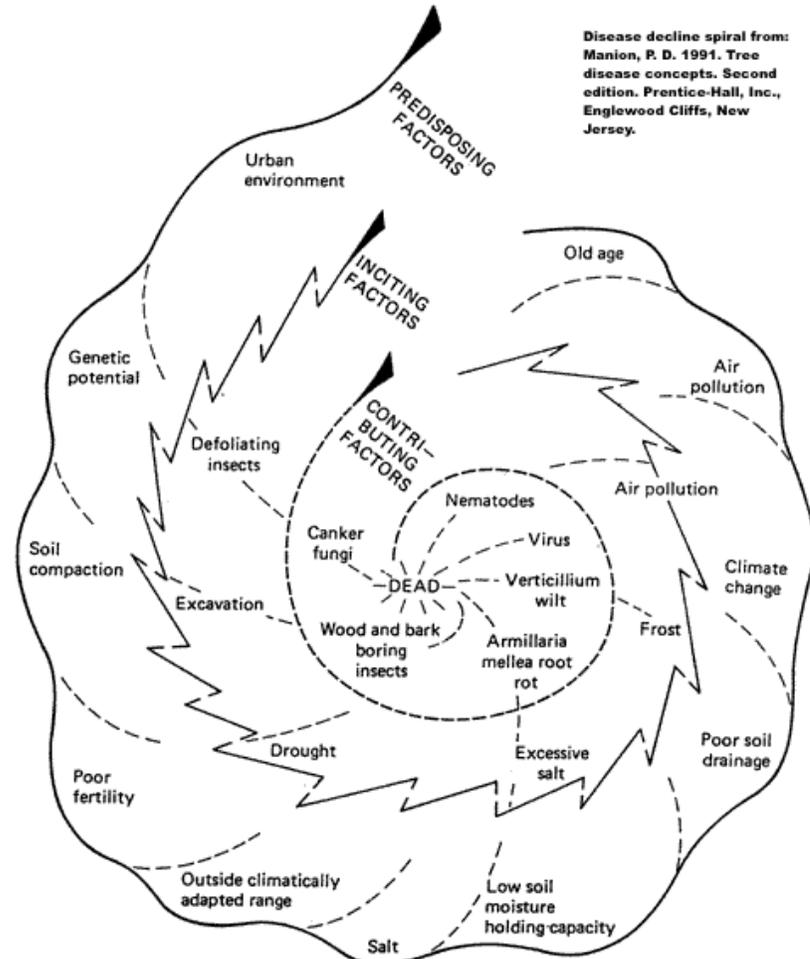
Cut-Remove/Open field, Infested, Uninfested

15 plots (3 plots/site)

5 replicates/treatment

** Number of sites and plots/site may change depend on field conditions*

It's Complicated



Some level of mortality is “normal”

We probably won't know there is a problem until there is a problem

Outbreaks typically occur in “cycles” so it could be decades before another outbreak occurs

More research needed on native pests

There are other factors that contribute to mortality

What Can We Do?



Forest Resilience – Management, Genetics, Diversity

Research – Ask questions, Be curious

Collaborate, Partner, Information Sharing



Thank You!

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