What's killing my oak tree??

Lori Chamberlin
Forest Health Manager
Virginia Department of Forestry

What's killing my oak tree??

frost

flooding

gypsy moth

stand disturbance

hypoxylon canker

poor soil

physiological age

armillaria root rot

bacterial leaf scorch

red oak borer

variable oakleaf caterpillar

chemical damage

climate change

density/competition

fall cankerworm

oak button gall

anthracnose

drought

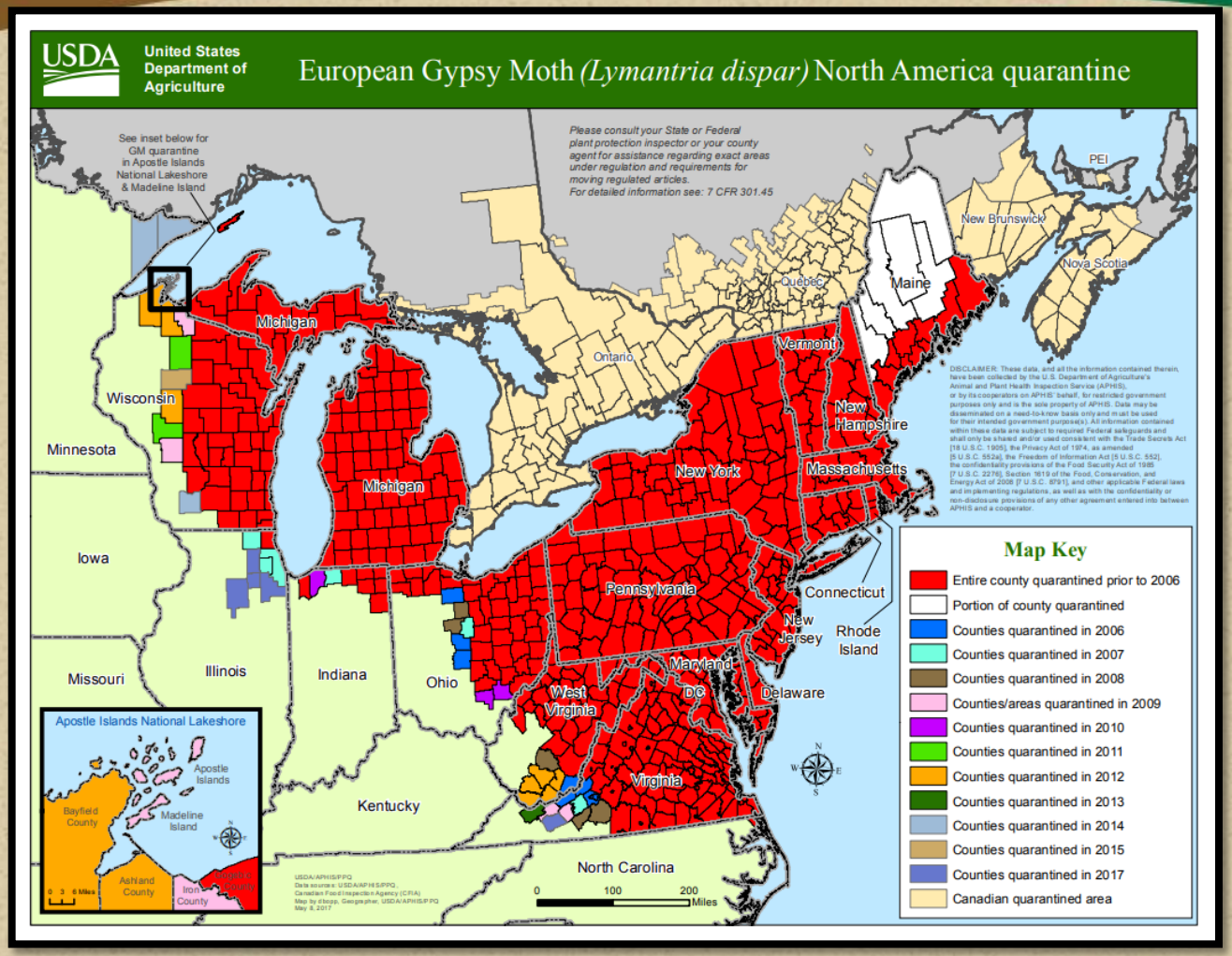
topography

invasive plants

soil compaction

two-lined chestnut borer

Gypsy Moth

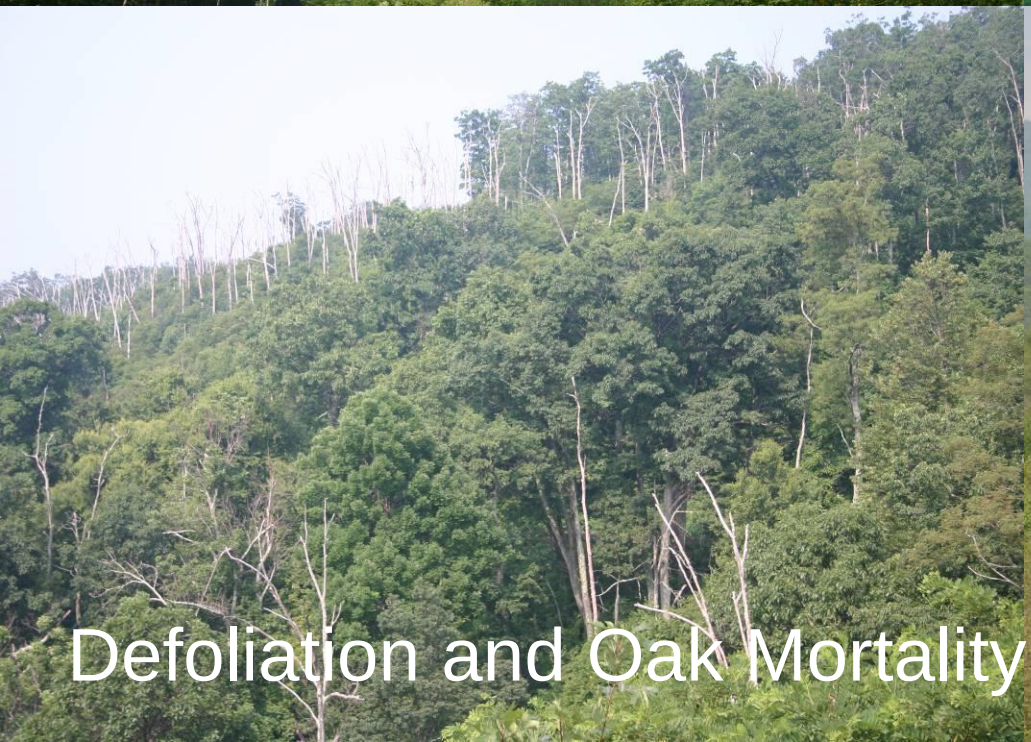


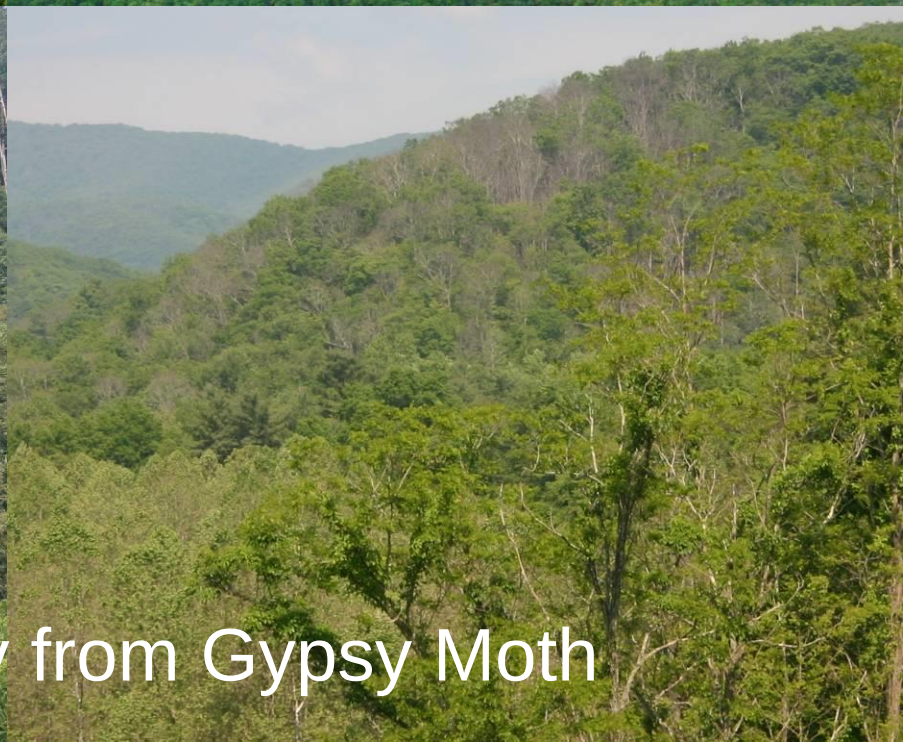
Lymantria dispar
(Lepidoptera: Erebidae)

- Native to Europe
- Brought to Massachusetts in 1869
- Feeds on hundreds of tree species

Oak Mortality, Skyline Drive, 2009

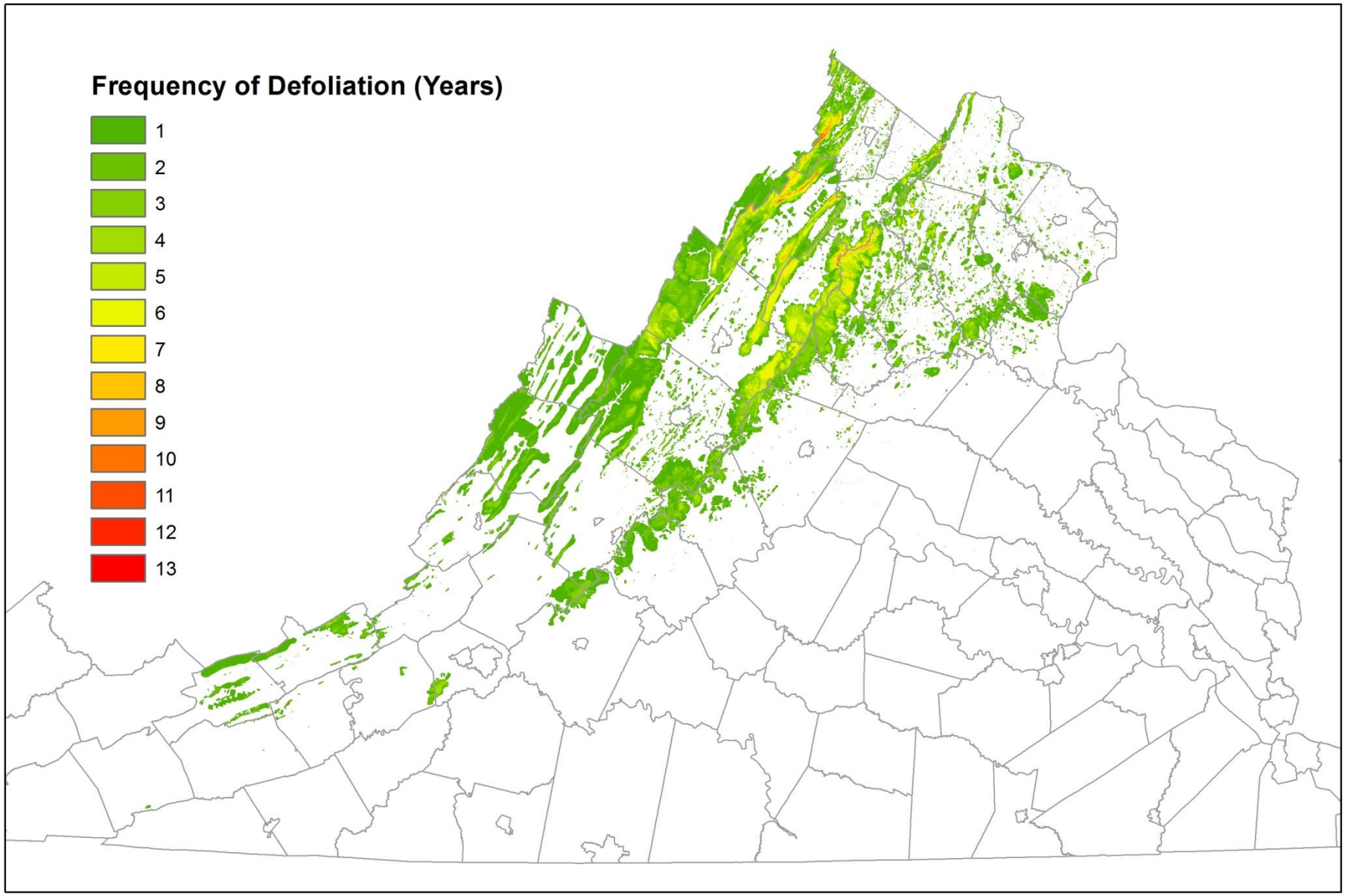
GW National Forest, Augusta Co. 2008



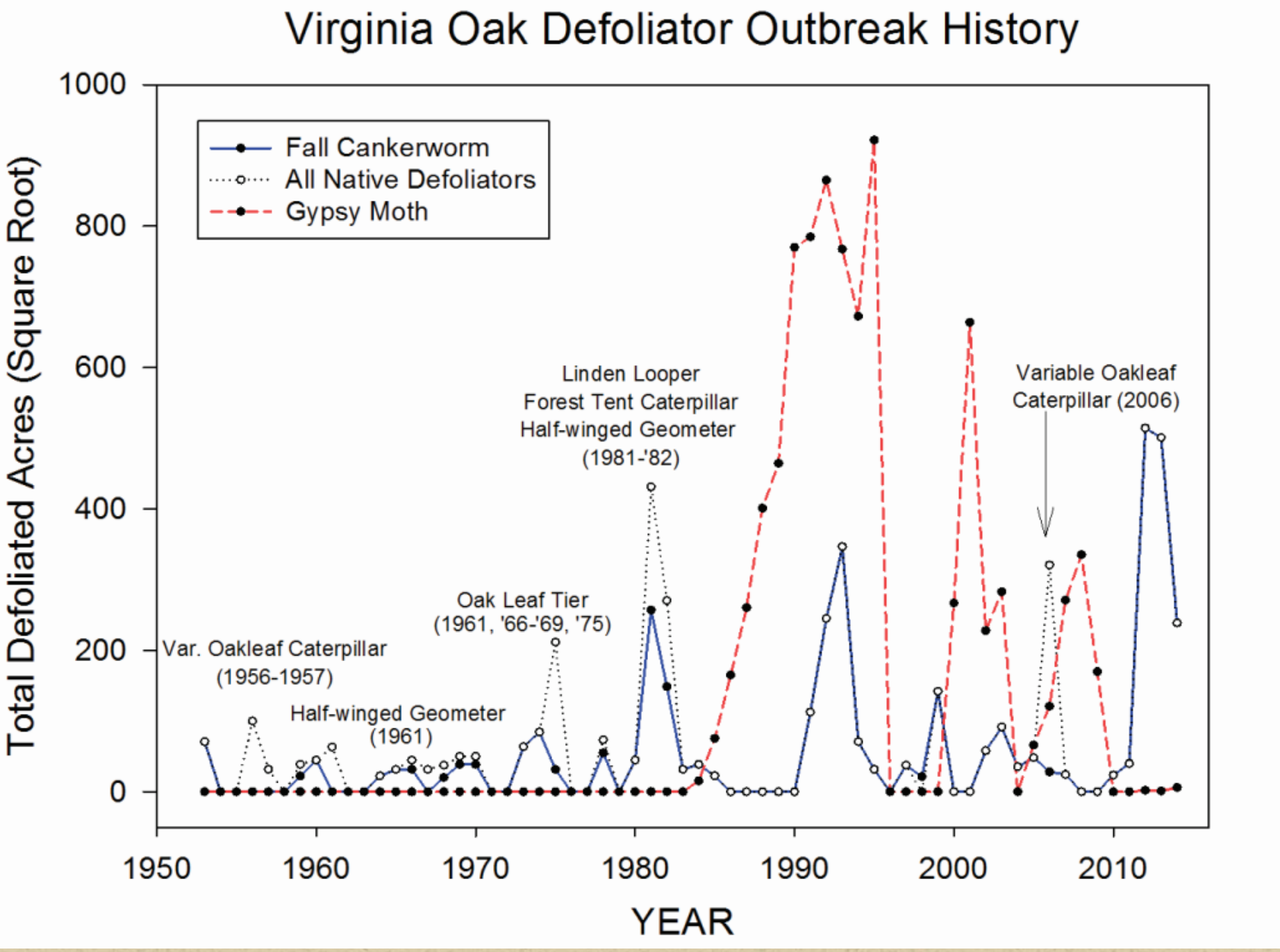


Defoliation and Oak Mortality from Gypsy Moth

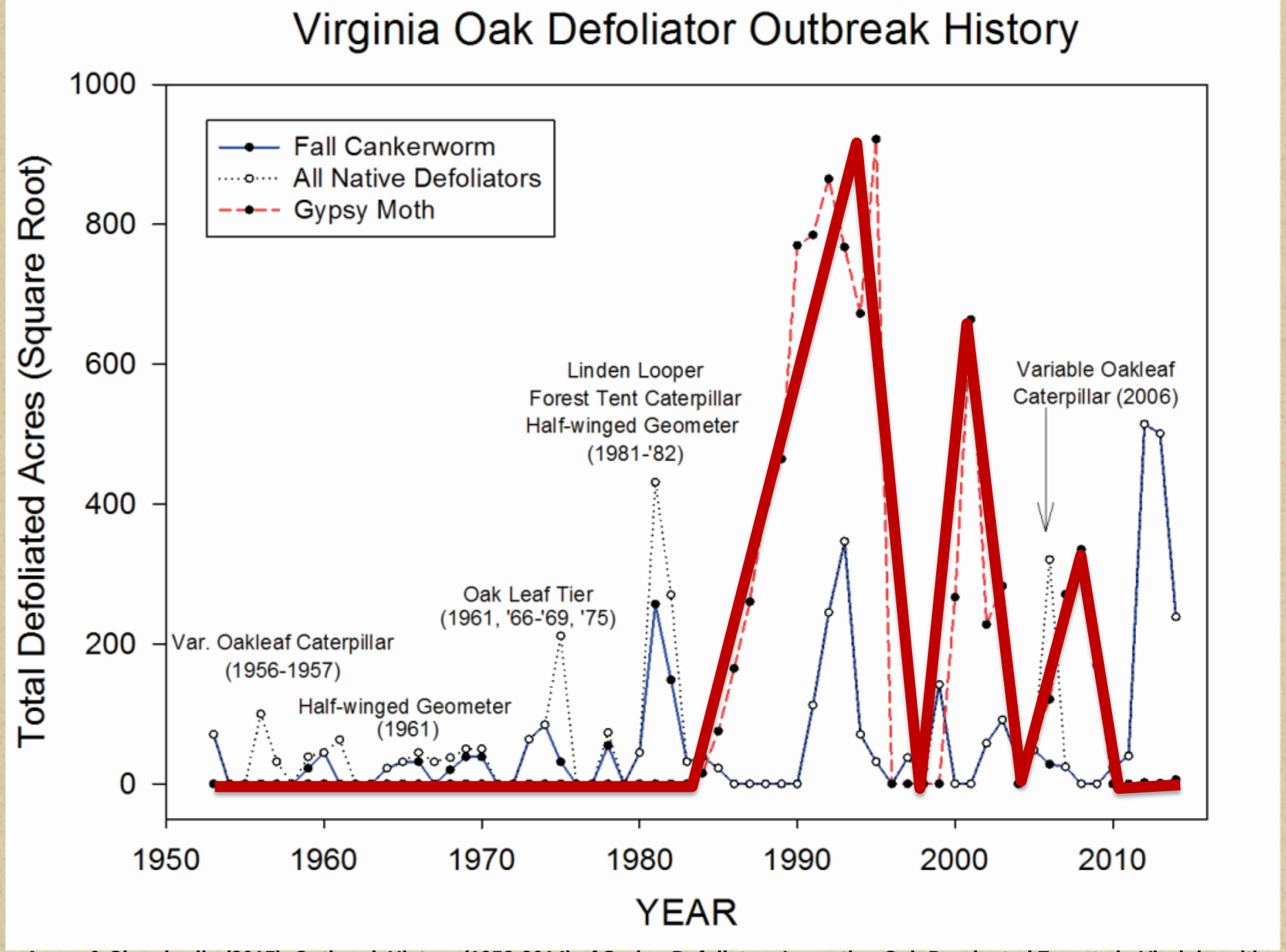
Gypsy Moth Cummulative Defoliation (1984-2018)



Mapped originally by Todd Edgerton 2/23/2010
Data acquired from L. Bradfield @ VDACS
Updated by Lori Chamberlin 4/8/2019



Asaro & Chamberlin (2015). Outbreak History (1953-2014) of Spring Defoliators Impacting Oak-Dominated Forests in Virginia, with Emphasis on Gypsy Moth (Lymantria dispar L.) and Fall Cankerworm (Alsophila pometaria Harris). American Entomologist. 61.



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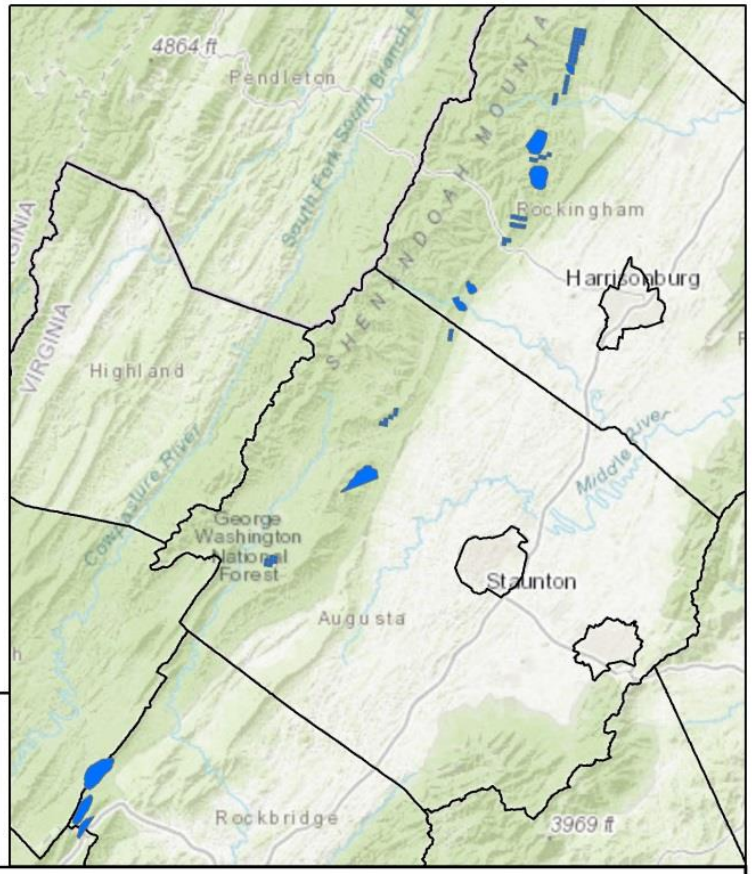
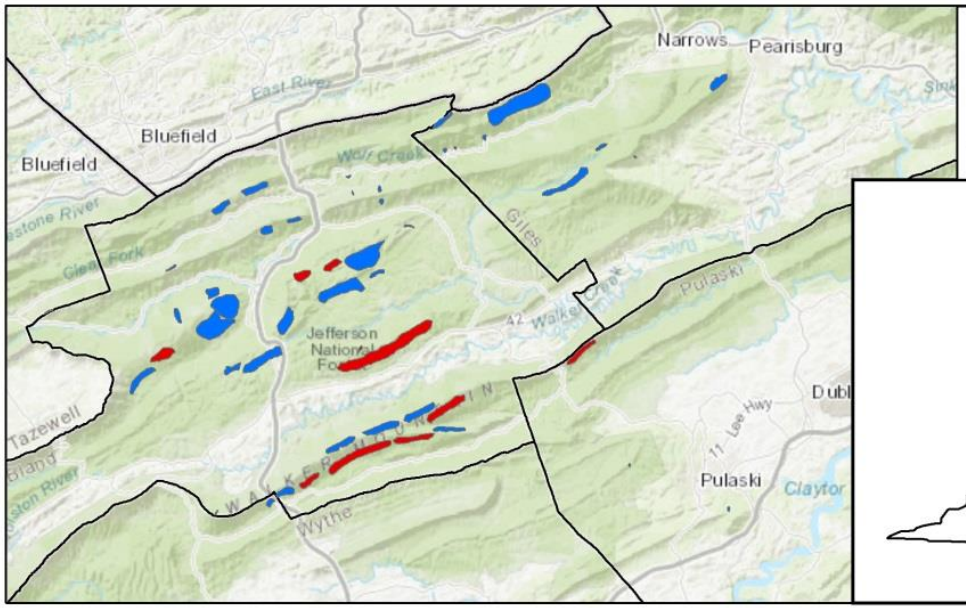
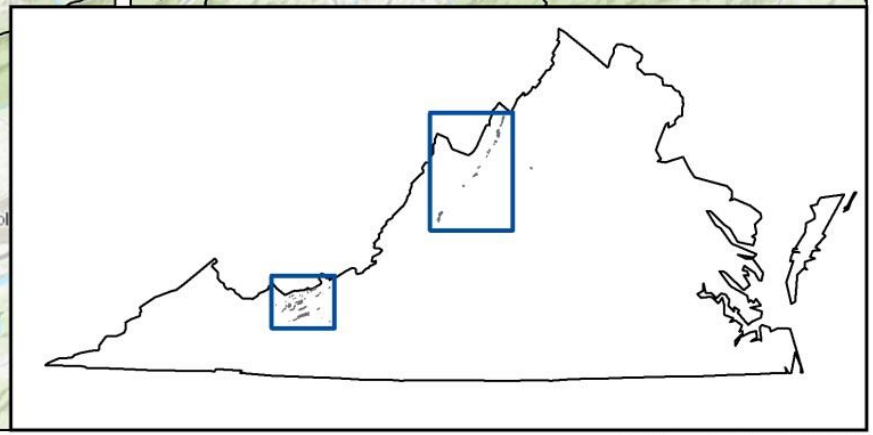
Gypsy Moth 2018

Approximately 20,000 acres with **moderate** defoliation

Approximately 3,600 acres with **heavy** defoliation







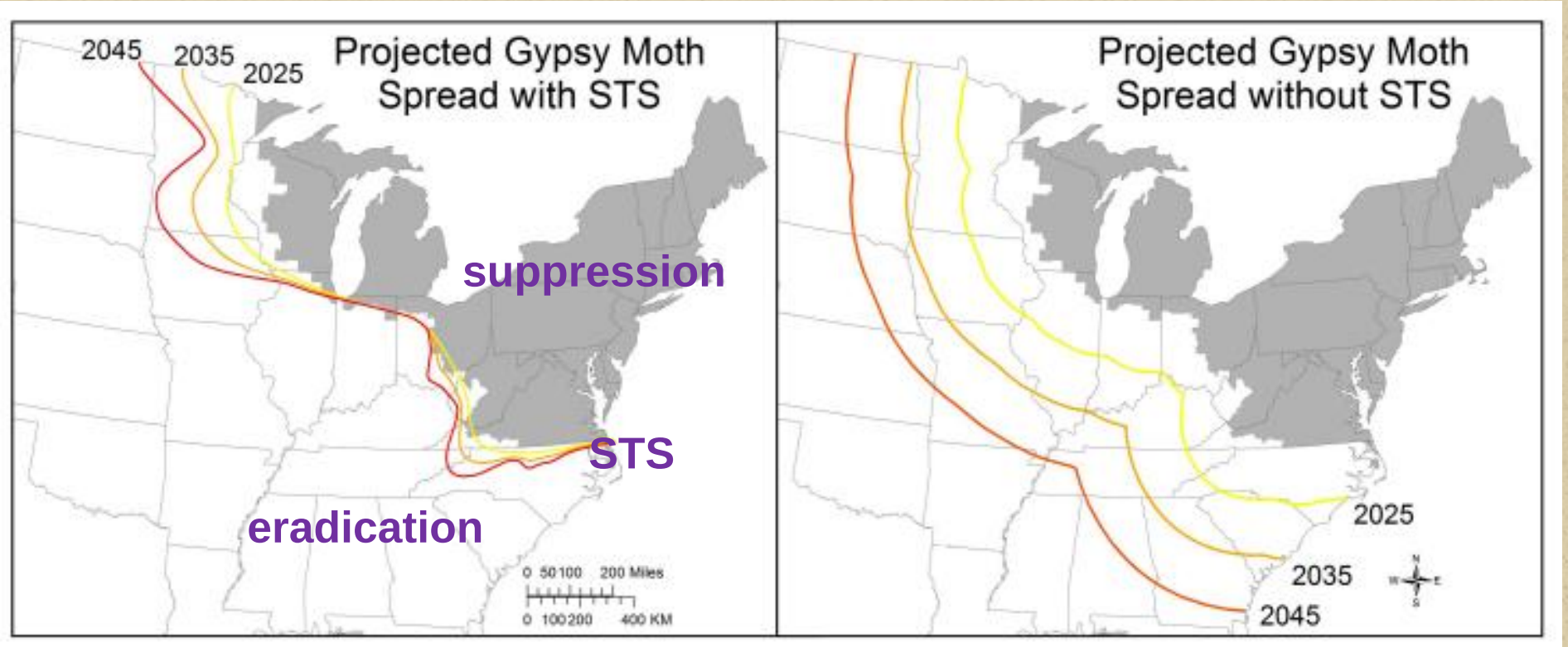
L. Chamberlin, 11/29/2018

Gypsy Moth

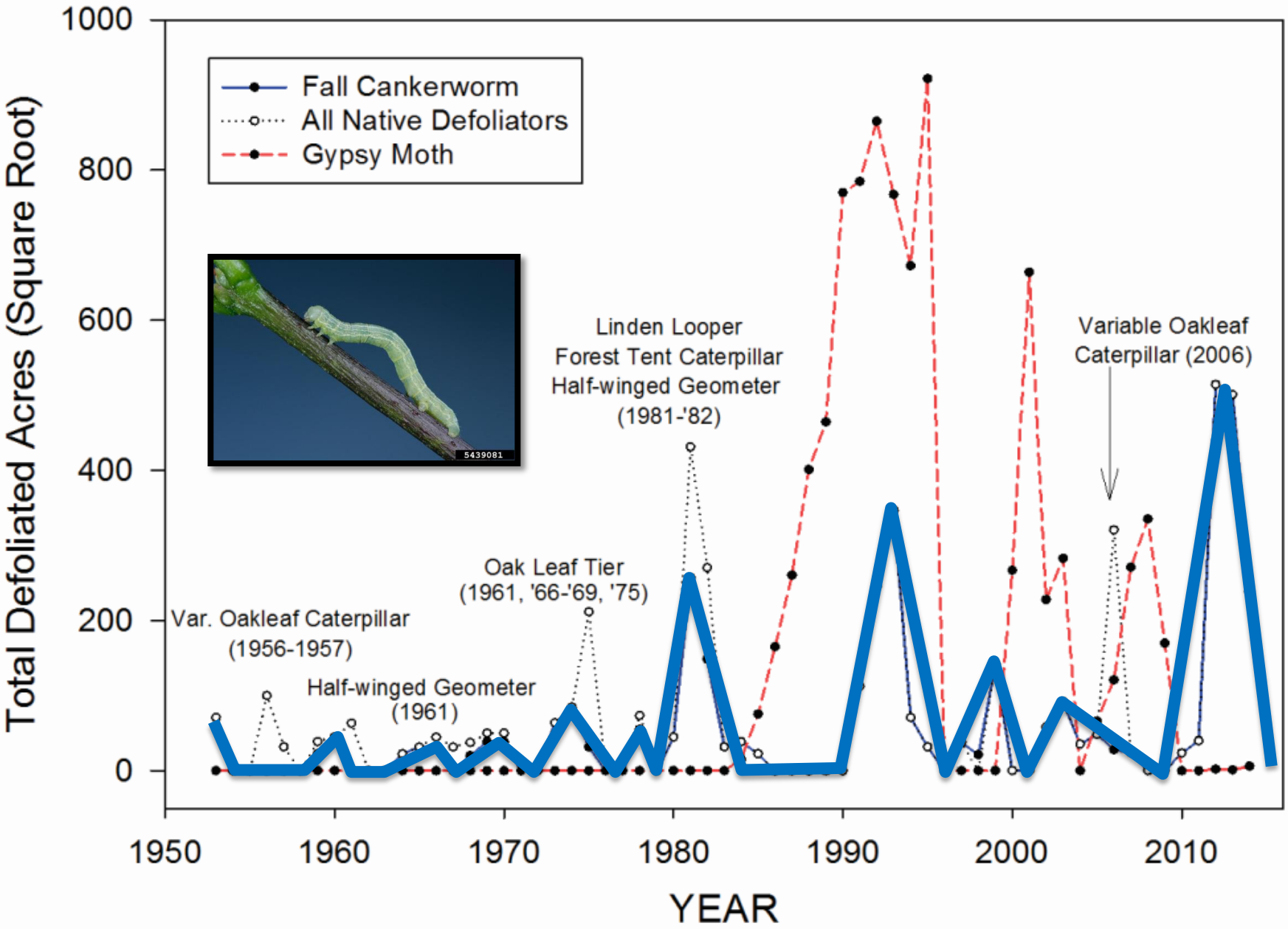
- Treatment: Mechanical, Chemical, Biocontrol

Gypsy Moth

National Gypsy Moth Program



Virginia Oak Defoliator Outbreak History



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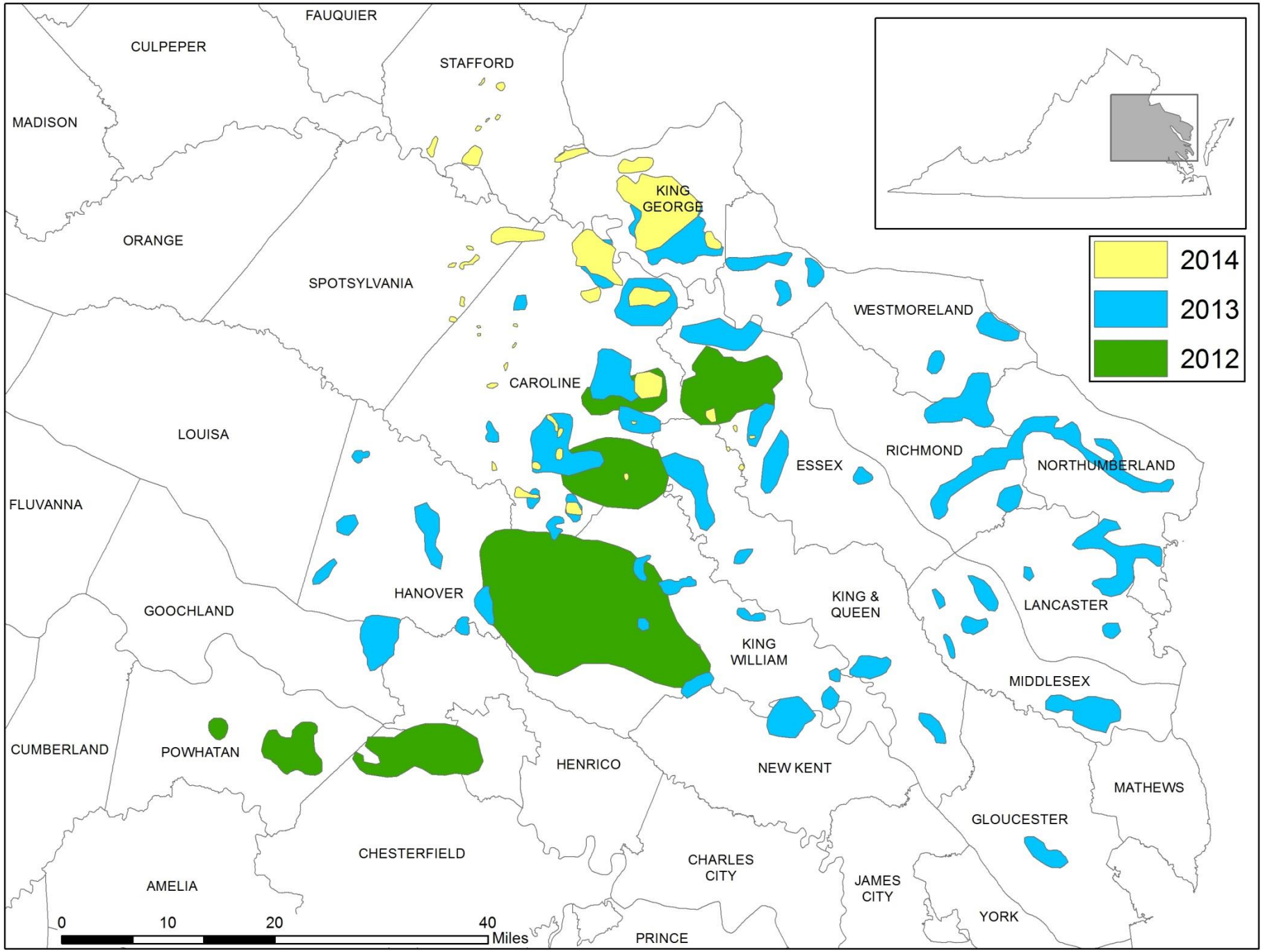
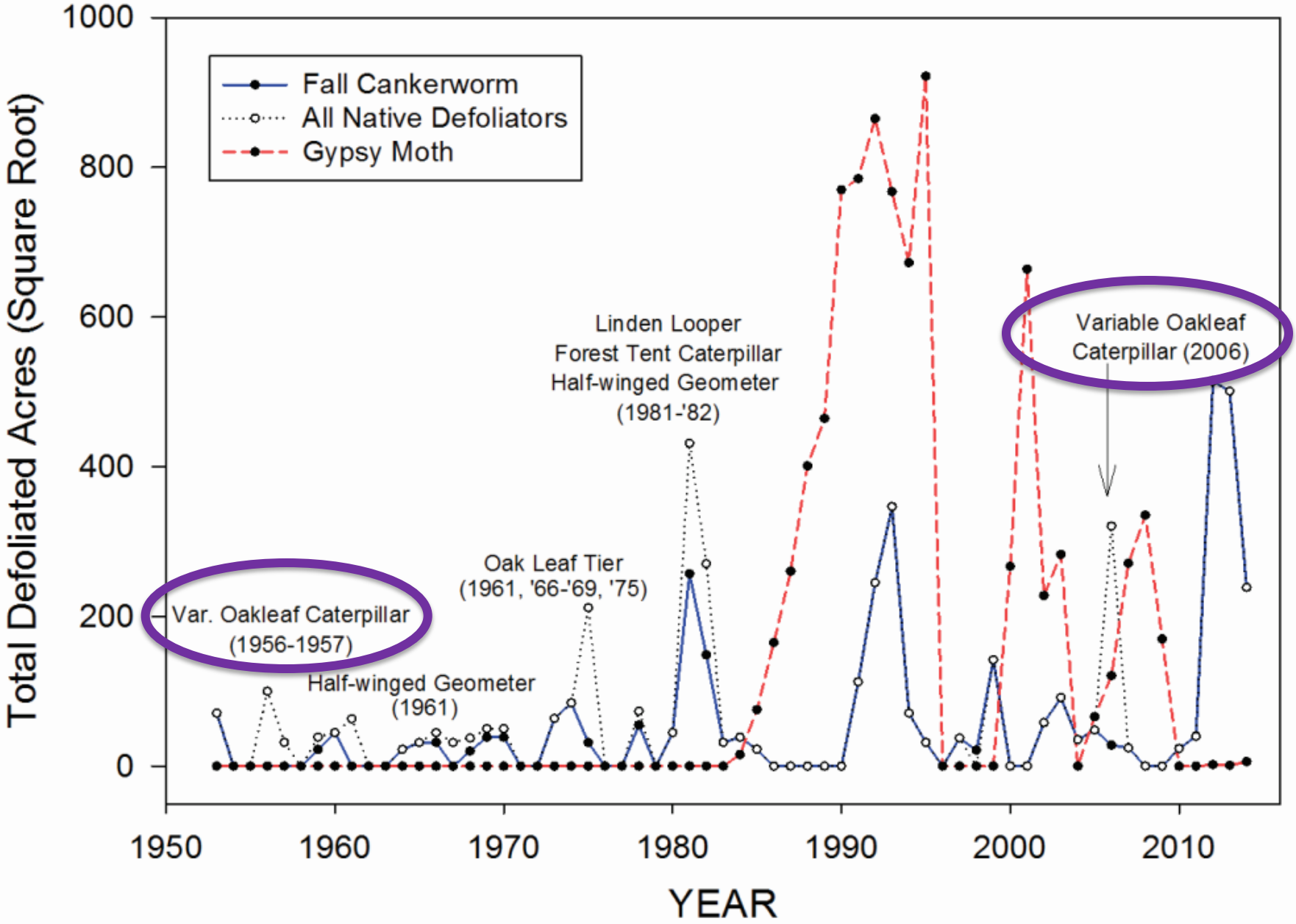

FAUQUIER
CULPEPER
STAFFORD
MADISON
KING GEORGE
ORANGE
SPOTSYLVANIA
WESTMORELAND
2014
2013
2012
CAROLINE
LOUISA
ESSEX
RICHMOND
NORTHUMBERLAND
FLUVANNA
HANOVER
KING & QUEEN
LANCASTER
GOOCHLAND
KING WILLIAM
MIDDLESEX
CUMBERLAND
POWHATAN
HENRICO
NEW KENT
MATHEWS
GLOUCESTER
CHESTERFIELD
CHARLES CITY
JAMES CITY
AMELIA
YORK
PRINCE
0
10
20
40
Miles

Fall Cankerworm

Fall Cankerworm

- Most common recurring defoliator in Virginia
- Population crashed after 2014
- Where did the cankerworm go?

Virginia Oak Defoliator Outbreak History



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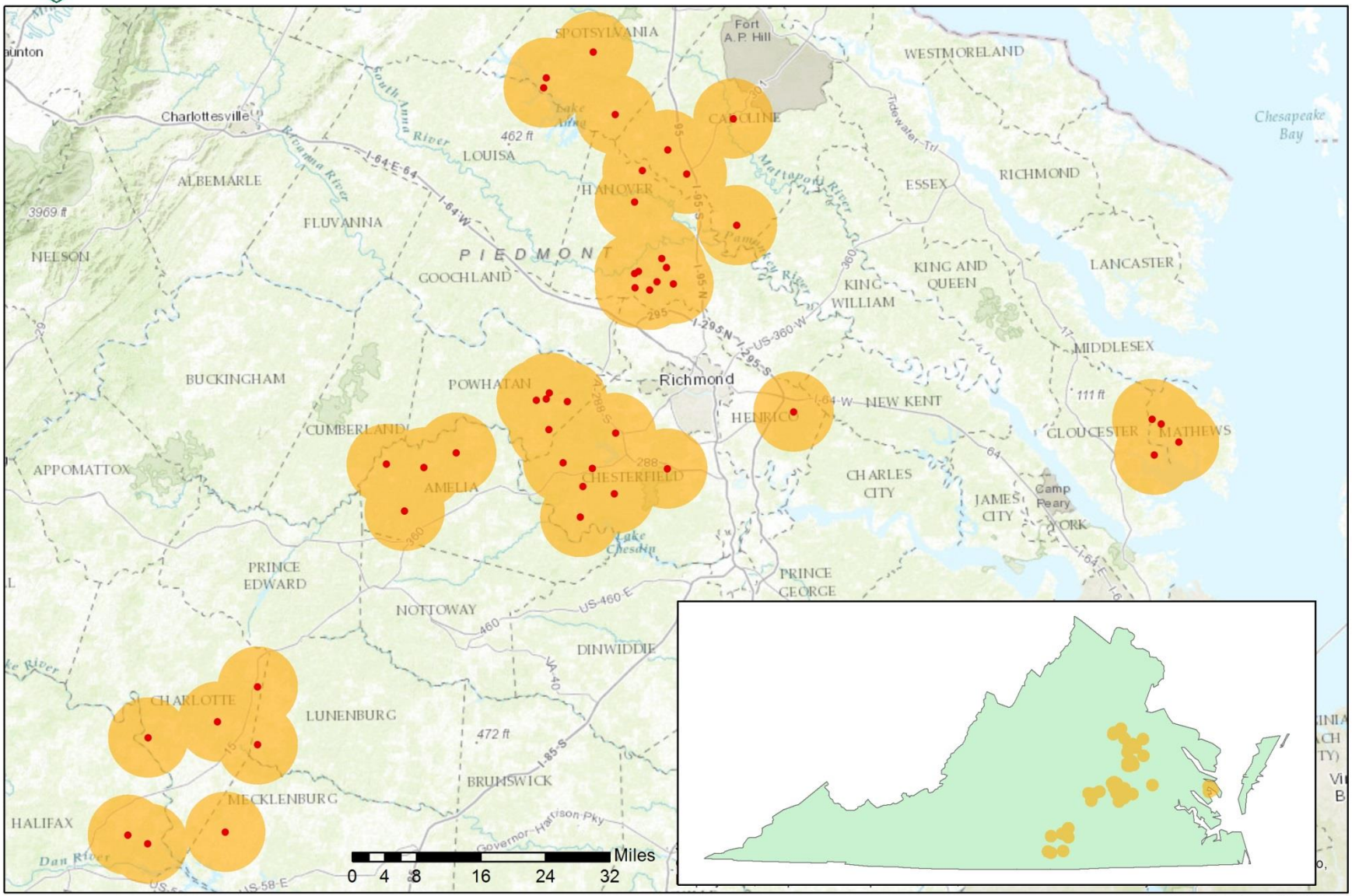
Variable Oakleaf Caterpillar

Variable Oakleaf Caterpillar 2017



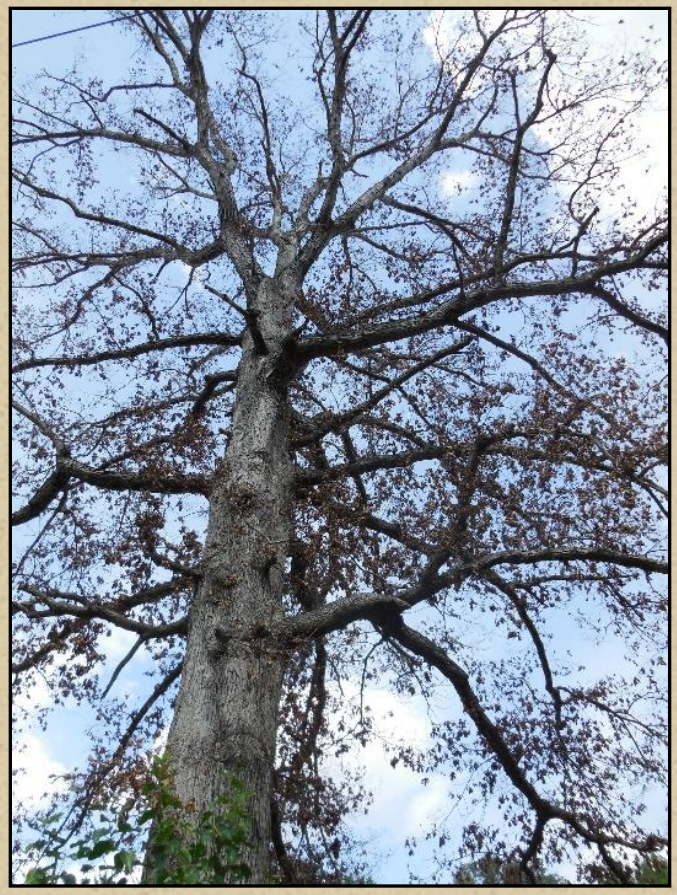
L. Chamberlin, 8/23/2017

Defoliation

- A **healthy** tree should recovery after one year of defoliation
- Defoliation of an tree that is **already stressed**, will lead to decline
- Multiple consecutive years of defoliation may lead to tree mortality

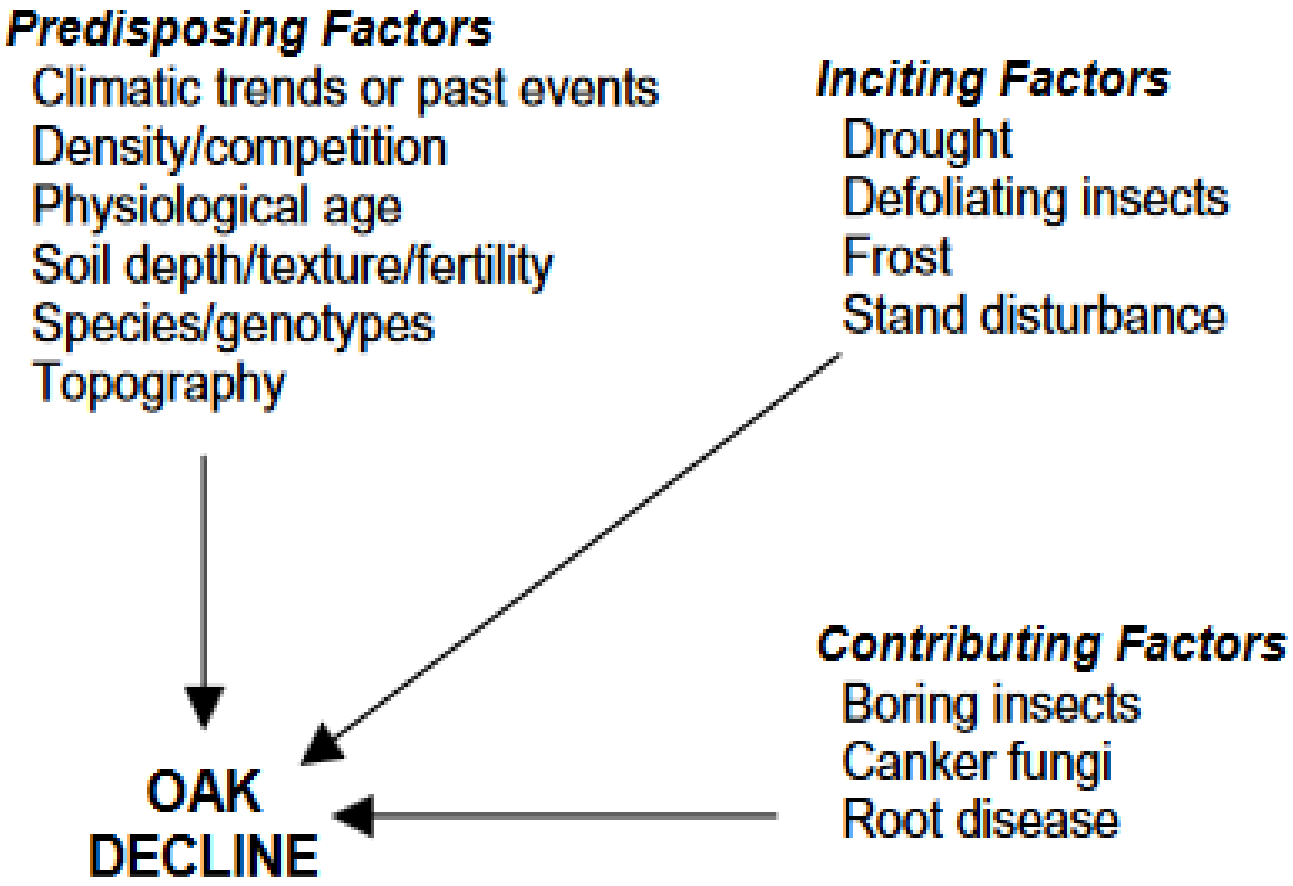
Oak Decline

- Symptoms
  - Crown dieback progressing from top down and outside inward
  - Premature autumn leaf color
  - Foliage browning but remaining on tree
  - Tree mortality after a few years or decades



Oak Decline

- The **gradual** failure in the health of a tree that results from the **interaction** between three groups of stress factors: predisposing, inciting, and contributing



Causal factors of oak decline organized by their function in the decline syndrome.

From: Starkey et al. 2004.

OAK DECLINE AND RED OAK BORER IN THE INTERIOR HIGHLANDS OF ARKANSAS AND MISSOURI: NATURAL PHENOMENA, SEVERE OCCURRENCES

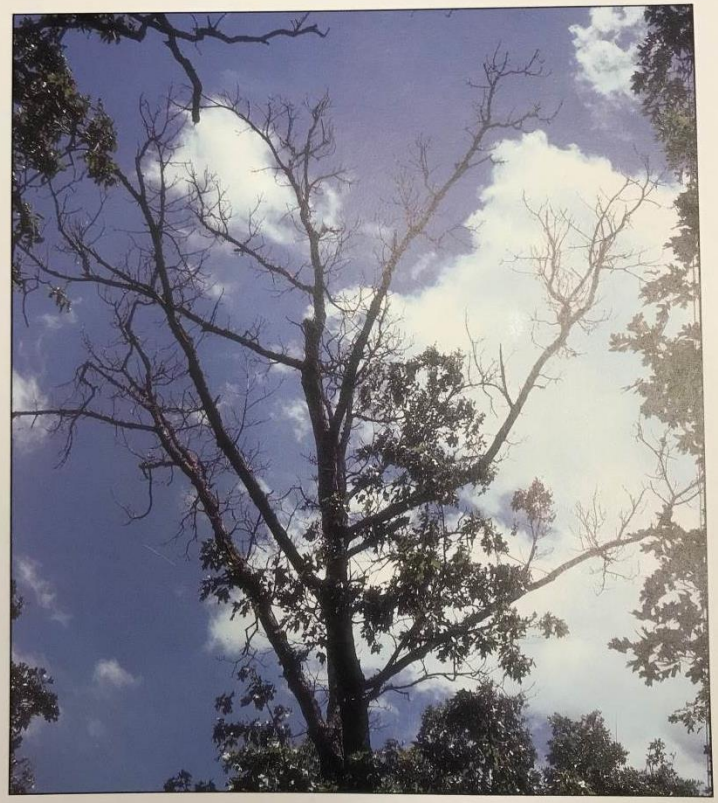
Citation for proceedings: Spetich, Martin A., ed. 2004. Upland oak ecology symposium: history, current conditions, and sustainability. Gen. Tech. Rep. SRS–73. Asheville, NC: U.S. Department of Agriculture, Forest Service, Southern Research Station. 311 p.

United States Department of Agriculture

Forest Service
Southern Region

Protection Report R8-PR 17
September 1989

Evaluation of Oak Decline Areas In The South



W Oak, Steven & A Starkey, Dale & M Dabney, Joseph. (1988). Oak Decline Alters Habitat in Southern Upland Forests. Proc. Annu. Conf. Southeastern Assoc. Fish Wildlife Agencies. 42.

United States Department of Agriculture

Forest Service

Southeastern Forest Experiment Station

Resource Bulletin SE-123

Incidence and Impact of Oak Decline in Western Virginia, 1986

Steven W. Oak
Cindy M. Huber
Raymond M. Sheffield

Oak Decline

- **Predisposing Factors**: weaken tree over time
  - Poor soil
  - Topography
  - Competition
  - Advanced age

https://invest-in-albania.org/prolonged-drought-takes-toll-crops/

Oak Decline

- **Inciting Factors**: rarely kill the tree outright but initiate decline
  - Defoliating insects
  - Drought events
  - Frost

Oak Decline

- **Contributing Factors**: secondary pests that ultimately lead to tree death
  - Boring insects
  - Root diseases

Armillaria Root Rot

- Fungus colonizes roots and base of trunk
- Results in insufficient water and nutrient transport
- Branch dieback and crown thinning
- Causes wood to decay
- Trees fall over
- **Secondary disease** in our forests

Armillaria Root Rot

White mycelial fans

Photo: William Jacobi, Colorado State University, Bugwood.org

Honey-colored mushrooms

Black shoe-string rhizomorphs

Hypoxylon Canker

- aka Biscogniauxia canker
- Most common on stressed red/post oaks
- Bark becomes thin and flakes off
- Spores travel in wind and are everywhere
- Weak pathogen – only kills stressed trees

Hypoxylon Canker

Photo: Molly Giesbrecht, Texas A&M AgriLife Extension Service, Bugwood.org

Photo: Robert L. Anderson, USDA Forest Service, Bugwood.org

Decline Disease Spiral

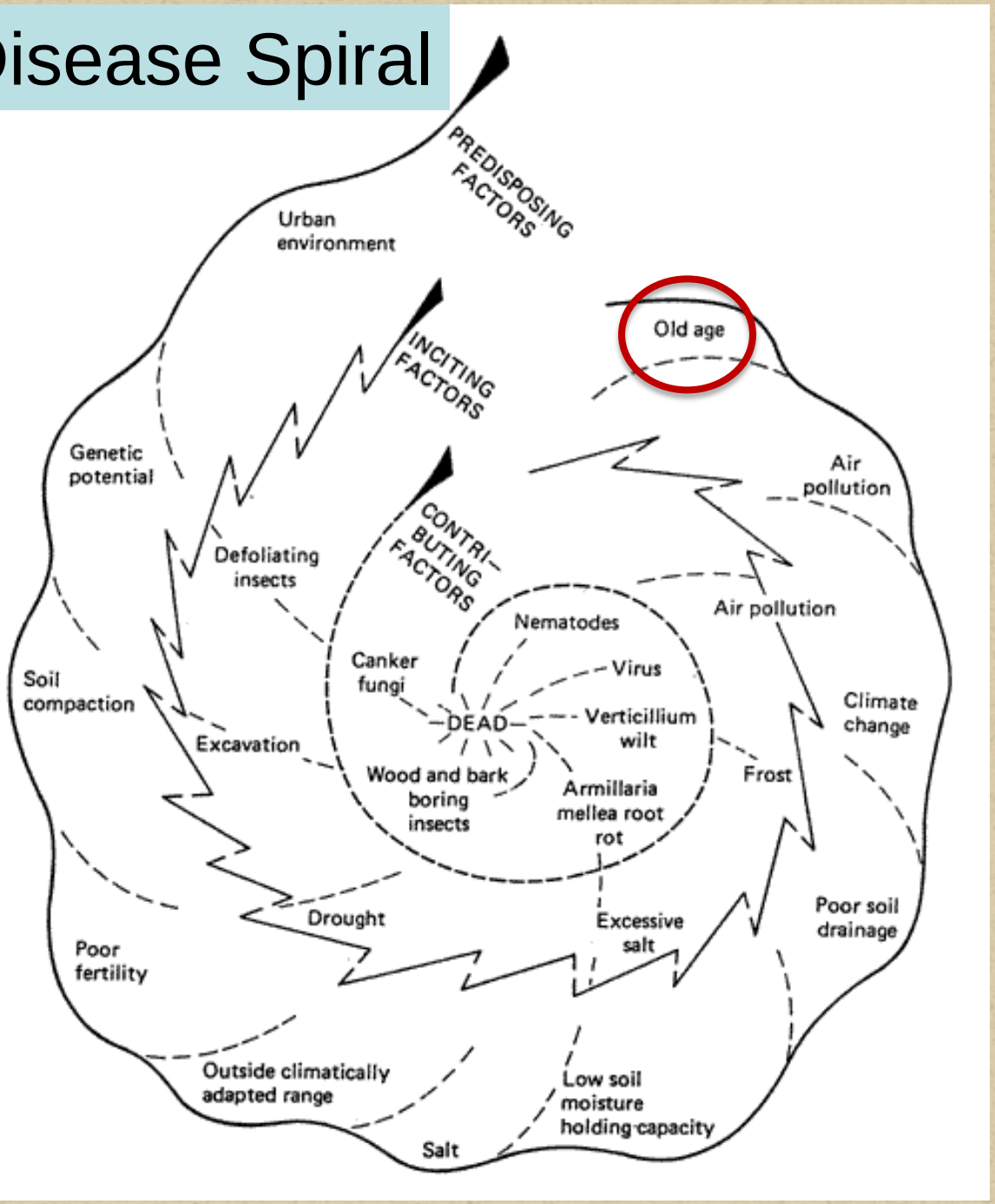
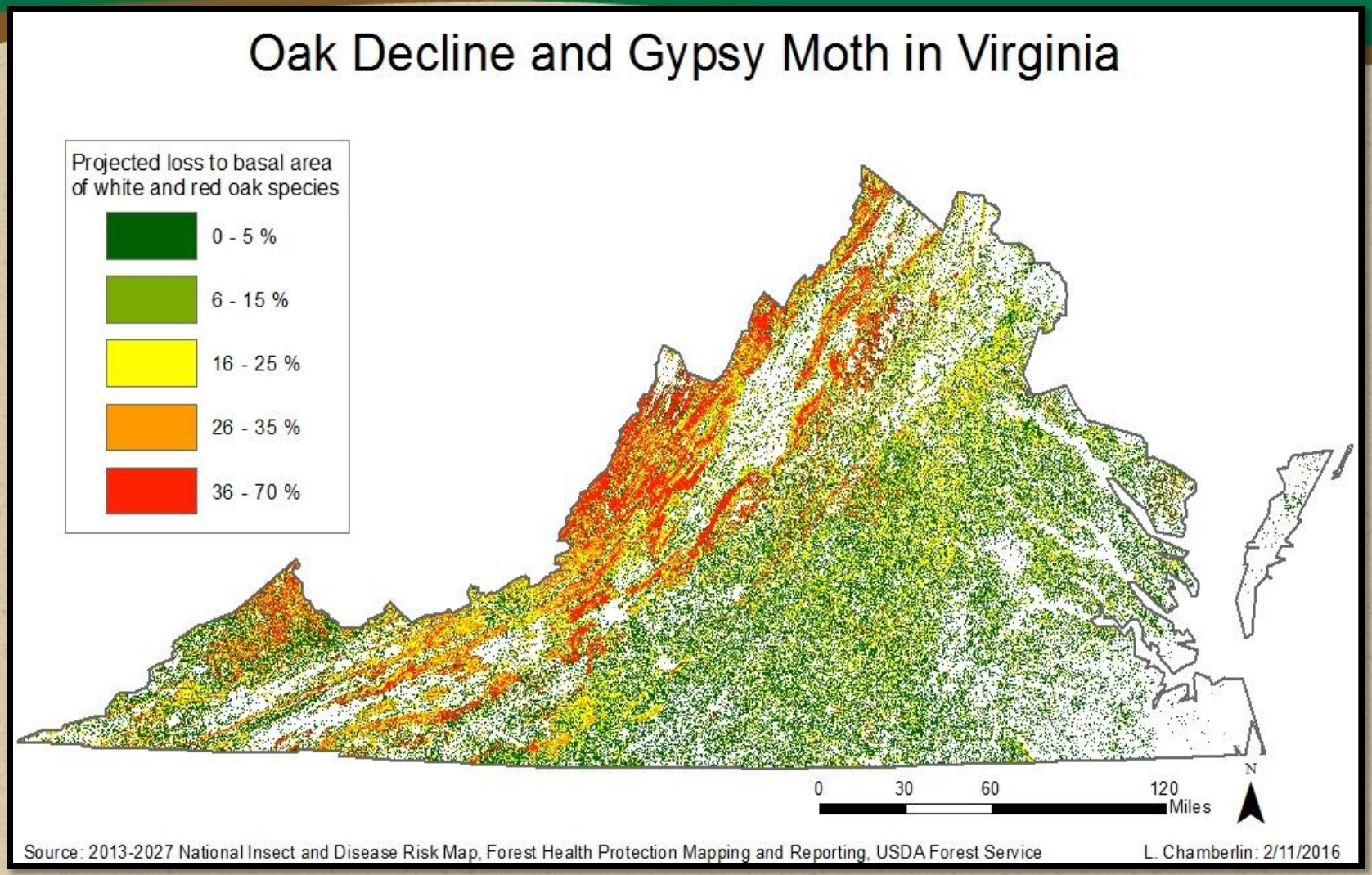


Fig. 1. Decline disease spiral (Reprinted with permission from Tree Disease Concepts by Paul D. Manion c 1991, Prentice-Hall, Inc., Englewood Cliffs, NJ).

Oak Decline

- Prior to 1900s, southern Appalachian forests were dominated by American chestnut in many places
- Chestnut Blight!
- Oaks came in as a relatively even-age cohort after the loss of chestnut
- These oaks are now reaching mature ages → predisposing factor for decline

Oak Decline


Oak Decline and Gypsy Moth in Virginia
Projected loss to basal area of white and red oak species
0 - 5 %
6 - 15 %
16 - 25 %
26 - 35 %
36 - 70 %
0
30
60
120
Miles
N
Source: 2013-2027 National Insect and Disease Risk Map, Forest Health Protection Mapping and Reporting, USDA Forest Service
L. Chamberlin: 2/11/2016

What's killing my oak tree??

frost

flooding

gypsy moth

hypoxylon canker

poor soil

physiological age

armillaria root rot

bacterial leaf scorch

red oak borer

variable oakleaf caterpillar

chemical damage

climate change

density/competition

fall cankerworm

oak button gall

anthracnose

drought

soil compaction

topography

two-lined chestnut borer

Questions

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