Urban/Suburban Ecology

Virginia Master Naturalist Training

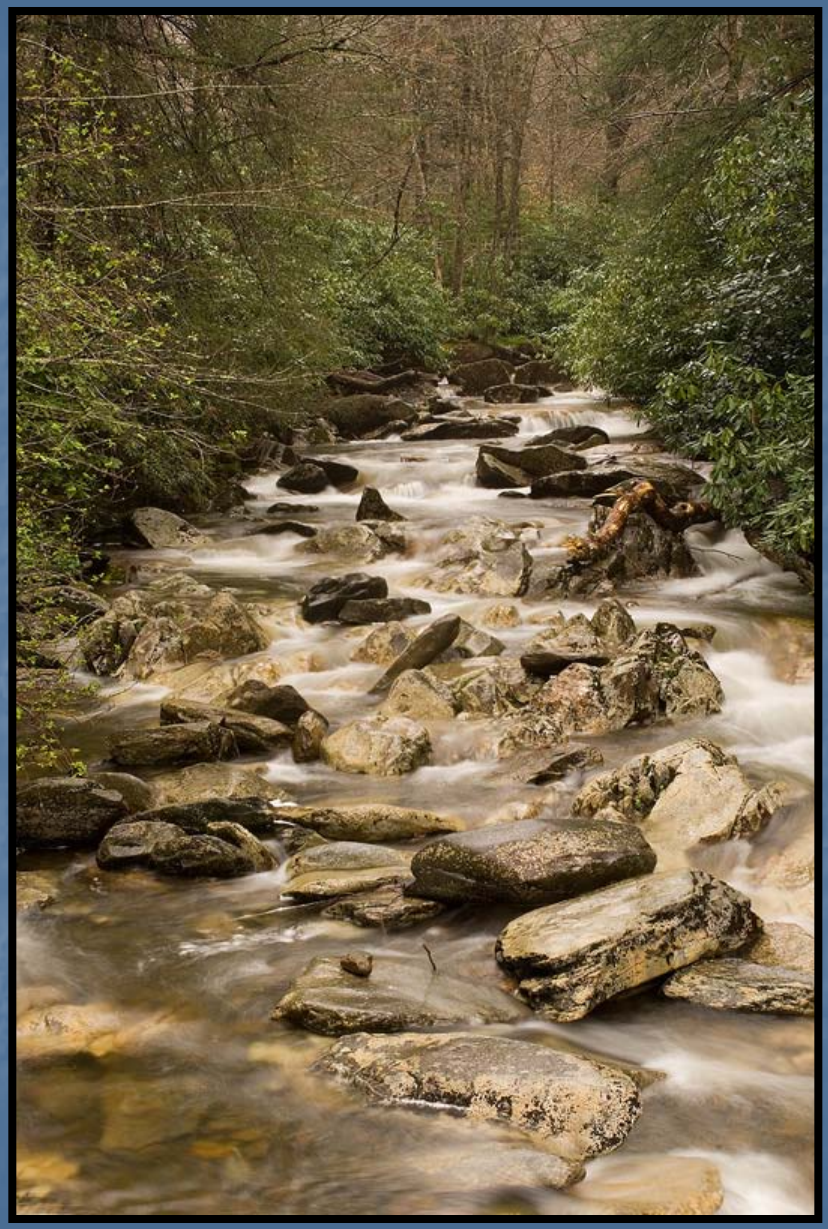
Merrimac Farm Chapter

Presented by Julia Flanagan

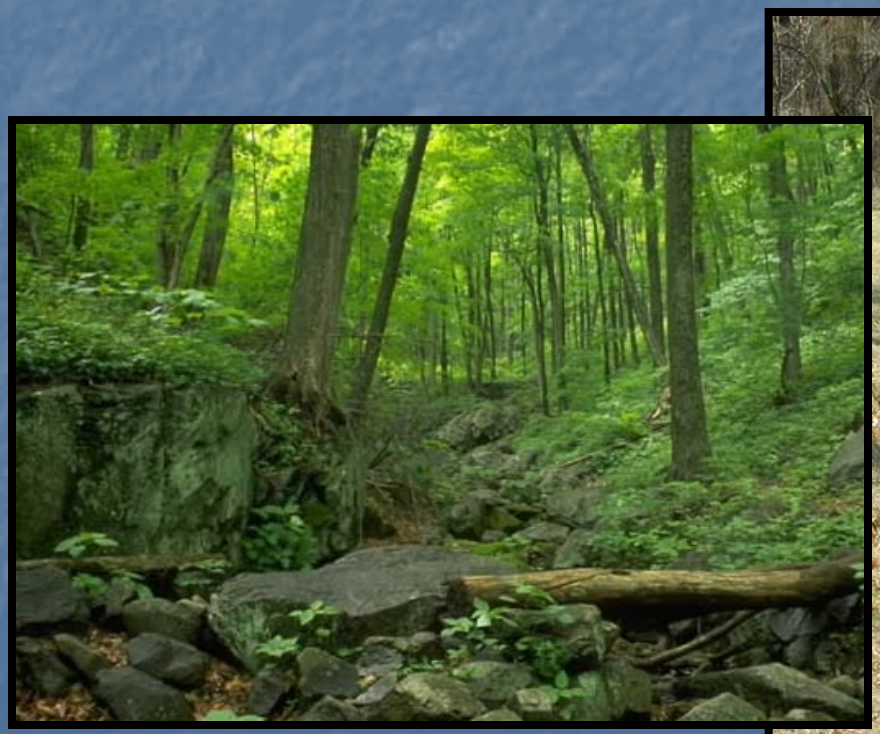
July 9, 2009

I. Urban Ecology Defined

Urban Ecology is a network of living organisms and non-living elements interacting dynamically to sustain life.



The Distinction is the Degree to which the Ecosystem is *Influenced by Human Activity*

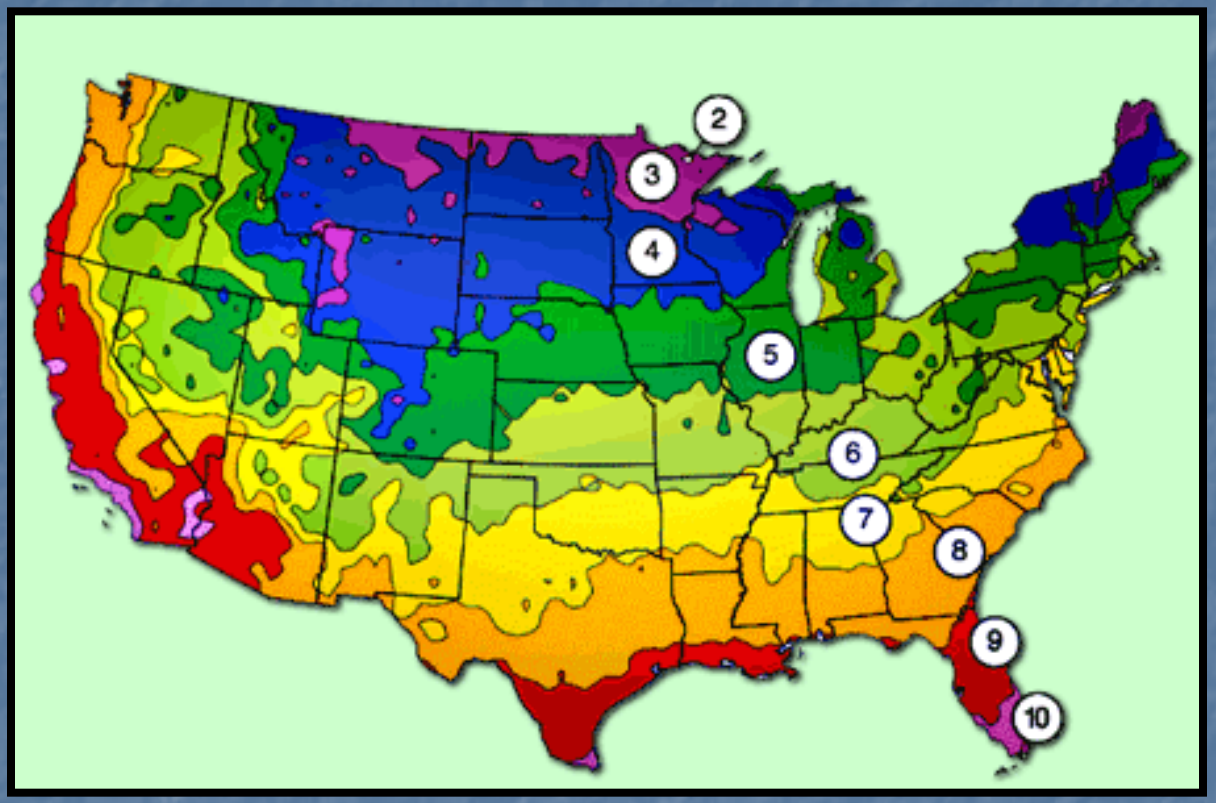


II. Characteristics of the Urban/Suburban Ecosystem

- Some Basic Ecological Concepts
  - Macroclimate and Microclimate
  - Carrying Capacity
  - Cover
  - Food Web
  - Nutrient Cycling
  - Niche

Macroclimate - Example

USDA Plant Hardiness Zone Map



Zone 2
-40 to -50

Zone 3
-30 to -40

Zone 4
-20 to -30

Zone 5
-10 to -20

Zone 6
0 to -10

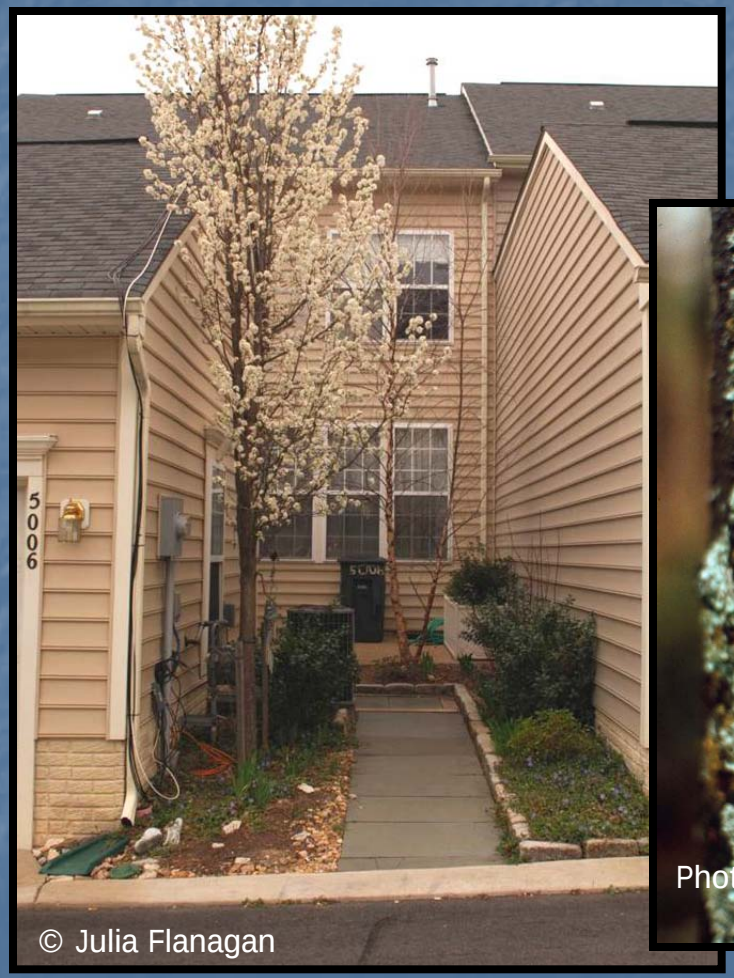
Zone 7
10 to 0

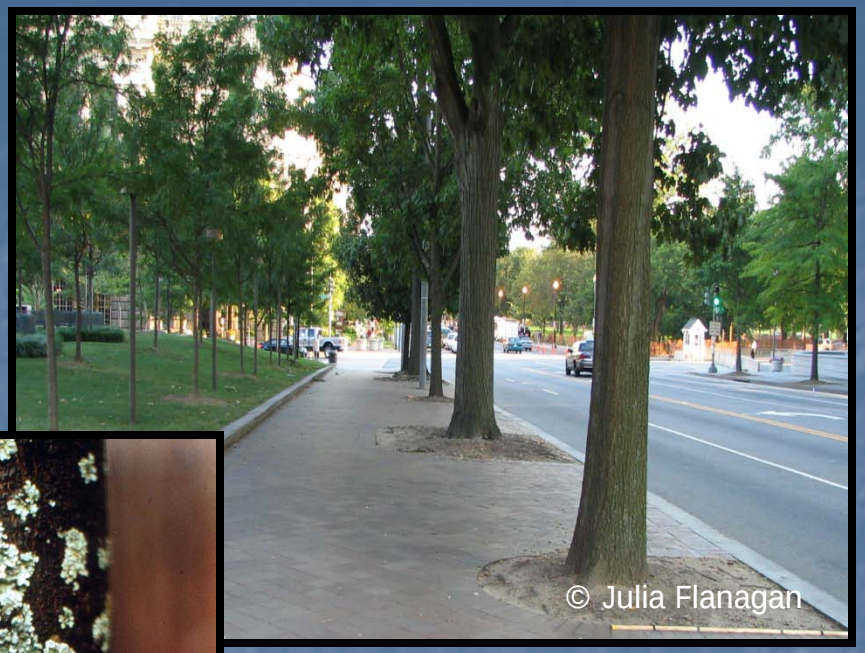
Zone 8
20 to 10

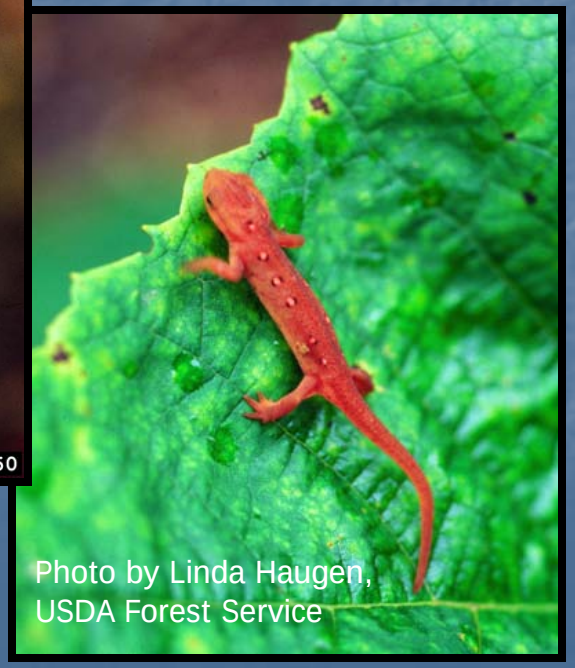
Zone 9
30 to 20

Zone 10
40 to 30

Microclimate







II. Characteristics of the Urban/Suburban Ecosystem

High Degree of Human Influences

- Level of Disturbance
- Mix of Native & Developed Landscapes
- Invasive, Non-native Species
- Greater Input of Chemicals
- Simplification

Levels of Disturbance: Rural vs. Urban Dwellers 1790 – 2000

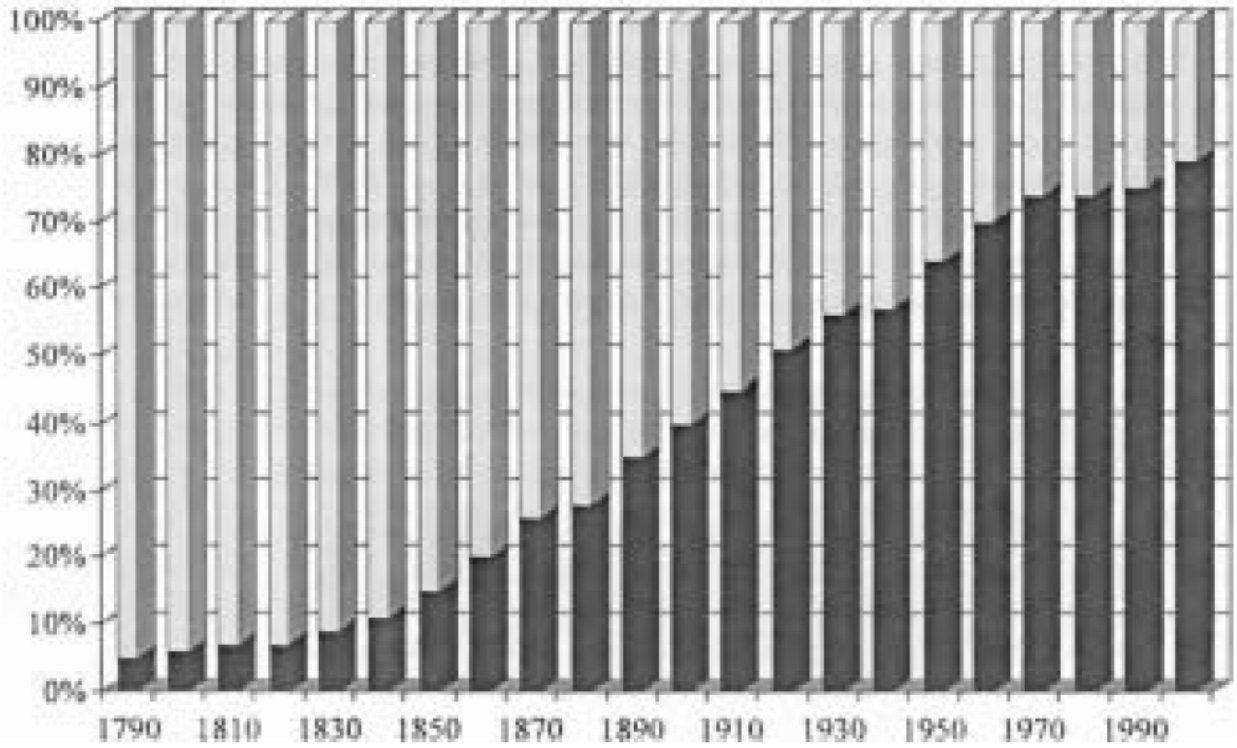
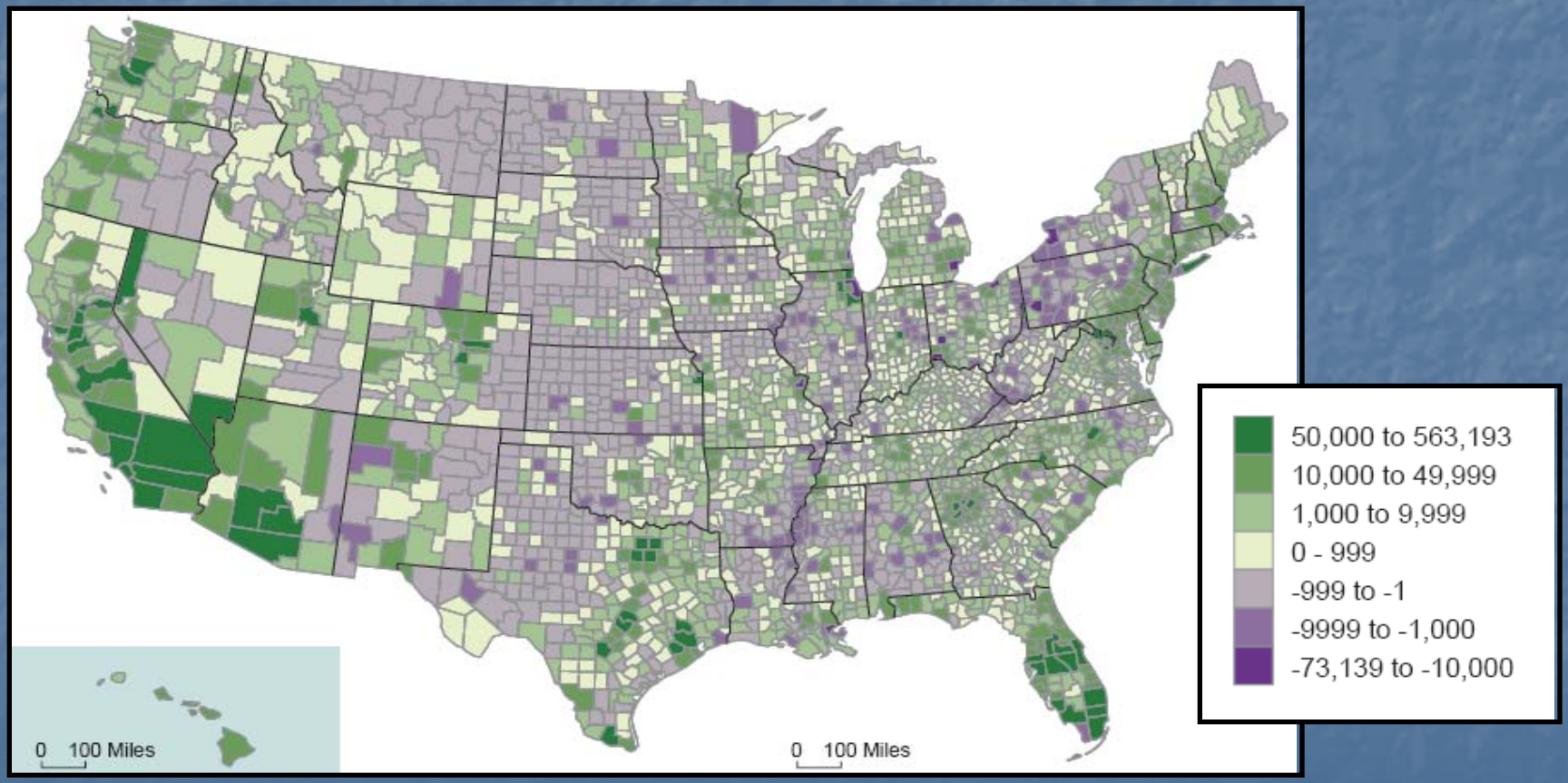


Figure 1. Proportion of U.S. residents classified as rural (light-colored portion) versus urban (dark-colored portion) dwellers from 1790 to 2000. The U.S. Bureau of Census classifies urban-suburban regions as areas with >193 people per km^2 (>50 people per mi^2). Urban-suburban residents have increased from about 5% in 1790 to about 80% by 2000. (Data derived from U.S. Bureau of Census.)

DeStephano, et. al., 2005

Numeric Change in Population: 2000 to 2005



Source: U.S. Census Bureau Population Estimates Program

Numeric Change in Population: 2000 to 2005

Source: U.S. Census Bureau Population Estimates Program

Level of Disturbance

Prince William County

Population

- Current : ~ 388,000
- Growth from 1980 – 1990: 49.1%
- Growth from 1990 – 2000: 30.2%
- Growth from 2000 – 2008: 38.2%

Acres of Land Issued Permits for Clearing:

2003: 3500 acres

2004: 4800 acres

2006: ~1200 acres

Mix of Natural & Man-made Landscapes

Rt. 15 Corridor

2004

Characteristics of the Urban/Suburban Ecosystem

- Non-native Invasives

  Organisms not historically natural to an area, but introduced either intentionally or accidentally by people, and that tend to invade and become established in natural areas.

  - Typically have a destructive or disruptive effect.
  - May have some beneficial aspects
    - Food source
    - Nutrient Uptake

Characteristics of the Urban/Suburban Ecosystem

- High Chemical Inputs

Atmosphere: Higher levels ground level ozone, nitrous oxides, carbon dioxide

Streams/Water: Siltation, Temperature, Nitrogen, Phosphorous

Soils: Over fertilization and fallout from air pollutants.

Characteristics of the Urban/Suburban Ecosystem

- Simplification

  The loss of the complexity of a healthy, native ecosystem to the simplistic environs of man.

  - Soil
  - Plant Communities
  - Animal Communities

Simplification Cont.

The loss of complexity in an ecological community

Buffer of Preserved Native Forest -
17 Species of Trees & Shrubs

Man-made Buffer – 1 Species
(White Pine)

III. Threats to a Healthy Urban Ecology

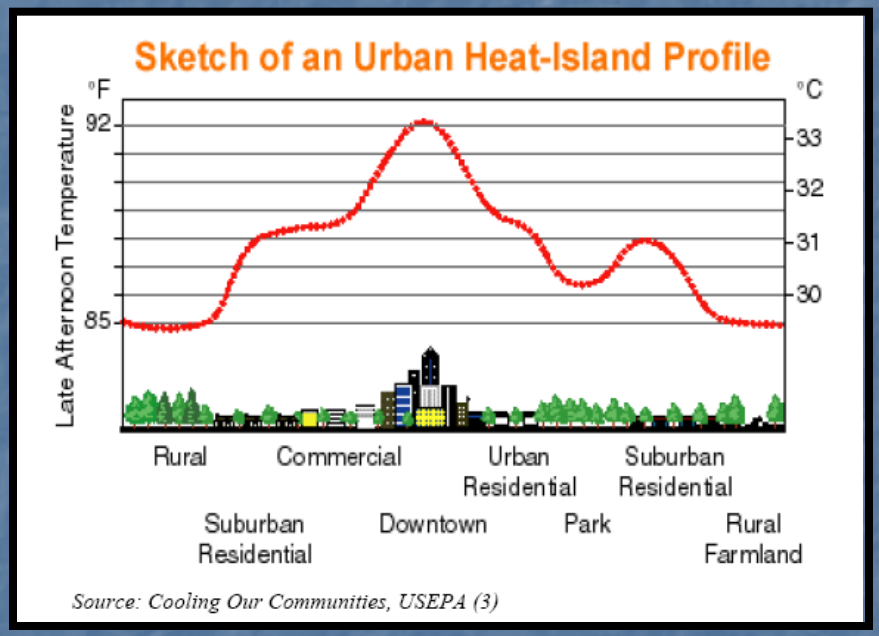
- Habitat Loss
- Pollution
  - Urban Heat Island Effect
- Fragmentation
- Invasive, Non-native Species

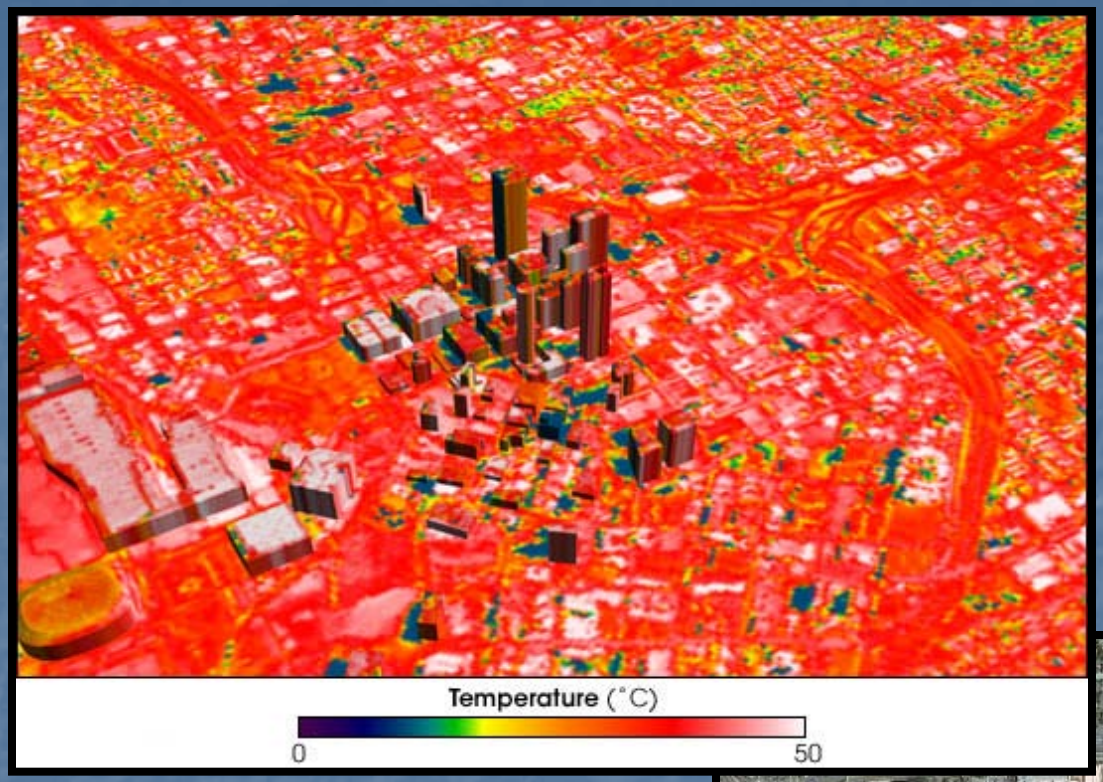
Threats: Pollution and the Urban Heat Island Effect

Causes:

- Loss of Tree Cover
- Radiant Heat from Increased areas of Dark Surfaces (e.g., roads, roofs)
- Reflective heat off Buildings
- Heat generated from Vehicles & Buildings

www.epa.gov/heatisland





Thermal Image, Atlanta, GA

May 11-12, 1997

Aerial Image Atlanta

~ 2007

Threats: Fragmentation

- Defined:

The loss of larger tracts of habitat or the breaking up of a contiguous area of habitat into smaller areas resulting in similar habitats being separated or isolated from each other.

Threats: Fragmentation cont'

Rt. 15 Corridor

2000

2004

Effects of Fragmentation

- Research on Birds, in particular, shows:
  - Species that rely on large forest tracts have less habitat for breeding & foraging
  - Increased levels of brood parasitism
  - Increased levels of nest predation.
  - Result is lower reproductive success in the habitat that remains (Brittingham & Temple 1983; Wilcove 1985; Martin 1988; Robinson et al. 1995).

- http://www.birds.cornell.edu/conservation/tanager/

Ovenbird

Scarlet Tanager (Male)

Edge to Interior

Fragmentation/Urbanization Winners & Losers

- Winners
  - Canada Goose
  - White Tailed Deer
  - Racoon
  - Robins
  - Bluejays
  - American Toad
  - Coyote
- Losers
  - Scarlet Tanager
  - Cerulean Warbler
  - Wood Thrush
  - Timber Wolf
  - Mountain Lion

Threats: Invasive, Non-native Species

Defined: *An organism introduced, either intentionally or accidentally, into an area or ecosystem in which it had not historically occurred.*

- Not all non-native introductions become invasive.
- However, many have been devastaing.

Short List of Invasive Non-native Pests

- English Ivy
- Japanese Honeysuckle
- Chinaberry
- Kudzu
- Japanese Stilt Grass
- Dutch Elm Disease
- Chestnut Blight
- Dogwood Discula anthracnose
- Sudden Oak Death
- Multi-flora Rose
- Callery Pear
- Autumn Olive
- Domestic Cat
- Snakehead Fish
- Starlings
- Fire ants
- Hemlock Wooly Adelgid
- Asian Longhorn Beetle
- Gypsy Moth
- Emerald Ash Borer

Why Non-natives are Bad

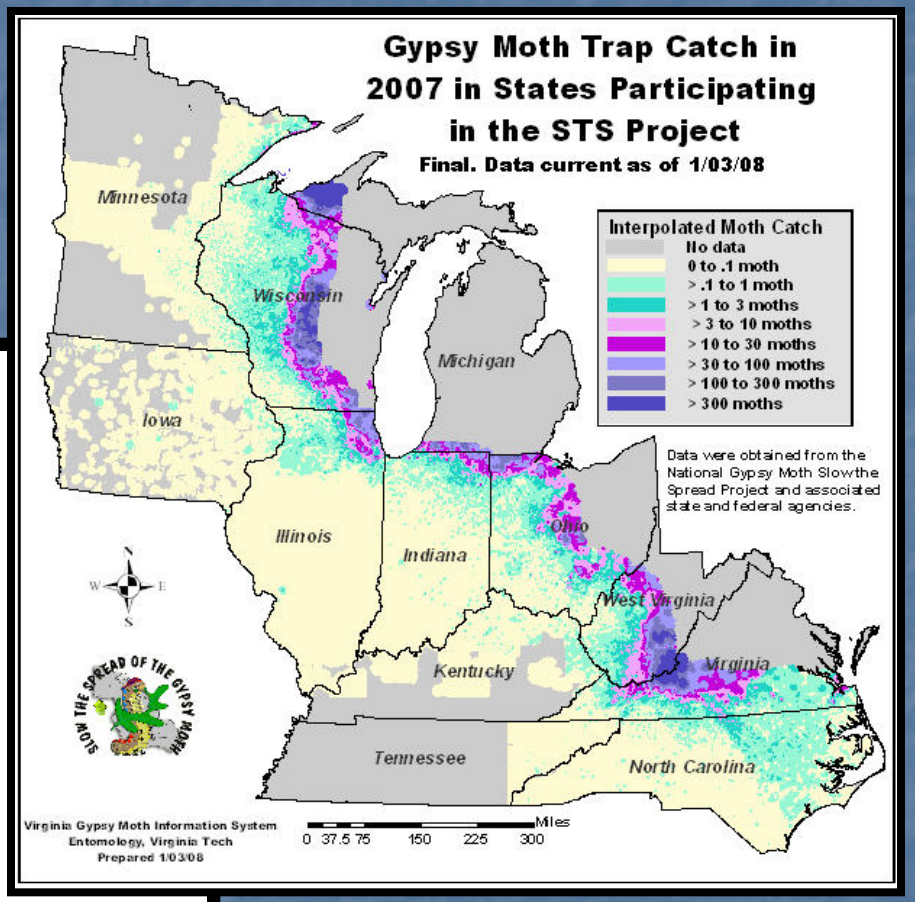
- Compete with natives for space, food, water & other limited resources.
- Can cause catastrophic death of important native species.
- Predation
- Disrupt the availability of foods during important period (breeding, migration)

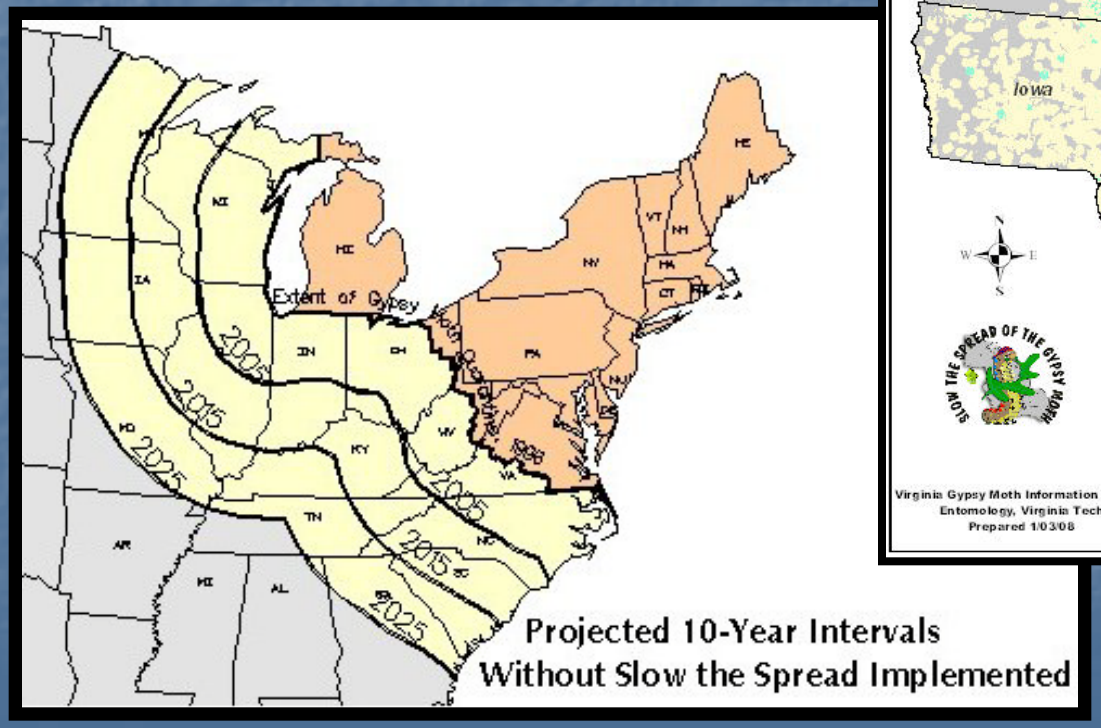
Gypsy Moth Life Stages

Eastern Tent Catepillar:
A Native that Knows Its Place

Forest Defoliated by Gypsy Moth

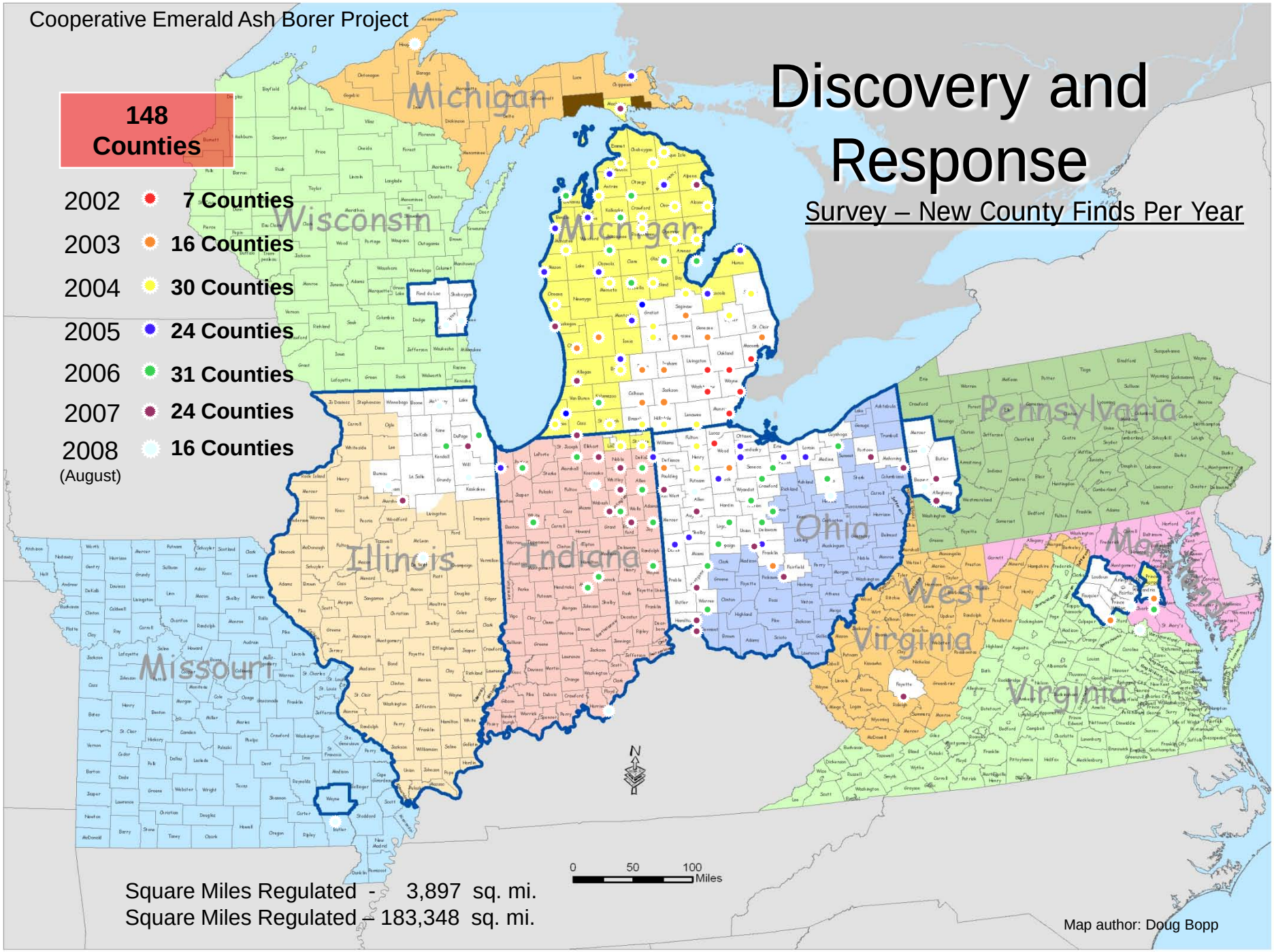
Gypsy Moth Spread





Emerald Ash Borer

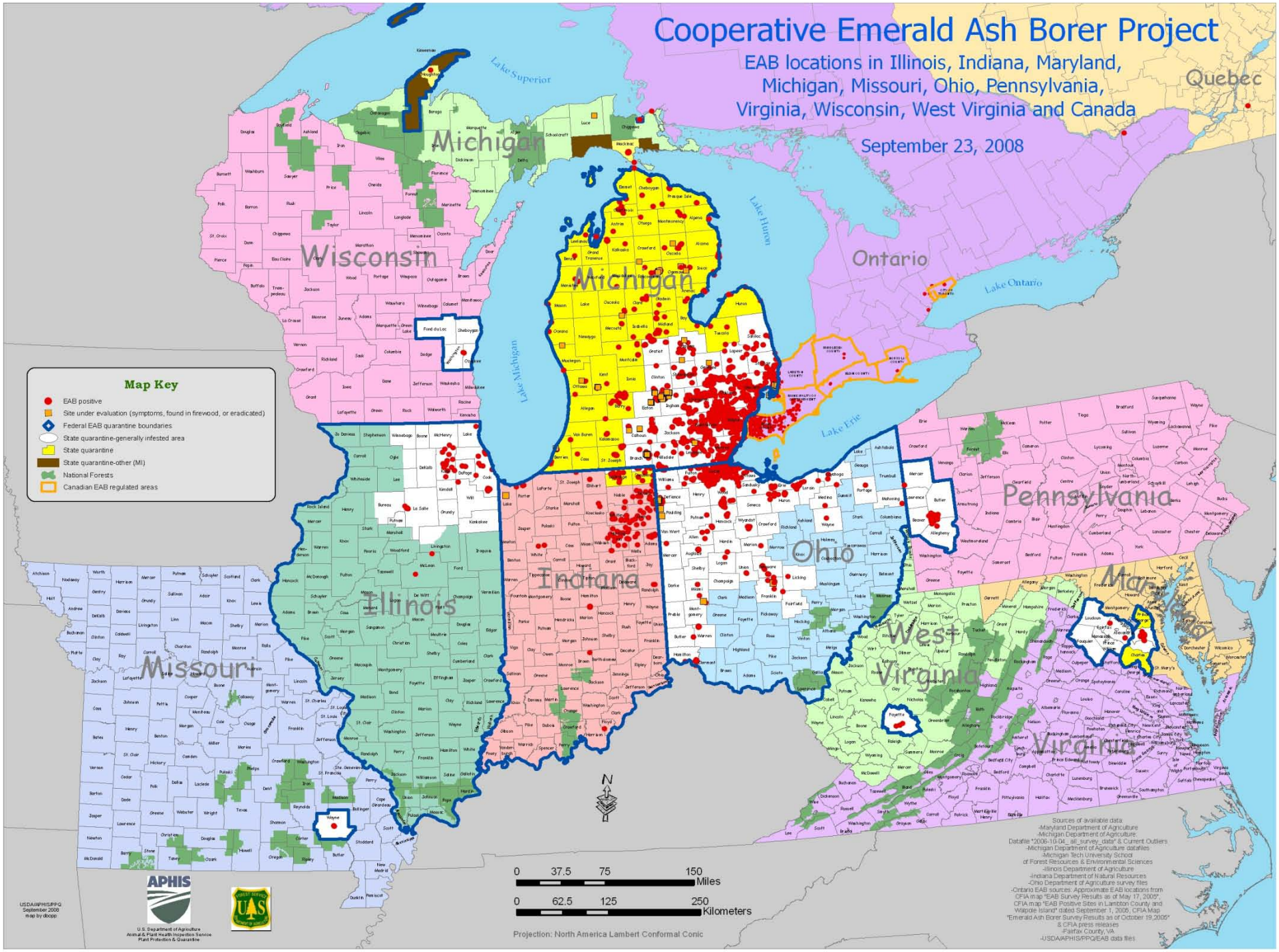
Declining Sections of Tree and Bark Splitting with Gallery Beneath.


Cooperative Emerald Ash Borer Project
Discovery and Response
Survey – New County Finds Per Year
148 Counties
2002 7 Counties
2003 16 Counties
2004 30 Counties
2005 24 Counties
2006 31 Counties
2007 24 Counties
2008 (August) 16 Counties
Michigan
Wisconsin
Michigan
Pennsylvania
Illinois
Indiana
Ohio
West Virginia
Virginia
Missouri
N
0 50 100 Miles
Square Miles Regulated - 3,897 sq. mi.
Square Miles Regulated – 183,348 sq. mi.
Map author: Doug Bopp

Cooperative Emerald Ash Borer Project

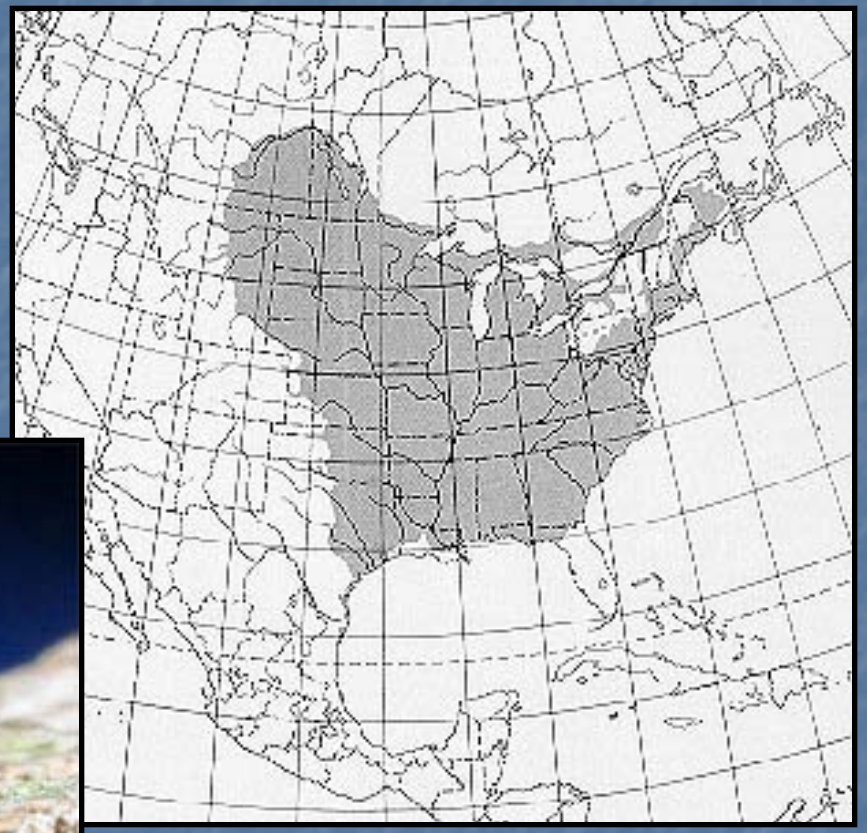
EAB locations in Illinois, Indiana, Maryland, Michigan, Missouri, Ohio, Pennsylvania, Virginia, Wisconsin, West Virginia and Canada

September 23, 2008



Emerald Ash Borer

Natural Range of Green Ash
(Fraxinus pennsylvanica)



IV. Principles, Tools & Methods for Urban Ecosystem Management

3 Principles

1. Preserve what is most valuable.
2. Restore to the best natural function of the land.
3. Educate to change people's thinking about the value of the natural world around us & how to improve it.

Preserving Nature

- Undeveloped vs. Protected Land
- Potential and Limitations of Local Government
- Private Opportunities

Preservation: Undeveloped vs Protected Land

- Undeveloped Land is not protected. Basically it is waiting to be developed.
- Protected Land has legally derived restrictions preventing development.
  - Chesapeake Bay Resource Protection Areas
  - Wetlands
  - Conservation Areas & Easements
  - National Parks vs National Forests

Preservation & Local Government

- Most Development,, is Regulated by Local Government through Zoning.
- Limited by the Dillon Rule
- Importance of Citizen Involvement

Local Government

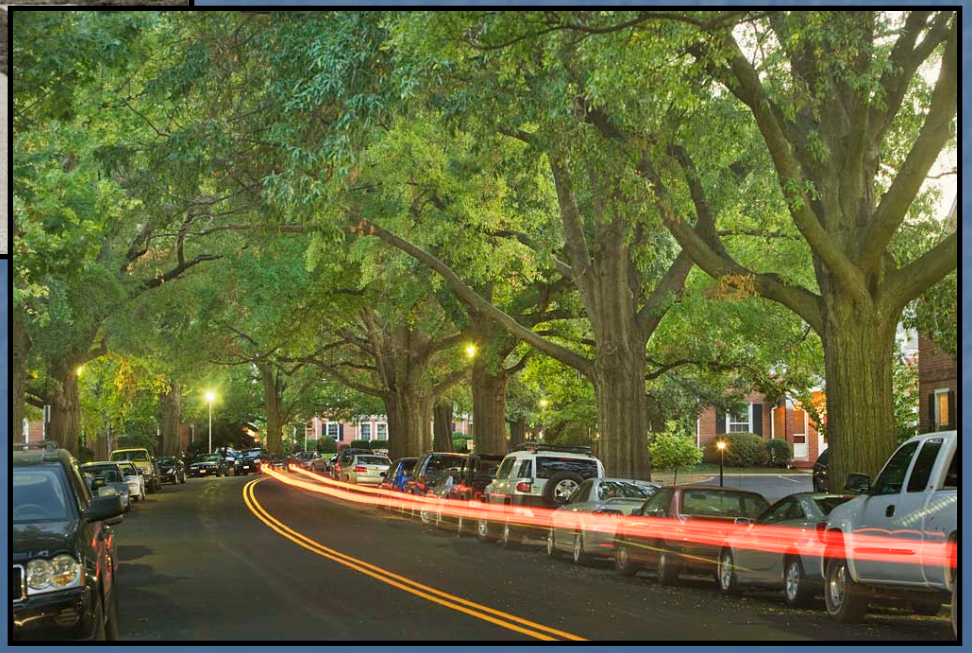
- Comprehensive Plan.
- Rezonings.

  Proffers
- Local Codes

  (Design & Construction Standards Manual)

Local Urban Forestry Codes

Arlington Co. ~1950



Arlington Co. ~2008

Private Opportunities

- Conservation Easement
- Transfer of Development Rights
- Purchase of Development Rights

Restoration

- Government Efforts
- Public/Private Efforts
- Private Efforts

Education

- The Importance of What Seems So Small
- The Value of Personal Example

Intermission