Important Invasive Pests in the Mid-Atlantic Region

2017 Allegheny SAF Winter Meeting

Feb. 17, 2017

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Outline

- Biological Invasions
- FIA Program changes
  - Periodic to annual
- Invasive Pests in Mid-Atlantic
- Regional Impact Analyses
- Interactive Web Tools

Biological Invasions

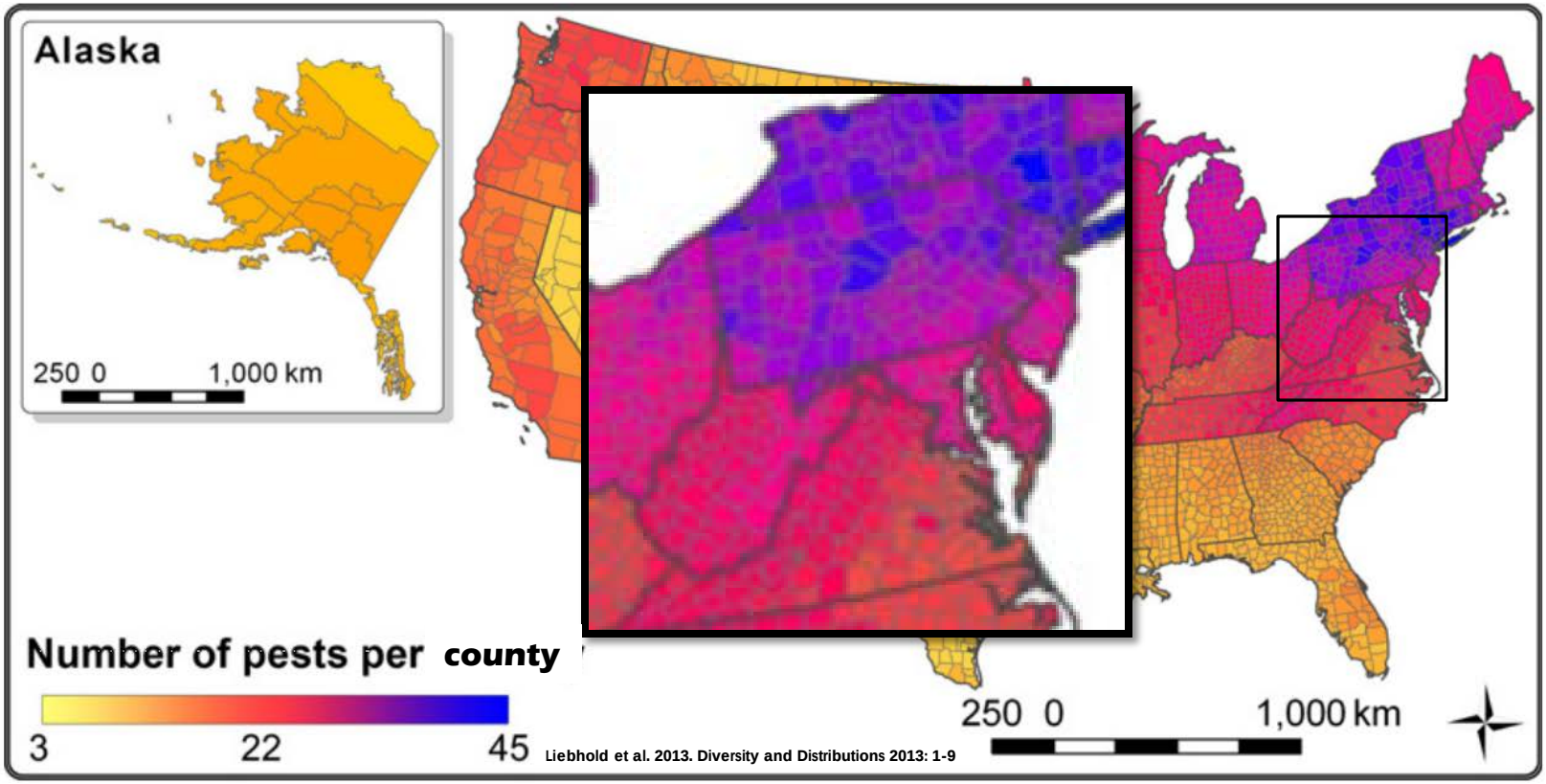
- ~ 2.5 invasions per year
  (Aukema et al. 2010. Bioscience 60: 886-897)
  - Most are inconsequential

- Some cause significant disturbance (e.g., chestnut blight)
  - Eliminate hosts
  - No longer disturbance factors

- Some become established (e.g., gypsy moth)
  - Host damage/mortality
  - Recurrent outbreaks

‘Hot Spot’ of Invasion

Non-native forest pest species richness is highest in the northeast US

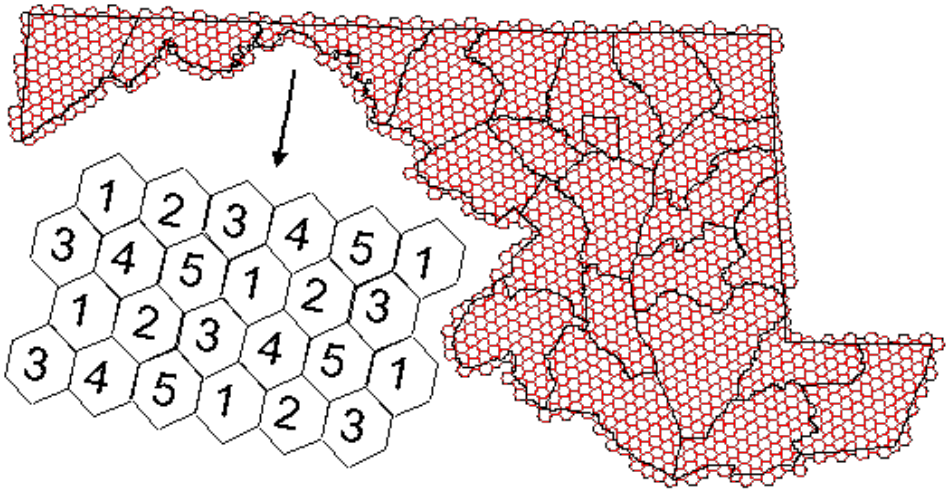


- Propagule pressure
- Habitat invisibility
- Invasion spread

FIA Annual Inventory

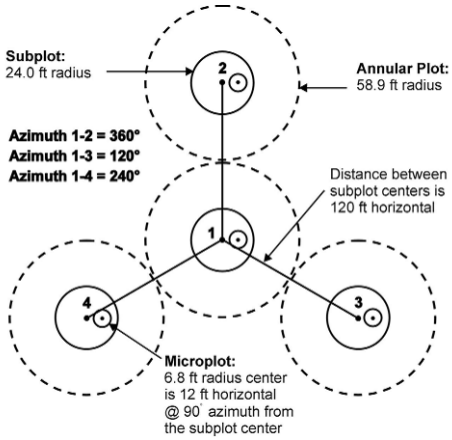
Periodic:

- State inventories
- 10-15 year intervals
- Spotty plot re-measurement



Annual:

- National inventory
- 7-year re-measurement in most of the East
- Most plots re-measured

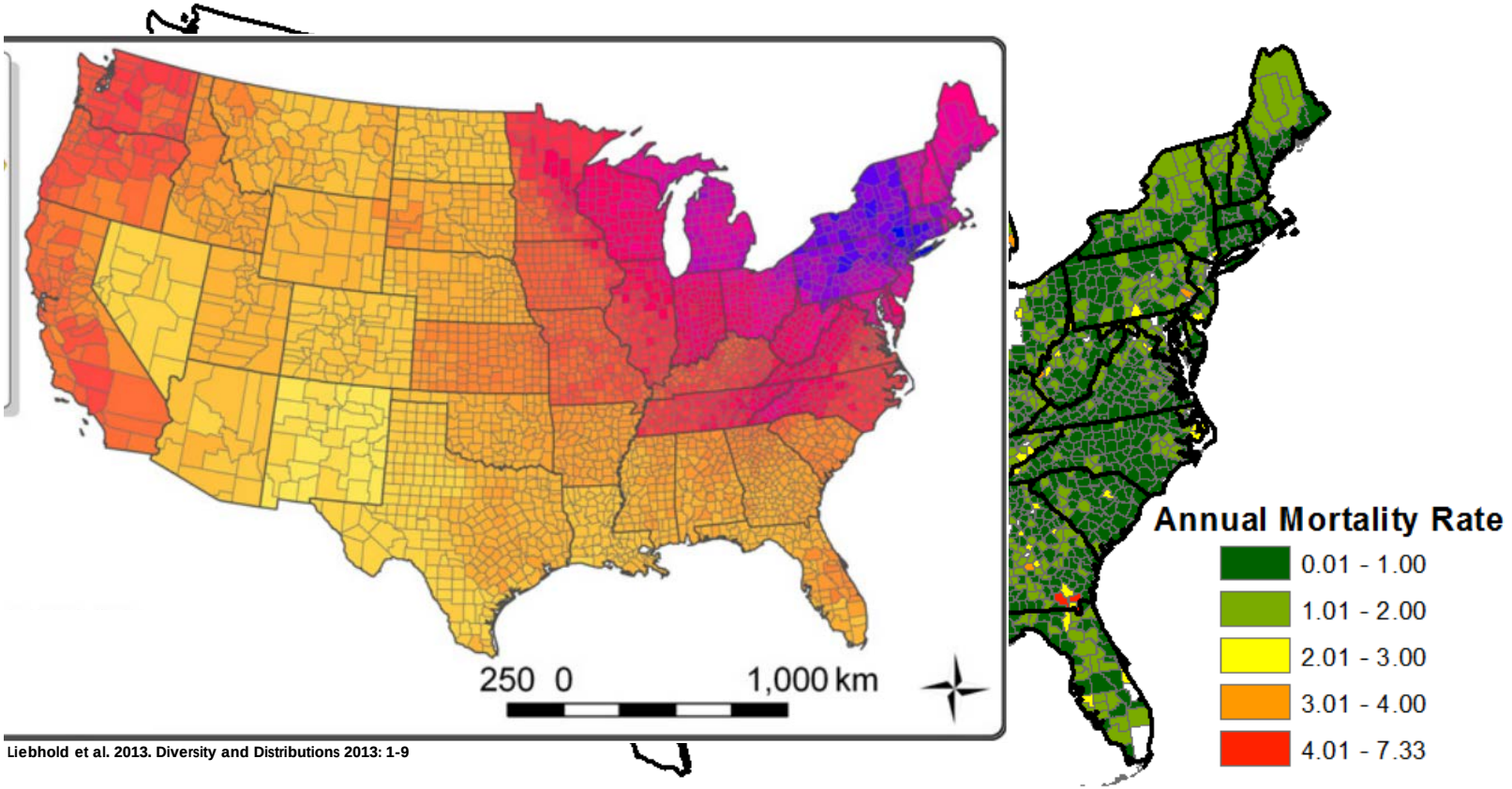


2002 → 2009
2003 → 2010
2004 → 2011
2005 → 2012
2006 → 2013
2007 → 2014
2008 → 2015

Result is a much more useful dataset for estimating growth and mortality rates

County-Level Mortality Rates

Pattern of mortality is not associated with number of invasions



Liebhold et al. 2013. Diversity and Distributions 2013: 1-9

- **Propagule pressure**
- Habitat invisibility
- **Invasion spread**

Anthropogenic Movement

Major Invasions in the Mid-Atlantic

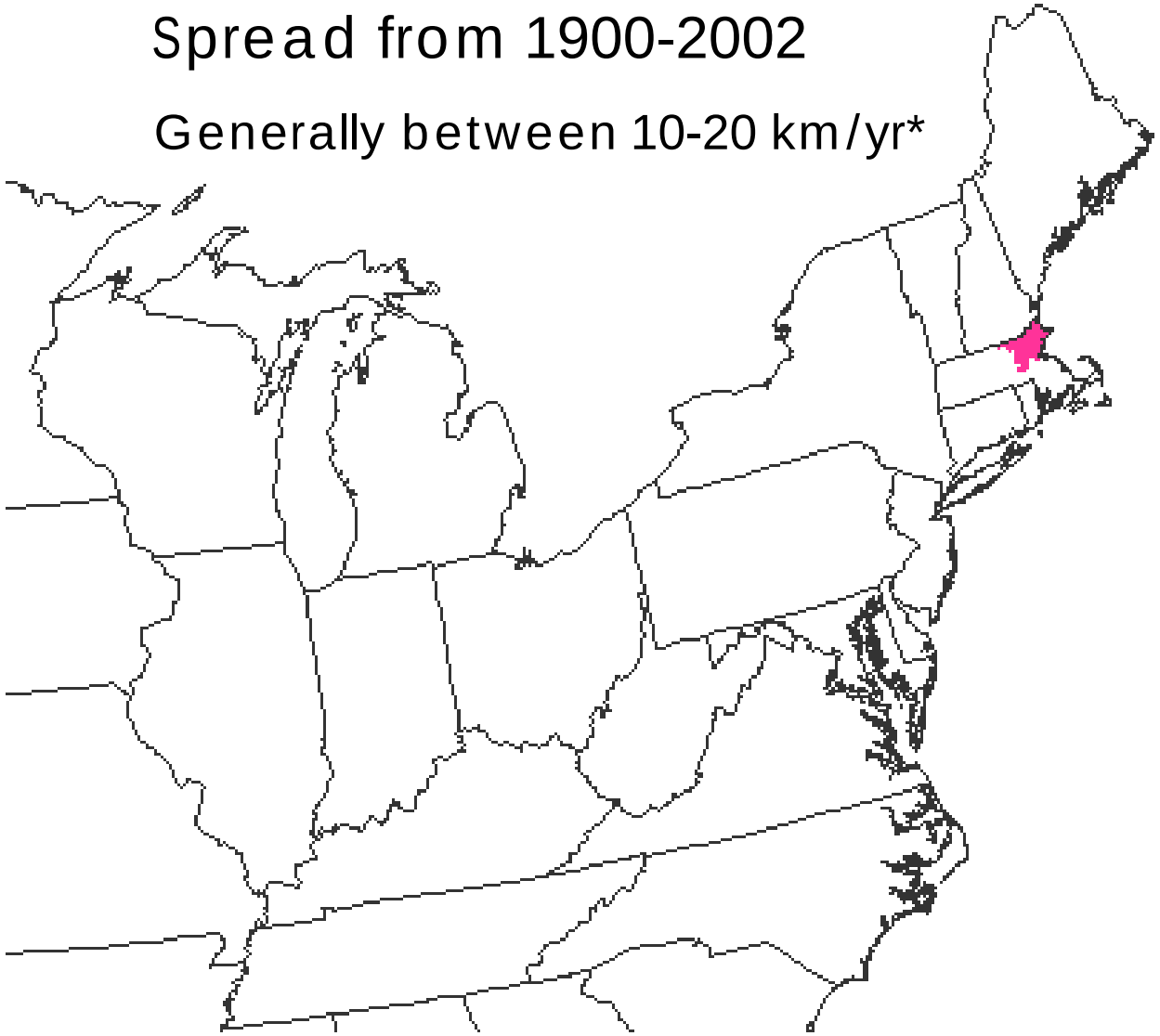
- Gypsy moth – Boston, MA (1869)
- Beech Bark Disease – Halifax, NS (1890)
- Chestnut Blight – NYC (1904)
- Hemlock Woolly Adelgid – Richmond, VA (1951)
- Emerald Ash Borer – Detroit, MI (1990)
- *Spotted Lantern Fly – Berks Co., PA (2014)

Gypsy Moth (GM)

GM Range in US

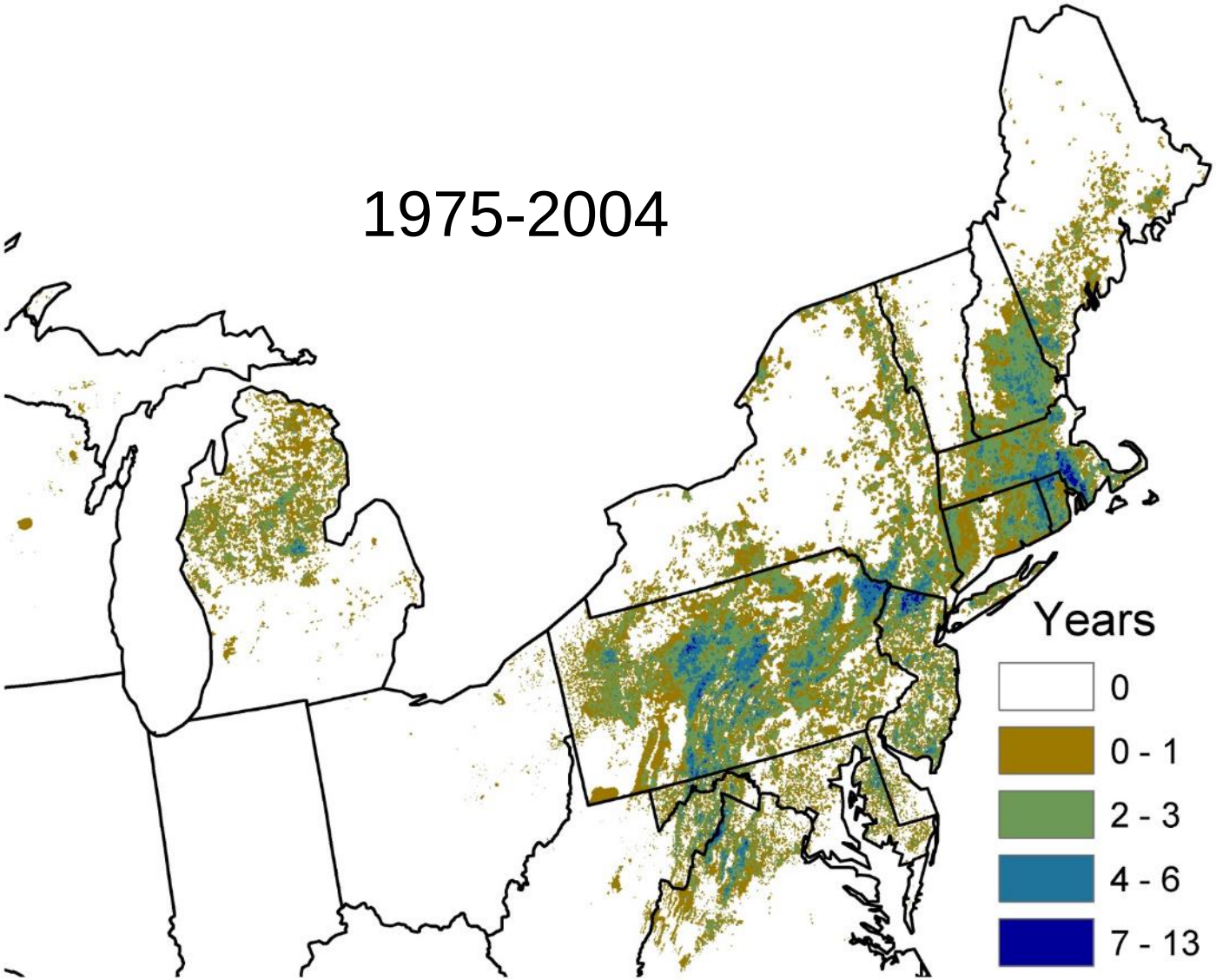
Spread from 1900-2002

Generally between 10-20 km/yr*

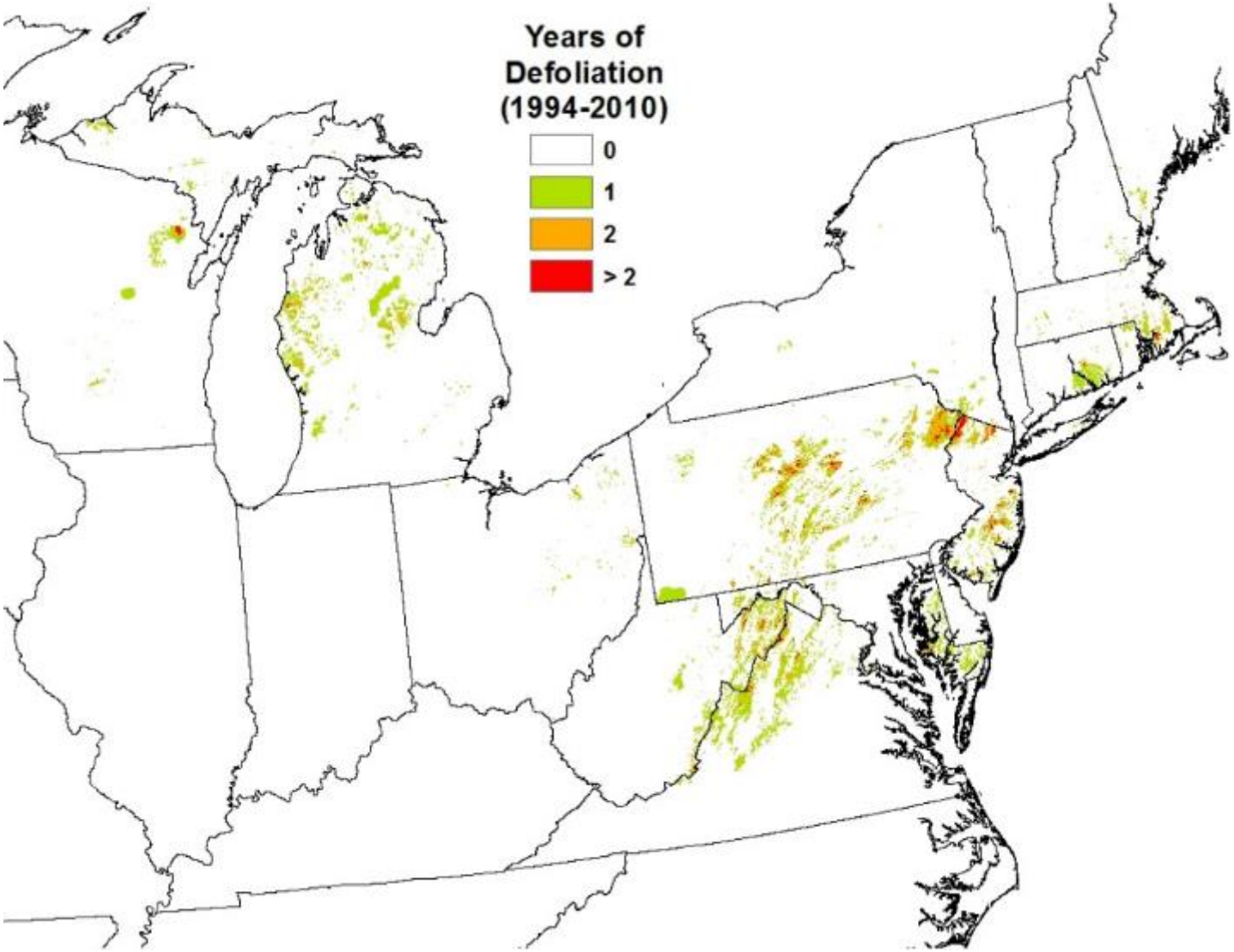


*Liebhold et al. 1992. J. Biog. 19:513-520

Historical GM Defoliation



15 Years of Defoliation

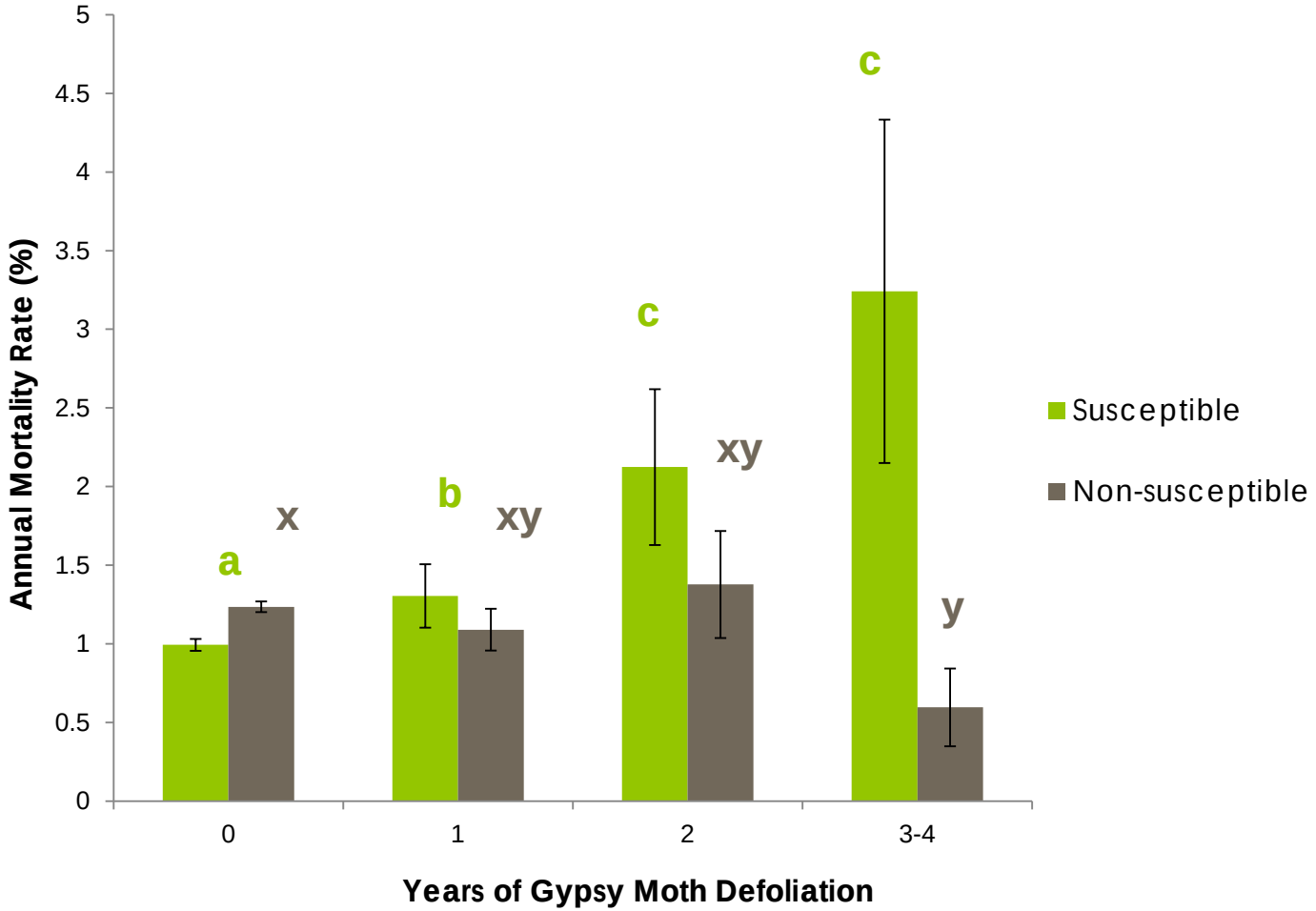


Quantification of GM Impacts

- Many studies in localized areas
- Wide variation in impact levels
- Goal: characterize impacts over large regions to account for variability

Defoliation vs. Mortality

Annual mortality rate of preferred species increases with years of GM defoliation while mortality of non-preferred species is slightly lower in areas defoliation by GM.



*Morin et al. 2015. Forestry: An International Journal of Forest Research

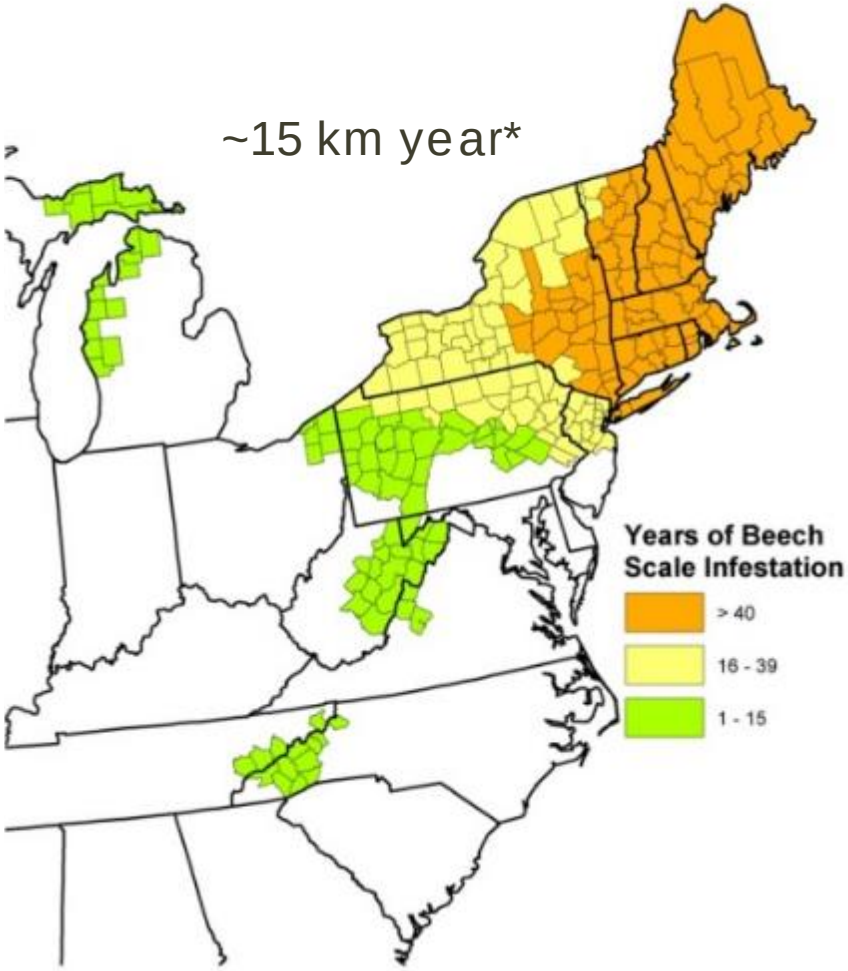
Regional Impact Analyses

Beech Scale

Hemlock Woolly Adelgid

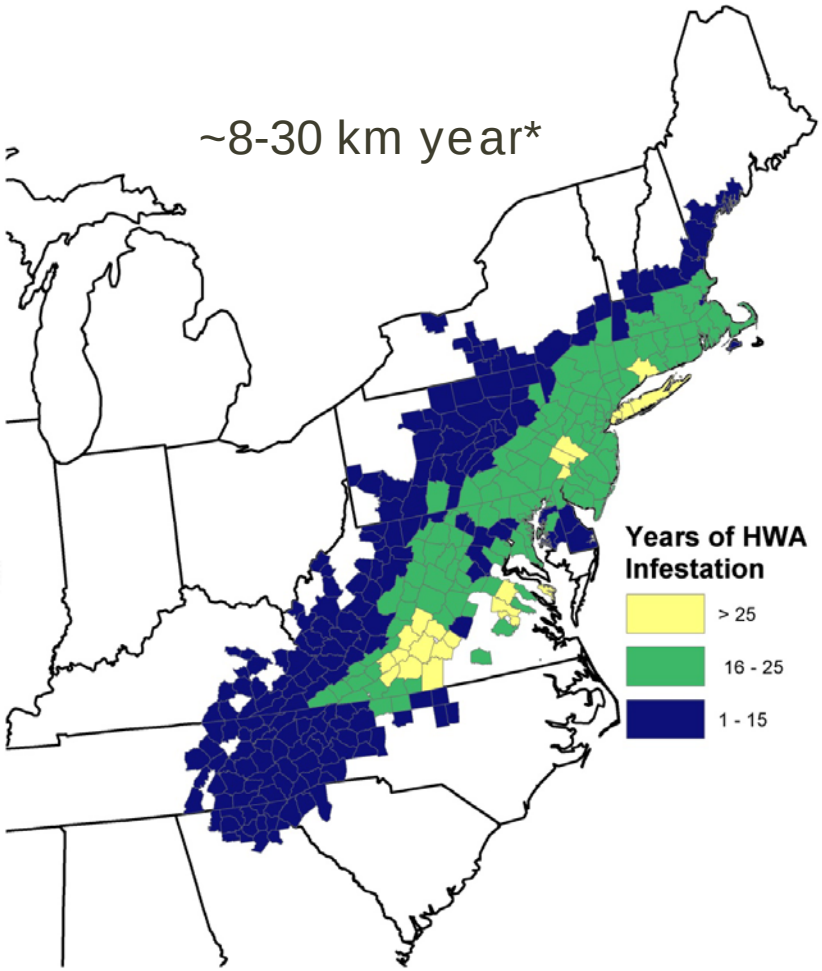
BS/HWA Spread

Beech scale



*Morin et al. 2007. CJFR 37: 726-736

Hemlock woolly adelgid

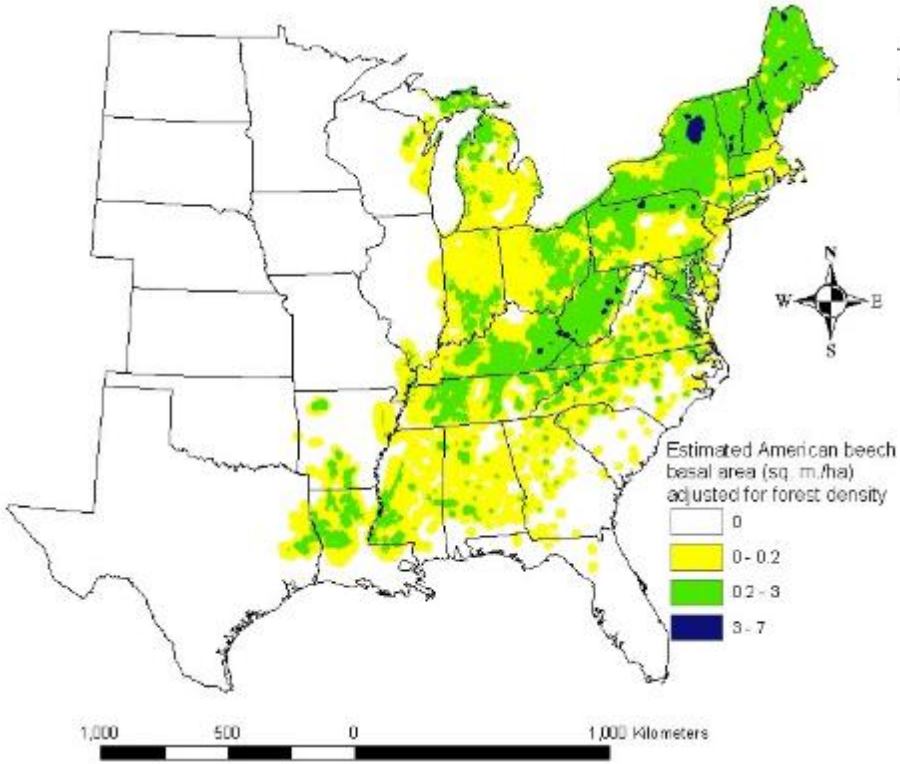


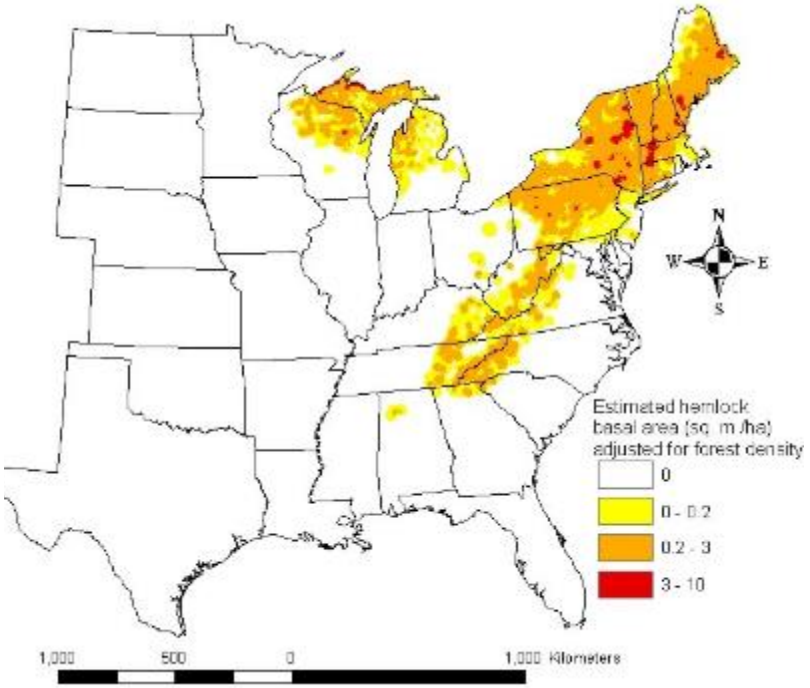
*Morin et al. 2009. Biol. Invas. 11: 2341-2350

*Evans and Gregoire 2007. Biol. Invas. 9: 369-382

BBD/HWA Hosts

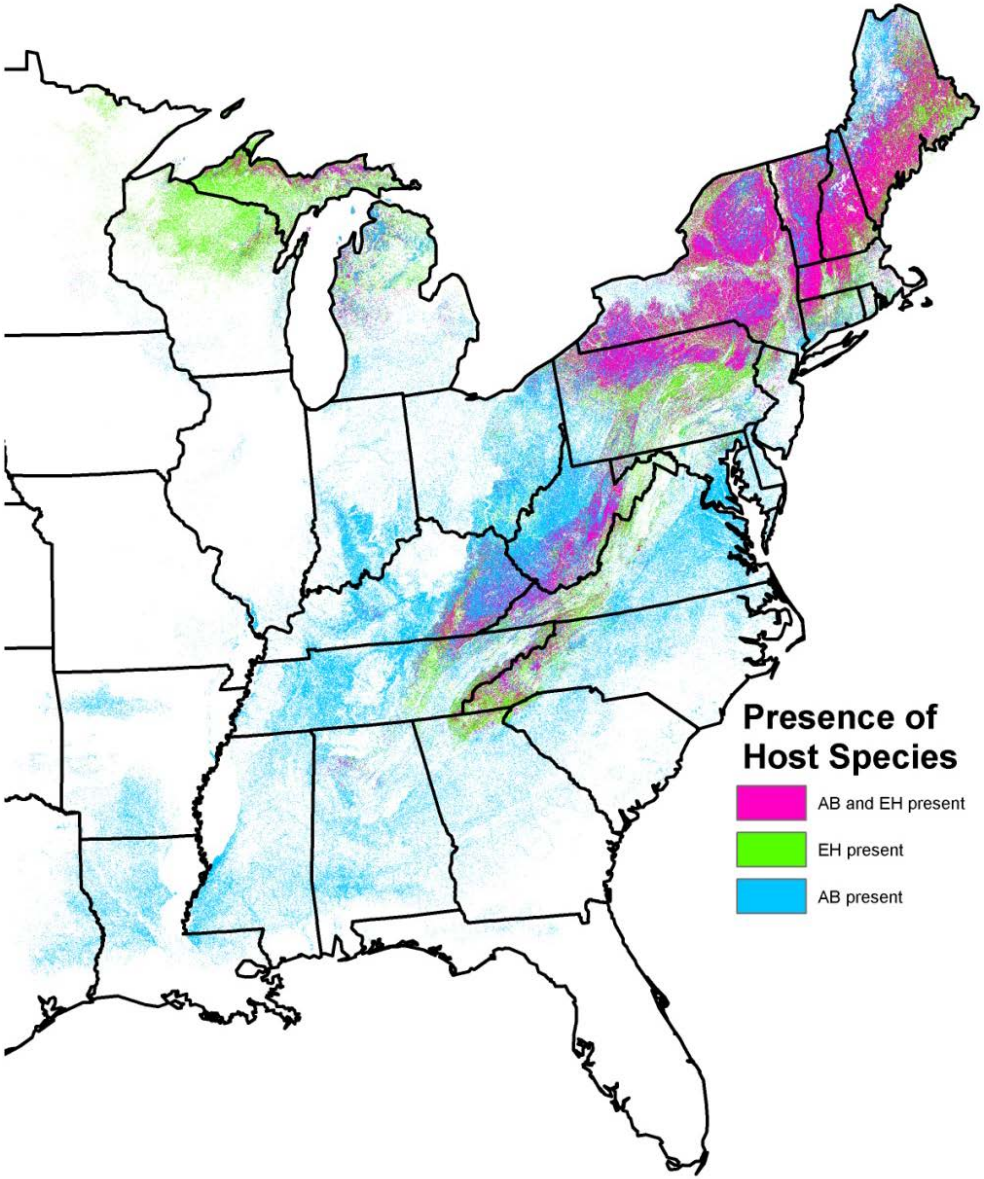
Basal Area of American Beech



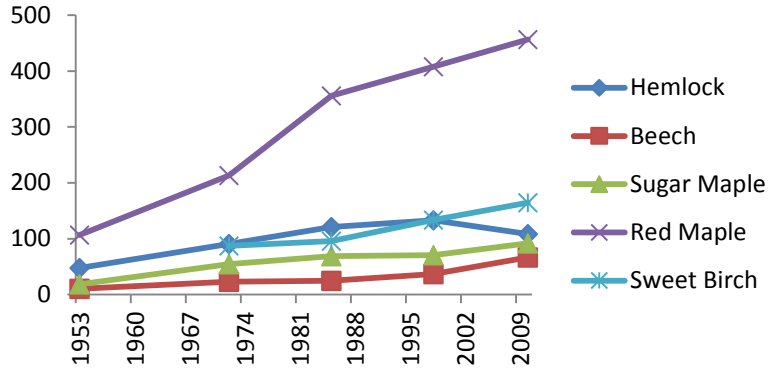


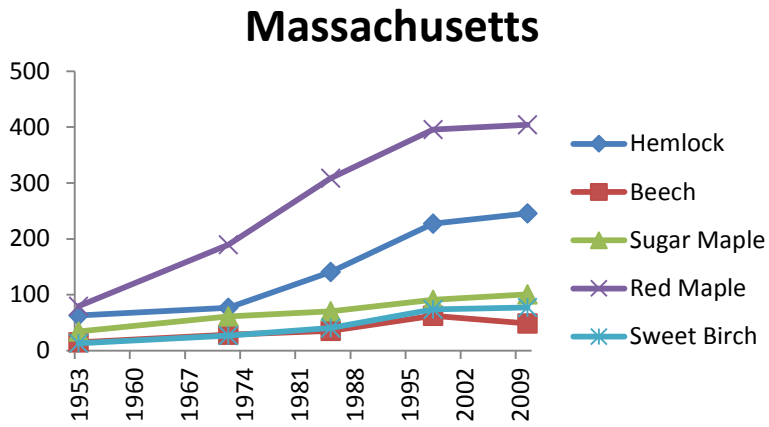
Basal Area of Eastern Hemlock

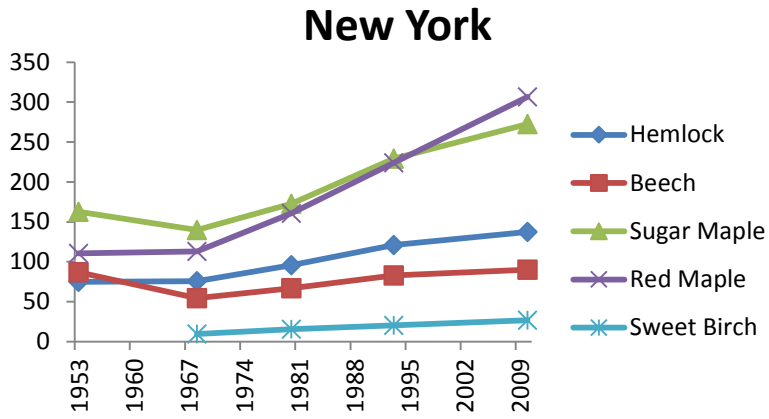
BBD/HWA Hosts

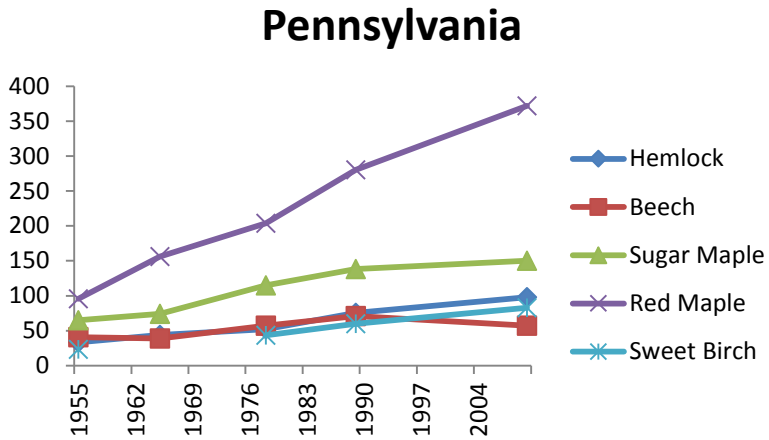


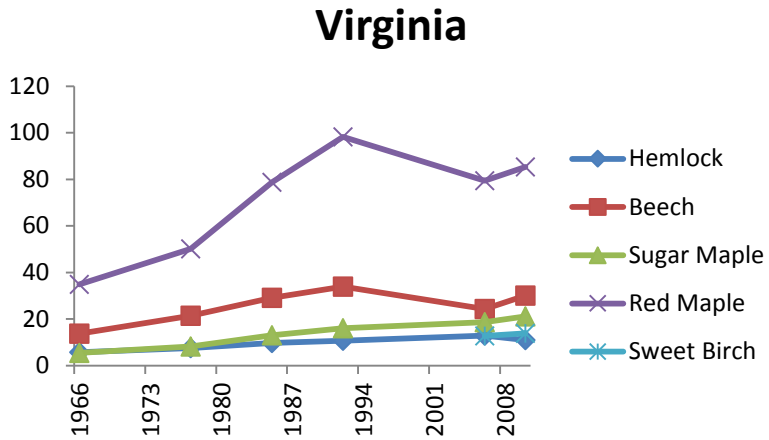
Trends in Hosts and Associates





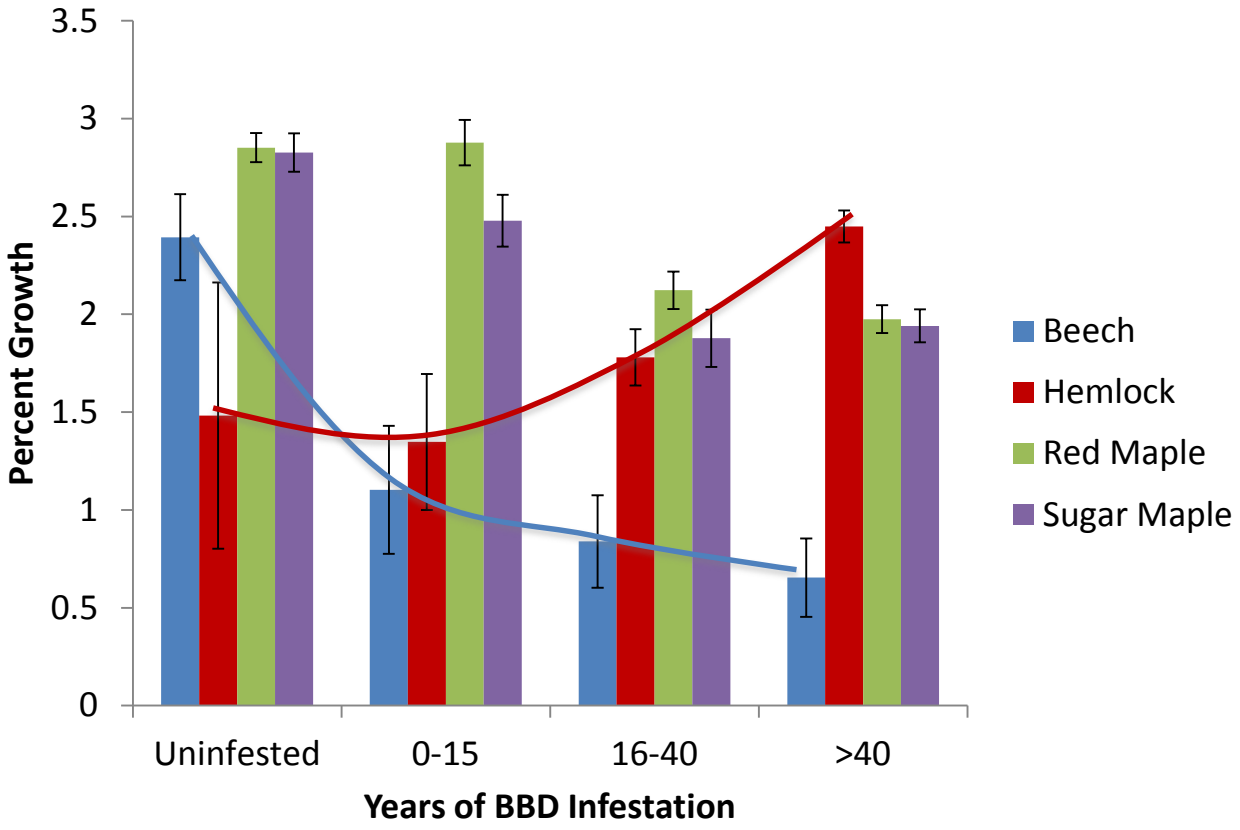






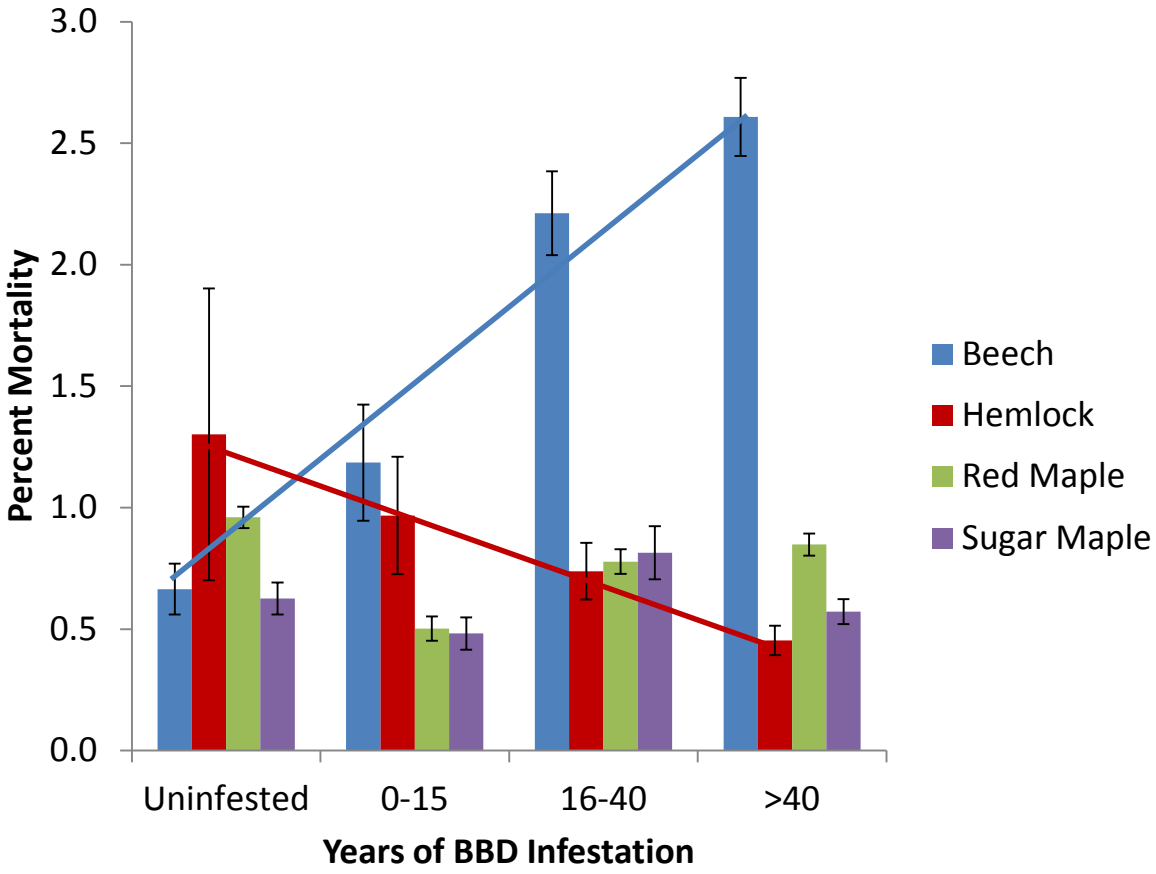
BBD Infestation vs Growth

Beech growth decreases with duration of BBD infestation. Despite growth in uninfested areas being 4 times higher than those infested for 40 years, beech volume continues to increase.



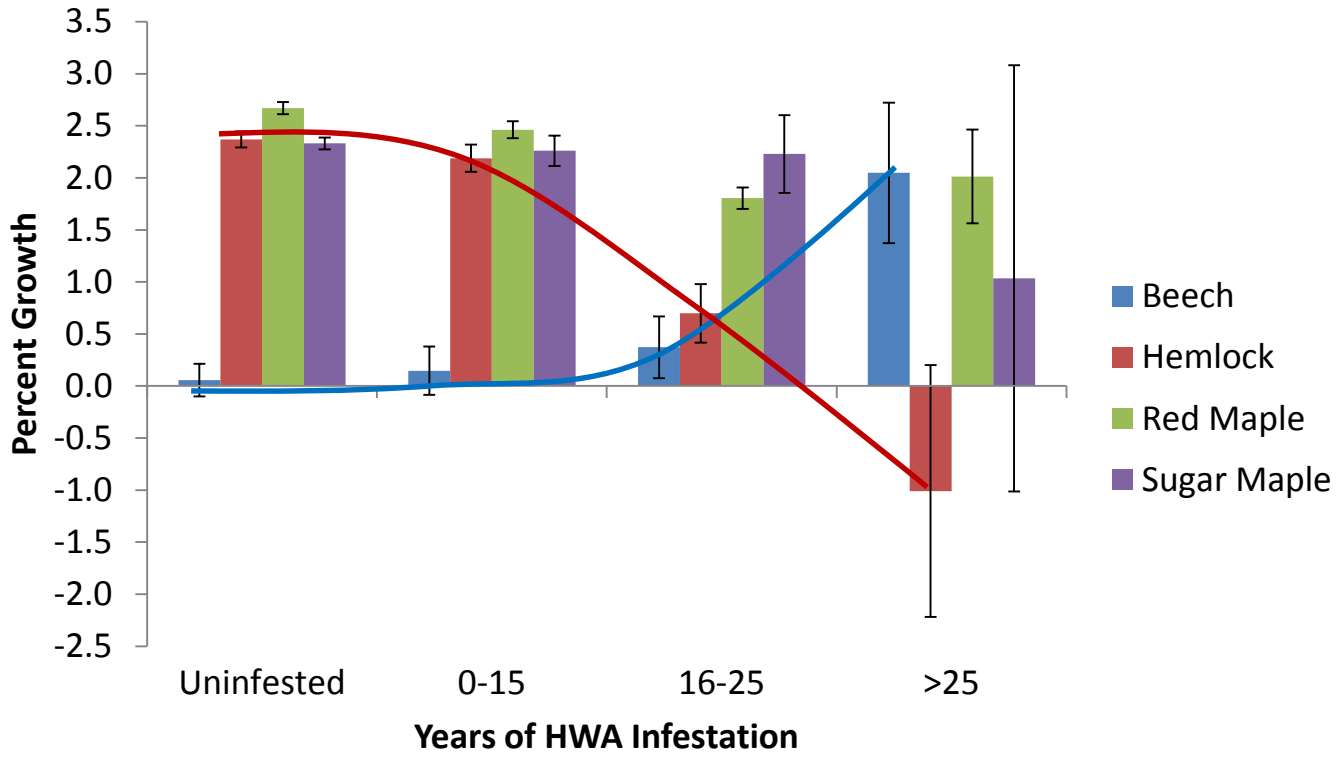
BBD Infestation vs Mortality

Annual beech mortality increases with duration of BBD infestation. Increases most markedly after 15 years and then levels off.



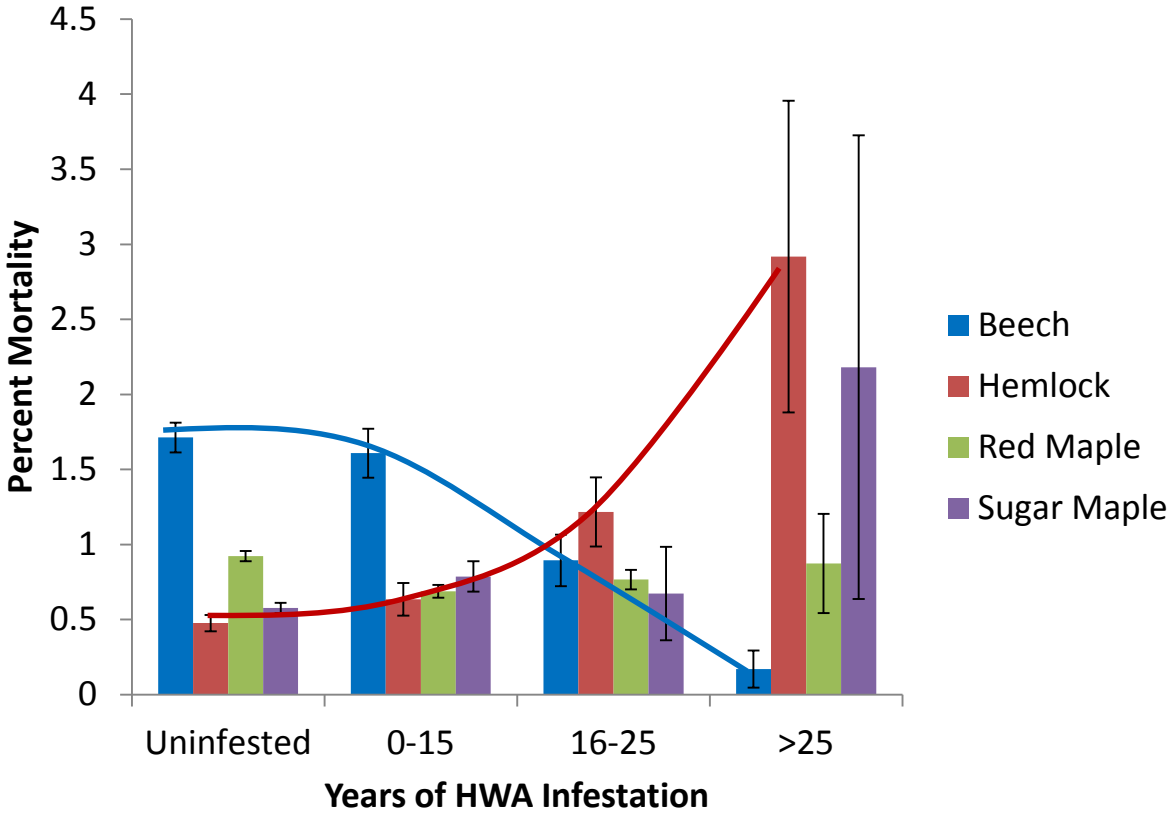
HWA Infestation vs Growth

Similarly, hemlock growth decreases with duration of HWA infestation. Once infestation surpasses 15 years growth rates drop significantly and become negative after 25 years.



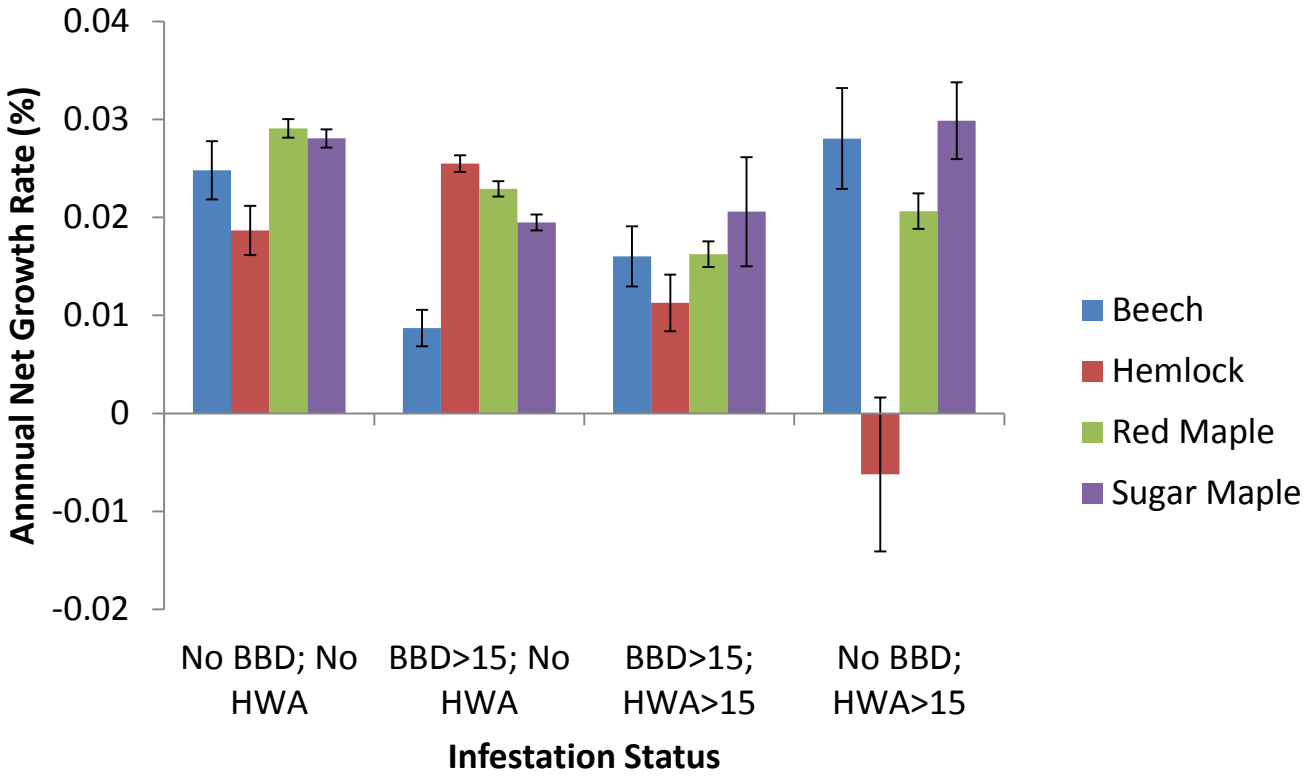
HWA Infestation vs Mortality

Hemlock mortality increases strongly with duration of HWA infestation, particularly after 15 years.



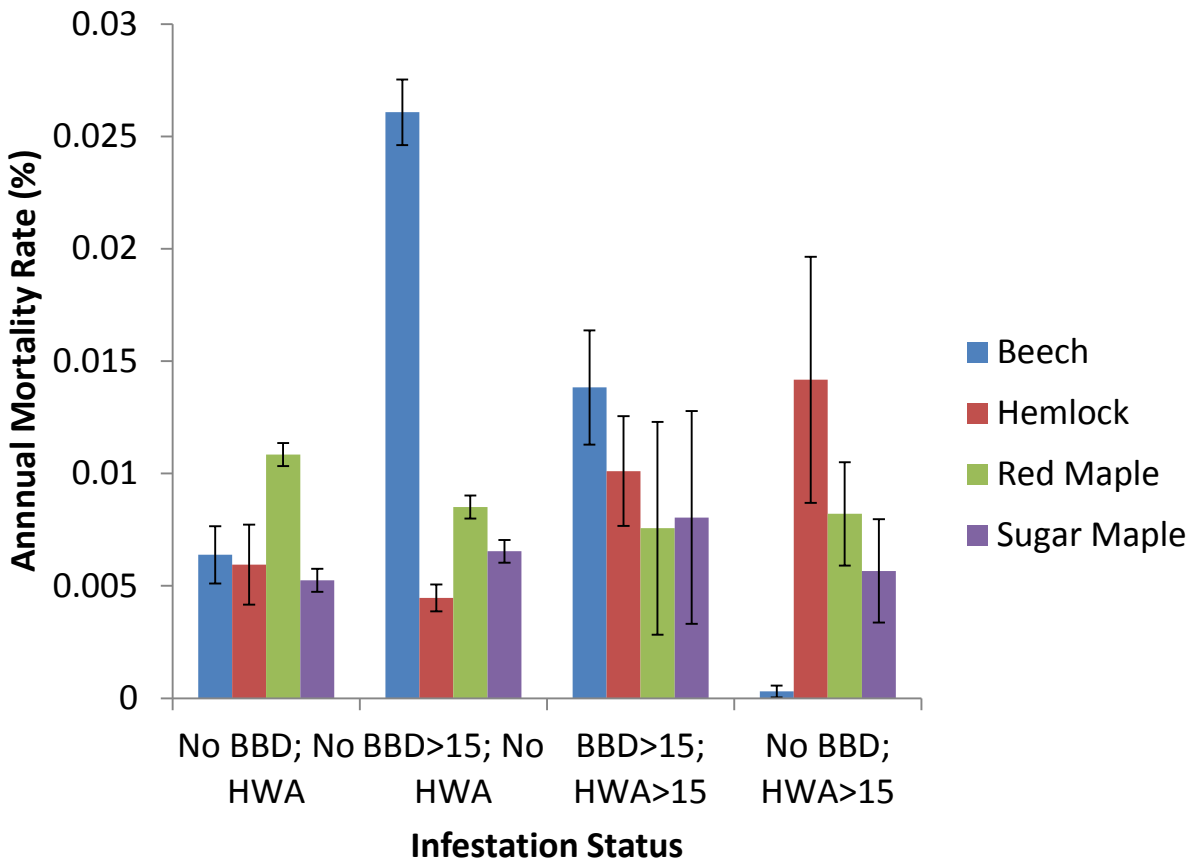
Beech and Hemlock Compensation

American beech and hemlock net growths are higher when the other species' pest duration is greater than 15



Beech and Hemlock Compensation

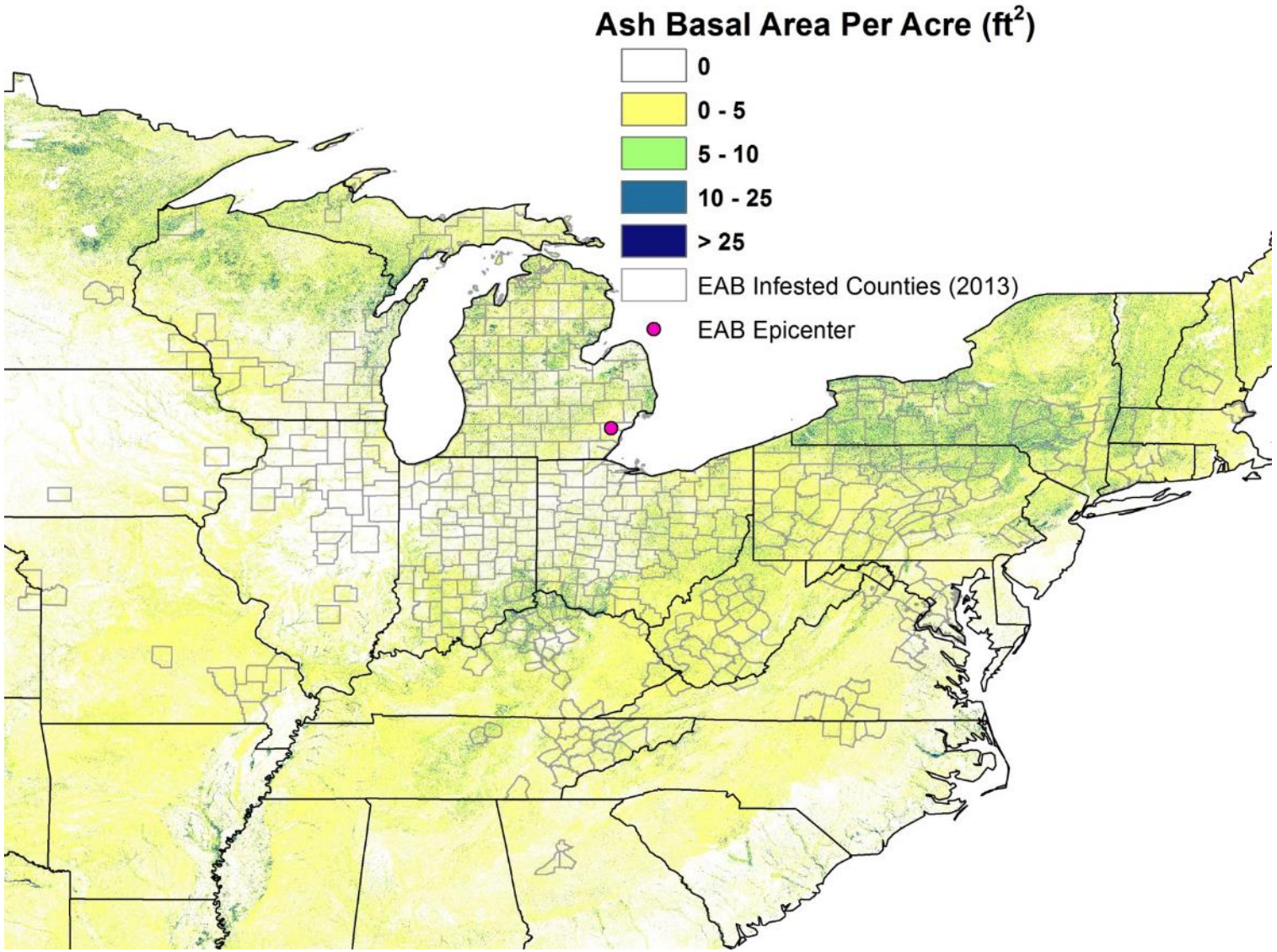
Interestingly, beech appears to benefit from hemlock mortality associated with HWA while hemlock benefits from beech mortality related to BBD.



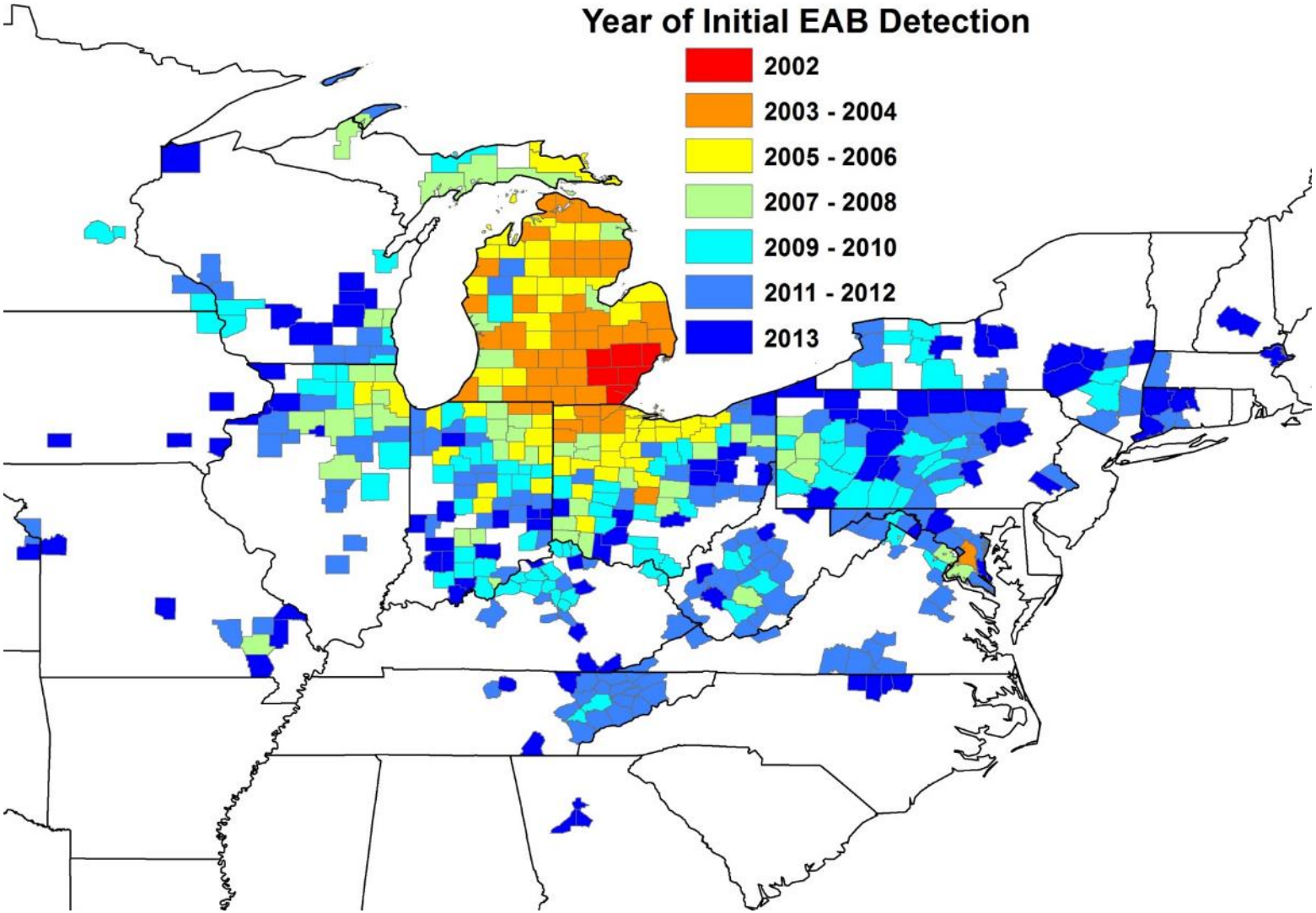
Recent Impact Analyses

Emerald Ash Borer (EAB)

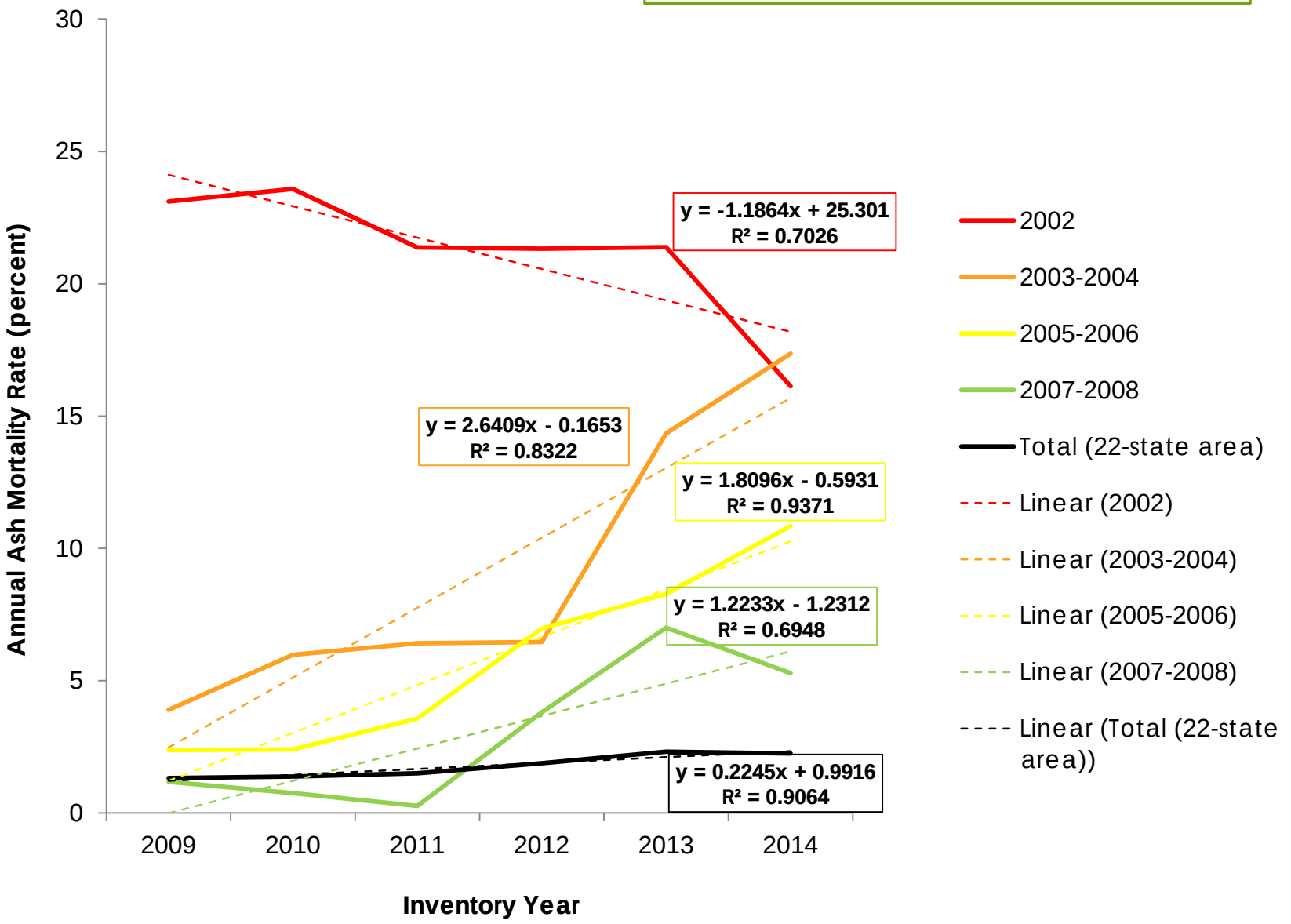
Ash Range in Northern US



EAB Spread

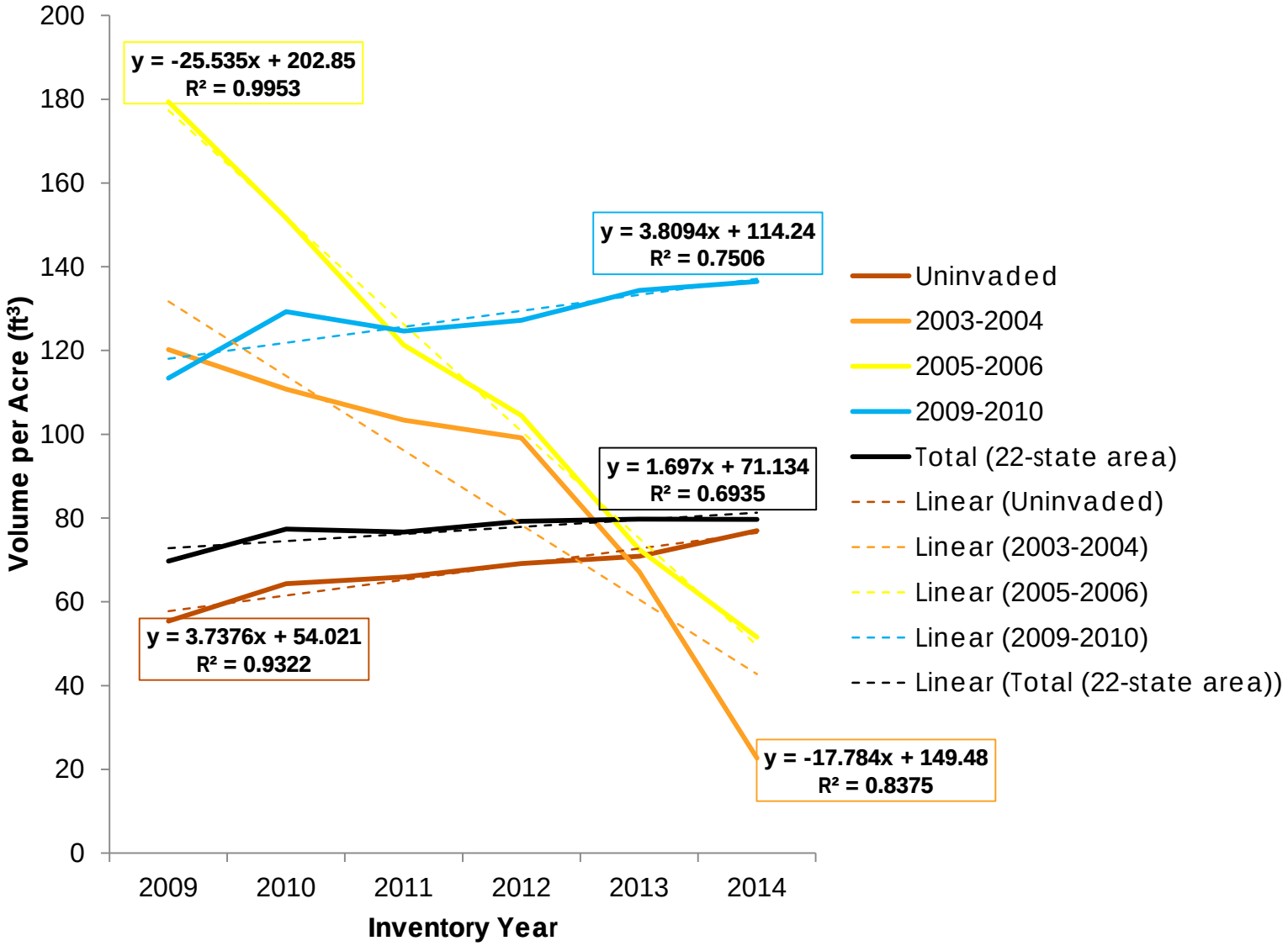

Year of Initial EAB Detection
2002
2003 - 2004
2005 - 2006
2007 - 2008
2009 - 2010
2011 - 2012
2013

Ash Mortality Trends



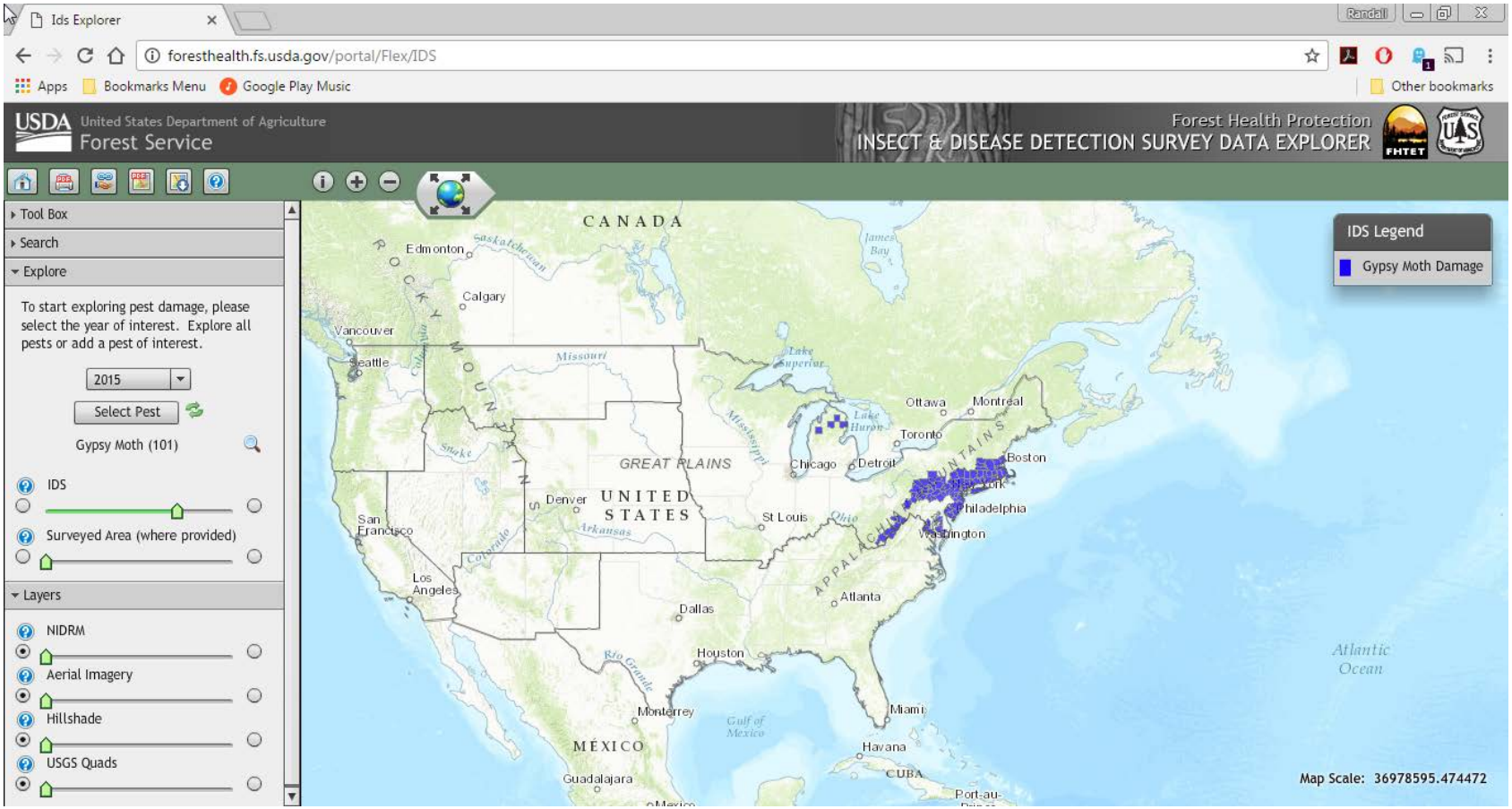
*Morin et al. 2016. Biological Invasions

Ash Volume Trends



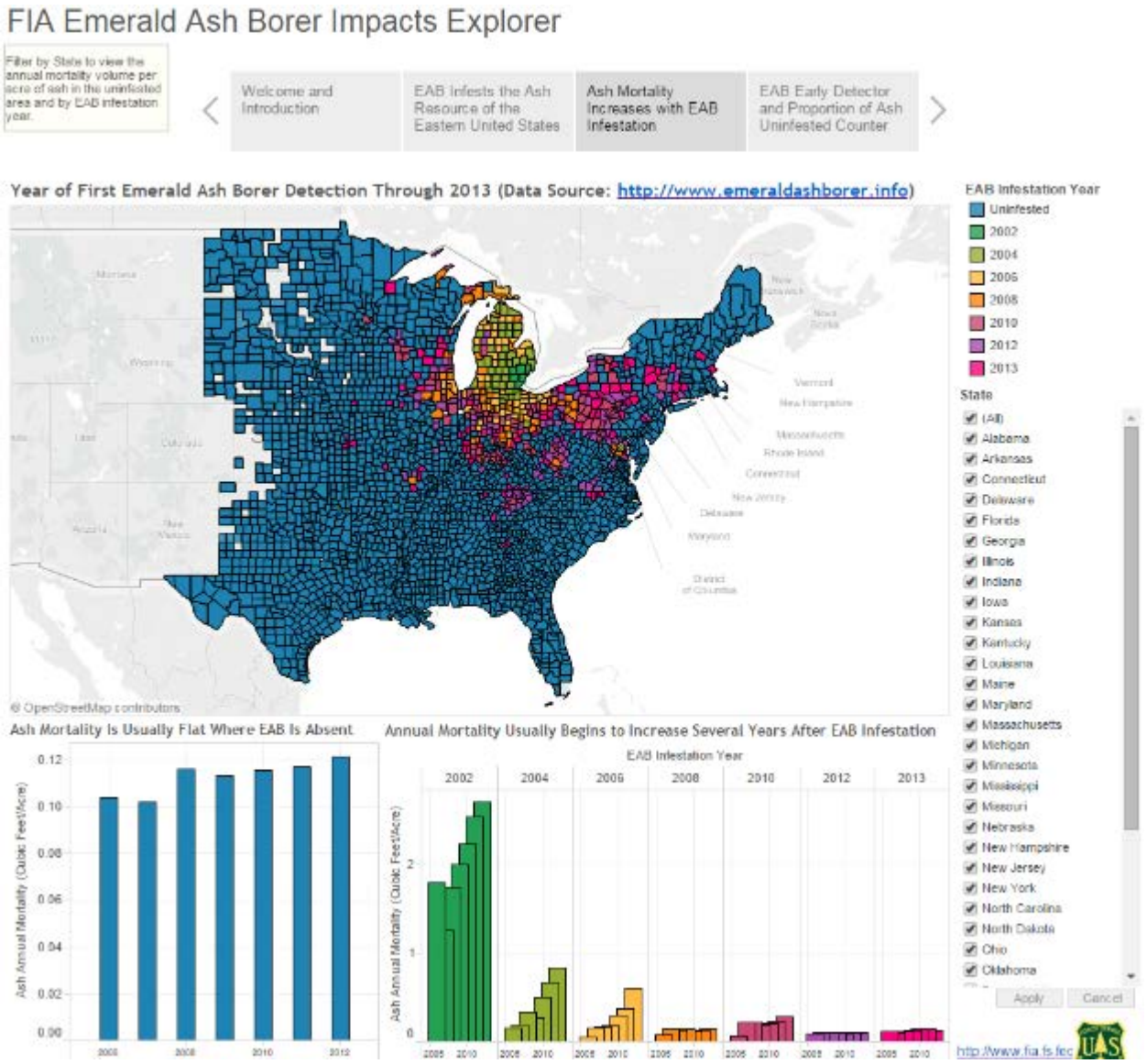
*Morin et al. 2016. Biological Invasions

FHP Insect and Disease Surveys

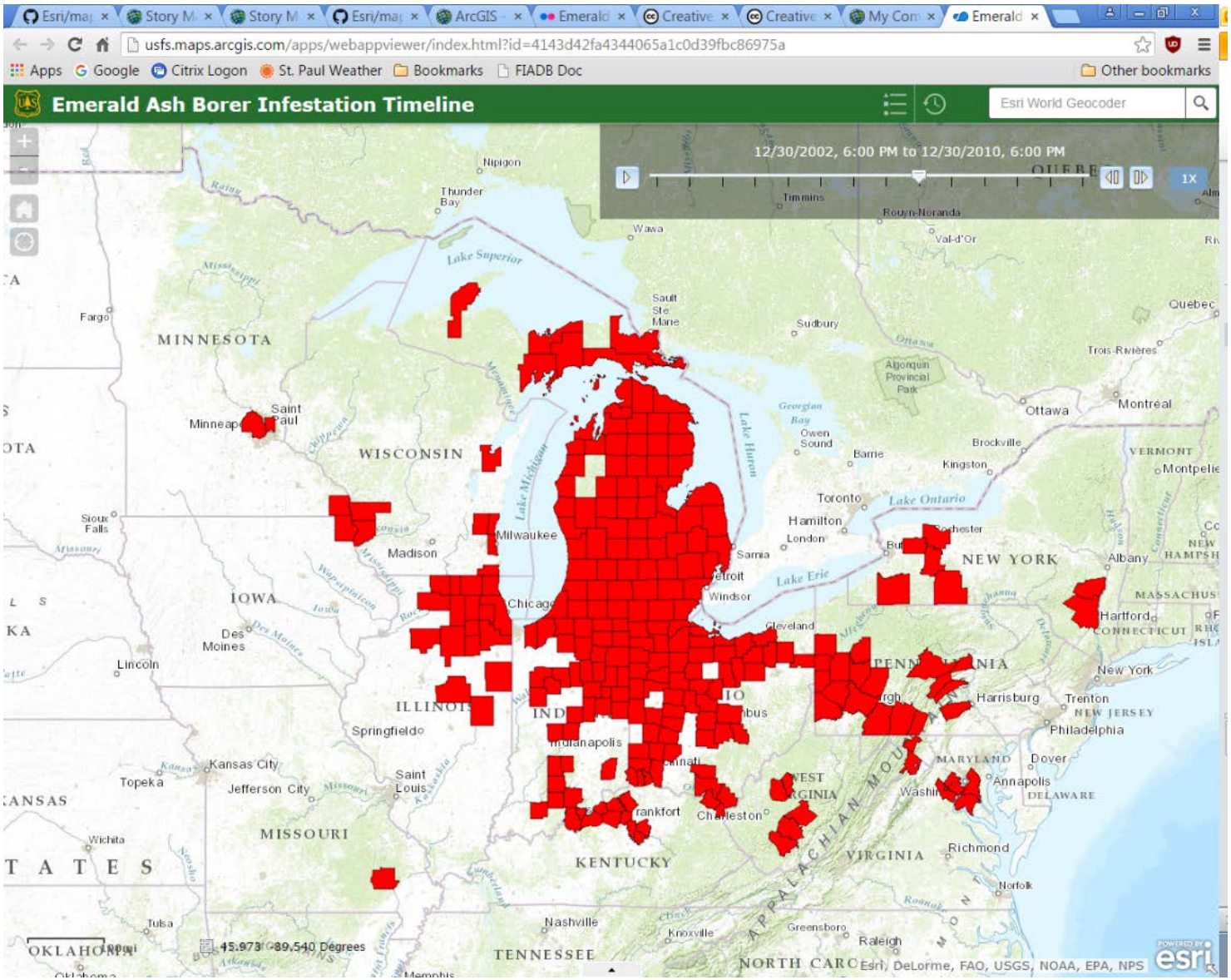


Damage is mapped but impacts are not quantified

Interactive Tools - Tableau



Interactive Tools – ESRI Story Maps / Map Journals



Questions?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