Ash (Fraxinus spp.) mortality and survival in areas infested by emerald ash borer (Agrilus planipennis)

Kathleen S. Knight¹, Daniel A. Herms², John P. Brown¹, Reid Plumb³, Eileen Sawyer³, Daniel Spalink³, Karen Menard³, Bernadette Wiggin³, Rachel Kappler³, Elizabeth Pisarczyk³, Robert P. Long¹

1USDA Forest Service Northern Research Station
2Ohio State University, Ohio Agricultural and Research Development Center
3Metroparks of the Toledo Area
Emerald Ash Borer (EAB)  
*Agrilus planipennis*
Ash (*Fraxinus* spp.)
• Ash mortality: general patterns and survival analysis

• Field surveys for potentially EAB-tolerant ash
Effects of emerald ash borer on forest ecosystems
Monitoring sites
Ohio: 165 plots
Michigan: 99 plots
Gradient of EAB infestation
Variety of habitats and stand ages
5 ash species
Monitoring Ash Canopy Condition

• Rating scale from healthy (1) to dead (5) canopy (Smith 2006)
• Related to EAB gallery cover (Charles Flower unpub.)
Ash survival over time

Percent of ash trees alive vs Years since infestation
Survival analysis

- Response: survival time of individual tree, based on estimated year of infestation
- Predictors (all subsets):
  - Hydrology OR Species
  - Ash density (trees per hectare)
  - Ash basal area (m² per hectare)
  - Median canopy condition at first year data collected
  - Crown class
  - DBH
  - Canopy condition rating at first year data collected
  - Canopy condition relative to median at first year data collected
  - Block by plot#
Best survival model selected by AIC

- N=908 (560 censored, 348 event)
- Validation (N=311) 71% correct prediction of survival
- Predictors:
  - Initial canopy condition p<0.0001
  - crown class p<0.0001
  - Tpha p=0.001
  - Hydrology (or Species) p<0.0001
Canopy condition

- Initially healthier trees survived longer than initially stressed trees
Crown class

- Dominant and codominant trees survived longer than intermediate or suppressed trees
Ash tree density

- Trees in higher ash density stands survived longer than trees in lower ash density stands
- Resource dilution effect
Ash mortality

- Mortality of ash – Although rate of mortality varies based on initial tree health, canopy position, ash density, and ash species or hydrology, most die within 6 years.
Survey for potentially EAB tolerant or resistant ash
Dead ash

- We estimate that there were approx. 11,000 ash trees along Swan Creek that died
- Of those, we estimate that approx. 2,300 have already fallen
Lingering ash

• 302 live ash in 2010 (2.8%)

• About 1/3 of those live ash trees were healthy (1%)

• 2011 re-survey is ongoing
• Almost always, the live ash trees were very near dead ash trees that had obviously died of EAB within the past 5 years.

• So we don’t think the live trees are just in an area that EAB missed.
EAB is persisting at low densities and may attack these trees.
• Live ash were smaller than dead ash ($p<0.0001$)
- Dead ash had more EAB exit holes than live ash (p<0.0001)
- Declining live ash had more EAB exit holes than healthy live ash (p<0.0001), and many healthy ash had no exit holes
2011 Re-survey of Swan Creek
Survey for potentially EAB tolerant or resistant ash
Indian Springs Lingering Ash

![Bar chart showing canopy condition ratings for 2010 and 2011.]
Future Plans

• Continue monitoring lingering ash and EAB populations
• Search for lingering ash of all five species native to Ohio and Michigan
• Work with collaborators to test lingering ash for resistance or tolerance to EAB
Thank You!

Field Work
Lawrence Long
Kyle Costilow
Charles Flower
Stephanie Smith
Steffanie Fluke
Joan Jolliff
Tim Fox
Winn Johnson
Trevor Walsh
Jenny Finfera
Alejandro Chiriboga
Rodrigo Chorbadjian
Diane Hartzler
B. Chambers
D. Rice
D. Lightle
I. Gomez

Research Sites
Cleveland Metroparks
Toledo Metroparks
5 Rivers Metroparks
Columbus Metro Parks
Erie Metroparks
Johnny Appleseed Metro Parks
Holden Arboretum
Ohio Division of Forestry
Ohio State Parks
Ohio Wesleyan University
Dempsey Middle School
Stratford Ecological Center
Huron-Clinton Metroparks
Michigan State Recreational Areas
Ohio Division of Natural Areas and Preserves
Private Landowners: Schmerge, Kryder, Lavens, McKinney, Nagel, Planson, Edwards

Manager Input
John Jaeger
Glen Palmgren
Paul Muelli
Karen Gourlay

Funding
USDA APHIS
USDA NRI Competitive Grants
US Forest Service