Insects and Diseases that Influence Forest Management in Michigan

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TODAY'S FORESTS – TOMORROW'S MARKETS
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MichiganTech

Examples of Insects and disease influencing forest management

- Today
  - Emerald ash borer
  - Beech bark disease
- Tomorrow
  - Sirex woodwasp
  - Sugar maple dieback
  - Hemlock woolly adelgid
  - Sudden oak death
  - Asian longhorned beetle

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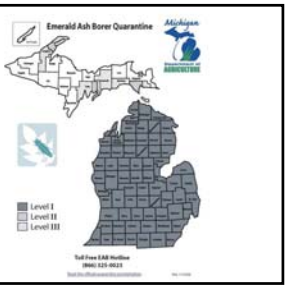
Forests today – Markets tomorrow

- Detection to delimit distribution
  - Where will material come from?
- Direct effect of insects or disease on timber supply
  - How much material will there be as a result of salvage of infested material?
- Indirect effect of insects or disease on timber supply – management efforts
  - How much material will be generated during pre-salvage or sanitation ahead of the infestation?

Emerald ash borer – detection by visual survey

- Usually only finds well established populations
- Houghton County
  - Confirmed in August 2008
  - Over 50 infested trees
  - Estimates of up to 8 years old
  - Spread less than one mile based on initial ground survey
  - Site processing to reconstruct spread is underway

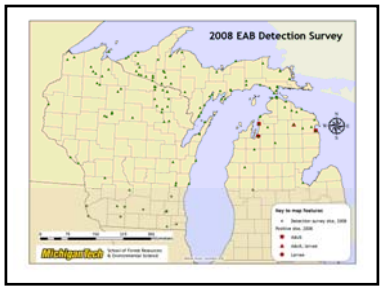


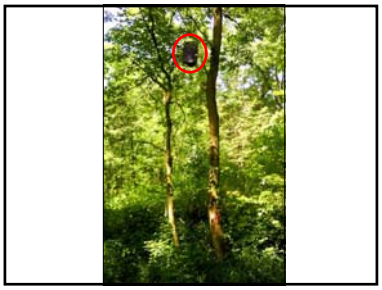
Quarantine

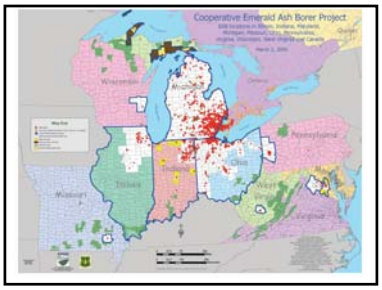
- Compliance agreements can be obtained by working with the MDA
- Location receiving the material (mills etc) also need a compliance agreement

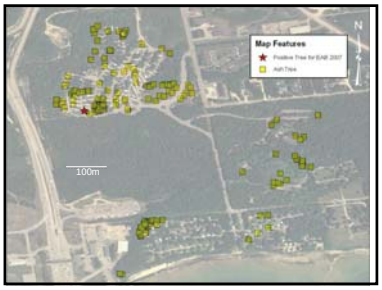
EAB Detection at low density 2008 Detection survey methods

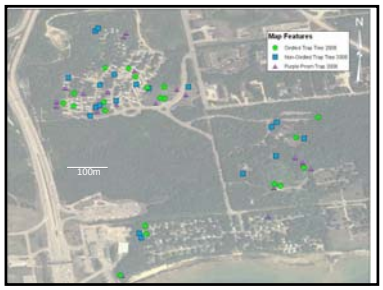
- At each site
  - 3-6 new trap trees established
  - 0-6 trap trees from previous years used (2007 and 2006)
  - 1 purple trap hung at base of canopy of non-girdled ash tree







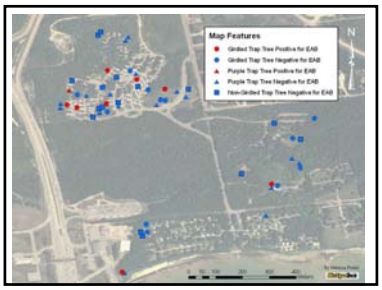


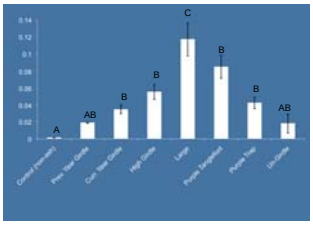


Results – Straits State Park

	Adults trapped	Trees infested
Girdled trap tree	1	5 (1-1?? larval)
Non-girdled trap tree	0	0
Purple prism trap	0	1

Purple traps ineffective at this low population density
Girdled trees act as sinks



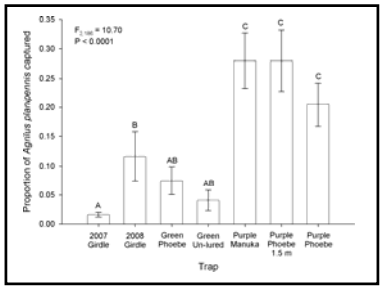


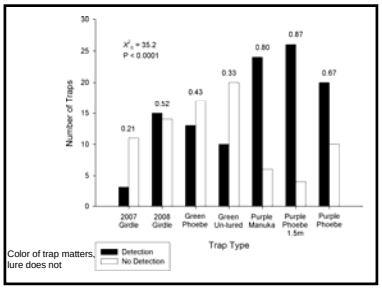
Results

- At Low EAB Density with logistic reg.
  - The odds of detecting EAB decrease by 5.3% with each increase of 1 m^2/ha of live ash basal area using all these traps.
  - An increase of 8.88 m^2/ha (2 SD) in live ash basal area would result in a reduction by 47% in the odds of detecting EAB.

Results

Trap Type	Change in Odds with ash basal area increase
Prev. Year Girdle	-6.70
Curr. Year Girdle	-8.78
High Girdle	-9.48
Large Girdle	5.43
Purple Tanglefoot	-6.24
Purple Trap	-3.68
Un-girdled	-14.67

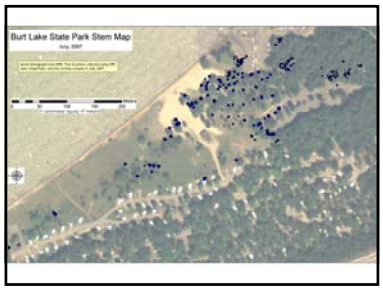


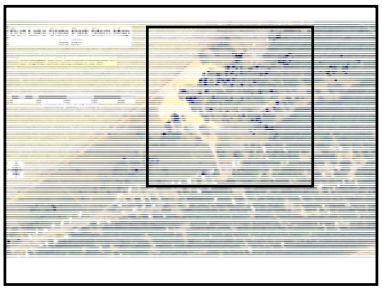


Color of trap matters, lure does not

Trap tree methods development

- Which trees are preferred in areas with low EAB population density?
- Which non-girdled trees does the beetle land on?
- Avoids use of girdled trap trees and colored traps





Sticky bands on non-girdled trees

- Burt Lake State Park
  - Detection in 2006
  - 2007 32 beetles on 10 trees
  - 2008 196 beetles on 37 trees
- Harrisville State Park
  - Detection in 2006
  - 2007 0 beetles
  - 2008 15 beetles on 11 trees

Trees most likely to have landings

- Larger dbh
- Higher amount of dieback
- More dominant crown class

How many dead and infested ash trees are there?

	Live and dead with EAB	Live w/o EAB	Live w/EAB
Entire area	16.9%	80.6%	12.1%
SE MI area	21.1%	75.7%	13.4%
Other areas	12.9%	85.1%	10.8%

	Dead w/o EAB	Dead w/EAB	Dead
Entire area	2.5%	4.8%	7.3%
SE MI area	3.1%	7.7%	10.8%
Other areas	2.0%	2.1%	4.1%

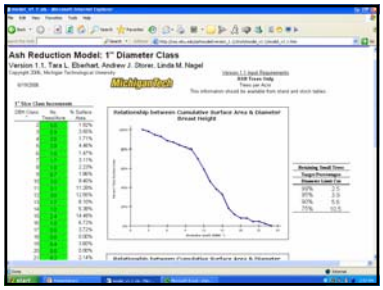
- Only 21.1% of ash in SE Michigan (generally infested area) have EAB
- This does not include trees that have been removed
- FIA estimates 277,967,629 ash trees (>2 inches DBH) in the sample area
- Ball park number of estimated ash trees >2 inches, live + dead, w/ EAB would be 50 million

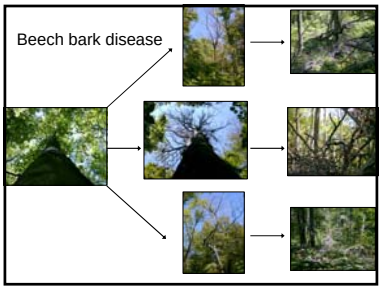
An optimists project

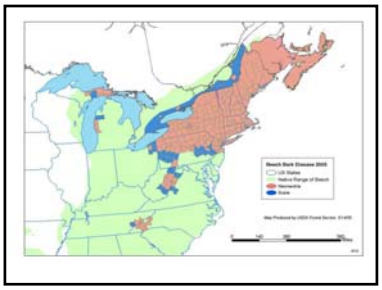
- Identify and characterize ash trees in the core area that are still alive.
- Demonstrate that there is a population of ash trees in southern Michigan that will persist into the future.
- Produce a database of these trees to enable long-term assessment of the impacts of EAB.

Pre-salvage thinning of ash

- Ash phloem models to reduce the amount of ash phloem in stands ahead of or shortly after arrival of emerald ash borer
- www.ashmodel.org







Disease Progression

- **Advancing front** - Recently invaded by beech scale. Characterized by many large, old trees supporting building populations of scale
- **Killing front** - Characterized by severe scale infestation, Nectria infections and high tree mortality
- **Aftermath forest** - Heavy mortality occurred at some time in the past. Some residual big trees persist and many small trees (often of sprouting origin) that are deformed

Impacts on trees

- Large trees, over about 8 inches (20.3 cm) in diameter, succumb more readily than small ones
- Data from plots in Vermont, New Hampshire, and Maine show that about 28 percent of the large beech had died, another 22 percent were dying
- Many of the surviving trees were so severely injured that they offer little hope as a source of quality material
- Some trees do appear to be resistant

Impacts on Forests

- Loss of a dominant or codominant tree species
- Loss of major mast producing species in many areas
- Elevated coarse woody debris
- Altered tree community structure

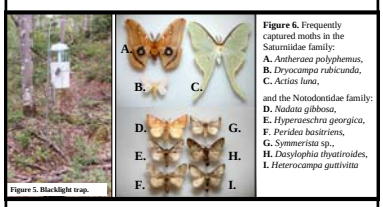


Figure 5. Blacklight trap.

Figure 6. Frequently captured moths in the Saturniidae family: **A.** *Antheraea polyphemus*, **B.** *Dryocampa rubicunda*, **C.** *Actias luna*, and the Notodontidae family: **D.** *Nadata gibbosa*, **E.** *Hyperaeschra georgica*, **F.** *Peridea basitriens*, **G.** *Symmerista* sp., **H.** *Dasylophia thyatiroides*, **I.** *Heterocampa guttivitta*

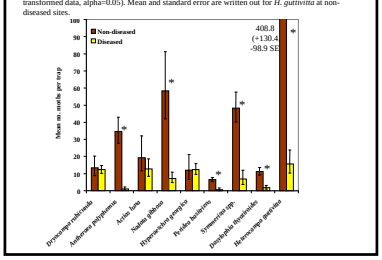


Figure 9. Mean number of moths caught per trap in healthy and diseased beech forests. Asterisks represent significant differences in trap catch between site types (two sample t-test on square root transformed data, alpha=0.05). Mean and standard error are written out for *H. guttivitta* at non-diseased sites.

European *Sirex*

9-36 mm in length (0.35 inch – 1.4 inches)

Sirex noctilio – European woodwasp

- Native to Europe, Asia and North Africa
- Established in Australia, New Zealand, South America, South Africa
- Trapped in New York in February 05
- Confirmed as reared from Scotch pine in New York in July 2005
- Established in various states including Michigan ('thumb' counties)

Sirex woodwasp is likely a manageable insect

- Management options include:
  - Silvicultural treatments to thin stands
  - Biological control using a parasitic nematode
- To succeed we need to know where the insect is in order to
  - Prioritize entry to reduce basal area and remove over mature trees
  - Focus biological control efforts in the future (if needed)

Sirex woodwasp

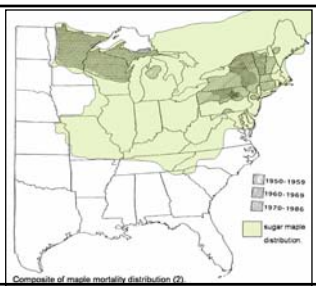
- Detection techniques:
  - Funnel trap baited with a blend of alpha- and beta-pinene
  - Trees stressed by injecting with herbicide with a flight intercept trap hung from them

Sirex woodwasp

- Currently limited to the 'thumb' area
- Insect will spread
- Favors overmature, high density pine resources
- Impact remains to be seen – likely quite high in areas with suitable resources

Sugar maple dieback

- An emerging issue, especially in the western Upper Peninsula
- Appears to be widespread
- Similar dieback has occurred in the past



Composite of maple mortality distribution (2).

- Largest amounts of mortality occurred in the 50's and 60's in the northern Great Lakes region attributed mostly to:
  - drought,
  - pathogens
  - past cutting practices.
- Mortality events in the east in the 70's and 80's were mostly attributed to:
  - air pollution
  - insect defoliation.

Sugar maple dieback

- Unanswered questions:
  - What is/are the cause/causes of the latest dieback?
  - Will tree mortality result?
  - Will salvage result in increased sugar maple harvesting from the forest?

Conclusions

- Multiple agents are of concern and influence cutting practices and therefore markets
- Agents may be direct causes of tree mortality and resulting salvage harvests
- Agents may indirectly result in pre-salvage or sanitation harvests as part of management responses to the threat

Acknowledgments

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