SLAM: A Strategy to Slow Ash Mortality Caused by Emerald Ash Borer

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Fall 2007: EAB outlier site was identified when a girdled tree was debarked near Moran, MI. Delimitation survey identified 13 trees with low larval densities with 0.5 miles.

A single infested tree was found in 2007 at St. Ignace.
SLAM = SL.owing A.sh M.ortality

Goals: Reduce the rate of EAB population growth to delay the onset & slow the progression of widespread ash decline & mortality.

Develop, implement & evaluate an integrated strategy appropriate for individual sites.

Focus is on the ash resource *(not SLEAB!)*
Tactics to suppress EAB population growth

- Girdled & debarked ash trees function as “sinks.”
- Systemic insecticide treatment (emamectin benzoate): TREE-äge® applied as a trunk injection provides nearly 100% control of EAB adults & larvae for up to 3 years.
- Ash utilization: Timber harvests reduce phloem available to EAB & provide value to landowners.
Tools: Outreach & Regulatory Efforts

Raise awareness of EAB & the SLAM program; build support for SLAM (residents, landowners, tourists, tribes)

Reduce potential transport of infested ash firewood by residents & tourists

Inform residents, stakeholders, tourists about regulations. Encourage local ash utilization.

SLAMEAB.info website
Tools: Intensive Surveys - 390 km² project area

A. DTs: Girdled ash Detection Trees debarked in fall to assess EAB distribution, density & development.
B. ATs: Artificial Traps (APHIS baited purple prisms in ash canopies) supplemented DTs.
C. Ash inventory: distribution & size of ash trees tallied in forested, rural & urban areas.
Extensive inventory of ash across the project area in 2010 & 2011. Inventory data & ash phloem model were used to calculate & map ash phloem for each grid cell.

Second-order polynomial model: $y = 0.024x^2 - 0.307x + 2.63$; $r^2 = 0.94$

McCullough & Siegert. 2007. J. Econ. Entomol.
Tools: Coupled Map Lattice Model

1. Adult EAB disperse
2. Adults reproduce (1 & 2-year cohorts tracked)
3. Phloem is consumed by larvae
4. EAB population grows

Systematic trap grids (DTs, ATs or both) were established in a 6 mile radius around known infested trees annually.  

1 trap per 40 acres  \(\approx\) 1-2 miles  
1 trap per 160 acres  1-3 miles  
1 trap per 640 acres  3-6 miles  

<table>
<thead>
<tr>
<th>Number</th>
<th>2008</th>
<th>2009</th>
<th>2010</th>
<th>2011</th>
</tr>
</thead>
<tbody>
<tr>
<td>DTs</td>
<td>444</td>
<td>603</td>
<td>748</td>
<td>855</td>
</tr>
<tr>
<td>ATs</td>
<td>229 (171)</td>
<td>331 (99)</td>
<td>475 (0)</td>
<td>480 (0)</td>
</tr>
</tbody>
</table>

Project Area: > 390 km\(^2\)
Moran: 2009 larval counts from DTs plus 800m buffers

- 0.1-1 per m²
- 1-2
- 2-6
- 6-8
- 8-34
- No EAB
Proposed Treatments for 2009 (but not realized!)

Girdle trees within 150m

Inject trees within 150 m to 400 m

Satellites

Clusters of girdled trees

Inject trees within 400m to 800m

Primary “Core”

O Girdle trees within 150m

O Inject trees within 150 m to 400 m

Satellites
Insecticide use in the SLAM Project area was limited by:

1. Hiawatha National Forest
2. HNF Wilderness area & (3) HNF Research Area
3. Endangered dragonfly habitat (expanded in 2009)
4. Wild & Scenic River corridor

Most treated trees were on right-of-ways along roads.

Protected areas

2009: 229 trees

2010: 358 trees
Results from SLAM Pilot Project


McCullough. 2015. SLAM. EAB University Webinar www.emeraldashborer.info

McCullough & Mercader. 2012. Int. J. Pest Manage. 58: 9-23


Girdled ash Detection Trees were much more effective than baited Artificial Traps.

Estimated rates of EAB spread

Moran: 1.50 - 1.75 km per yr
St Ignace: 0.58 km per yr

The larger Moran infestation likely became established earlier than the St. Ignace infestation, or more EAB were originally introduced, or both. Infestations merged in 2010.  

Key Result: TREE-äge injections slowed EAB population growth


Number of treated trees was significant ($P=0.009$). Area of treated ash phloem was not ($P=0.21$).

Insecticide treatment did not exert a detectable effect on spread of the infestation.

Mercader et al. 2015. For. Ecol. Manage.
Key Result: Sinks (girdled & debarked ash trees)

Sinks reduced EAB population growth the following year but the effect did not persist for 2 years.

Number of sinks reduced population growth ($P=0.015$).

Sinks had a small but detectable effect on EAB spread. Effect depended on the proportion of ash phloem in a grid cell that was in girdled trees & on EAB density.

Interactions were significant; Sinks attract EAB & larval counts on nearby trees can increase (spillover effect).
Lessons Learned...

- Treat as many trees as possible with TREE-äge to slow EAB population growth. This insecticide remains effective for up to 3 years.

- Treating more trees has a greater effect on slowing EAB population growth than selectively treating large trees.

- Insecticide treatments did not slow EAB spread. Long distance EAB dispersal behavior & cues that trigger dispersal not well understood.
  
  *(Mercader et al. 2012; Env. Entomol.)*

- Treating trees with TREE-äge retains ecological services provided by mature trees & can protect future seed source.
Lessons Learned...

- Heavily infested ash trees should be removed, ideally before high densities of EAB adults can emerge.

- Ash utilization can provide value for landowners. Merchantable trees (>12 inch DBH) represent a small portion of the ash resource in forested settings but produce a high proportion of the EAB.

- Simply removing ash trees, however, is not a SLAM strategy. Ash removal had a small effect on EAB population growth & eventually increased spread rates.

- Combine ash removal with other tactics (sinks, TREE-age)
**Lessons Learned...**

- Girdled ash trees are highly attractive to EAB in low density sites & are the most effective detection tool.

- Choose small (4-8 inch DBH) trees for detection trees. Small trees can be efficiently girdled & debarked.

- Debarking girdled ash trees in low density sites:
  1. Provides useful data on EAB density & development
  2. Kills larvae on those trees, slowing population growth
  3. Retains beetles in the area, slowing spread

- Coupling girdled trees with “toxic trees” should be highly effective.
Acknowledgements

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Strong fit between our simulation model & EAB distribution in Moran ($r^2 = 0.937$). Including treatment effects improved the fit. Fit was shaky near the edge of the project area (very low EAB density = low detection ability).

Model allowed us to compare predicted versus observed EAB population growth & spread