SLOWING ASH MORTALITY: A POTENTIAL STRATEGY TO SLAM EMERALD ASH BORER IN OUTLIER SITES

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ABSTRACT

Several isolated outlier populations of emerald ash borer (*Agrilus planipennis* Fairmaire) were discovered in 2008 and additional outliers will likely be found as detection surveys and public outreach activities continue. In past years, regulatory officials attempted to eradicate selected outlier populations by removing and destroying ash trees within 400 to 800 m radius of known infested trees. These efforts were expensive, difficult to implement and often alienated affected landowners. Most eradication projects were unsuccessful, largely because of the difficulty of identifying infested but nonsymptomatic trees.

Currently, when a new outlier site is discovered, the township or county is quarantined. Efforts may be made to delimit the extent of the infestation, but no additional action is taken to control or contain the emerald ash borer (EAB) population. This is effectively a “do-nothing” approach that ensures the EAB populations in these sites will build and expand. Results of studies in southeast Michigan, where the EAB infestation in North America originated, indicate that as outlier populations build and coalesce, the rate of spread increases substantially. Additional research shows that once EAB infests a stand, ash (*Fraxinus* sp.) mortality approaches 100 percent, regardless of site or stand variables. If this situation continues, more than 8 billion ash trees representing at least 15 species in U.S. forests may be at risk.

We have learned a considerable amount about EAB since it was discovered in North America in 2002. Integrating the tools currently available to slow the growth and spread of EAB populations in outlier sites could provide a means to slow the expansion of this destructive pest across North America. This would offer communities, resource managers, and landowners with more time for planning. It may also buy time for researchers working with biological control organisms, microbial insecticides, or other potential controls. The gypsy moth Slow-the-Spread (STS) program is an example of what can be achieved by implementing a similar strategy. In the STS program, detection of a new infestation in the action area is followed by intensive surveys to define the extent of the population. Subsequent applications of pheromone flakes or *Bacillus thuringiensis* (Bt) typically follow. Although these activities occur in an action zone, they serve to protect areas well in advance of the action zone from gypsy moth infestation.

We have begun to develop, implement, and evaluate a strategy to delay the onset and progression of ash mortality caused by EAB. This strategy, termed SLAM (SL.ow A.sh M.ortality), integrates management tools or options that are appropriate for a specific site. The overall goal of SLAM is to slow the progression of ash mortality, which requires that we reduce the rate at which EAB populations build and expand. Several tools, including girdled ash trees, insecticides, and ash utilization, can be applied in an integrated manner appropriate for conditions at a specific site.

Girdled ash trees are highly attractive to adult EAB, particularly where EAB densities are at low to moderate levels. Girdled trees can serve many purposes in a SLAM site. Trees that are girdled in spring, then felled and debarked in fall provide information about EAB density, distribution and larval development. Girdled trees can function as a “sink” for EAB larvae; when female beetles preferentially oviposit on girdled trees that are subsequently removed or destroyed, a substantial portion of the next generation of beetles is eliminated. At low EAB densities, girdled trees may even influence beetle dispersal, providing opportunities to draw beetles away from an area of concern. Removing girdled trees also reduces the ash phloem available to future generations of EAB larvae.

Insecticides provide another option for slowing the rate of EAB population growth. Our data from a 2007-2008 study show that injecting ash trees with emamectin benzoate, a recently developed product sold as Tree-äge, provided nearly 100 percent control of EAB for at least 2 years post-treatment. Tree-äge currently has a special registration in 10 states and full EPA registration has been requested. This product not only alters the economics of treating ash trees in landscape settings, it may also have a role in slowing EAB population growth in outlier sites.

Utilizing ash trees for timber or firewood may provide some value to landowners, as well as reducing the potential number of EAB that can be produced in a given SLAM site. Research we published in 2007 showed that on average, about 100 EAB adults can develop per m^2 of ash phloem. Complete ash inventories collected in five different sites have shown that only 5 to 6 percent of the ash trees in a site are ≥25 cm in d.b.h. (10 inches). These large trees, however, contain at least 50 percent of the ash phloem in the site. Selectively harvesting only the large ash trees, which make up only 5 to 6 percent of all the ash stems, could reduce the potential EAB production in a site by at least 50 percent.

Other tools that could eventually be incorporated into a SLAM effort may include biological control. Asian parasitoids of EAB eggs or larvae were introduced into several sites in 2007 and 2008; their ability to establish and exert some effect on EAB populations will be evaluated over the next few years. Similarly, native parasitoids such as *Atanycholus hicoriae*, may have potential for augmentative biocontrol. Woodpeckers remain the single most important cause of EAB larval mortality, but we still know relatively little about whether woodpecker predation of EAB could be enhanced.

If a SLAM strategy is implemented at an EAB outlier site, evaluation will become important. We are developing a simulation model that can use spatially explicit data to estimate how EAB populations will build and spread and how ash mortality will advance if no action is taken in an outlier site. We can also compare the rate at which ash mortality progresses in a SLAM site that observed in southeast Michigan, where an extensive dendrochronological analysis was completed. An economic analysis of costs and benefits associated with a SLAM project will obviously be important.

Several cooperators are currently working to implement a SLAM pilot project in the eastern Upper Peninsula of Michigan near the towns of Moran and St. Ignace. This EAB infestation was discovered in fall 2007 when a girdled detection tree was found to be infested. The Michigan Department of Agriculture felled several additional ash trees in the area in winter 2007 and a total of 13 infested trees were found. The infestation appears to be relatively recent in origin and to date, no ash trees exhibit any external symptoms of infestation.

In 2008, the area was intensively surveyed to better define the extent and distribution of the infestation. Using a grid pattern, girdled ash detection trees were established at densities of 16, 4 or 1 trap tree per mi^2 within a 1, 1-2 and 2-3 mile radius, respectively, of the trees determined to be infested in 2007. More than 500 trap trees, typically 4-6 inches d.b.h., were girdled in June, then felled and debarked in September and October. Survey crews recorded number and stage of larvae on positive trees. If there was no suitable ash tree for girdling in a grid cell, an APHIS program trap (purple canopy trap baited with Manuka oil) was installed. In addition, APHIS officials required that a purple canopy trap be placed in every grid cell, in addition to the girdled tree.

Results from the intensive sampling in 2008 showed that in the area centered around Moran, there were 24 girdled trees that had EAB larvae, with an overall average density of approximately eight larvae per m^2. Several trees had only small larvae that would likely have fed again in 2009 and emerged as adults in 2010. Nine of the panel traps captured at least one EAB adult; seven of those traps, however, were attached to girdled trees that had larvae. Two additional positive trap trees were located in grid cells near St. Ignace.

Density and development stage of EAB larvae (1-year or 2-year larvae) on each positive girdled tree were imported into a GIS. Maps revealed that a core infestation and four distinct satellite populations could be defined. Cooperators drafted a plan of action for 2009 that includes establishing clusters of 2 to 3 girdled ash trees within the core infestation centered on Moran. The goal of these girdled trees would be to attract and contain adult female EAB and to reduce the likelihood of oviposition on trees outside that core area. The trees will be removed in fall 2009. An additional 50 ash trees, located 400-800 m around the perimeter of the core infestation, would be treated with a trunk injection of Tree-äge insecticide. Ideally, this would establish a “buffer” of trees that would be toxic to any EAB that dispersed beyond the existing core. In the satellites, up to four girdled trees would be established within 150 m of the original positive tree and at least four additional trees located 150-400 m around the perimeter would be treated with Tree-äge.

Additional activities in the SLAM outlier site also were initiated in 2008. A consulting forester worked with private landowners in the area and arranged a timber sale, which will reduce ash phloem and provide some financial reward for the landowners. On national forest land, several large ash trees were identified in an area accessible by foot only during winter. These trees, which were probably not yet infested, could not be harvested or otherwise treated, so they were felled, bucked into sections and left on site, simply reducing the potential production of adult EAB in that area. A street tree inventory was completed for St. Ignace to identify the abundance and size of ash trees that may require insecticide treatment or replacement. Outreach activities were initiated with residents and property owners in the area to inform them about SLAM and potential options for treating their landscape trees. Efforts are underway to quantify the ash resource within and around the SLAM site.

It seems likely that the SLAM strategy developed for this outlier site should be successful, assuming that adequate funding is available. A SLAM strategy needs to be tested in additional pilot sites, however, where conditions and management options are different. Knowledge gained from additional pilot sites, as well as ongoing EAB research, will be needed to develop an effective approach to dealing with this devastating pest.