FEATURE ARTICLE

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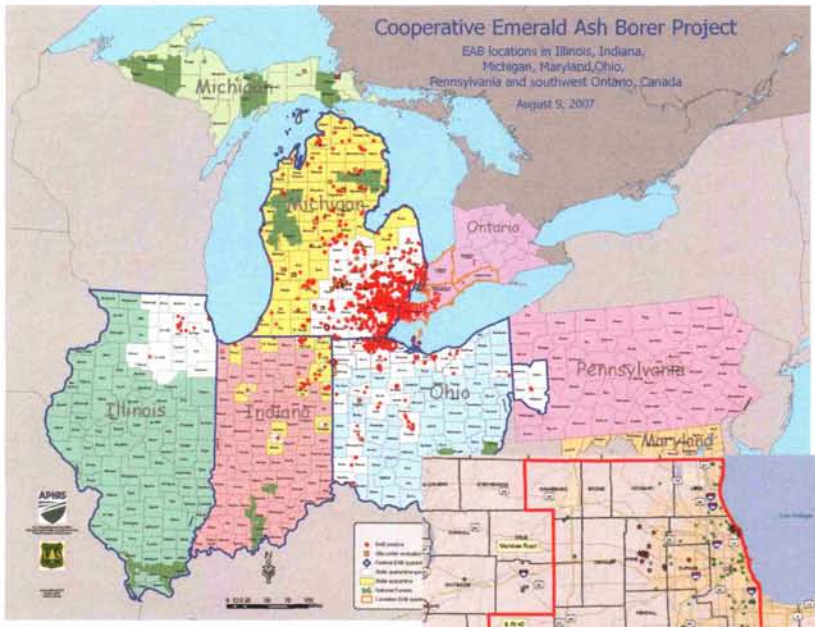
Emerald Ash Borer One Year Later

The Emerald Ash Borer is making its way west (See Map 1). No longer news to the green industry of Illinois the EAB keeps being discovered. It was found in Kane County last June and continues to be discovered in Illinois. As recently as this July, the borer was discovered in LaSalle and DuPage Counties. The La Salle County case was discovered in a cloverleaf interchange at Interstate 80 and Rte. 251. The DuPage find was at Concord Green Shopping Center in Glendale Heights. Kane County leads the pack, though, with 12 confirmed locations, the most recent being an industrial park in northeast Batavia. EAB was also discovered in Wilmette and Evanston last year.

Quarantine

These new discoveries prompted the Illinois Department of Agriculture to expand the quarantine to 18 counties in northeastern Illinois (See Map 2). What does the quarantine mean to our industry? Since most of the courses that MAGCS members manage fall within the quarantine, not much, unless you move an ash out of the quarantine area or over state lines. The quarantine prohibits the movement of ash firewood out of a regulated area into a non-quarantined area. I know some golf courses, park districts, and villages sell or give away firewood to local homeowners and area residents. As long as both parties are in the quarantine area, no laws have been broken. In fact, the Illinois Department of Agriculture encourages Illinoisans to purchase only locally cut firewood in order to avoid accidental introduction of the beetle into new areas.



Map 1.
The infestation of EAB spreads west.

No Area Golf Course Infested

To date, there have been no confirmed findings of the emerald ash borer on any golf course in Illinois. The running joke, though, is that a few golf courses could benefit from an infestation, or at least some turf conditions could improve. In truth, we all lose when our native trees get wiped out. Those of us who remember what Dutch elm disease did to the American Elm certainly don't have to fire too many synapses to recognize what our land would be without ash trees. Those of you that remember the American Chestnut understand what it means to lose an estimated four billion trees from one non-native pest (check out acf.org to learn more).

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Map 2.
The EAB quarantine is expanded in Illinois marked by the solid red line.

Quarantine Prohibits the Removal of the Following items from Regulated Areas:

- The emerald ash borer in any living stage of development.
- Ash trees of any size.
- Ash limbs and branches.
- Any cut, non-coniferous firewood.
- Bark from ash trees and wood chips larger than one inch from ash trees.
- Ash logs and lumber with either the bark or outer one-inch of sapwood, or both, attached.
- Any item made from or containing the wood of the ash tree that is capable of spreading the emerald ash borer.
- Any other article, product, or means of conveyance determined by the Illinois Department of Agriculture to present a risk of spreading the beetle infestation.

Illinois Department of Agriculture – What are they doing?

When a discovery is made and confirmed, the first step is to set up a quarantine of the area, if the discovery area is not already in quarantine. The second step is the removal of infested trees. This reduces the population of ash borers and minimizes their spread. These steps are carried out in conjunction with a comprehensive survey that determines the extent of the infestation. To date, the IDA has removed over 400 infested trees (at no cost to any property owners), and an additional 1000 trees have been surveyed throughout the state. This fall, the IDA will follow up surveying more than 1200 trees in Lake, Cook, Will, DuPage, McHenry, Kane, Kendall, Grundy, LaSalle, DeKalb, Boone, Winnebago, Ogle, and Lee counties. Survey for the EAB is tough, time consuming work.

Image 2.
An ash takes one for the team as it becomes a trap tree through girdling.

How is a tree surveyed?

It is very difficult to detect low-level EAB populations. Newly infested trees may appear healthy and have no visible symptoms of attack. I recently drove past a confirmed infestation in Batavia, and if it wasn't for the little orange tags that the IDA placed on the ash trees, I would have never noticed the site. (See Image 1) In smaller trees (< 3-4 inches DBH*), a few exit holes may be visible on the trunk. In larger trees, the insect is more apt to be located in the canopy, at least for the first few years as insect populations build. By contrast, trees in areas containing high density EAB populations, where the insect has been present for several years, are likely to exhibit decline and mortality along with visible signs of infestation such as thin crowns, vertical bark splits, D-shaped exit holes, dead and dying branches, woodpecker damage, and epicormic sprouts.

DBH = Diameter Breast High (Circumference at 4.5" from the ground/3.14)

Traps and attractants for adults are not yet available, although Forest Service (FS), APHIS, and university scientists are continuing to evaluate promising lures and traps. Emerald Ash Borer adults are, however, attracted to ash trees that are girdled to serve as detection trees (often referred to as trap trees). Trap trees work because the insects are attracted to trees that are stressed by the girdle. Based on this principle, ash trees that are not girdled but that are under stress — indicated by signs and symptoms like branch dieback, stunted growth, and epicormic branching — may also be attractive to EAB. These trees are candidates for cut down and careful peeling in order to look for EAB life stages and larval galleries. These trees are termed destructive sample trees or more commonly known as "taking one for the team." (See Image 2)

Detection methods currently in use:

- Detection trees (girdled trap trees)
- Destructive sampling (cut and peel)
- Visual Surveys

The use of detection trees and destructive sampling are the primary techniques employed in the USDA National EAB Program for detection of low-level populations or new introductions.

Visual surveys are not effective in finding early infestations of EAB because few signs or tree symptoms are evident. However, if EAB has become well established in an area, then visual surveys may be an excellent means for finding the infestation. Visual surveys can also be helpful in identifying candidates for destructive sampling as well as areas in which to create detection trees. Whenever possible, it is recommended that detection trees be used in surveys that target high-risk points of introduction.

Why Survey?

Find EAB infestations occurring outside of known areas.

Identify and survey the most likely areas for EAB introduction and establishment.

Provide a format for reporting and recording survey data.

Pros and Cons of the Three Survey Strategies

A detection tree strategy may require more time and effort per survey site than the other methods. The reason for this is that it requires a minimum of two site visits during the year, one to establish the girdle, the second to cut, peel, and sample the tree. However, detection trees are considered the most sensitive survey tool for finding low-level EAB populations. The destructive sampling method can also take multiple visits, the first to locate candidate trees and then later visits to cut and peel the trees. Because ash decline and die-back is not uncommon there are many candidates for this type of survey. Destructive sampling could overwhelm a survey program that needs to cover a large region. Visual surveys can cover large areas quickly, but

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visual inspection can miss low-level infestations easily. If many trees need to be closely examined, visual inspections can also be very time consuming. In many cases a single detection tree may be a more efficient survey tool than a large-scale visual survey.

Sampling Season

Many of the signs of EAB infestation (D-shaped exit holes, bark splits, and serpentine galleries) can be observed at any time of the year. However, dead and declining trees are most easily observed during the growing season, because fall coloration can mimic crown decline. Therefore, the best time period for visual surveys is from June through mid-September. Detection trees must be girdled prior to adult emergence and should be cut down and peeled after late September. Peeling detection trees prior to late September is not recommended; later peeling allows larvae time to develop in size and to extend their galleries for easier observation. Detection trees can be left standing for a second summer. This can provide a longer window of opportunity for EAB to locate and infest a girdled tree. These trees should then be cut and sampled after late September of the second year. Cutting and peeling of suspected EAB trees (i.e., destructive sampling) can be conducted at any time. The IDA will begin bark stripping more than 600 trees this fall in Lake, Will, DuPage, Grundy, DeKalb and Winnebago Counties.

Overview of Insecticide Options

There has been much confusion surrounding the question of whether insecticides are an effective management option for EAB. Research and experience has shown that insecticides can protect ash trees from being killed by EAB. However, success is not guaranteed. In some university trials, insecticide treatments were effective, but in other trials the same treatments failed. Some studies conducted over multiple years revealed that EAB infestations continued to increase despite ongoing treatment programs. Insecticides are not effective in eradicating EAB infestations, which is why they have not been used as an eradication tool by the Cooperative EAB program in other states. Research suggests that the best control can be achieved when insecticide treatments are started in the earliest stages of infestation before visible symptoms are present or possibly the year before trees are infested. It is important to understand that insecticide treatments must be repeated each year. Consequently, it may be more cost-effective to remove and replace the tree with a different species. However, for a golf course superintendent, it might be worth preserving some key ash trees. Another option would be to prolong the life of a noteworthy ash tree while nurturing a replacement. As with most research, past research has led to more research (codename: job security for investigators).

Table 1.
Product and Application Method Trial at North Shore CC.

On July 2, 2007, seven EAB insecticide treatments were applied for evaluation.

Chemical Name	Product Name	Application Method
emamectin benzoate	Denim	trunk injection ArborJet
imidacloprid, IMA-Jet	Merit	trunk injection ArborJet
thiamethoxam	(many listed)	soil injection
imidacloprid	Merit	soil injection
dinotefuron	Safari	bark spray
dinotefuron	Safari and Pentra-Bark	bark spray
untreated control	applied to 28 trees	

Trees ranged in size from 8.9-23.2 inches DBH* (27.9-72.8 inches circumference).
Each treatment was applied to four (4) randomly selected ash trees.

Insecticidal Controls of EAB - Any New Options?

Important studies are still being conducted to determine what the best products are for controlling the emerald ash borer. Not only are products being tested, but methods for applying different insecticides are being evaluated right here in our area. Drs. R. Chris Williamson, University of Wisconsin-Madison, and Steve Sanborn, Syngenta recently set up a study at North Shore Country Club in Glenview. They are evaluating registered insecticide products and application methods in non-infested ash trees as a pre-emptive measure for protecting ash trees. **See Table 1.**

The researchers theorize that most of the treatments and application technologies will provide effective protection from future EAB infestations. However, annual insecticide treatments will be required. To this end, yearly re-applications will be performed. This is a long term study that will require at least three years to properly assess the value and performance of the treatments and application technologies.

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Table 2.
EAB Insecticide options for professionals.

Formulation	Chemical Name (AI)	Application Method	Timing
Merit	Imidacloprid	Soil Injection	Mid-April to mid-May
IMA-jet	Imidacloprid	Trunk Injection, Arborjet	Mid-May to mid-June
Imicide	Imidacloprid	Trunk Injection, Mauget	Mid-May to mid-June
Pointer	Imidacloprid	Trunk Injection, Wedgle	Mid-May to mid-June
Inject-A-Cide B	Bidrin	Trunk Injection, Mauget	Mid-May to mid-June
Astro	Permethrin	Preventative cover sprays on bark and foliage	2 applications at 4 week intervals, the first in early May.
Onyx	Befenthrin		
Sevin SL	Carbaryl		
Tempo	Cyfluthrin		

*table adapted from EAB fact sheet – OSU rev. Jan 2007

Chemical Control in the Meantime

If you do have a prized ash tree, or perhaps several, there are chemical control options available that have worked well in protecting non-infested trees. In some cases they have reduced existing infestations. Again, research suggests that the best control will be obtained when treatments are initiated in the earliest stages of infestation before visual symptoms are present, or perhaps even the year before trees are infested.

Insecticides used for control of EAB fall into three categories: (1) systemic insecticides that are applied as soil injections or drenches; (2) systemic insecticides applied as trunk injections or trunk implants; and (3) protective cover sprays that are applied to the trunk, main branches, and (depending on the label) foliage. **See Table 2.**

As with all preventative application programs, timing is important. Be aware when using a soil injection, soil drench, or trunk injection that it will take time for the product to be translocated throughout the tree. Costs for treatment will vary with the size of the tree. The first product listed in Table 2, Merit, has been estimated to cost $1.60 per inch of DBH per tree. An ash tree with a DBH of 15" will cost about $24.00 per year to treat in product alone. As with all pesticides, read, understand, and follow all label directions.

Insecticides will not eradicate EAB. However, when your objective is to protect individual trees from being killed insecticides have been effective in most cases.

Biological Control of EAB

Release of Parasitoids to Control EAB Considered

In May of this year, the U.S. Department of Agriculture announced that an environmental assessment was available for comment regarding the proposed release of three parasitoids (a parasitoid is an insect that lays its eggs inside the living body of another animal or insect — the newborns feed off the body, eventually causing the death of the host) for biological control of the emerald ash borer. Animal and Plant Health Inspection Service (APHIS) and Forest Service (FS) have proposed to release three parasitoids into the environment of the continental United States for the purpose of reducing EAB populations. Releasing a parasitoid is not an easy decision to make, because the ramifications can never be fully predicted.

APHIS has responsibility for excluding, eradicating, and/or controlling plant pests, including EAB, under the Plant Protection Act (7 United States Code (U.S.C.) 7701 et seq.). APHIS has been granted the authority to administer these statutes. They have promulgated Quarantines and Regulations (7 CFR 319) that control the importation of commodities and means of conveyance to help protect against the introduction and spread of harmful pests. In the proposal for the release of the three parasitoids, APHIS indicates that the expected outcome is a reduction in the population of EAB and its spread throughout the United States, but not a complete eradication. They state that the release of the parasitoids is another tool to help control EAB. The previously described strategies (survey, quarantine, and eradication) would continue as methods for controlling the pest.

The Three Parasitoids

These parasitoids are known to attack EAB consistently in its native range in China. The biocontrol agents include one larval ectoparasitoid, *Spathius agrili* (Hymenoptera: Braconidae), one species of egg parasitoid, *Oobius agrili* (Hymenoptera: Encyrtidae), and one species of larval endoparasitoid, *Tetrastichus planipennisi* (Hymenoptera: Eulophidae). Post-release monitoring, including impacts on EAB and non-target wood-boring beetles as well as spread and establishment of each parasitoid species, will be conducted.

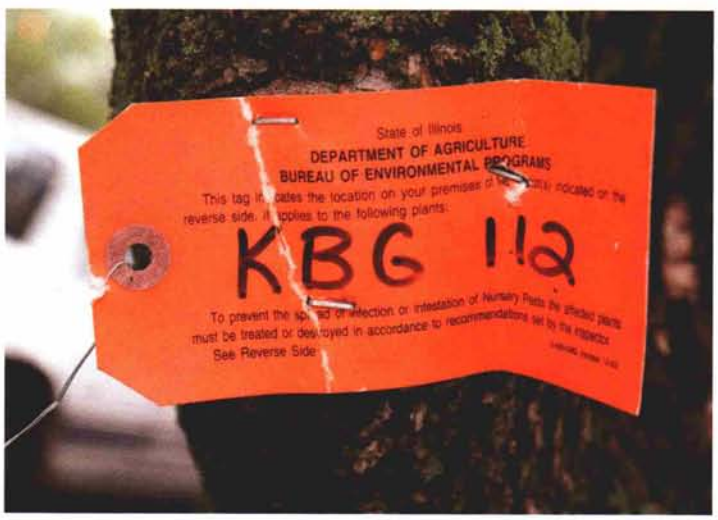
Spathius agrili is a gregarious larval ectoparasitoid; adult wasps lay multiple eggs on a surface of EAB larvae after paralyzing the host EAB during oviposition (egg laying) and stopping further development of the host.

Oobius agrili is an egg parasitoid. Adult wasps lay an egg inside EAB eggs, which are laid between bark layers and crevices on ash trunks and branches. Larval wasps consume and kill host eggs in order to complete their own development.

Tetrastichus planipennisi is a larval endoparasitoid. Adult wasps lay one or more eggs inside EAB larvae; larval wasps consume and kill host larvae to complete their development.

The status of the release of the parasitoids is uncertain at present. While the comment period officially closed on June 22, 2007, work is still underway to predict the impact of releasing these non-natives in the United States. One can imagine trying to foresee the impact of purposefully releasing a non-native species. The possibility of the parasitoid moving off target and attacking our native insects (during host specificity testing, S. *agrili* did not attach to any non-target species other than some *Agrilus* species) is a major concern. This could cause environmental impacts not measurable or understood until post-release studies are conducted. Moreover, the release of a parasitoid is not always successful. Introduction does not always lead to establishment. Establishment does not always lead to control. Releasing parasitoids is nothing new. Hundreds, if not thousands, or parotid species have already been purposefully released in the U.S. to attack various insect pests such as mealybugs, aphids, whiteflies, and agriculturally important lepidopteran pests.

Destructive larvae of the EAB, hard to detect and find without destructive sampling.



The Illinois Department of Agriculture's plant tag states the doom of its bearer. This ash tree is one of about 10 that has been infested with EAB.

Where to go from here?

As local nurseries rip out ash stock from their fields and the IDA completes more intensive surveys this fall, I won't be surprised to learn of more EAB infestations. It is already apparent that EAB has been in Illinois for several years. We won't know the true extent of the infestation for several years to come. Necessary research is in hyper-drive, but even that may be too slow for some of our trees.

There is plenty of EAB information on the web, some of which I have tried to summarize here. I feel it is time to develop a strategy for managing this pest at your golf course. First and foremost, educate your members, owners and others. Take an inventory of your ash population (at the same time do a little scouting), and categorize these trees. Are there key trees on your course that would negatively affect play if they were to die? If so, develop a plan to protect them and/or prolong their life until you are able to replace them or until a solution to the problem is found. Are there ash trees that are in marginal health? It wouldn't make much sense to try and preserve these. The choice is up to you.

This past July there was a press release announcing that APHIS is close to announcing Chicago's Ravenswood neighbourhood has successfully eradicated the Asian Long Horned Beetle. For this declaration to occur, any quarantined area must be free of the pest for four years. Chicago hopes to receive a formal declaration of eradication from the USDA early next year. The people involved with this non-native pest are commended for their actions and achievement. At present, it seems there won't be a formal declaration of the eradication of EAB anytime soon in fact most people in the know believe if the Emerald Ash Borer is not stopped, the only eradication we will see is our ash trees. **-OC**